Region 3 Background

Region 3 (see figure 3.1, page 9) is bounded by Bayou Lafourche to the east and Freshwater Bayou to the west and is made up of three hydrologic basins created as the Mississippi River shifted course over time. The Terrebonne basin originated from the LaFourche delta, which developed 3,500 years ago and was abandoned in the early 1900's. The Teche/Vermilion basin was created by the Teche delta lobe, which was an active distributary from 6,000 to 350 years ago. The third is the Atchafalaya basin, which is a modern distributary of the Mississippi River that has been actively creating a new delta lobe in Atchafalaya Bay for the last 50 years (Frazier 1967).

Currently, Region 3 contains approximately 1,078,800 acres of wetlands (figure 5.6). Between 1932 and 1990, Region 3 lost 247,650 acres of wetlands, a rate of 4,270 acres per year (LCWCRTF and WCRA 1998). Altered hydrology, subsidence, and shoreline erosion have been identified as major causes of wetland loss in Region 3. Louisiana's most rapidly deteriorating barrier islands are along the southern boundary of Region 3. The islands and smaller shoals have protective value for modern wetlands and human communities but have been damaged from tropical storms and hurricanes, sea-level rise, and human alterations. Over the last century, shoreline retreat rates have exceeded 20 m/yr, on average, and barrier island mass has decreased by between 40 and 75 percent (Stone et al. 1997). This condition has led to the rapid disintegration of the barrier islands, as well as a decrease in the ability of the islands to help protect the adjacent mainland marshes from the effects of storm surge, and energetic storm waves (McBride and Byrnes 1997). Without the first line of defense that the barrier islands provide, productive estuarine environments will be rapidly transformed into open marine environments and coastal infrastructure will become increasingly more vulnerable to storms (refer to Section 2). Additionally, barrier islands and adjacent shoals provide important habitat for many fish and bird species—most notably Louisiana's state bird, the brown pelican, and many Neotropical migrant species (Leberg 1996). Projects designed to improve or create nesting bird habitat rely on scientific studies such as Mendoza and Ortiz (1985) and Helmers (1992) to identify specific habitat requirements. Region 3 also contains unique floating marshes, some of the most critically degraded wetlands in Louisiana in recent years. Floating marshes serve as habitat for numerous waterfowl and aquatic organisms. Subsidence rates in Region 3 are currently between 1 and 2 feet per century.

The most important natural hydrologic influences in Region 3 are the Atchafalaya River, Bayou LaFourche, and long-shore currents from the modern Mississippi delta. Each of these has either now or in the past provided the sediments, nutrients, and freshwater flow necessary for wetland health. Alterations to this natural hydrology include major navigation channels, such as the Houma Navigation Canal (HNC), the Gulf Intracoastal Waterway (GIWW), the Wax Lake Outlet, and the channelization of Freshwater Bayou (FWB; McBride and McIlhenny 1959). Although the HNC, FWB, and GIWW have had some detrimental effects on coastal wetlands, causing saltwater intrusion, increased water exchange, and boat-wake induced shoreline erosion, the Wax Lake Outlet (constructed by the USACE) is effectively a distributary of the Mississippi River and has allowed the creation of new delta lobes where it enters Atchafalaya Bay. This area was once open water, and it now provides valuable deltaic habitat for fish and wetland wildlife. The GIWW has provided value in beneficially distributing Atchafalaya River water laterally across the region.

Many different types of restoration projects have been employed in Region 3, but the predominant active project types are hydrologic restoration (26%) and shoreline protection (19%). These projects address the most critical losses resulting from human intervention, dredging canals for navigation and access to interior wetlands, and isolating areas from the benefits of the rivers. Other project types include vegetation planting, beneficial use of dredged material, sediment and nutrient trapping, barrier island restoration, marsh creation, freshwater diversion projects, and marsh management projects. The barrier island projects are some of the most expensive projects to construct, but the maintenance of these dwindling islands is critical to the protection of the interior bays, wetlands, oil and gas infrastructure, and coastal communities, especially during tropical storms and hurricanes. There are 18 completed projects, nine projects in progress, and four deauthorized projects under the first eight Breaux Act priority project lists (figure 5.7, table 5.5).

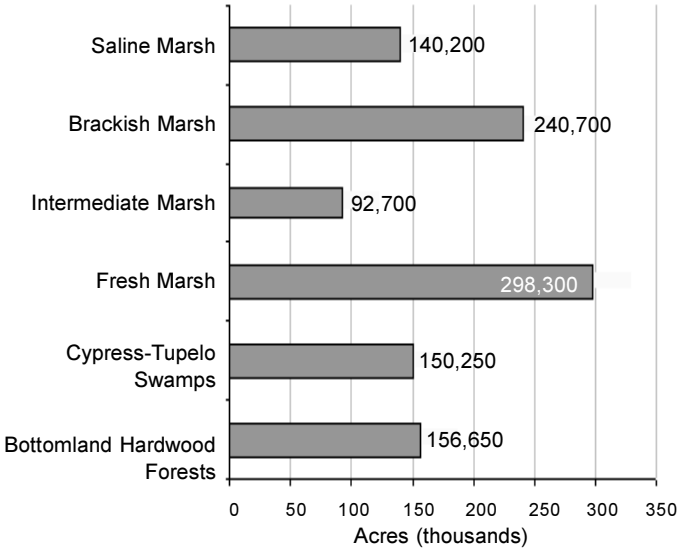


Figure 5.6 *Number of acres representing different wetland types in Region 3.*

Breaux Act Projects in Region 3

Thirty-one Breaux Act projects have been authorized from Priority Project Lists 1-8 in Region 3 (Table 5.5; Figure 5.7). These projects were authorized prior to the promulgation of the Regional Ecosystem Strategies of the Coast 2050 Plan and address critical problems identified in the 1993 Restoration Plan (LCWCRTF 1993).

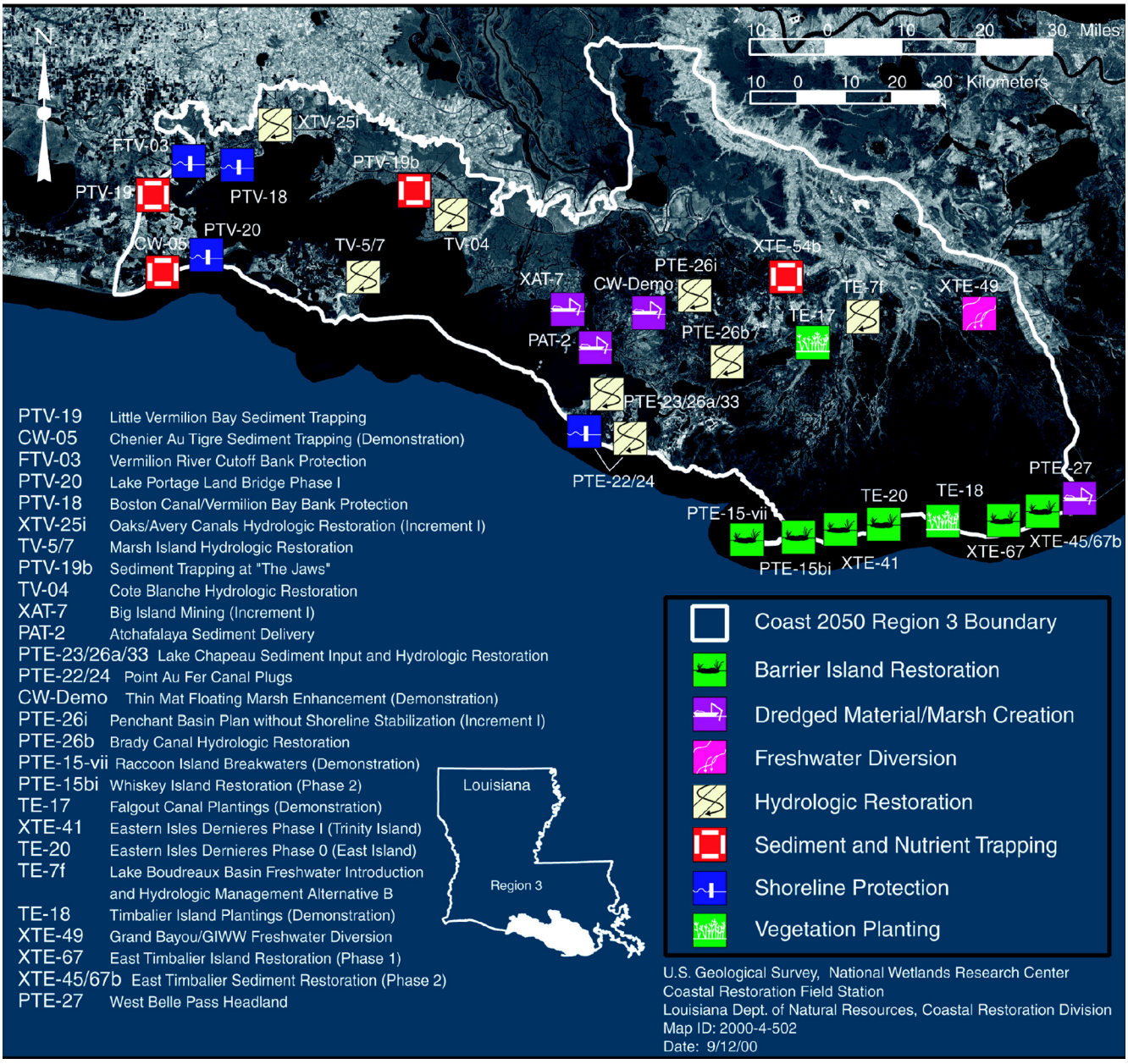


Figure 5.7 *Location of Breaux Act projects authorized on priority project lists 1-8 in Region 3.*

Table 5.5. Projects authorized on Breaux Act priority project lists 1-8 in Region 3.

	Project Name	Activities[a] Engineering	Landrights	Construction	Monitoring	Operations & Maintenance	Priority List	Agency[b]	Project Type[c]	Year Completed	Anticipated Acres Created/ Restored and Protected[d]	Current Estimated Cost (20 yr)
Completed Projects	Boston Canal/Vermilion Bay Bank Protection (PTV-18)	C	C	C	I	I	2	NRCS	SP	1995	378	$ 1,008,710
	■ Discussed on page 51.											
	Vermilion River Cutoff Bank Protection (FTV-03)	C	C	C	I	I	1	USACE	SP	1996	65	$ 2,046,940
	■ Discussed on page 52.											
	Timbalier Island Plantings (Demonstration) (TE-18)	C	C	C	I	NA	1	NRCS	VP	1996	NA	$ 432,858
	■ Discussed on page 53.											
	Pointe Au Fer Canal Plugs (PTE-22/24)	C	C	C	I	I	2	NMFS	SP/ HR	1997	375	$ 2,909,663
	■ Discussed on page 54.											
	Falgout Canal Plantings (Demonstration) (TE-17)	C	C	C	I	NA	1	NRCS	VP	1997	NA	$ 204,979
	■ Discussed on page 55.											
	Raccoon Island Breakwaters (Demonstration) (PTE-15-vii)	C	C	C	I	I	5	NRCS	BI	1997	NA	$ 2,049,633
	■ Discussed on page 56.											
	Atchafalaya Sediment Delivery (PAT-2)	C	C	C	I	NI	2	NMFS	SD/ DM/MC	1998	2,232	$ 2,559,023
	■ This project was authorized to enhance natural delta growth, which has been reduced as a result of maintenance dredging of the Atchafalaya River navigation channel, by reopening Natal Channel and Radcliff Pass and restoring fresh water and sediment delivery to the East Delta lobe of the Atchafalaya River Delta. The channels were cut to 90 ft wide, 6 ft deep, and 6,300 ft long, and construction was completed on March 27, 1998. Dredged material was pumped onto the adjacent marsh and shallow mudflats to increase marsh elevation and create new marsh. Baseline data have been collected as part of ongoing project monitoring. See photo on page 58.											
	Big Island Mining (Increment 1) (XAT-7)	C	C	C	I	NI	2	NMFS	SD/ DM/MC	1998	1,560	$ 7,550,903
	■ This project was authorized to enhance natural deltaic growth which had become hampered as a result of maintenance dredging of the Atchafalaya River navigation channel by restoring fresh water and sediment delivery processes to the northwestern portion of the Atchafalaya delta. Approximately 24,000 linear ft of distributary channels were completed in September 1998, extending from the Atchafalaya River into the shallow waters west of Big Island. Dredged material was placed in a pattern to mimic natural delta lobes and to create conditions conducive to trapping of riverine sediments and deltaic expansion. Baseline data have been collected as part of ongoing project monitoring. See photo on page 58.											
	Cote Blanche Hydrologic Restoration (TV-04)	C	C	C	I	I	3	NRCS	HR	1999	2,223	$ 6,109,005
	■ Discussed on page 57.											
	Lake Chapeau Sediment Input and Hydrologic Restoration (PTE-23/26a/33)	C	C	C	I	I	3	NMFS	HR/ MC	1999	509	$ 5,644,322
	■ This project was authorized to (1) restore interior marsh hydrology and (2) protect localized regions of Point Au Fer Island from imminent loss. The project components include the reestablishment of a hydrologic separation of the island's two major watersheds utilizing dredged material from Atchafalaya Bay and the restoration of the island hydrology by plugging oil field access canals and gapping artificial spoil banks to restore natural hydrologic pathways (i.e., improve marsh sheetflow and flow through natural bayous). Construction was completed in August 1999, and baseline monitoring data have been collected. See photo on page 58.											
	West Belle Pass Headland (PTE-27)	C	C	I	I	I	2	USACE	DM/ SP	2000*	474	$ 6,751,441
	■ This project utilized dredged material from maintenance dredging of Bayou Lafourche, installed several water control devices and armored approximately 17,000 ft of shoreline to protect a deteriorated wetland area adjacent to Belle Pass and Bayou Lafourche to address site-specific wetland loss. The project utilized approximately 1,400,000 yd^3 of dredged material from Bayou Lafourche to rebuild approximately 184 acres of wetland on the west side of Belle Pass. Dredging was completed in June 1998; however, complications during construction have delayed final completion of project. Monitoring has been initiated. See photo on page 58.											

