



Coastal Wetlands Restoration

R E S I D E N T S ' G U I D E

Barataria-Terrebonne National Estuary Program
Coastal Wetlands Planning Protection and Restoration Act



The Barataria-Terrebonne National Estuary is situated between the Mississippi and Atchafalaya Rivers in southeastern Louisiana.

Because it was recognized as an estuary of national significance, in 1991 a National Estuary Program was established here to help build consensus to preserve and protect our unique environment and culture.

Estuaries are areas where freshwater from lakes, rivers, bayous, and streams meet with the saltwater of the sea. This mixing of habitat types and water chemistries makes estuaries some of the most ecologically productive places on earth.

The *Residents' Guide* series was developed to promote awareness and good stewardship of the great natural resources of our estuary.



why is it critical to preserve and restore our wetlands?

Louisiana's coastal wetlands contribute to our culture and economy, provide wildlife habitats and recreation resources, and protect the land from storms.



Our coastal wetlands are a bounty of natural resources. From fisheries, wildlife, and tourism to oil, gas, and navigation, these vital coastal lands support and protect Louisiana's diverse communities and our natural, economic, and cultural contributions to the nation.

Louisiana's coastal wetlands:

- Offer a winter habitat or a place of rest for millions of birds that migrate across the Gulf of Mexico each year
- Help protect the infrastructure of crude oil and natural gas production, for which Louisiana ranks 4th and 5th, respectively, in the nation
- Support the state's vital fisheries which provide 25% of America's seafood
- Protect a network of waterborne commerce and the boats, ships, and barges that move 25% of the nation's exports
- Provide a storm buffer for the homes, livelihoods, and diverse cultures of nearly two million residents along the coast of Louisiana, including historical Cajun, African American, Vietnamese, Native American, and Isleños communities.



An area the size of a football field disappears every hour.

Since 1930, an area the size of Delaware has been lost.

Our Vanishing Coast

Many man-made and natural factors contribute to coastal wetland loss. Subsidence, or soil settling, is a natural process. Human activity, however, has made things much worse. Levees, canals, and roadways change the way water and sediment naturally flow in the wetlands. Not enough new sediment gets deposited to replace what gets lost, and the result is a coastal catastrophe. As the coastal wetlands disappear, so do our fisheries, our industries, our communities, and our natural protection from storms. Our coast is much too valuable to allow the destruction to continue.

Storm Impacts

The US Geologic Survey estimates that Hurricanes Katrina and Rita in 2005 caused 217 square miles of land loss in coastal Louisiana. That's almost 10 years' worth of land loss in just one month.

How can we restore our coastal wetlands?

The term, "coastal restoration" is often used to describe the technologies and techniques that physically recreate our coastal wetlands, forested ridges, and barrier islands. But coastal restoration actually encompasses much more. It includes research, legislation, funding, planning, implementation, and evaluation.

Coastal restoration involves cooperation and participation from many groups, from local communities and governments to state and federal partners.

Restoration Techniques

The many types of coastal habitats and land features can be restored using a variety of techniques. Here are some of the most promising methods and successful projects.

Marsh Creation –

Moving sediment from a "borrow area" to a site of open water or damaged marsh to build a new soil platform for marsh vegetation

River Diversions –

Introducing river water into wetlands to bring in fresh water, nutrients, and sediment

Ridge Restoration –

Using dredged sediment to reconstruct elevated ridges where trees can grow

Hydrologic Restoration –

Returning the flow of water to a more natural state by using shoreline protection or water control structures

Barrier Island Restoration –

Placing sediment on or near barrier islands to make them longer, wider, or taller



marsh creation

Building New Land

As marshes subside, the soils and vegetation sink and flood. Eventually the plants drown and die, and the marsh becomes shallow open water. Marsh creation uses sediment dug up from one place, the “borrow site,” and moves it to an area of degraded marsh or shallow open water to build up a platform for new vegetation to grow on. The borrow site can be nearby, such as an adjacent lake or bay bottom, or miles away in the case of offshore sand. The Mississippi and Atchafalaya riverbeds make ideal sources of borrow, as sediment there is replenished every year during spring floods.

