AN OVERVIEW

THE TEXAS COAST: SHORING UP OUR FUTURE

Ecologic Health
Economic Growth
Future Opportunities

WELCOME

Texans have a long and storied history of independence, and we are proud of our lands and waters. The Texas General Land Office (GLO) works to embody this tradition by protecting and restoring our coastal areas for the benefit of all Texans.

Each year, proud Texans commemorate the Battle of San Jacinto, the decisive moment of the Texas revolution. In modern times, a new battle emerges to save the same land fought for in 1836: the Texas Coast.

Today our shores are threatened by both natural and man-made forces, and a Texas-sized solution is required to save one of the most important and valuable landscapes on the planet.

This overview highlights the primary threats to the Texas Coast, along with the opportunities that must be seized if we are going to secure our future.

Meeting these challenges will not be easy, but it can be done. We have the best scientists, engineers and local experts committed to caring for our coast, and we are working together on solutions that will benefit all Texans for generations.

Please join all of us here at the General Land Office as we work to ensure a strong coast for a strong Texas.

Sincerely,
The Texas General Land Office

Overview

In the spirit of stewardship we present an overview of the issues affecting the Texas Coast. As a powerful economic engine and an invaluable environmental treasure, the coast is truly vital to our state and nation's success. But as our shores face stronger storms, land loss, population growth and a number of other forces, one of the state's most productive regions is in jeopardy.

6.1 MILLION — Number of people living in the 18 Texas coastal counties in 2010, nearly one quarter of the state's population.

9.3 MILLION — Projected population of the Texas Coast by year 2050, an increase of 50 percent.

A real estate agent in Dallas, a contractor in Houston, a boat captain in Beaumont, an oilman in Odessa, a tour operator in Galveston, a refinery technician in Corpus Christi, an engineer in Midland or a soldier stationed at Ft. Hood: all Texans are linked in some way to the coast.

Home to major industries such as energy, shipping, tourism and recreation, fishing and more, the Texas Coast is growing and changing.

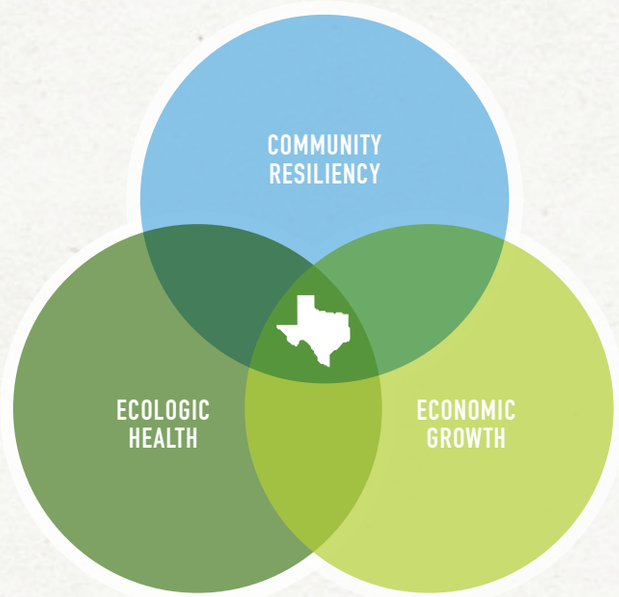
Rapid development is underway, signaling the need to protect the land that will support progress, not just on the coast but across the state.

Erosion coupled with rising sea levels and larger, more intense storms are warnings that we must prepare for our future now. The nation seems intent on waiting for disasters before taking action – a costly mistake. Waiting to act hits taxpayers harder in the pocketbook, and it's just not how Texans take care of business.

Texas barrier islands, bays, estuaries and wetlands are deteriorating. This means more exposed inland communities and a weaker foundation for our state's key industries. It also puts at risk the steady supply of clean water that communities depend on for safe drinking, swimming and fishing. These are but a few of the benefits a healthy coastal environment provides that are at stake.

These issues may seem confined to our shores, but in truth, the consequences of a fragile coast ripple far inland. Statewide economic growth, job creation, community resiliency and environmental sustainability all tie back to the Texas Coast.