(continued)

Table 5.5. Continued.

	Project Name	Activities[a] Engineering	Landrights	Construction	Monitoring	Operations & Maintenance	Priority List	Agency[b]	Project Type[c]	Year Completed	Anticipated Acres Created/ Restored and Protected[d]	Current Estimated Cost (20 yr)
Completed Projects	Eastern Isles Dernieres Phase 0 (East Island) (TE-20)	C	C	C	I	I	1	USEPA	BI	1999	9	$ 8,745,210
	■ This project was authorized to rebuild and extend the life expectancy of East Island, a barrier island in the Isles Dernieres chain, in Terrebonne Parish. Approximately 3,925,000 yd^3 of sand were dredged from adjacent waters and were used to build a retaining dune which was then hydraulically filled to create an elevated marsh platform sloping from the dunes to +4.0 ft at the bay side of the island. Sand fences and vegetation were also installed to stabilize the sand and minimize wind-driven transport. Construction was completed in July 1999 and monitoring has been initiated. See photo on page 58.											
	Eastern Isles Dernieres Phase I (Trinity Island) (XTE-41)	C	C	C	I	I	2	USEPA	BI	1999	109	$ 10,785,706
	■ This project was authorized to rebuild and extend the life expectancy of Trinity Island, a barrier island in the Isles Dernieres chain, expected to be lost by the year 2007 without restoration. Approximately 4,850,000 yd^3 of sand were dredged from adjacent waters and were used to build a retaining dune which was then hydraulically filled to create an elevated marsh platform sloping from the dunes to +4.0 ft at the bay side of the island. Sand fences and vegetation were also installed to stabilize the sand and minimize wind-driven transport. Construction was completed in July 1999 and monitoring has been initiated. See photo on page 58.											
	Whiskey Island Restoration (Phase II) (PTE-15bi)	C	C	C	I	I	3	USEPA	BI	1999	1,239	$ 7,721,186
	■ This project was authorized to rebuild and extend the life expectancy of Whiskey Island, a barrier island in the Isles Dernieres chain, expected to be lost by the year 2007 without restoration. Approximately 2,852,875 yd^3 of sand were dredged from adjacent waters and were used to build a retaining dune which was then hydraulically filled to create an elevated marsh platform sloping from the dunes to +4.0 ft at the bay side of the island. Sand fences and vegetation were also installed to stabilize the sand and minimize wind-driven transport. Construction was completed in July 1999 and monitoring has been initiated. See photo on page 58.											
	Little Vermilion Bay Sediment Trapping (PTV-19)	C	C	C	I	I	5	NMFS	SNT	1999	441	$ 1,460,196
	■ This project is designed to optimize the retention of sediments from the Atchafalaya River to create new marsh areas in Little Vermilion Bay. The project created earthen terraces to provide marsh habitat and protect adjacent wetlands from wave erosion. Construction was completed in August 1999 and monitoring has been initiated. See photo on page 58.											
	East Timbalier Island Restoration Phase I (XTE-67)	C	C	C	I	I	3	NMFS	BI	2000	1,913	$ 4,040,843
	■ The objective of the project is to increase the size and life expectancy of the island. This is the first of two projects approved to enhance East Timbalier Island. This phase involves the dredging of sand from submerged areas near the island and pumping that material to create dune and intertidal wetland habitats at three locations on the island which are extremely narrow and subject to storm overwash and breaching. Construction was complete in February 2000 and monitoring has been initiated. See photo on page 59.											
	East Timbalier Sediment Restoration Phase II (XTE-45/67b)	C	C	C	I	I	4	NMFS	BI	2000	215	$ 13,849,106
	■ This is the second of two projects approved to enhance and extend the life expectancy of East Timbalier Island. Dredged material was placed from the center of the island in approximately 6,000 ft eastward at a width of approximately 935 ft. Construction was complete in February 2000 and monitoring has been initiated. See photo on page 59.											
	Brady Canal Hydrologic Restoration (PTE-26b)	C	C	C	I	I	3	NRCS	HR	2000	297	$ 5,662,176
	■ The project will restore interior marsh hydrology by replacing outdated and ineffective water control structures, installing new controls on existing canals, and protecting the shoreline along Superior Canal, Jug Lake, and Bayou DeCade to enhance fresh water, sediment, and nutrient delivery to the project area from Bayou Penchant. Construction was completed in April 2000 and monitoring has been initiated. See photo on page 59.											

(continued)

Table 5.5. Continued.

	Project Name	Activities[a] Engineering	Landrights	Construction	Monitoring	Operations & Maintenance	Priority List	Agency[b]	Project Type[c]	Year Completed	Anticipated Acres Created/ Restored and Protected[d]	Current Estimated Cost (20 yr)
Projects in Progress	Chenier Au Tigre Sediment Trapping (Demonstration) (CW-05)	C	I	I	I	I	6	NRCS	SNT/ SP	2000*	NA	$ 500,000
	■ This demonstration project will field test the effectiveness of four devices designed to trap and retain sediment from gulf tides and potentially stabilize the existing shoreline on Chenier Au Tigre. Increased sediment accretion on the Gulf of Mexico side of the chenier is expected to act as an area of defense between the higher salinity seawater and the brackish marsh which lies immediately behind the chenier.											
	Thin Mat Floating Marsh Enhancement (Demonstration) (CW-DEMO)	C	I	I	I	I	7	NRCS	MC	2000*	NA	$ 542,570
	■ This demonstration project, in conjunction with the existing Breaux Act project (PTE-26i), will look at techniques to create and enhance thin floating mats of marsh, as well as the effects of water movement and sediments on these marshes. This project will induce development of thick, continually floating mats from a thin-mat floating marsh using plugs of wetland vegetation and fertilizers. Three of four project sites have been constructed. Construction has begun on the fourth site.											
	Marsh Island Hydrologic Restoration (TV-5/7)	C	I	I	I	NI	6	USACE	HR	2000*	408	$ 5,118,626
	■ The project was authorized to stabilize the northeastern shoreline of Marsh Island, including the northern shoreline of Lake Sand, to restore historical hydrology. The project consists of the construction of nine plugs in oil and gas canals at the northeast end of Marsh Island, the protection of the northeast shoreline of Marsh Island, and the isolation of Lake Sand from Vermilion Bay with dredged material. Construction is anticipated to be complete by December 2000.											
	Sediment Trapping at "The Jaws" (PTV-19b)	C	C	I	I	NI	6	NMFS	SNT	2000*	1,999	$ 3,392,135
	■ This project was authorized to reduce wave-induced shoreline erosion (currently 15 ft/yr) within the project area and promote the deposition of sediment by creating vegetated wetland terraces and reducing wave fetch. Distributary channels will be dredged to deliver water and sediment to the project area. Construction was initiated in July 2000.											
	Oaks/Avery Canals Hydrologic Restoration (Increment 1) (XTV-25i)	C	C	C	I	I	6	NRCS	HR	2000*	160	$ 2,373,597
	■ This project will address the shoreline erosion on the north side of Vermilion Bay (currently 7-12 ft/yr) and associated marsh loss resulting from altered hydrology. Project components include shoreline stabilization, several weirs and plugs, sediment fencing, and vegetation planting. Construction is anticipated to be complete in September 2000.											
	Lake Boudreaux Basin Freshwater Introduction and Hydrologic Management Alternative B (TE-7f)	C	I	I	NI	NI	6	USFWS	FD/ HR	2001*	619	$ 10,519,383
	■ The purpose of the project is to reduce saltwater intrusion and promote vegetative diversity by routing available fresh water from the north through the project area to the south. This project has a dredging component to facilitate freshwater distribution, as well as sluice gates under Hwy 57 and several outfall management structures to allow for drainage and reduce ponding of water.											
	Grand Bayou/GIWW Freshwater Diversion (XTE-49)	C	I	I	NI	NI	5	USFWS	FD	2002*	1,808	$ 10,303,446
	■ The objective of the project is to maintain emergent wetlands in this area by providing supplemental fresh water, nutrients, and some mineral sediments from the Atchafalaya River via the GIWW. Restriction of the Cut Off Canal will reduce saltwater intrusion and retain fresh water and the deepening of a portion of Bayou L'eau Bleu will provide for increased freshwater input. The USACE has developed a hydrologic model for this project to predict responses to the proposed hydrologic alterations.											
	Penchant Basin Plan without Shoreline Stabilization (Increment 1) (PTE-26i)	I	NI	NI	NI	NI	6	NRCS	HR	No Date	1,155	$ 14,103,051
	■ Hydrologic restoration of the Penchant Bayou Basin will include dredging and marsh creation, the construction of weirs and plugs, and maintenance to existing weir structures. This project will combine long-term realignment of Penchant basin hydrology with restoration and protection measures aimed at maintaining the physical integrity of the area during the transition toward greater riverine influence. Project engineering and design are anticipated to begin in November 2000.											
	Lake Portage Land Bridge Phase I (PTV-20)	C	I	C	NI	NI	8	NRCS/ USEPA	SP	2000*	24	$ 1,013,820
	■ The project was authorized to address localized wetland loss and imminent shoreline breaching of the Gulf of Mexico into Lake Portage. Project features include placement of a rock containment dike approximately 100 ft off the gulf shoreline and backfilling with dredged material from Lake Portage. A pipeline canal will also be backfilled from the gulf to Lake Portage. Construction is anticipated to be complete in November 2000.											

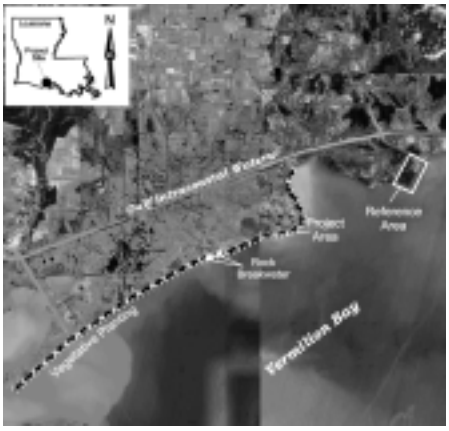
(continued)

Table 5.5. Concluded.