Pipeline sediment delivery

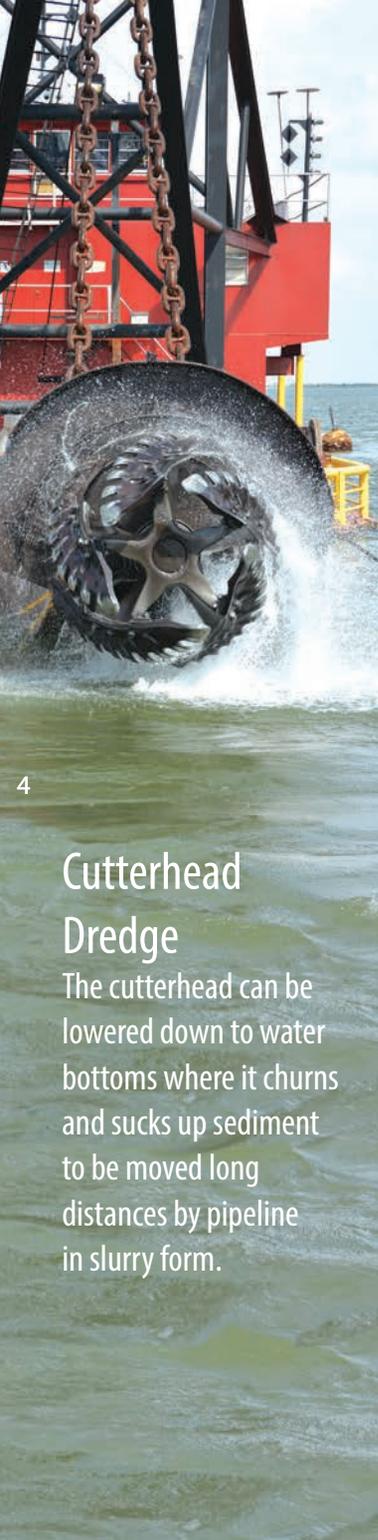
Sediments dredged for restoration can be transported in a variety of ways – by barge, hopper dredge, or through a pipeline in a water and sediment mixture called a slurry. Pipeline sediment delivery requires some planning and infrastructure, such as acquiring rights-of-way and placing booster pumps, but it can move sediments for many miles very quickly over land or water to restore marshes, ridges, or barrier islands practically anywhere.

Beneficial use of dredged material

Sediment dredged for navigation channel maintenance is frequently dumped into deep water and lost forever. But more and more often we are finding ways to use this material for restoration projects instead. To accomplish this, the U.S. Army Corps of Engineers partners with the state and coastal parishes on a program called BUDMAT, the Beneficial Use of Dredged Material.

Cutterhead Dredge

The cutterhead can be lowered down to water bottoms where it churns and sucks up sediment to be moved long distances by pipeline in slurry form.



Bayou Dupont

Jefferson Parish and Plaquemines Parish

Marsh Creation in Action

Marsh creation projects were among the first to be constructed when the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) was enacted in 1990. Over the years, CWPPRA has built dozens of marsh creation projects, usually using sediment dredged from nearby canals, lakes, or bay bottoms. But CWPPRA took a novel approach in 2009 with the Bayou Dupont Sediment Delivery System which was the first marsh creation project to use sediment dredged from the Mississippi River, a few miles downstream of Belle Chasse. Initially, the sediment slurry was pumped five miles to the project site, an area of degraded marsh and shallow open water, through a pipeline to create 471 acres of new marsh. But as the river delivered new supplies of sediment, the same infrastructure of dredges, pipelines, and booster pumps could be reused for more restoration in the area. Additional projects using multiple funding sources were “piggybacked” onto the Bayou Dupont project, saving millions of dollars. The “Mississippi River Long-Distance Sediment Pipeline” now stretches a dozen miles, nearly to the town of Lafitte, and is helping to create well over 1,000 new acres of marsh.



“In order to realize the beauty of humanity, we must realize our relation to nature.”

—Walter Anderson

Project Partners: CWPPRA, Coastal Impact Assistance Program (CIAP), NOAA, EPA, CPRA, NRCS, Jefferson, Lafourche, and Plaquemines Parish Governments

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Bayou Dupont Pre-Project



Bayou Dupont Post-Project

The initial phases of the Bayou Dupont project created 471 acres of new land in less than two years.

Types of Diversions

Siphons are pipes that function like large straws, drawing small amounts of water out of the river, over the levee, and into the wetlands.