This overview of a state at risk illustrates the Texas Coast's economic and environmental significance and describes the primary challenges facing the coast. The issues of concern outlined in this overview are based on the work of more than 40 coastal experts that form the Texas GLO Coastal Management Program's Technical Advisory Committee (TAC). Representing an array of coastal expertise from the public, private and non-governmental sectors, TAC members participated in a series of workshops to identify and evaluate the most pressing threats to each of the four regions of the Texas Coast. The Texas General Land Office is grateful for the time, dedication and expertise of this team. The TAC evaluated the issues of concern listed below, which represent the focus of this overview.



► A healthy balance is essential for a strong Texas Coast.

ISSUES OF CONCERN:

- **Wetlands/Habitat Loss**
- **Water Quality and Quantity**
- **Impact to Fish and Wildlife**
- **Impact to Marine Resources**
- **Gulf Beach/Dune Erosion**
- **Bay Shoreline Erosion**
- **Flooding and Storm Surge**
- **Tourism/Local Economy**
- **Others: Public Access, Community Resiliency, Navigation, Public Health and Safety, Marine Debris, Land Subsidence, Invasive Species, and Lack of Data and Information**

► Texas has 6 barrier islands and 2 peninsulas, including Padre Island — the longest undeveloped barrier island in the world — providing the state's first line of defense against storms.

Bolivar Peninsula

Galveston Island

Follet's Island

Matagorda Peninsula

Matagorda Island

St. Joseph Island

Mustang Island

Padre Island

THE TEXAS COAST: WHAT'S AT STAKE?

Community Resiliency

Wetlands, barrier islands, beaches and dunes protect the Texas Coast and inland areas from hurricanes and storm surge. These natural defenses are threatened by alarming erosion rates, the demands of a rapidly growing population and rising sea levels.

Increasingly Powerful Storms

A hurricane hits Texas on average every other year, and new predictions call for a 100-year storm to land twice in a lifetime. Storms are projected to be stronger and have wider footprints, meaning that even a category 1 or 2 hurricane like Ike will destroy shorelines and inundate the cities and infrastructure in its path.

1.2 MILLION

Number of Texans forced to evacuate as Hurricane Ike barreled into the Gulf in 2008. The storm caused blackouts and water and fuel shortages, leaving a tragic swath of death and destruction in its wake.

Such storms will inevitably have an impact, but catastrophic damages can be avoided by making our communities more resilient. Through better land and water management strategies, smarter development, and improved emergency readiness and response, communities will be less vulnerable to coastal hazards.

$29 BILLION Property damages due to Hurricane Ike, one of the costliest hurricanes in U.S. history.

$142 BILLION Total statewide economic losses in the year after Hurricane Ike.

Deteriorating Lines of Defense

FEMA ESTIMATES THAT EVERY $1 SPENT ON MITIGATION TO PRESERVE WETLANDS AND OTHER NATURAL DEFENSES SAVES AN AVERAGE OF $4 IN THE LONG RUN.

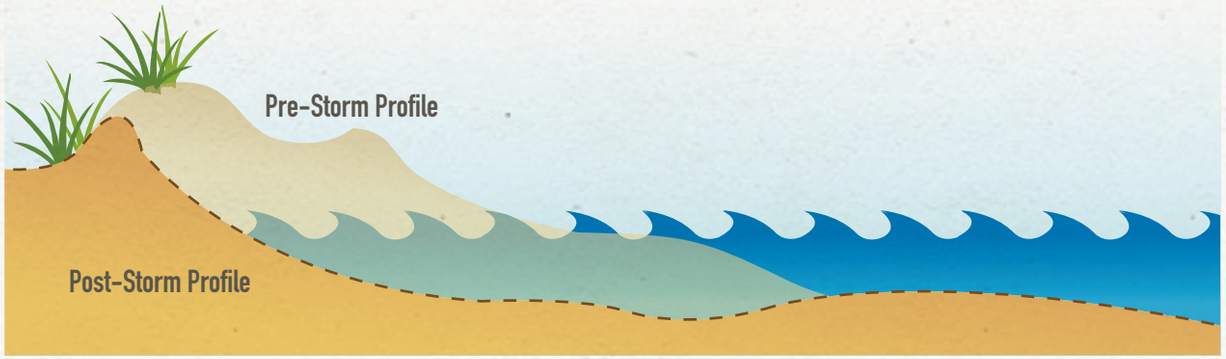
Barrier islands, wetlands and natural sand dunes are the least expensive, most efficient forms of protection for coastal communities. However, these valuable landscapes are fragile and dynamic so their degradation puts populations and property at risk from erosion and storm impacts.