	Project Name	Activities[a] Engineering	Landrights	Construction	Monitoring	Operations & Maintenance	Priority List	Agency[b]	Project Type[c]	Year Completed	Anticipated Acres Created/ Restored and Protected[d]	Current Estimated Cost (20 yr)
Deauthorized Projects	Lower Bayou LaCache (TE-19)	I	I	NA	NA	NA	1	NMFS	MM	Deauthorized	NA	$ 99,625
	■ The project was officially deauthorized by the Breaux Act Task Force on February 28, 1996, because of problems with landrights and navigation.											
	Flotant Marsh Fencing (Demonstration) (XTE-54b)	I	I	NA	NA	NA	4	NRCS	SP	Deauthorized	NA	$ 540,240
	■ Deauthorized because restoration techniques originally suggested for this project were not feasible.											
	Bayou Boeuf Pump Station, Increment 1 (XTE-32i)	I	NI	NI	NA	NA	6	USEPA	HR	Deauthorized	NA	$ 3,452
	■ This project was intended to develop information and recommend project features for protection and restoration in the Verret Basin. A critical part of the effort was to be public scoping/involvement at a cost of $500,000. The federal sponsor, in concurrence with the state, requested that the project be deauthorized based on the belief that the project's objectives may be more appropriately achieved through the USACE Lower Atchafalaya Reevaluation Study and consistency reviews of flood control projects. The project was officially deauthorized by the Breaux Act Task Force on July 23, 1998.											
	Marsh Creation East of the Atchafalaya River Avoca Island (CW-5i)	I	NI	NI	NA	NA	6	USACE	MC	Deauthorized	NA	$ 66,159
	■ The project involved the beneficial use of dredged material from the Crew Boat Chute reach of the Atchafalaya River for marsh creation in the Avoca Island area. The project would have benefitted 434 acres at a cost of $6,438,400. However, the cost of the project was estimated to be considerably higher than originally planned, making it economically unjustifiable. The federal sponsor (USACE), in concurrence with the state, had requested that the project be deauthorized. The project was officially deauthorized on July 23, 1998.											

[a]Activities: Initiated (I); Completed (C); Not Initiated (NI); or Not Applicable (NA).
[b]Agency: U.S. Environmental Protection Agency (USEPA); National Marine Fisheries Service (NMFS); Natural Resources Conservation Service (NRCS); U.S. Army Corps of Engineers (USACE); and U.S. Fish and Wildlife Service (USFWS).
[c]Project Type: Beneficial Use of Dredged Material (DM); Hydrologic Restoration (HR); Marsh Creation (MC); Marsh Management (MM); Shoreline Protection (SP); Vegetation Planting (VP); Barrier Island (BI); Sediment/Nutrient Trapping (SNT); Freshwater Diversion (FD); Sediment Diversion (SD).
[d]Acres Created/ Restored and Protected: The net gain in emergent marsh as a result of project implementation as projected by the Environmental Work Group during the Wetland Value Assessment. This figure includes acres of emergent marsh to be protected, created, and restored as a result of project implementation estimated at the time the project was approved by the Breaux Act Task Force.
*: Anticipated construction date.

Boston Canal/Vermilion Bay Bank Protection (PTV-18)



PTV-18 project location.

Problem:

- Construction of the Gulf Intracoastal Waterway (GIWW), Boston Canal, and oil field canals has greatly increased tidal exchange between Vermilion Bay and the adjacent marshlands to the north. This condition combined with the effects of wave action from the bay and boat wake from traffic on the canal has contributed to significant shoreline erosion along the Vermilion Bay shoreline and along Boston Canal, particularly near its confluence with Vermilion Bay.

Proposed Solution:

- Rock revetments and sediment traps were constructed along the shoreline at the mouth of Boston Canal to promote sediment deposition and to protect the shoreline and adjacent wetlands from continued wave-induced erosion.
- Vegetation was planted along 14 mi of Vermilion Bay shoreline to stabilize sediments and decrease shoreline erosion rates.

Progress to Date:

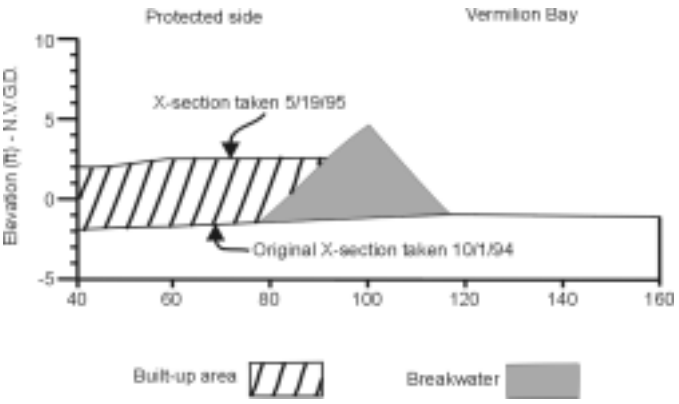
- Since construction of the rock revetment, as much as 4.5 ft of sediment has vertically accreted in the lee of the structures. The structures also appear to have increased vegetation cover resulting in 57.4 acres of land growth.
- The shoreline has been stabilized at the mouth of Boston Canal.
- The survivorship and percent cover of vegetation were more pronounced in areas where native vegetation did not exist. Survivorship and percent cover was least pronounced when smooth cordgrass (*Spartina alterniflora*) was planted in established stands of roseau cane (*Phragmites australis*). Overall survivorship of planted smooth cordgrass was over 90% after 12 months.

Challenges for the Future:

- Remove the sediment traps in the lee of the revetments to promote a more uniform distribution of sediment in the impoundment area.
- Avoid planting smooth cordgrass in established stands of roseau cane.
- Determine the effect of vegetative plantings on shoreline movement by analyzing pre- and post-construction aerial photography and GPS surveys.

Photo by LDNR

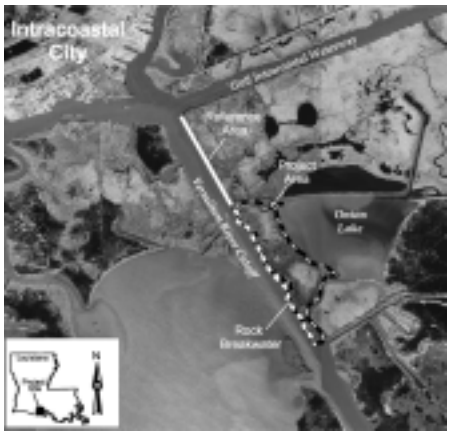
Accumulated sediment and natural vegetation have filled in the open water area behind the rock breakwaters at the mouth of Boston Canal.



Elevation profiles before (October 1, 1994) and after (May 19, 1995) construction of the Boston Canal project showing vertical accretion of up to 4 ft behind the rock breakwater.

This project summary was synthesized from the project's finalized Monitoring Plan (LDNR 1998f), the project's most recent Comprehensive Monitoring Report (Thibodeaux 1998), and unpublished data. More information about this project is available on the Internet at the CRD website, www.saveLAwetlands.org, and at the Breaux Act website at www.lacoast.gov.

Vermilion River Cutoff Bank Protection (FTV-03)



FTV-03 project location.

Problem:

- A large section of the west bank of the Vermilion River Cutoff (VRC) has eroded due to bayside shoreline erosion in Vermilion Bay and boat wake-induced shoreline erosion within the VRC. Historical shoreline erosion (1955-85) along the VRC bank is estimated at 23.3 ft/yr, and the shoreline has breached in several places. These breaches have exposed the eastern bank of the cutoff to wave energy that threatens to breach the land bridge between the cutoff and Onion Lake to the east.

Proposed Solution:

- The east bank of the VRC was stabilized by armoring the shoreline with a 6,520-ft rock breakwater to maintain the shoreline position and protect the integrity of several thousand acres of the Onion Lake wetland complex.

Progress to Date:

- Shoreline position data (collected by using GPS) indicate no change in shoreline position between 1995 and 1999. However, direct measurements in February 2000 indicate 1.95 ft and 5.45 ft of shoreline progradation at two of the five stations. There was no measurable change in shoreline position at the remaining three stations.

Challenges for the Future:

- Acquire more detailed information about habitat changes in the Onion Lake wetland from high-resolution, color-infrared aerial photography scheduled to be flown in 2002.
- Determine wetland gain/loss within the project area.


Photo by LDNR

Rock dike paralleling shoreline along the Vermilion River Cutoff.

Photo by LDNR

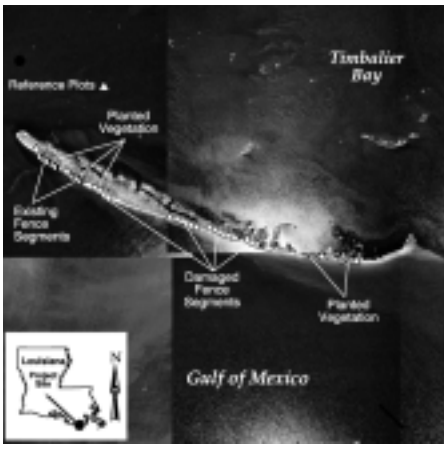
Rock dike placed parallel to the Vermilion River Cutoff shoreline.


Photo by LDNR

Sediment accumulated between the rock dike and the shoreline.

This project summary was synthesized from the project's finalized Monitoring Plan (LDNR 1998g), the project's most recent Comprehensive Monitoring Report (Thibodeaux 2000), and unpublished data. More information about this project is available on the Internet at the CRD website, www.saveLAwetlands.org, and at the Breaux Act website at www.lacoast.gov.

Timbalier Island Plantings (Demonstration)
(TE-18)



TE-18 project location.

Problem:

- Timbalier Island, like all of Louisiana's barrier islands, is narrowing and losing land as a result of the combined effects of global sea-level rise, subsidence, tropical and extra-tropical storm activity, inadequate sediment supply, and significant human-related disturbances.
- Island breaches and overwashes during storms have damaged vegetation and made Timbalier Island more vulnerable to erosional processes.

Proposed Solution:

- Vegetation suited to the salinity and habitat of the barrier island was planted and sand fencing was constructed along several overwash areas to decrease wind-induced erosion, increase emergent vegetation cover, increase elevations in the vicinity of the sand fencing, and demonstrate the effectiveness of these management approaches in mitigating barrier island erosion.
- Determine project effectiveness by monitoring elevation and vegetation.

Progress to Date:

- Sand fencing and planted vegetation created dunes at an average rate of 0.9 ft/yr during the first 2 years after construction. Reference area dunes were created at an average rate of 0.7 ft/yr. The performance and life-expectancy of sand fences is dependent on the frequency and magnitude of overwash events. By the end of 1998, nearly all of the fences and vegetation plots had been destroyed by wave damage.
- Bitter panicum (*Panicum amarum*) and marsh hay cordgrass (*Spartina patens*) had higher rates of survival in areas behind the dunes.

Challenges for the Future:

- Utilize existing data and data collected on final sampling scheduled for August 2001 to determine dune performance and response to chronic shoreline erosion.
- Utilize data from this project to maximize sand retention and vegetative cover to improve the design of future barrier island projects.

Photo by LDNR

Sand fences on Timbalier Island shortly after construction.

Photo by LDNR

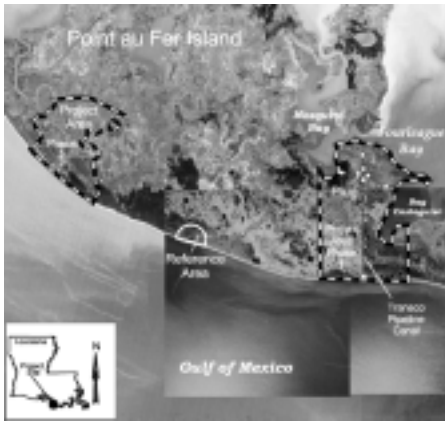
Vegetation plantings on Timbalier Island. Notice the formation of a 4-ft dune from accumulated sand.