Freshwater and sediment diversions are gated structures built into the levee to control large flows of water into the wetlands. Freshwater diversions are designed to manage salinity in the estuary by pushing back against saltwater intrusion. Sediment diversions are designed to carry as much sediment as possible with the river water to sustain marshes and build new land.

An uncontrolled diversion is a cut in the levee with no gate to control flow. The river's stage determines the diversion's flow. These can be used in areas where flooding of communities is not a concern.

river diversions

Helping to Replace a Lost Natural Process

Over the last 7,000 years, the Mississippi River used sediment transported from its vast North American watershed to build over four million acres of new land in southern Louisiana. Our delta was built by several different but complementary processes. Overbank flooding due to springtime snowmelt allowed sediment to escape the banks and nourish surrounding wetlands. Crevasses occurred when a high river burst through a spot in its natural levee, creating a new delta splay. The river also changed course at least seven times in 7,000 years, laying new deltas on top of old abandoned ones, and building the coastline we see today. River levees built in the 20th century have changed these natural processes. While the levees protect us from flooding, they also stop the river's ability to build new land. The river's sediment now bypasses the wetlands on its way to the gulf, resulting in land loss. Diversions attempt to reconnect the river to the wetlands by "poking holes" in the levee to reintroduce freshwater, nutrients, and sediment.

Planning future large scale sediment diversions is a delicate balancing act. Too much freshwater can increase flood risks or impact fisheries. But the right amount in the right places may provide the coast with some degree of long term sustainability not usually realized with other restoration techniques.

"Mini" Diversions

Stormwater runoff and treated wastewater can be redirected into wetlands as small freshwater diversions. Nutrients in the water help to reinvigorate plants, while the wetlands help to remove pollutants.

Siphon pipes



Box culvert control gates



Uncontrolled diversion



West Bay

Plaquemines Parish



Dredge cutterhead



Pipeline Sediment Delivery and River Diversions Working Together

The west bank of the Mississippi River in lower Plaquemines Parish has some of the highest land loss rates in the state. Thousands of acres of marsh have converted to shallow open water in recent decades. But the geography around West Bay offered planners a unique opportunity. Since the area lies downstream of Venice, the southernmost town, flood risks to communities would not be an issue. There would be no need for expensive control gates. And because the area is past the end of the highway and the federal river levee, constructing the diversion channel would be relatively easy. A dredge could simply cut a gap in the remaining sliver of natural levee separating the river from West Bay.

The plan for an uncontrolled sediment diversion at West Bay was approved in 1992, and as the dredge dug the channel, the excavated material was used to create marsh in the outfall area. As more dredging has taken place near the diversion, the sediment has occasionally been used to create more marsh islands in the bay. The diversion nourishes the marsh, and in turn the new land slows the flow of water, allowing more sediment to accumulate.



Dredging the West Bay diversion channel



©Map Data: Google, Digital Globe

Diversion channel and constructed islands

Project Partners: CWPPRA, USACE, CPRA, Plaquemines Parish Government



©Map Data: Google, Digital Globe



Developed Ridges

ridge restoration



Reconstructing Vital Habitats

Our delta's ridges formed as the annual flooding of rivers and their distributary streams deposited coarse sediments closest to their banks. Over time these natural levees rose higher than the surrounding wetlands. These elevated "fingers" of land are the only high ground on an otherwise flood-prone landscape. Their height over the marsh allows for the growth of trees, which provide forage and cover for resident animals and critical stopover habitat for birds migrating across the Gulf. Forested ridges also form windbreaks, acting as speed bumps for approaching storm surges. Ridges are where we have placed our agriculture, infrastructure, communities, and industries for generations. But like the wetlands around them, ridges are subsiding and disappearing at an alarming rate.

Restoring ridges is a lot like restoring marshes, except that the sediment is piled up into tall, linear features rather than spread out. The "crown" of the ridge is then planted with native woody tree species selected for their hardiness and habitat value. A marsh "apron" is constructed alongside the ridge to protect it and to provide additional wetland habitat.



8 The city of Houma, Louisiana, sits at the confluence of several bayous that built distributary ridges over the centuries before human occupation. Visible in this satellite image are the farms, homes, roads, and businesses along the ridges of Bayous Black, Terrebonne, Blue, Dularge, Petit and Grand Caillou, Pointe aux Chenes, and Lafourche. Forested ridges are also known as "cheniers" – a French term meaning "place of oaks."