Receding Shores & Rising Seas

Texas has some of the highest erosion rates in the nation. Shores are retreating an average of 4 feet per year, with some areas experiencing losses greater than 30 feet per year, placing communities, business, and infrastructure at risk. Storm surge, disrupted sediment supply, coastal development and relative sea level rise also amplify shoreline retreat.

Growing Populations

Erosion and coastal habitat loss are further exacerbated by the growing number of people now living near the coast and using Texas natural resources. The key question is how to best accommodate this growth in a sustainable way to ensure ecologic health and economic growth.



► Dunes help prevent loss of life and property by absorbing the impact of storm surge and wave action. They also slow shoreline erosion and replenish eroded beaches after storms.

► Ike storm surges of 15 to 20 feet struck the Bolivar Peninsula and much of the Galveston Bay area. Sections of Bolivar saw nearly every structure completely wiped off its foundation.

$5.8 BILLION Value of Galveston Bay coastal wetlands, based on replacement cost of $6,000 per acre.

$12.6 MILLION Amount that seagrasses contribute annually to regional economies, due to their recreational value and importance to commercial fisheries.

$5.6 MILLION Estimated value of municipal water quality improvements provided by wetlands in Brazoria National Wildlife Refuge.

Ecologic Health

Healthy bays, wetlands and estuaries provide the critical foundation for sustainable environments and thriving economies, both along the coast and throughout Texas. Yet these priceless coastal landscapes are stressed in many places to their breaking point, endangering the tremendous benefits they provide.

Disappearing Coastal Habitats

Texas coastal habitats are disappearing as they are encroached upon by development, eroded or inundated by rising seas. Coastal habitats help maintain native plant and animal populations, improve water quality, provide recreational opportunities, and maintain community resiliency by reducing the impact of coastal hazards such as flooding and storm surge. Wetlands and barrier islands serve as nesting and foraging habitats for birds and wildlife, such as sea turtles. As a home to wildlife and a nursery for fish, crabs and other shellfish, Texas wetlands, bays and estuaries are essential for maintaining the state's tremendous biodiversity and overall environmental health. More than 457 species of fish and 343 species of invertebrates rely on wetland habitats.

CRITICAL COASTAL HABITATS:

- **Wetlands & Marshes**
- **Beaches, Dunes & Barrier Islands**
- **Woodlands, Swamps & Forests**
- **Seagrass Beds**
- **Mangroves & Shrubs**
- **Oyster Reefs**
- **Bays & Estuaries**
- **Coastal Prairies**
- **Bird Rookery Islands**

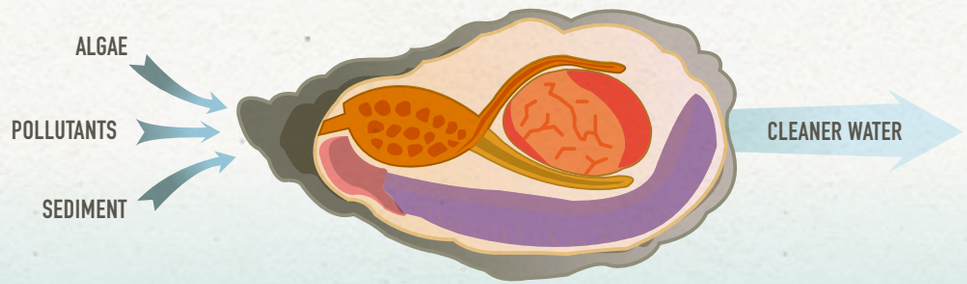
Clean Water

In addition to providing habitat and stabilizing shores, wetlands and oyster reefs absorb and filter estuary waters for swimming, fishing and, most importantly, drinking.

By acting like a giant sponge, wetlands absorb nutrients, sediments and pollutants that would otherwise degrade plant, animal and marine life, and spoil beaches and coastal waters. This sponge effect also helps reduce flood damage and recharge the state's groundwater supply, as water caught by wetlands seeps back into underground aquifers – the source of 60 percent of water used in Texas annually. As wetlands deteriorate, so will the state's reservoirs of fresh water along the coast.