Photo by LDNR

Storm damage to sand fences on Timbalier Island.

This project summary was synthesized from the project's finalized Monitoring Plan (LDNR 1998h), the project's most recent Monitoring Series Progress Report (Townson 2000), and unpublished data. More information about this project is available on the Internet at the CRD website, www.saveLAwetlands.org, and at the Breaux Act website at www.lacoast.gov.

Point Au Fer Canal Plugs (PTE-22/24)



PTE-22/24 project location.

Problem:

- Pipeline canals and access channels on Point Au Fer Island are conduits for saltwater infiltration to interior marshes during periods of low river flow, resulting in the break up of interior marshes. In addition, along areas of the gulf shoreline that abut oil field canals, breaches produced during storms can also provide a conduit for salt water to penetrate the island's interior marshes.

Proposed Solution:

- Plugs were installed at strategic locations to restore hydrologic circulation to conditions prior to construction of access and pipeline canals.
- The shoreline was armored along stretches vulnerable to breaching and overtopping during storms to reduce marsh loss and the potential for saltwater intrusion during storms and high tides.

Progress to Date:

- Shoreline erosion along the canals that were plugged has been reduced by more than 1 ft/yr relative to measured historical rates.
- Visual observation suggests that the shoreline revetment has halted shoreline erosion; however, data are not yet available.

Challenges for the Future:

- Determine the effectiveness of the plugs and structures on Point Au Fer Island land loss rates utilizing pre-construction and post-construction aerial photography.

Photo by LDNR

Canal plug to limit saltwater exchange in eastern project area.

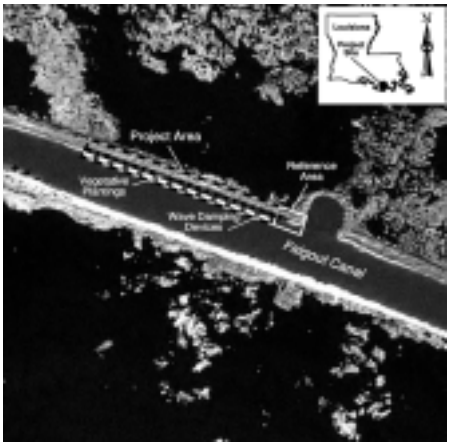
Breached shoreline before project construction.

Photos by LDNR

Armored shoreline separating interior wetlands (right) from the Gulf of Mexico (left).

This project summary was synthesized from the project's finalized Monitoring Plan (LDNR 1998i), the project's most recent Monitoring Series Progress Report (Fulger 1998), and unpublished data. More information about this project is available on the Internet at the CRD website, www.saveLAwetlands.org, and at the Breaux Act website at www.lacoast.gov.

Falgout Canal Plantings (Demonstration)
(TE-17)



TE-17 project location.

Problem:

- Construction of the Houma Navigation Canal in 1964 created a direct connection from the Falgout Canal to the Gulf of Mexico, increasing water level variability, salinity, and boat traffic in the interior canals and marshes.
- The levee bordering Falgout Canal has experienced erosion at a rate of approximately 3 ft/yr.

Proposed Solution:

- Smooth cordgrass (*Spartina alterniflora*) was planted along the northern bank of Falgout Canal to prevent the canal shoreline from breaching and exposing the interior marshes to boat wake.
- Six different types of wave damping structures were constructed along a stretch of the northern bank of Falgout Canal to provide protection to the vegetation plantings from boat wake. The relative effectiveness of these structures will be evaluated through monitoring.

Progress to Date:

- Plant survival decreased from 20% during the first year to approximately 11% during the second year after plants were installed.
- Shoreline erosion rates were lower during the year following plantings and increased during the second year.
- Shoreline erosion rates averaged 1.84 ft/yr during the 2-year monitoring period.

Challenges for the Future:

- Achieve better replication of structure types in future projects to determine relationships between vegetation planting performance and structure design.
- Potentially modify design of structures in future projects to improve wave dissipation.
- Plant alternative plant species along the canal banks, which may be a poor habitat for smooth cordgrass.

Photo by LDNR

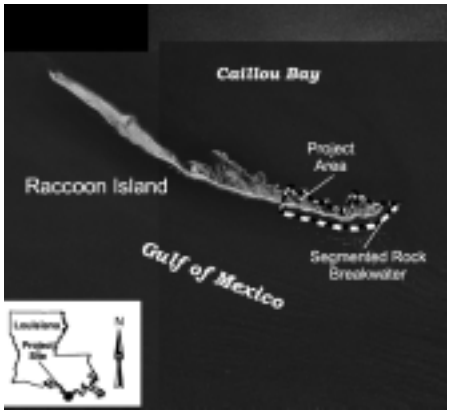
Experimental wave damping structures parallel to shoreline on Falgout Canal.

Photo by LDNR

Experimental wave damping structures perpendicular to shoreline on Falgout Canal.

This project summary was synthesized from the project's finalized Monitoring Plan (LDNR 1998j), the project's most recent Comprehensive Monitoring Report (Lee et al. 2000), and unpublished data. More information about this project is available on the Internet at the CRD website, www.saveLAwetlands.org, and at the Breaux Act website at www.lacoast.gov.

Raccoon Island Breakwaters (Demonstration)
(PTE-15-vii)



PTE-15-vii project location.

Problem:

- Raccoon Island, like all of Louisiana's barrier islands, is narrowing and losing land as a result of the combined effects of sea-level rise, subsidence, storm activity, inadequate sediment supply, and significant human-related disturbances.
- Raccoon Island provides critical nesting habitat for the endangered brown pelican as well as other bird species such as herons, egrets, and terns. Chronic shoreline erosion and land loss has resulted in a continual decline in suitable nesting habitat for several seabird species.

Proposed Solution:

- Eight detached, segmented breakwaters were constructed along the eastern end of the island to reduce the rate of shoreline retreat, promote sediment deposition along the beach, and protect seabird habitat.
- Project effectiveness will be determined by monitoring changes in the shoreline, wave energy, elevations along the beach, and surveys of the gulf floor between the shoreline and the breakwaters.

Photo by LDNR

Oblique aerial photograph of Raccoon Island and breakwaters, looking from east to west.

Progress to Date:

- Based on wave data collected through September 1998, the segmented breakwaters have significantly reduced wave energy landward of the structures and are providing protection to the adjacent shoreline.
- The breakwaters have reduced the long-term shoreline retreat rate of 36.4 ft/yr (McBride et al. 1991) along the western flank of the project by more than 10%, but shoreline retreat continues to be persistent along the eastern end of the project where the breakwaters were constructed in deeper water.
- From an engineering perspective, an unanticipated response has occurred along the western flank of the breakwater system, resulting in the deposition of more than 41,000 yd^3 of sediment. Deposition has occurred on both the gulf and shore sides of the breakwaters. An ebb-shoal complex, upon which the breakwaters were constructed, appears to be supplying sand to the breakwater system. It is hypothesized that this process will continue for as long as the source remains viable or until the breakwater compartments are filled.

Photo by LDNR

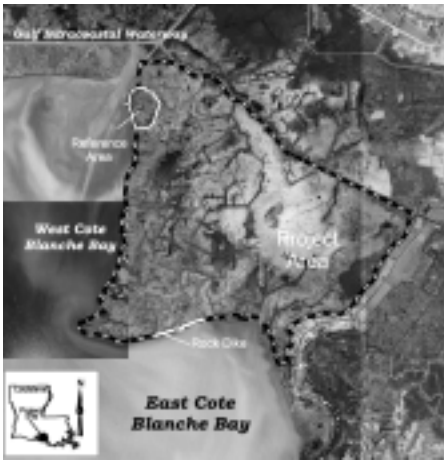
Sand deposition between breakwaters and Raccoon Island.

Challenges for the Future:

- Supplemental monitoring of wave-shoal interactions is needed to determine modes of sediment transport and potentially identify local sediment transport pathways.
- Higher resolution bathymetric surveys are needed to characterize seasonal elevation changes in the vicinity of the breakwaters.
- Scrutinize breakwater configuration and wave energy conditions along the eastern flank of the breakwater system to determine if modification is necessary.
- Determine potential down-draft impacts associated with the presence of the detached breakwater system.

This project summary was synthesized from the project's finalized Monitoring Plan (LDNR 1998k), the project's most recent Monitoring Series Progress Report (Armbruster 1999), and unpublished data. More information about this project is available on the Internet at the CRD website, www.saveLAwetlands.org, and at the Breaux Act website at www.lacoast.gov.

Cote Blanche Hydrologic Restoration (TV-04)



TV-04 project location.

Problem:

- Construction of several oilfield canals has changed the hydrologic regime of Cote Blanche marsh, resulting in increased tidal action and rapid water exchanges between the interior marsh and East and West Cote Blanche Bays. Rapid exchanges of water through canal systems has contributed to marsh deterioration and loss.

Proposed Solution:

- Low-level weirs were constructed across seven major water exchange avenues to reduce water exchange between Cote Blanche marshes and East and West Cote Blanche bays to prevent scouring and persistent erosion of the interior marsh.
- The shoreline was armored on the southern boundary between Humble and British canals to minimize wave-induced erosion.

Progress to Date:

- Water level variability has been significantly reduced within the project area compared to the reference area.
- The frequency of short-duration marsh flooding events has decreased since project construction, indicating that the project structures may decrease regular tidal exchange as designed; however, the frequency of long-duration flooding events (greater than 1 week) has also increased, indicating that drainage may be hindered.

Challenges for the Future:

- Determine project effects on land loss/gain rates and vegetation response to changes in hydrology utilizing pre- and post-construction aerial photography.
- Evaluate shoreline movement within the project area and reference area utilizing pre- and post-construction GPS data.

Photo by LDNR

Monitoring personnel establishing a data recorder to monitor water level and salinity in the interior marsh at Cote Blanche.

Photo by LDNR

Rocks armoring the southern shoreline of the Cote Blanche project area.

This project summary was synthesized from the project's finalized Monitoring Plan (LDNR 1998l), the project's most recent Monitoring Series Progress Report (Thibodeaux 2000b), and unpublished data. More information about this project is available on the Internet at the CRD website, www.saveLAwetlands.org, and at the Breaux Act website at www.lacoast.gov.

Region 3 Recently Constructed Projects

Photo by LDNR

Little Vermilion Bay Sediment Trapping (PTV-19) terraces.

Photo by LDNR

Whiskey Island Restoration (Phase 2) (PTE-15bi).

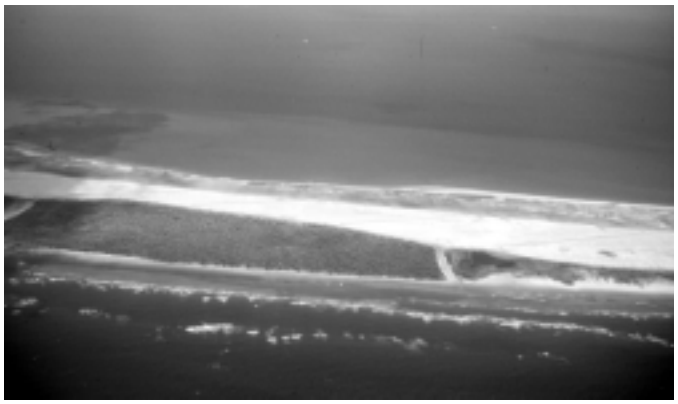


Photo by LDNR

Eastern Isles Dernieres Phase 0 (East Island) (TE-20).

Photo by LDNR

Atchafalaya Sediment Delivery (PAT-2).

Photo by LDNR

West Belle Pass Headland (PTE-27).

Photo by LDNR

Big Island Mining (Increment 1) (XAT-7).

Photo by LDNR

Lake Chapeau Sediment Input and Hydrologic Restoration (PTE-23/26a/33).

Photo by LDNR

Eastern Isles Dernieres Phase I (Trinity Island) (XTE-41).

Photo by LDNR

Area of East Timbalier Island filled by dredged material. Part of the East Timbalier Island Restoration Phase I project (XTE-67).

Photo by LDNR

Rock embankment at Brady Canal Hydrologic Restoration (PTE-26b).