Fourchon Maritime Ridge

BTNEP and the Greater Lafourche Port Commission

Ridge Restoration in Action

When wetlands are impacted by development, landowners are required to mitigate the damage by restoring wetlands elsewhere. And when the burgeoning offshore oil and gas industry necessitated expansion of the facilities at Port Fourchon, the Barataria-Terrebonne National Estuary Program and the Greater Lafourche Port Commission had a restoration opportunity. Huge new slips were dredged in wetlands to accommodate the expanding port, and the mitigation took the form of newly created marsh surrounding a restored ridge just north of the port using the dredged material from the port expansion. Many other agencies and organizations joined the partnership to develop an ongoing program of pipeline sediment delivery, marsh creation, revegetation, and soil research around the Fourchon Maritime Ridge project.



To date, the program has created over a thousand acres of new marsh plus a ridge six feet high and a mile long. The slopes and fringes along the ridge have been planted with native grasses and other marsh plants, and the crown of the ridge has been planted with native trees selected to provide quality habitat for migratory birds.

Project Partners: BTNEP, Greater Lafourche Port Commission, EPA Gulf of Mexico Program, Gulf of Mexico Foundation, LDNR, NOAA, Shell Oil Company, NRCS Plant Materials Center

Fourchon Ridge Revegetation

Trees and shrubs planted: Live Oak, Red Mulberry, Hackberry, Hercules' Club, Persimmon, Roughleaf Dogwood, Wax Myrtle, Yaupon, Honey Locust, American Beautyberry, Salt Matrimony Vine

Grasses Planted: Coastal Dropseed, Bitter Panicum, Seashore Paspalum, Saltgrass, Marshhay Cordgrass, Smooth Cordgrass



2004



2008



2013



©Map Data: Google, Digital Globe

This time series begins with a large area of shallow open water and degraded marsh. Restoration of the ridge and 1,000 acres of adjacent marsh soon follows. Also note the expansion of the port's slips that provided the sediment for restoration.

hydrologic restoration

Returning Water Flow to a More Natural State

The goal of hydrologic restoration is to return the flow or retention of water in our wetlands to their condition before the introduction of levees, canals, roadways, and other impediments to healthy flow regimes. Depending on the situation, this might mean increasing water movement, decreasing it, or blocking it altogether. Ultimately, the goal is to allow wetlands to use freshwater, sediment, nutrients, or tides more effectively to benefit vegetation, wildlife and fisheries.

Hydrologic restoration can include the following:

weir: *a submerged dam designed to change the level of water in a stream or divert its flow*

plug: *a barrier built to close off a canal or channel*

gap: *creating a new connection between two waterbodies*

culvert: *a tunnel-like drain that can direct water under roads and other structures*

Though not dealing directly with the flow of water, terracing and shoreline stabilization are two restoration techniques also commonly used.

terracing: *the molding of water bottom sediment into marsh ridges. These features increase marsh edge habitat for fish and wildlife, and reduce erosion by decreasing wave fetch which further promotes sediment deposition.*

shoreline stabilization: *the use of man-made structures or sediment to protect stream banks or shorelines from erosion. Man-made structures include breakwaters, revetments, bulkheads, and sea walls. Degraded shorelines or stream banks can also be renourished with sediment.*

Below from Left:
Marsh terraces, a rock plug,
shoreline protection, and box
culverts under construction.



GIWW to Clovelly

Hydrologic Restoration | Lafourche Parish

Hydrologic Restoration in Action

In Lafourche Parish, south of the Gulf Intracoastal Waterway (GIWW) and near the Clovelly Canal, there are 15,000 acres of wetlands that are critically important to the Barataria estuary and its communities. Predominantly intermediate and fresh marsh, this area was experiencing substantial land loss due to saltwater intrusion, shoreline erosion, and the adverse effects of navigation channels.

A Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) project to improve the hydrology of the area and stop the loss of wetlands was constructed in 1998-2000. This was CWPPRA's first hydrologic restoration project of many to follow. The project used a combination of hydrologic restoration and shoreline protection features:

- three rock weirs
- five canal plugs
- one culvert with flap gate
- reestablishment of 11,000 feet of canal and lake shoreline
- maintenance of canal banks

These techniques have reduced salinity and improved water flow to a more natural state. The project is estimated to produce 175 net acres over its 20-year life.