1 OYSTER FILTERS 2 GALLONS OF WATER EVERY HOUR

► Oyster reefs act like giant filters; they pull out harmful pollution, toxins, sediment and algae from Gulf bays and estuaries. By keeping the water clean and clear, oyster reefs also boost aquatic life, which is good for the overall ecosystem and for commercial and recreational fishing.



TEXAS COASTAL ECOSYSTEM

Wetlands improve water quality, provide habitat for wildlife, control flooding and erosion, and recharge groundwater supplies.

The **flow of rivers** and streams transports water and sediment to support estuary health, control shoreline erosion and promote barrier island formation.

Estuary **water quality** can be impacted by upstream runoff from agricultural, residential and industrial activities within the watershed.

Oyster reefs act as water purification systems, helping keep waters clean and providing habitat for other aquatic life.

Coastal vegetation, such as seagrasses, mangroves, marshes, swamps, and forests, reduce greenhouse gases by storing carbon.

Estuaries provide critical nursery habitat for the majority of Gulf commercial and recreational finfish and shellfish species.

Beaches, bays and barrier islands provide wildlife habitat and allow access to **recreational opportunities** for residents and tourists alike.

Barrier islands, beaches, dunes and wetlands provide the first line of defense against storm surges and inland flooding by protecting infrastructure, like ports and refineries.

Sustainable fisheries support local economies and provide a bounty of seafood to the nation.

Offshore energy and supporting coastal infrastructure provide a substantial portion of the nation's domestic oil production and refining capacity.

Economic Growth

The state's ports, intracoastal waterways, recreational activities and tourism all contribute to a robust Texas economy. But as the coastline recedes and natural defenses diminish, valuable infrastructure is put at greater risk, as are the state's key economic drivers.

$2 BILLION — The economic impact of saltwater fishing in Texas in 2011.

$107 MILLION — State and local tax revenue generated by saltwater sport fishing in 2011.

$64 MILLION — The harvest value of commercial oysters in 2011.

Local Livelihoods

Commercial and recreational fishing have long supported local and state economies and provided an array of seafood to the nation. Top commercial species include various shrimp, oysters, blue crab, red snapper and black drum. Recreational saltwater anglers fish for red drum, spotted trout and flounder in Texas inshore waters, as well as red snapper, tuna, wahoo, marlin and other species in offshore waters.

These marine resources are threatened by pollution, water flow modifications, invasive species and stock population declines. For instance, an outbreak of "Red Tide" in Galveston County resulted in a $9.9 million loss due to fish kills, temporary closure of shellfish harvesting, lost tourism revenue and substantial clean-up costs.

Vulnerable Epicenters of Global Commerce

Texas is the nation's top state for waterborne commerce. More than 500 million tons of cargo pass through Texas ports annually, including machinery, grain, seafood, oil, cars and retail merchandise. Texas ports generate $6.5 billion in tax revenues and support more than 1.4 million jobs. This is the very definition of "critical infrastructure." With an expanded Panama Canal, Texas ports will need continued maintenance and protection.

95% Percent of recreational and commercial fish species in the Gulf of Mexico that depend on healthy wetlands to survive.

$240 MILLION Value of seafood landed at Texas ports in 2011.

16,819 Number of jobs created in 2011 by recreational saltwater fishing.

In addition to capacity and sophisticated shipping capabilities, Texas ports offer critical links to other modes of transportation throughout the state, such as major railroad lines and trucking routes. In 2010, 7.4 million tons of intermodal rail freight were shipped from Texas, the nation's third highest total.

$251 BILLION Value of goods exported from Texas ports in 2011, topping all other states.

$178 BILLION Total statewide economic impact generated by the Port of Houston in 2011.

$6.5 BILLION Tax revenues generated by the Texas ports in 2011.