Photo by LDNR

East Timbalier Sediment Restoration Phase II project (XTE-45/67b).

Progress in Region 3

The small wetland gains in Region 3 resulting from the Wax Lake and Atchafalaya deltas are greatly offset by losses from the effects of altered hydrology, saltwater intrusion, shoreline erosion, nutrient and sediment deficits, and subsidence. The Breaux Act projects in Region 3 have focused on slowing or stopping the destructive processes created by human intervention, as well as maximizing the land-building potential of the active Atchafalaya River delta.

Five of the 18 completed projects have restored most of the barrier islands in the Isle Dernieres and Timbalier island chains. These projects will provide the first line of defense to protect coastal communities, infrastructure, and interior wetlands from tropical storm and hurricane impacts. These islands will also provide valuable habitat for birds and protected waters for many fish species. Without these Breaux Act projects, many of the barrier islands were expected to disappear over the next decade.

Four of the 18 projects (22%) constructed to date in Region 3 utilize rock structures to address shoreline erosion. These shoreline protection projects utilizing rock have been very successful, helping to build nearly 60 acres of land at Boston Canal and stopping shoreline erosion at Point Au Fer and the Vermilion River Cutoff. Segmented breakwaters at Raccoon Island have reduced wave energy and shoreline retreat while accumulating 41,000 yd^3 of new sediment to protect a rookery of brown pelicans and other bird species. An additional two demonstration projects involve the planting of vegetation to absorb wave energy and strengthen sediments. Although the vegetation planting projects were of limited success, vegetation used alone or in conjunction with other shoreline protection techniques have provided valuable information regarding species to be planted, location of plants, and planting techniques that can be used when planning future projects. The demonstration of sand fencing at Timbalier Island was initially very successful in trapping sand and allowing planted grasses to grow and colonize, and also showed the fragile nature of narrow island beaches during strong storms.

Two of the projects constructed in Region 3 have been hydrologic restoration projects (five more are in development). Both of these projects were constructed in 1999. Cote Blanche Hydrologic Restoration (TV-04) has shown promise at reducing water level variability and rapid water exchange, but drainage of water may be hindered. Evaluation of monitoring data will determine if this is the case and whether adaptive management strategies are necessary.

In addition to protecting and preserving existing wetlands, Region 3 has the Atchafalaya River as an important resource for building new wetlands. The Atchafalaya Sediment Delivery (PAT-2) and Big Island Mining Increment 1 (XAT-7) projects (completed in 1998) created new delta lobes in Atchafalaya Bay utilizing material dredged from navigation and distributary channels. Baseline monitoring was conducted on these projects, and it is anticipated that the natural delta-building potential of the river will be enhanced by these projects.

In addition to lake, bay, and navigation channel shoreline protection, hydrologic restoration, and the enhancement of the Atchafalaya River flow to build new land, the long-term ecosystem management strategies developed through the Coast 2050 Plan recommend a sediment diversion from the Mississippi River via a conveyance channel, the creation of an artificial reef, and better control of navigation channels. Also important are the preservation and maintenance of the barrier islands. Restoration projects consistent with the Barrier Shoreline Feasibility Study have been constructed (or are under construction) on all of the Isles Dernieres and Timbalier islands. Additional projects are in various stages of development for Region 3, which will conform to the strategies outlined by the Coast 2050 Plan.

Region 4 Background

Region 4 (see figure 3.1, page 9) is the westernmost region in Louisiana. It extends from the western bank of Freshwater Bayou Canal westward to the Louisiana/Texas border and from the marsh areas just north of the GIWW south to the Gulf of Mexico. This area includes the Mermentau, Calcasieu, and Sabine rivers, and several large lakes such as Grand, White, and Calcasieu lakes, and the eastern half of Sabine Lake.

Region 4 encompasses the chenier plain of southwestern Louisiana. It is a complex system influenced primarily by three coastal plain rivers, the intermittent longshore mudstream from the Atchafalaya River, and the Gulf of Mexico. The land of the chenier plain was formed as sediments from the Mississippi River moved from east to west in a coastal mudstream. These fine-grain sediments formed mudflats which were colonized by marsh grass creating new wetlands adjacent to the gulf. When the delta lobes of the Mississippi River were farther westward, a steady supply of sediment created new wetlands and kept existing wetlands from eroding. Shells and coarser sediments were worked by gulf waves to form chenier ridges parallel to the shore during periods when the river occupied an easterly position. Though the Atchafalaya River still provides a limited amount of sediment, when the Mississippi River switched to a more easterly position, such as where it is today, the chenier plain became deprived of its main source of sediment and erosion resulted.

Currently, Region 4 contains approximately 768,210 acres of coastal wetlands (Figure 5.8). Between 1932 and 1990, Region 4 lost 226,000 acres of wetlands, an average of 3,897 acres per year (LCWCRTF and WCRA 1998). Wetland loss in Region 4 is caused by a combination of interrelated factors. For example, storm events, subsidence, and herbivory may contribute to marsh loss, but the leading causes of wetland loss in Region 4 are altered hydrology and shoreline erosion.

Navigation channels and canals dredged for oil and gas extraction have dramatically altered the hydrology of the coastal area. North-to-south channels, such as the Calcasieu Ship Channel, act as conduits bringing salt water into interior fresh marshes. It is documented that the Calcasieu Ship Channel has brought salt water as far north as Lake Charles (Gosselink et al. 1979). This influx of saline water can kill vegetation and result in the creation of exposed mudflats and eventual loss of wetlands. East-to-west canals, such as the GIWW, can alter natural hydrology by impeding sheet flow and ponding water on the marsh, which leads to accelerated rates of marsh loss.

Artificial spoil banks and levees, which also alter hydrology, have also caused wetland loss. Spoil banks are formed when dredged material is piled along the edges of a canal that is being dredged for navigation. Spoil banks help prevent canals and channels from widening and scouring the marsh, and they provide refuge and nesting habitat for bird species (Bettinger and Hamilton 1985), but they can also hinder water exchange in wetlands and trap salt water brought in by storms. Unless plants are especially flood tolerant, increased water levels over extended periods of time can result in plant death. Constructed levees keep high salinity water from entering interior freshwater marshes and prevent the export of organic material from the marsh, but they also prevent channels from overflowing their banks into surrounding wetlands. Although the chenier plain does not have major rivers such as the Mississippi or Atchafalaya, it does contain several smaller rivers with natural banks that allow occasional overflow where nutrients and sediment can enter the marsh. Wetlands need nutrients to maintain healthy plants, provide substrate for plants, build new marsh, and maintain marsh level.

Shoreline erosion exacerbates land loss from altered hydrology. Boat-wakes from vessels traveling on these dredged canals and channels erode the banks, causing the channel to widen. In several areas along the GIWW, the spoil banks have been eroded until the channel threatens to breach or actually does breach, thus exposing the fragile organic soil of surrounding wetlands to erosion. Erosion from wind-generated waves is also a problem, particularly along lake shorelines. In many instances, rims of firmer soil around lakes and bays have eroded away leaving highly organic marsh soils directly exposed to open water wave attack.

In Region 4, there were 22 Breaux Act projects authorized on the first eight priority project lists, and two were subsequently deauthorized. Five of the 11 projects (45%) constructed to date are hydrologic restoration or marsh management projects designed to manage hydrology. Another five of the constructed projects are shoreline protection projects along navigation channels to armor the shoreline and protect the interior wetlands. Of the nine projects not yet constructed in Region 4, five are either marsh management or hydrologic restoration and will also address these critical objectives for Region 4. These projects are itemized in figure 5.9 and table 5.6.

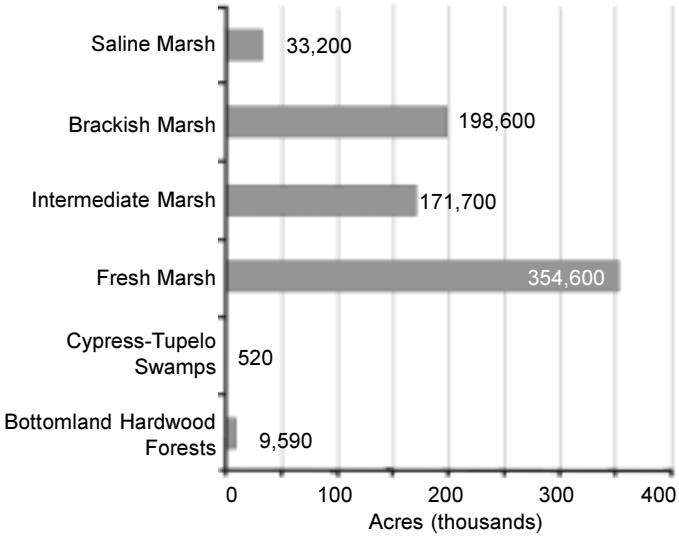


Figure 5.8 *Number of acres representing different wetland types in Region 4.*

The predominance of hydrologic and shoreline protection projects in this region reflect the magnitude of the problems caused by the dredging of canals. These projects will use control structures and other techniques to reduce erosion, improve hydrology, and increase vegetative cover within the project areas. These problems will also be addressed by the long-term strategies outlined in the Coast 2050 Plan to reach a sustainable state for these wetlands. The long-term Coast 2050 Regional Ecosystem Strategies include managing the interior watersheds to reduce rapid water level fluctuations, preventing the GIWW shoreline from eroding into adjacent wetland areas, stabilizing the shorelines of Grand and White lakes, and preventing increases in salinity resulting from existing navigation channels and possible future reduced freshwater availability in the Sabine River.

Breaux Act Projects in Region 4

Twenty two Breaux Act projects have been authorized from Priority Project Lists 1-8 in Region 4 (table 5.6; figure 5.9). These projects were authorized prior to the promulgation of the Regional Ecosystem Strategies of the Coast 2050 Plan and address critical problems identified in the 1993 Restoration Plan (LCWCRTF 1993).

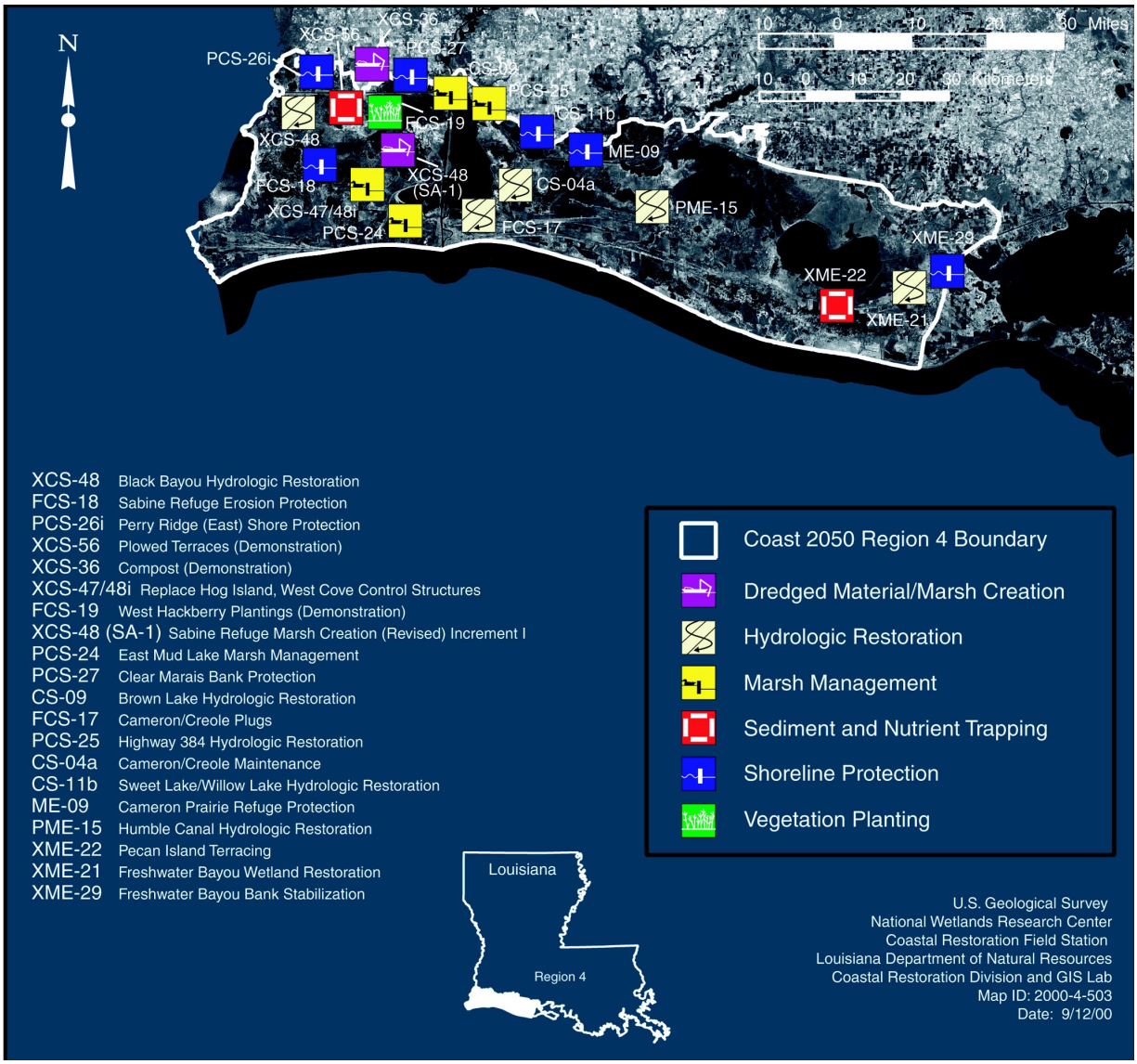


Figure 5.9 *Location of Breaux Act projects authorized on priority project lists 1-8 in Region 4.*