Project Partners: CWPPRA, CPRA, NRCS, USGS





barrier islands

Saving the Islands That Help Save Our Wetlands

Barrier Islands, together with headlands and barrier shoreline, form the thin perimeter that separates Louisiana's coastal wetlands from the Gulf of Mexico. Often called the "first line of defense" against hurricanes, these small islands bear the brunt of approaching storms and protect wetlands and coastal communities by reducing wind and waves. The islands are composed mainly of sand beaches, but may also contain dunes or marshes, all critical habitat for fish, shellfish, and birds. They are especially important to migratory birds. These islands are often the first land they see after their exhausting trip northward over the gulf in spring, and the last place to fatten up before departing in fall. Some islands were once heavily forested with trees similar to chenier ridge habitat. But, except for Grand Isle, forests have almost completely disappeared from Louisiana's barrier islands as they have subsided, shrunk, and been exposed to storms. If left alone, most of our barrier islands would disappear within 50 years.

But there is now a great effort underway to restore and protect our islands and shorelines. Much of our coastal perimeter has already been rebuilt using sediment dredged from the Mississippi River bottom and offshore shoals. Once the sediment is in place, workers erect sand fences to catch wind-blown sand, and plant native grasses to hold the soil and create new valuable habitat.



Timbalier Island

Dune and Marsh Restoration | Terrebonne Parish

Barrier Island Restoration in Action

Timbalier Island lies in a string of barrier islands that separate the Gulf of Mexico from Terrebonne Bay. Long and narrow, the 1,000 acre island has experienced severe erosion from currents, tides, storms, and sea level rise.



CWPPRA initiated a barrier island restoration project on Timbalier in 2003 that used offshore sediment to restore the island's beach, to rebuild and reshape its dunes, and to create new marsh on the bay side. Sediment was dredged from the gulf and pumped nearly three miles by pipeline to the island, where it was placed mostly on the eastern end. Over time, it is anticipated that currents will transport much of this new material from east to west along Timbalier Island's beachfront, increasing the island's longevity.

Over four miles of sand fencing was erected to capture wind-blown sediment and heighten the dune. Hundreds of thousands of plants were placed in the ground, representing eight different species, to further stabilize the island and enhance this critical habitat for shorebirds and other wildlife.

Project Partners: CWPPRA, EPA, CPRA, Terrebonne Parish Consolidated Government



©Map Data: Google, Digital Globe



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who is doing the restoration?

Many organizations participate in coastal restoration. These include environmental and community non-profits, volunteer groups, business and industry, academia, government agencies on the federal, state, and local levels, and multiple coalitions of all of these.



Overseeing all of this collaborative work is Louisiana's Coastal Protection and Restoration Authority. Established after Hurricane Katrina, the CPRA is the single state entity with oversight of project planning across Louisiana's coast, as well as the allocation of funding sources. The CPRA also develops the state's Master Plan for restoration and hurricane protection, which is updated every five years. The current version is a 50-year, \$50 billion plan to restore and protect the coast and its people.



The Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) is federal legislation enacted in 1990 to provide annual federal funding for restoration. Made up of a Task Force chaired by the US Army Corps of Engineers and composed of five federal agencies and the governor's office, CWPPRA is responsible for the majority of the restoration that has taken place. As of 2015, CWPPRA funding has resulted in 149 active projects that have restored and protected nearly 100,000 acres of Louisiana's coast.

"In every walk with nature one receives far more than he thinks."

—John Muir



These federal agencies and the State work with coastal Parishes, local governments, and other organizations to implement restoration projects.

taking the lead what you can do to help

For decades, human activity has had a devastating impact on our coast. We are now beginning to undo some of the damage. Some land loss and sea level rise will inevitably continue, but with awareness of the issues, a strong sense of stewardship, and a commitment to cooperation from all stakeholders, we can turn the tide. This turning point involves you.