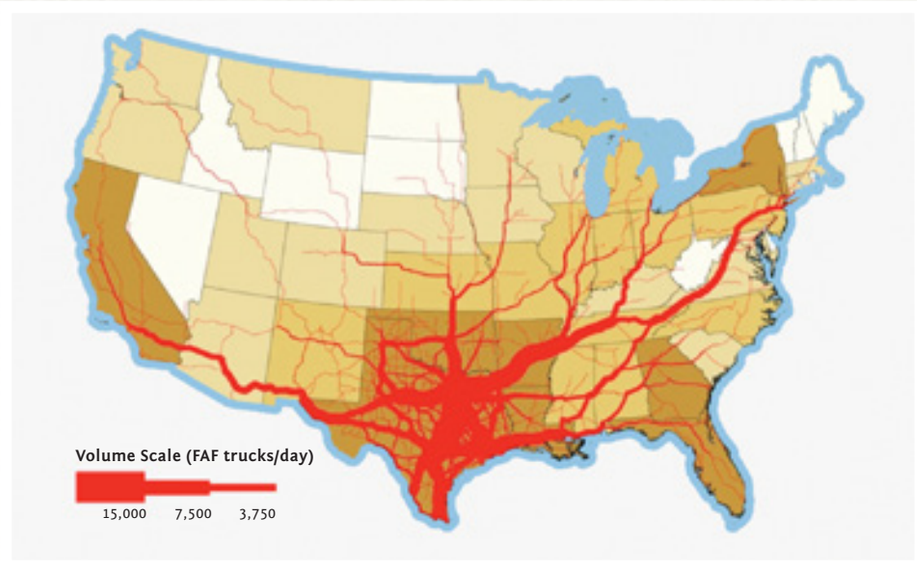
$6 BILLION Value of agricultural commodities produced by Texas farmers and ranchers exported each year through Texas ports.

The shutdown of even a single Texas port can deliver a devastating blow to state and national economies. In the days following Hurricane Ike, closures at the Port of Houston cost the economy an estimated $322 million each of the five days the port was offline, for a total impact of more than $1.6 billion.

Global Energy Powerhouse

As a world leader in the production of oil and petroleum products, Texas plays a key role in the economic and domestic energy security of the nation. The Texas Gulf Coast Refining District has a distillation capacity of more than 4 million barrels of crude oil daily. Overall, the 26 Texas refineries can process more than 4.7 million barrels of crude oil per day, representing more than 25 percent of the nation's total refining capacity.

Texas exported more than $57 billion of petroleum and coal products in 2012, by far the largest segment of its export market, making it one of the top commodities shipped through Texas ports. Much of this activity takes place around Houston, a home to 3,700 energy-related companies and 16 of the nation's top 20 oil pipelines. The series of refineries and more than 400 chemical plants along the Texas Gulf Coast is the largest petrochemical complex in the world, employing around 33,000 Texans.



Source: *U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework (FAF), version 3.1.2.*

Major Flows by Truck To, From and Within Texas: 2007. Map at left shows the flow of domestic and international freight that moves by truck to, from and within the State of Texas. Note the heavy volume of cargo that flows into and out of the Texas Coast to other states.

73 MILLION Tons of cargo that traveled along the Texas portion of the GIWW in 2010.

91% Percent of GIWW cargo listed as petroleum and chemical-related goods.

The Texas Coast delivers a larger volume of energy products, such as jet and diesel fuel, to the U.S. military than any other state. Texas is also poised to become a leader in exporting liquefied natural gas, a cutting-edge industry that will be part of the world's energy future.

Eroding Inland Waterways

$25 BILLION Value of cargo passing annually through the 406 mile section of the GIWW that runs along the Texas Coast.

Barge transportation is fuel-efficient and reduces both highway congestion and emissions compared to truck or rail. The wave action of barges, however, is taking its toll on the Gulf Intracoastal Waterway (GIWW), causing shoreline erosion and wetland loss. These issues are compounded by population growth and the density of development along the coast and adjacent to the GIWW. New housing, marinas, docks, piers and other modifications are restricting and crowding channels, creating additional navigation risks.

Healthy wetlands are the least costly method of shoreline stabilization. Developing erosion control measures, including wetland restoration, will protect coastal resources, improve navigation, and reduce the frequency and expense of maintenance dredging.

► The Gulf Intracoastal Waterway (GIWW) is one of the nation's most important commercial byways.

360 Number of public beach access points in Texas, a major draw for residents and visitors.

$14 BILLION Amount spent by tourists visiting the Texas Coast in 2011, generating about 143,000 jobs.