Table 5.6. Projects authorized on Breaux Act priority project lists 1-8 in Region 4.

	Project Name	Activities[a] Engineering	Landrights	Construction	Monitoring	Operations & Maintenance	Priority List	Agency[b]	Project Type[c]	Year Completed	Anticipated Acres Created/ Restored and Protected[d]	Current Estimated Cost (20 yr)
Completed Projects	Cameron/Creole Plugs (FCS-17)	C	C	C	I	I	1	USFWS	HR	1997	865	$ 1,022,686
	■ Discussed on page 66.											
	West Hackberry Plantings (FCS-19) (Demonstration)	C	C	C	I	I	1	NRCS	VP	1994	NA	$ 246,240
	■ Discussed on page 67.											
	Sabine Refuge Erosion Protection (FCS-18)	C	C	C	I	I	1	USFWS	SP	1995	5,542	$ 1,576,703
	■ Discussed on page 68.											
	Cameron Prairie Refuge Protection (ME-09)	C	C	C	I	I	1	USFWS	SP	1994	247	$ 1,401,125
	■ Discussed on page 69.											
	East Mud Lake Marsh Management (PCS-24)	C	C	C	I	I	2	NRCS	MM	1996	1,520	$ 3,348,967
	■ Discussed on page 70.											
	Freshwater Bayou Wetland Restoration (XME-21)	C	C	C	I	I	2	NRCS	HR/ SP	1998	1,593	$ 2,923,123
	■ Discussed on page 71.											
	Clear Marais Bank Protection (PCS-27)	C	C	C	I	I	2	USACE	SP	1997	1,067	$ 3,717,443
	■ The integrity of an existing water management levee between the GIWW and the project area was threatened by increased tidal action and boat wakes. In response, a 35,000 ft limestone breakwater was constructed to prevent continued erosion of the levee and to prevent encroachment of the GIWW into the project area which consists of hundreds of acres of highly organic freshwater marsh. Post-construction monitoring is underway. See photo on page 72.											
	Cameron-Creole Maintenance (CS-04a)	NI	I	C	NA	NI	3	NRCS	HR	1997	2,602	$ 3,799,365
	■ Cameron-Creole Maintenance includes maintenance provisions for 19 mi of levee and five structures. This project seeks to keep the levees and structures of the Cameron-Creole Watershed Management Project in good condition. The Cameron-Creole Watershed Management Project was constructed before the Breaux Act was authorized and was funded as a Louisiana state project under the auspices of an NRCS small watershed program (PL-566).											
	Perry Ridge (East) Shore Protection (PCS-26i)	C	C	C	I	I	4	NRCS	SP	1999	1,203	$ 2,664,613
	■ Marsh loss in the vicinity of Perry Ridge has been caused by water level fluctuations and tidal scour from the GIWW as the result of breaches in the northern spoil bank. As the GIWW has widened, it has acted as a conduit for salt water to enter the fragile surrounding marshes. To protect these marshes, a 12,000 linear ft rock dike was constructed along the banks of the GIWW. This dike serves to protect the existing emergent wetlands, prevent further deterioration from erosion, prevent the widening of the GIWW, and reduce salinity spikes in the project area by keeping a pool of fresh water behind the rocks. Post-construction monitoring is underway. See photo on page 72.											
	Freshwater Bayou Bank Stabilization (XME-29)	C	C	C	I	I	5	NRCS	SP	1998	511	$ 2,533,882
	■ The main cause of wetland loss in this project area is boat wake-induced erosion of the canal spoil banks and the fragile organic soils of the adjacent marsh along the west bank of Freshwater Bayou Canal. The subsequent impact of tidal scour and seasonal salinity spikes entering the canal exacerbates the loss of shoreline marsh in the project area. To decrease the erosion rate and slow wetland loss, a 23,193 linear ft free-standing continuous rock dike was installed parallel to the shoreline. Construction was completed in May 1998, and post-construction monitoring is underway. See photo on page 72.											
	Highway 384 Hydrologic Restoration (PCS-25)	C	C	I	I	NI	2	NRCS	MM	2000	150	$ 1,068,509
	■ The Highway 384 project area along the northeast shoreline of Calcasieu Lake is experiencing wetland loss due to increased tidal volume, enlarged tidal routes, and saltwater intrusion. The project area has also been isolated from its major source of fresh water, the Calcasieu River Basin. The project seeks to improve hydrologic conditions with the installation of culverts, plugs, and weirs within the project area and to stabilize shorelines by rock-lining canals and planting vegetation. Salinity, shoreline change, and water level will be monitored, and vegetation surveys will be conducted. Project construction was completed in February 2000, and post-construction monitoring is underway. See photo on page 72.											

(continued)

Table 5.5. Continued.

	Project Name	Activities[a] Engineering	Landrights	Construction	Monitoring	Operations & Maintenance	Priority List	Agency[b]	Project Type[c]	Year Completed	Anticipated Acres Created/ Restored and Protected[d]	Current Estimated Cost (20 yr)
Projects in Progress	Brown Lake Hydrologic Restoration (CS-09)	C	C	C	I	NI	2	NRCS	MM	2000*	282	$ 3,201,890
	■ Wetlands surrounding Brown Lake have suffered since the construction of the GIWW and the Calcasieu Ship Channel. These major navigation channels have allowed salt water to enter surrounding marshes and have exposed the wetlands to increased erosion from wind and waves. This project includes installing and maintaining water control structures to reduce fluctuations in salinity and water level, constructing levees and terraces to dissipate wave energy and promote establishment of aquatic vegetation, and planting vegetation on exposed mudflats to help stabilize and protect eroding shorelines. Salinity, water level, and vegetation will be monitored to determine the project's effectiveness.											
	Replace Hog Island, West Cove Control Structures (XCS-47/48i)	C	C	I	I	NI	3	USFWS	MM	2000*	953	$ 4,466,354
	■ This project was authorized to replace the water control structures on three major avenues of water passage that allow water to flow from saline areas into the project area's interior marshes. The new structures on Hog Island Gully, West Cove Canal, and Headquarters Canal will be operated to effectively discharge excess water, increase cross sectional area for movement of estuarine species, and help curtail saltwater intrusion into the interior marshes. This project should help to maintain intermediate and brackish vegetation communities and increase submerged aquatic vegetation. Salinity, water level, and vegetation will be monitored.											
	Plowed Terraces (Demonstration) (XCS-56)	C	C	NI	I	NI	4	NRCS	SNT	2000*	NA	$ 321,939
	■ Severely eroded marshes in the project area, adjacent to the GIWW, have resulted from excessive water level fluctuations, saltwater intrusion, and wind generated wave action. The soils of the area appear suitable for plow-constructed earthen terraces and provide an excellent opportunity to develop and demonstrate a nontraditional procedure for constructing earthen terraces in shallow water areas. These demonstration terraces are expected to serve as wave-stilling, sediment-trapping structures that provide a base for the establishment of emergent vegetation. Vegetation will also be planted. Terrace dimensions will be measured to determine total area of wetlands created and vegetative cover will be assessed.											
	Compost (Demonstration) (XCS-36)	C	C	NI	I	NA	4	USEPA	MC	2000*	NA	$ 425,333
	■ This project was authorized to evaluate the effectiveness of using tree trimmings as compostable material, using compost amended material in providing a growth medium for emergent vegetation, and determining settlement rates of the compost amended materials and tree trimmings. This project should also serve to increase coverage of emergent marsh vegetation by addition of compost to 10.3 acres of existing emergent marsh and open water. If composting proves to be a good medium for marsh vegetation in this demonstration project, it may be used in future Breaux Act projects.											
	Sweet Lake/Willow Lake Hydrologic Restoration (CS-11b)	I	C	I	NI	I	5	NRCS	SP/ HR	2000*	247	$ 5,010,762
	■ As a result of waves and boat wakes, the GIWW spoil bank that protects the fragile marshes around Sweet Lake and Willow Lake has eroded and breached in several places. The GIWW has encroached on the lakes and their surrounding marshes, threatening to create one large open water body, exposing the marshes to salt water and erosive processes. This project includes construction of rock embankments on the GIWW to close off the lakes, vegetative plantings to reduce erosion, and construction of earthen terraces combined with vegetation plantings in open water areas to promote growth of vegetation. Vegetation and shoreline change will be monitored.											
	Black Bayou Hydrologic Restoration (XCS-48)	I	I	NI	I	NI	6	NMFS	HR	2000*	3,594	$ 6,382,511
	■ The marshes in the Black Bayou project area have been subjected to hydrological changes such as reduced freshwater inflow, increased magnitude and duration of tidal fluctuations, increased salinities, higher water levels, and excessive water exchange. This project includes the construction of spoil banks, weirs, plugs, and culverts designed to allow fresh water from the GIWW into the wetlands and to create a hydrologic head that increases freshwater retention time and reduces saltwater intrusion and tidal action in the wetlands. Vegetation will also be planted to decrease erosion and increase the establishment of emergent marsh. Salinity, shoreline change, and vegetation will be monitored.											
	Sabine Refuge Marsh Creation (Revised) Increment 1 (XCS-48 (SA-1))	NI	NI	NI	NI	NI	8	USFWS/ USACE	MC	No Date	993	$ 5,920,248
	■ This project will construct approximately 27,000 linear ft of earthen partitions in shallow open water areas to serve as material retention dikes for five marsh creation cells. Dredged spoil slurry obtained from operations and maintenance dredging of the Calcasieu Ship Channel will be deposited in the containment cells during USACE maintenance dredging events.											
	Pecan Island Terracing (XME-22)	I	I	NI	NI	NI	7	NMFS	SNT	No Date	442	$ 2,223,353
	■ This project will convert areas of open water back to vegetated marsh through the construction of earthen terraces in shallow water areas.											
	Humble Canal Hydrologic Restoration (PME-15)	I	I	NI	NI	NI	8	NRCS	HR	No Date	378	$ 91,764
	■ The objective of this project is to restore historical hydrology to the project area by constructing three 48-inch flap-gated structures, which will continue to protect the area from saltwater intrusion from the Mermentau River and allow for drainage of high water levels from the marsh to the river.											

(continued)

Table 5.6. Concluded.