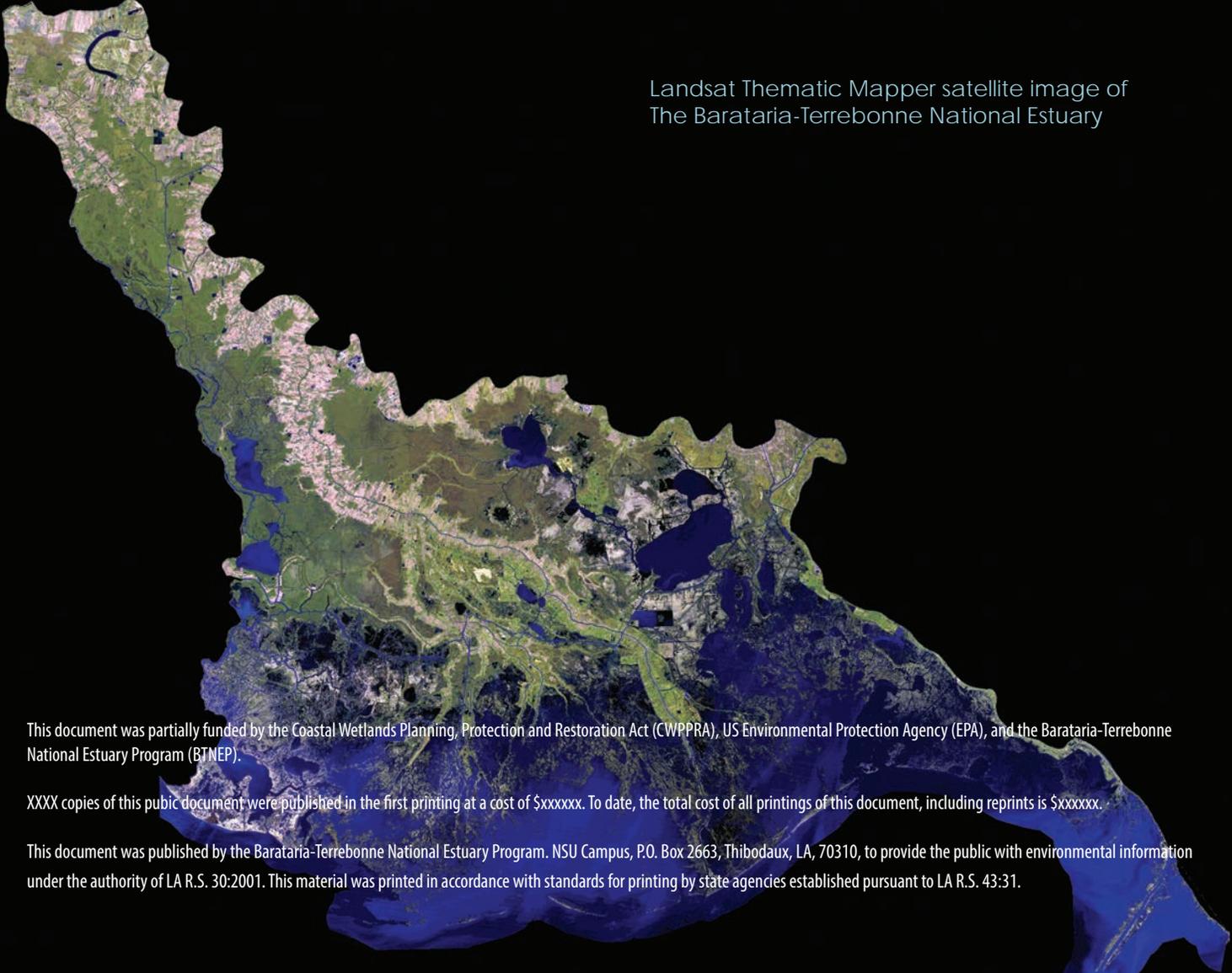
Here are some ways you can take action:

- Continue to learn about coastal restoration by digging deeper into media stories or visiting the websites of the organizations involved
- Share what you have learned with your family, friends, and colleagues
- Attend public meetings of BTNEP, CPRA, the US Army Corps of Engineers, CWPPRA, or other groups making restoration decisions
- Contact your representatives in Washington DC, Baton Rouge, your parish, or your town to let them know how you feel about restoration issues
- Volunteer

Volunteers make the difference

The Fourchon Maritime Ridge is a good example of the importance of volunteers in coastal restoration. Since 2005, BTNEP volunteers from around the nation have helped plant more than 82,000 native trees, shrubs, and grasses on the ridge and in the surrounding marsh. Volunteers can also help clear beaches and waterways of debris, help control invasive species, assist with workshops and events, and do many other things while having fun and learning about restoring and protecting our valuable wetlands.





Landsat Thematic Mapper satellite image of
The Barataria-Terrebonne National Estuary

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