Coastal Attractions

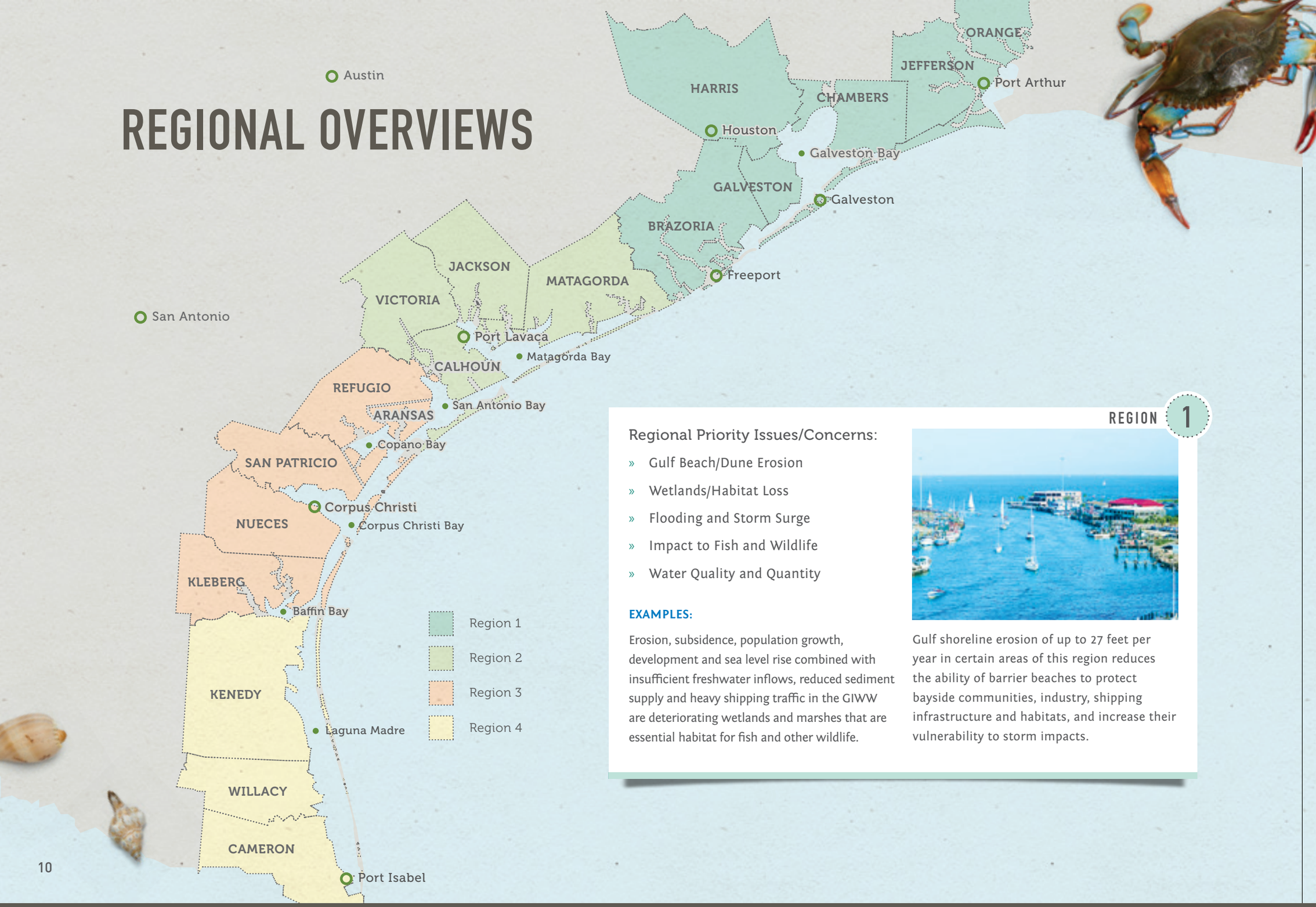
The Gulf Coast's natural bounty beckons visitors to Texas year after year, keeping the economy strong and creating jobs for both coastal residents and inland workers. Outstanding fishing, birding and waterfowl hunting opportunities, as well as family outings to the beach, make the coast the second most popular tourist destination in Texas.

> MORE THAN $1 BILLION WAS SPENT IN 2010 ON CRUISES DEPARTING FROM TEXAS, CREATING 16,500 JOBS AND $828 MILLION IN WAGES.

Tourists visiting the Texas Coast in 2011 spent $8 million at hotels and motels, and generated a total of $1.1 billion in state and local tax revenue. Nature tourism continues to thrive, creating 6,613 jobs in the Rio Grande Valley in 2011. The Great Coastal Birding Trail is the largest nature trail in the nation, with over 300 birding sites found along the Texas Coast.