	Project Name	Activities[a] Engineering	Landrights	Construction	Monitoring	Operations & Maintenance	Priority List	Agency[b]	Project Type[c]	Year Completed	Anticipated Acres Created/ Restored and Protected[d]	Current Estimated Cost (20 yr)
Deauthorized Projects	Dewitt-Rollover Plantings (ME-08)	C	C	C	C	I	1	NRCS	VP	1994	NA	$ 1,401,125
	■ This demonstration project was authorized to investigate the ability of vegetative plantings of smooth cordgrass (*Spartina alterniflora*) to colonize a newly accreted mudflat to enhance sediment trapping and to establish a buffer of vegetation to protect the beach from erosion. Plants were planted in a 1.5-mi long strip on the Gulf of Mexico shoreline. After planting, the shoreline erosion rate remained consistent with the long-term range of erosion rates for this area, but no plants remained after 10 months post-planting. The project was discontinued in 1996 because no plants remained.											
	SW Shore White Lake Protection (Demonstration) (PME-6)	C	C	C	C	I	3	NRCS	SP	1996	NA	$ 108,803
	■ The project was authorized to protect 25 acres of fresh and intermediate marsh along the southwest shore of White Lake. The area is exposed to high wave energy and severe shoreline erosion. Over 2,600 California bullwhip (*Scirpus californicus*) plants were installed along the shoreline in three rows, and vegetation was monitored after planting. After 12 months, plant percent survival was 0.17 and erosion rates reached 11.7 ft/yr. Water depth combined with high wind generated wave energy were the likely causes of the plantings' lack of success. This project was deauthorized in December 1998 and is no longer monitored.											

[a]Activities:	Initiated (I); Completed (C); Not Initiated (NI); or Not Applicable (NA).
[b]Agency:	U.S. Environmental Protection Agency (USEPA); National Marine Fisheries Service (NMFS); Natural Resources Conservation Service (NRCS); U.S. Army Corps of Engineers (USACE); and U.S. Fish and Wildlife Service (USFWS).
[c]Project Type:	Hydrologic Restoration (HR); Marsh Creation (MC); Marsh Management (MM); Shoreline Protection (SP); Vegetation Planting (VP); and Sediment/Nutrient Trapping (SNT).
[d]Acres Created/ Restored and Protected	The net gain in emergent marsh as a result of project implementation as projected by the Environmental Work Group during the Wetland Value Assessment. This figure includes acres of emergent marsh to be protected, created, and restored as a result of project implementation estimated at the time the project was approved by the Breaux Act Task Force.
*	Anticipated construction date.

Cameron/Creole Plugs (FCS-17)

FCS-17 project location.

Problem:

- High rates of marsh loss have resulted from saltwater intrusion from the Gulf of Mexico via the Calcasieu Ship Channel and Calcasieu Lake.
- Excessive pooling of saline water from hydrologic alterations in the southern end of the project area have resulted in vegetation death.
- Shoreline erosion from wind-driven wave action threatens fragile, broken marsh in the eastern project area.

Proposed Solution:

- Two plugs were installed in the Lakeshore Borrow Canal to moderate water circulation and water flow and reduce duration of marsh inundation. Five structures already exist in the project area.
- Project effectiveness will be determined by monitoring salinity, water flow, water level, and vegetation in the project area and reference area.

Progress to Date:

- Based on vegetation surveys, total vegetative cover was highest in the northern project area and reference area at 94.2% and 95.9%, respectively, in 1996, and 95.7% and 98.1% in 1997, indicating slight increases in cover over time. In the southern project area, a slight decrease in cover was detected over time, at 83.5% in 1996 and 79.8% in 1997.
  (NOTE: the project and reference areas are within the boundaries of the Cameron-Creole Watershed Management Project, which was funded as a Louisiana state project under the auspices of NRCS small watershed program (PL-566).)

Challenges for the Future:

- Isolate project effects from seasonal, meteorological effects (a severe drought in 1996, resulting in record low water levels, makes it difficult to distinguish effects that result from the project and effects that result from the drought).
- Appropriate operation of the preexisting control structures.
- Determine project effects on water level and salinity.
- Determine project effects on marsh gain/loss through analysis of post-construction aerial photography scheduled for 2010.


Photo by LDNR

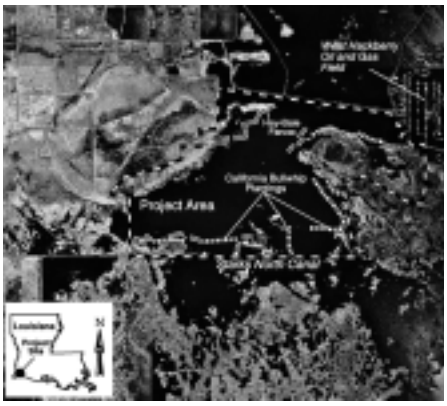
Measuring water flow in a bayou in the project area.


Photo by LDNR

An existing structure in the project area helps keep high salinity water out.

This project summary was synthesized from the project's finalized Monitoring Plan (LDNR 1998m) and the project's most recent Monitoring Series Progress Report (Weifenbach 1998). More information about this project is available on the Internet at the CRD website, www.saveLAwetlands.org, and at the Breaux Act website at www.lacoast.gov.

West Hackberry Plantings (FCS-19)



FCS-19 project location.

Problem:

- Dredging navigation canals has led to increased salinities, increased water fluctuations, and increased opportunities for saltwater intrusion, resulting in the death of marsh vegetation.
- Shoreline erosion has created vast expanses of shallow open water which in turn facilitates wind induced erosion along the remaining shorelines.

Proposed Solution:

- In total, 4,750 California bullwhip (*Scirpus californicus*) plants were installed along 11,875 ft of shoreline in the project area to protect the shoreline from continued wind-induced erosion.
- Hay-bale fencing was constructed parallel to 6,000 ft of shoreline to absorb wind-induced wave energy.
- Project effectiveness will be determined by monitoring vegetation, shoreline change, and salinity.

Progress to Date:

- Hay bales were washed out of hay-bale fences within 3 months, were replaced, and were washed out again within 2 weeks. Fences were then filled with recycled Christmas trees, but subsequent post-construction surveys have been canceled.
- The mean percent cover of vegetation at 1, 6, 12, and 36 months after planting was 5%, 9%, 45.2%, and 13.1%, respectively. The decrease in cover was noticed after high salinity water entered the project area during a 1996 drought. Survivorship of plants followed a similar trend.
- Salinities averaged 4 ppt in the area during pre-construction but increased dramatically and remained above 8 ppt during the 1996 drought.

Challenges for the Future:

- Utilize the information gained on salinity tolerance levels of California bullwhip to prevent exposure of future plantings to extreme salinities.
- Utilize the knowledge gained from the hay-bale fence problems to avoid their use in future projects unless a suitable means is found to hold the bales together and prevent their rapid deterioration.

Photo by LDNR

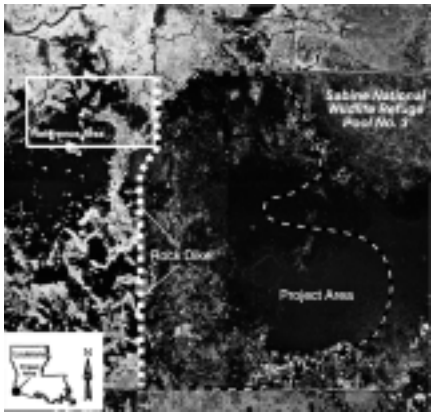
Vegetation plantings, 36 months after planting.

Photo by LDNR

Hay-bale fence immediately after construction.

This project summary was synthesized from the project's finalized Monitoring Plan (LDNR 1998n) and the project's most recent Comprehensive Monitoring Report (Miller 1997). More information about this project is available on the Internet at the CRD website, www.saveLAwetlands.org, and at the Breaux Act website at www.lacoast.gov.

Sabine Refuge Erosion Protection (FCS-18)



FCS-18 project location.

Problem:

- Impoundment 3, located within the Sabine National Wildlife Refuge, is a 27,000 acre fresh marsh that is hydrologically isolated and surrounded entirely by tidally influenced brackish canals.
- The levee protecting Impoundment 3 from brackish canals was in danger of breaching along the Burton-Sutton Canal as a result of erosion from boat traffic and weathering of the spoil bank. A breach in the levee would allow salt water to reach the fragile fresh marsh.

Proposed Solution:

- A 5.5-linear mi, free-standing, continuous rock dike was built along the east bank of the Burton-Sutton Canal. This canal forms the west bank of Impoundment 3.
- Project effectiveness will be determined by monitoring shoreline movement with shoreline surveys and monitoring changes in vegetation types and vegetation abundance by comparing aerial photographs from before and after construction.

Progress to Date:

- Pre-construction photos, taken in 1993, indicated a land-to-water ratio of 1:0.6 with 16,075 acres of land and 10,264 acres of water in the project area.
- Initial post-construction shoreline surveys were completed.

Challenges for the Future:

- Evaluate project effects on shoreline movement.
- Evaluate changes in wetland habitat utilizing pre- and post-construction aerial photography analysis.

Photo by LDNR

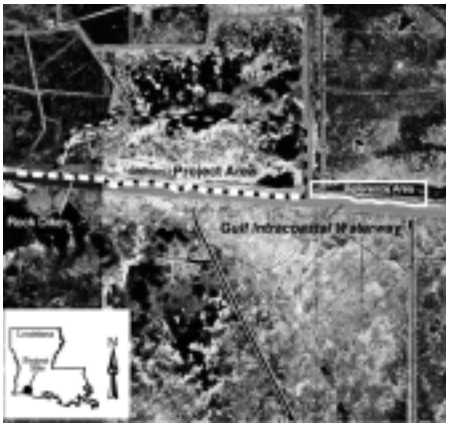
Rock was added to prevent erosion around an existing water control structure in the project area.

Photo by LDNR

Rock dike along the east bank of Burton-Sutton Canal.

This project summary was synthesized from the project's finalized Monitoring Plan (LDNR 1998o) and the project's most recent Comprehensive Monitoring Report (Castellanos 1998). More information about this project is available on the Internet at the CRD website, www.saveLAwetlands.org, and at the Breaux Act website at www.lacoast.gov.

Cameron Prairie Refuge Protection (ME-09)



ME-09 project location.

Problem:

- The levee between the GIWW and the Cameron Prairie National Wildlife Refuge was in danger of breaching as a result of erosion from boat traffic in the GIWW. If breaching occurs, wave energy from the GIWW and salt water will enter the 350 acres of highly organic freshwater wetlands.

Proposed Solution:

- A 13,200-ft rock breakwater was constructed 50 ft from the northern bank of the GIWW to prevent waves caused by boat traffic from overtopping and eroding the remaining spoil bank.
- Determine project effectiveness by monitoring shoreline movement with shoreline surveys and by monitoring changes in marsh loss rates over time by comparing aerial photographs from before and after construction.

Photo by LDNR

Construction of the rock dike along the Gulf Intracoastal Waterway.

Progress to Date:

- Analysis of 1997 aerial photography revealed noticeable new vegetation in the central portion of the project area between the breakwater and the shoreline. Overall, the project area (including the interior wetlands) had a 9.91% increase in water, and the reference area had a 1.58% increase in water when compared to the pre-construction photography.
- Shoreline surveys showed that the shoreline in the project area gained 10.0 ft ± 8.25 (SD), but the shoreline in the reference area eroded 8.17 ft ± 6.24 between 1995 and 1997. This difference translates into a gain of 4.61 ft/yr in the project area and a loss of 3.76 ft/yr in the reference area.
- Based on the shoreline erosion rates, this project has protected 1.14 acres/yr and created 1.40 acres/yr along the shoreline of the GIWW. Since the project was constructed, 2.47 acres of marsh have been protected and 3.03 acres have been created.

Photo by LDNR

Rock dike along the bank of the Gulf Intracoastal Waterway.

Challenges for the Future:

- Collect and analyze more post-construction aerial photography which may more accurately show changes in the land-to-water ratio. The 1995 and 1997 aerial photos were taken at different times of the year, which may have caused seasonal vegetation changes to be interpreted as changes in land-to-water ratio.
- Survey hubs in the reference area may have to be moved several times over the life of the project to keep up with the rapid rate of erosion occurring there.