► 50 percent of all waterfowl found traveling the Central North American Flyway winter in Texas. Birding generated $463 million in economic activity in the Rio Grande Valley.

REGIONAL OVERVIEWS



REGION 1

Regional Priority Issues/Concerns:

- Gulf Beach/Dune Erosion
- Wetlands/Habitat Loss
- Flooding and Storm Surge
- Impact to Fish and Wildlife
- Water Quality and Quantity

EXAMPLES:

Erosion, subsidence, population growth, development and sea level rise combined with insufficient freshwater inflows, reduced sediment supply and heavy shipping traffic in the GIWW are deteriorating wetlands and marshes that are essential habitat for fish and other wildlife.

Gulf shoreline erosion of up to 27 feet per year in certain areas of this region reduces the ability of barrier beaches to protect bayside communities, industry, shipping infrastructure and habitats, and increase their vulnerability to storm impacts.

REGION 2

Regional Priority Issues/Concerns:

- Wetlands/Habitat Loss
- Gulf Beach/Dune Erosion
- Impact to Fish and Wildlife
- Bay Shoreline Erosion
- Water Quality and Quantity

EXAMPLES:

Habitat and wetland loss threaten productive estuarine marshes and wetlands, as well as some of the state's important bird rookeries.

Bay shoreline erosion, marsh loss and habitat loss are concerns, especially along stretches of the GIWW where the shoreline is subject to dredging and vessel wake impacts.

Improving water quality to safeguard the region's diverse habitats is a critical concern for the sustained health and productivity of the Matagorda Bay system.

REGION 3

Regional Priority Issues/Concerns:

- Wetlands/Habitat Loss
- Impact to Fish and Wildlife
- Bay Shoreline Erosion
- Impact to Marine Resources
- Tourism/Local Economy

EXAMPLES:

Erosion and habitat loss are increasing concerns to this region's bay systems, which provide important nursery areas for commercial and recreational fisheries, and wetland habitat for wildlife and resident and migratory waterfowl and shorebirds.

Population growth and coastal development in this region are causing a loss of coastal habitats and a decline in water quality, which are both essential for maintaining healthy bay ecosystems.

REGION 4

Regional Priority Issues/Concerns:

- Wetlands/Habitat Loss
- Impact to Fish and Wildlife
- Tourism/Local Economy
- Gulf Beach/Dune Erosion
- Water Quality and Quantity

EXAMPLES:

A decline in water quality and an increase in nutrient loading in the Laguna Madre are jeopardizing the seagrass beds, which provide habitat and nursery areas for commercial fish and shrimp, and are a main source of food for 80 percent of wintering redhead ducks in the U.S.

Beach erosion and dune degradation hinder the tourism industry, diminish critical habitats, and reduce public access to the Gulf and bays.

TECHNICAL ADVISORY COMMITTEE

To identify specific issues of concern facing the Texas Coast and evaluate potential projects to address these challenges, the Texas General Land Office Coastal Management Program formed a Technical Advisory Committee (TAC) – a group of more than 40 coastal experts representing a wide variety of sectors: state and federal agencies, universities, local governments, non-profits, engineering firms, port representatives, and regional trusts, foundations and partnerships.

To begin addressing issues of concern in a systematic way, the Texas General Land Office and Harte Research Institute established a process to evaluate projects that had the potential to respond to each region's issues of concern. This process included a comprehensive review of public comments and a study of grants and proposals previously submitted for agency approval.

Regional meetings were held in September 2012 in Galveston (Region 1), Victoria (Region 2), Corpus Christi (Region 3) and South Padre Island (Region 4). At each meeting, the TAC identified issues of concern for particular areas in the region and evaluated corresponding projects for their expected benefit and feasibility, along with their ability to address local issues of concern. TAC members estimated the likelihood of economic, community and environmental losses that would result if the project did not occur. TAC members were also asked if they were aware of potential project challenges, any current funding allocations, and the estimated cost for each project.

PARTICIPATING ORGANIZATIONS

Brazoria County

Bureau of Economic Geology, University of Texas at Austin

Cameron County Parks & Recreation Department

CB&I

City of Corpus Christi

City of Galveston

City of South Padre Island

Coast & Harbor Engineering

Coastal Bend Bays & Estuaries Program

Coastal Coordination Advisory Committee

Coastal Technology Corporation

Galveston Bay Estuary Program

Guadalupe-Blanco River Authority

Guadalupe-Blanco River Trust

Harte Research Institute for Gulf of Mexico Studies

HDR Engineering, Inc.

Houston Advanced Research Center

LJA Engineering

Mission-Aransas National Estuarine Research Reserve

Naismith Engineering, Inc.

National Marine Fisheries Service

National Wildlife Federation

Ocean Conservancy

Peter A. Ravella Consulting, LLC

Port of Brownsville

Port of Corpus Christi Authority

Rice University

San Antonio Bay Foundation

San Antonio Bay Partnership

San Antonio River Authority

Texas A&M University at Galveston

Texas Coastal Partners

Texas Commission on Environmental Quality

Texas Department of Transportation

Texas General Land Office

Texas Parks & Wildlife Department

Texas Sea Grant College Program at Texas A&M University

Texas State Soil and Water Conservation Board

The Nature Conservancy

U.S. Army Corps of Engineers

U.S. Fish & Wildlife Service

THE TEXAS COAST: DEVELOPING A LEGACY OF CONSERVATION AND STEWARDSHIP

The Texas Coast and its resources are critical to the state and national economies, but the coast is at risk. Retreating shorelines, more frequent and powerful storms, growing industry and population growth near critical coastal habitats place increasing demands on limited natural resources while encroaching on fragile environments.

The Texas Coast and adjoining waters support a wealth of economic activities, such as maritime transportation, oil and gas drilling, commercial

fisheries and the development of offshore and coastal renewable energy. As these diverse uses grow, they extend into recreation and conservation activities, such as fishing, boating, bird watching and beach recreation. Traditionally, these activities have been managed separately, at times causing conflicts among users and the coastal environment. When conflict occurs, decision-makers and stakeholders can only react to events and are unable to plan for and shape actions that could lead to more cost-effective and desirable outcomes.

The time has come for Texas to create a collaborative approach to plan for and balance competing natural and human uses along the coast. With funding from the National Oceanic and Atmospheric Administration (NOAA), the Texas General Land Office has begun a long-term coastwide planning process to develop a framework utilizing Coastal and Marine Spatial Planning (CMSP). CMSP will help identify and protect key resources along the coast while reducing conflict between users. CMSP provides a method to balance coastal economic growth with the protection of critical habitats and ecosystems.

Every Texan has a stake in the health of the coast, and this process will only succeed with citizen involvement. CMSP encourages a user-friendly approach to managing the state's resources. As part of the framework's development, public meetings will be held to provide an opportunity for interaction among stakeholders to share ideas and develop strategies for addressing issues affecting the coast.

To further the framework, a web-based visualization tool will be developed to aid in coastal resource management decisions. By providing information on coastal resources, this tool will help to examine ecologic, social and economic interests to establish common goals.

The intent of this ongoing effort is to keep the Texas Coast vibrant and reflective of everyone who calls this state home. With input from coastal experts, local and state officials, industry representatives and the citizens of this great state, Texas is on the right path to prosperity and shoring up the coast's future.

TEXAS GENERAL LAND OFFICE: COASTAL RESOURCES

As the steward of state-owned lands, the GLO is responsible for management of the 367 miles of Texas coastline from the beach to nearshore waters and out to 10.3 miles into the Gulf of Mexico, as well as millions of acres of submerged land in our coastal bays. Texas has one of the longest coastlines in the country, where critical coastal habitat lives alongside communities, businesses, refineries and ports.

The Texas Coast suffers some of the worst erosion in the country. The GLO works to address erosion problems by renourishing beaches, restoring dunes, protecting the shoreline and restoring marsh habitat. GLO coastal programs also help protect and restore critical coastal areas, mitigate damage to natural resources, enhance public access to beaches (including ADA-compliant ramps), assist with beach maintenance costs for statutorily-approved counties, and allow the public to access up-to-date information regarding the water quality of the state's recreational beaches.

With diverse responsibilities related to protecting the Texas Coast, the GLO works every day to encourage, promote and engage in sound stewardship practices that preserve and enhance the use and enjoyment of the state's natural resources, while fostering economic growth along the Texas Coast.

For more information about the General Land Office and its coastal programs, visit www.glo.texas.gov.

TAC Region 3 meeting September 2012 in Corpus Christi, TX.

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