This project summary was synthesized from the project's finalized Monitoring Plan (LDNR 1998p) and the project's most recent Comprehensive Monitoring Report (Courville 1997). More information about this project is available on the Internet at the CRD website, www.saveLAwetlands.org, and at the Breaux Act website at www.lacoast.gov.

East Mud Lake Marsh Management (PCS-24)

PCS-24 project location.


Photo by LDNR

Culvert with flapgate in the East Mud Lake project area.

Problem:

- The Calcasieu Ship Chanel, immediately east of the project area, provides an avenue for the rapid movement of high-salinity water into the Mud Lake project area. This movement has increased salinity in the area and resulted in plant death and marsh loss.
- The construction of highways and levees around the project area has reduced the input of fresh water from all directions and subjected the area to prolonged flooding resulting from limited drainage avenues.
- Some of the existing structures had collapsed or had been otherwise reduced in a cross-sectional area, thereby decreasing flow capacity.

Proposed Solution:

- Earthen plugs, culverts with flapgates, variable crest culverts, and gated culverts were constructed and can be managed to control the passage of water into and out of the project area. In treatment unit 1, structures are operated to close only when salinities in the project area exceed a threshhold. Treatment unit 2 structures have drawdown capabilities in order to encourage shallow water areas to revert to emergent vegetation. The emphasis of this project is to stabilize salinity and water levels while ensuring the movement of fisheries species into and out of the project.
- Smooth cordgrass (*Spartina alterniflora*) was planted to stabilize canal shorelines and encourage marsh regeneration.
- Project effectiveness will be determined by monitoring land-to-water ratio, vegetation planting success, existing vegetation, soil bulk density, water quality, vertical accretion, surface elevation, and fisheries both before and after construction.

Progress to Date:

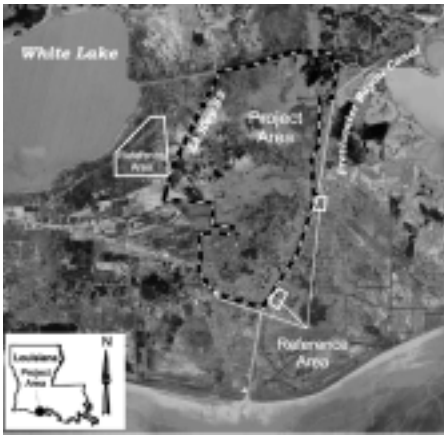
- Overall survivorship of planted vegetation was 62% 1 year after planting with survivorship above 90% in the canals.
- Total cover of existing vegetation decreased from 88.5% in 1995 to 64.5% in 1997 in the project area but remained stable in the reference area. Species richness increased in both areas.
- Water salinities remained under the threshhold of 15 ppt over 80% of the time during the data collection period.
- Surface elevation dropped in the project area by 1.76 ± 0.67 cm, likely because of a severe drought in 1996 that caused drying, cracking, and compaction of the soil surface.
- Transient fish and crustaceans were significantly more abundant in the reference area both before and after construction, and resident fish and crustaceans were significantly more abundant in the project area both before and after construction. These trends most likely indicate a previous and present access restriction for transient species to the project area. Fish and crustacean abundance patterns did not change between pre-construction and post-construction.

Challenges for the Future:

- Isolate project effects from seasonal, erosional, and meteorological effects.
- Develop flexibility of structure operations in responding to conditions incurred by environmental extremes.
- Combine fisheries data with data from other similar projects to determine optimal structure opening sizes for targeted fish species while still protecting interior wetlands.

This project summary was synthesized from the project's finalized Monitoring Plan (LDNR 1998q) and the project's most recent Comprehensive Monitoring Report (Weifenbach 1999). More information about this project is available on the Internet at the CRD website, www.saveLAwetlands.org, and at the Breaux Act website at www.lacoast.gov.

Freshwater Bayou Wetland Restoration
(XME-21)



XME-21 project area location.

Problem:
- Boat wake-induced shoreline erosion, which averaged 12.5 ft/yr along each bank of Freshwater Bayou Canal, has deteriorated the spoil banks along the channel, creating multiple breaches that allow tidal erosion of the organic soils in the adjacent wetlands.
- Between 1968 and 1990, the bank width of this navigation canal increased threefold from 172 ft to 583 ft, resulting in the loss of 1,124 acres of coastal wetlands.
- Water flows from the Grand-White Lake system into the project area through culverts and natural openings created ponding and converted emergent marsh to open water.

Proposed Solution:
- Approximately 28,000 linear ft of freestanding continuous rock dike were built along the west bank of Freshwater Bayou canal.
- Lowering water levels or reducing the frequency and duration of inundation in the project area will encourage growth of fresh to intermediate marsh vegetation. This modification will be done through the management of 19 water control structures located throughout the project area.
- Project effectiveness will be determined by monitoring vegetation, water quality, changes in vegetated and nonvegetated areas in the project area with aerial photography from before and after construction, and measuring shoreline change by conducting pre-construction and post-construction shoreline surveys.


Photo by LDNR

Rock dike along Freshwater Bayou.

Progress to Date:
- Shoreline surveys taken 1 year after construction show that the project area prograded at an average rate of 1.53 ft/yr whereas the reference area sites eroded at a rate of 9.00 ft/yr. These data indicate that the rock dike has successfully prevented or significantly reduced erosion of the protected segment of canal bank for the year following construction.
- In both the project area and the reference area, monthly mean post-construction salinities were higher at all stations than pre-construction salinities, but project area salinities generally remained within the target range of 0 to 5 ppt. Higher salinities in the post-construction period could be a result of drought and tropical storm activity.
- Vegetation surveys showed salinity levels for three stations in the reference area, and four stations in the project area were higher in 1998 than in 1996. This salinity increase could be a result of tropical storm activity.

Challenges for the Future:
- Evaluate project effects on land gain/loss within the project area utilizing pre- and post-construction aerial photography. Post-construction photography will be obtained in 2001.
- Isolate project effects from seasonal, meteorological effects.

This project summary was synthesized from the project's finalized Monitoring Plan (LDNR 1998r) and the project's most recent Monitoring Series Progress Report (Vincent et al. 2000). More information about this project is available on the Internet at the CRD website, www.saveLAwetlands.org, and at the Breaux Act website at www.lacoast.gov.

Region 4 Recently Constructed Projects

Photo by LDNR

Rock dike constructed along the shoreline by the Freshwater Bayou Bank Stabilization (XME-29) project.

Photo by LDNR

Highway 384 Hydrologic Restoration (PCS-25).

Photo by LDNR

Perry Ridge (East) Shore Protection (PCS-26i).

Photo by LDNR

Clear Marais Bank Protection (PCS-27).

Progress in Region 4

Region 4 is faced with a unique set of problems when it comes to wetland restoration. Although there are several small rivers in Region 4, the potential for utilizing these rivers as a source of fresh water and sediment is not as great as regions adjacent to the Mississippi and Atchafalaya rivers. The marshes of Region 4 have consequently been challenged to keep up with erosion and subsidence through vegetative growth without substantial input of sediment. Altered hydrology has been a major problem by introducing salt water to freshwater marshes and by trapping water on interior marshes. As a result of these and other factors, an average of 3,897 acres of wetland are lost each year in this region (LCWRTF and WCRA 1998). The Breaux Act projects in this area seek to address these issues and to halt this rate of wetland loss.

Altered hydrology is addressed in five Region 4 Breaux Act projects already constructed (three hydrologic restoration and two marsh management projects). Two hydrologic restoration projects, Cameron-Creole Maintenance (CS-04a) and Freshwater Bayou Wetland Restoration (XME-21), and the East Mud Lake Marsh Management (PCS-24) project are designed to restore the area to more natural water flow patterns with the installation of weirs and plugs to limit or control water exchange between the project area and the surrounding marsh. In the Cameron-Creole Maintenance (CS-04a) and East Mud Lake Marsh Management (PCS-24) projects, it is difficult at this time to distinguish effects resulting from the projects and effects resulting from other environmental factors, such as the drought conditions experienced in 1996. This drought necessitated some difficult management decisions and trade-offs not anticipated in the design of the projects. Future monitoring of these projects will help determine the overall project effectiveness and effects of environmental variability.

The Freshwater Bayou Wetland Restoration (XME-21) project also has a shoreline protection component which includes a rock dike placed along the eroding shoreline of the Freshwater Bayou navigation channel. In this area of the project, shoreline erosion has stopped and has actually prograded from the original shoreline towards the rock at an average rate near 1.5 ft/yr.

Shoreline erosion, which is another leading cause of wetland loss in Region 4, has been addressed by six other Breaux Act projects in the region. West Hackberry Plantings Demonstration (FCS-19), a vegetation planting project, sought to decrease erosion along a shoreline with the planting of vegetation and installation of wave-damping fences. Though this project was unsuccessful at achieving its goals, valuable information was gained that can be used in improving the success of future Breaux Act projects. Rock breakwaters were constructed in the Sabine Refuge Erosion Protection (FCS-18) and the Cameron Prairie Refuge Protection (ME-09) projects to protect fragile marshes from erosion. Post-construction data have not been analyzed for the Sabine Refuge project, but the Cameron Prairie project appears to be very successful at halting erosion and building new marsh in the project area. In addition to these 11 projects already constructed, there are nine Breaux Act projects that have been authorized in Region 4 on priority lists 1 through 8 but not yet constructed (excluding two deauthorized projects). Of these projects, six are projected to be completed by the end of 2000, and three do not yet have a scheduled completion date. Two projects in Region 4 have been deauthorized because they were ineffective. In both cases, vegetation was planted to decrease shoreline erosion, but the vegetation did not survive. This information is valuable in the planning of future Breaux Act projects and can influence such decisions as to what species of plant should be planted, within what salinity ranges, and in what water depth plants can be planted in and still survive.

The Breaux Act projects in Region 4 have addressed the major long-term strategies identified by Coast 2050 as necessary for ecosystem sustainability. The major problems of altered hydrology and shoreline erosion are the focus of most of the restoration projects implemented in this region which will all contribute to the overall health of the region. The effectiveness of these projects can only be determined with long-term monitoring and project evaluation. Through monitoring we can determine success or failure that may be vital in planning future projects. Region 4 Breaux Act projects approved on priority lists 1 through 8 are anticipated to protect and create a total of 19,587 acres of wetlands. These 22 projects, along with projects authorized on future priority lists, will help slow the rate of wetland loss in Region 4 by addressing the major causes of wetland loss, erosion, and altered hydrology.

LA-02 Nutria Harvest and Wetland Demonstration Project (LA-02/ PTV-5) - A Case Study

Nutria herbivory has been a noticeable problem for Louisiana's coastal wetlands for the past 40 years. Nutria (*Myocaster coypus*) are large herbivorous semi-aquatic rodents indigenous to South America. When large patches of marsh vegetation are removed as a result of over grazing by nutria, the very fragile organic soils are exposed to erosion through tidal action. If damaged areas do not revegetate quickly, they can become open water as tidal scour removes soil and thus lowers elevation. Frequently the plant's root systems are also damaged, making recovery through vegetative regeneration very slow.

The legendary Louisiana population of nutria can be traced to 13 animals imported in 1937 from Argentina for the purpose of establishing a captive population for fur harvest. Between 1937 and 1940, several animals escaped captivity, but nutria were not released in large numbers until a hurricane in 1940 resulted in the release of about 150 animals. It was believed at the time that these nutria would succumb to predation by alligators, but this was not the case. By 1956, a total of 419,000 nutria were harvested annually from wild populations and traded in the fur industry.

During the mid-1950's, rice and sugarcane farmers complained about nutria damage to crops and levee systems, and muskrat trappers blamed the increasing numbers of nutria for declining numbers of muskrats, the leading fur export at the time. In an effort to increase the harvest of nutria, the Louisiana State Legislature placed nutria on the list of unprotected wildlife in 1958 and created a $0.25 bounty on every nutria killed in 16 south Louisiana parishes, but the funds for this bounty were never appropriated.

Research efforts begun by the U.S. Fish and Wildlife Service during the 1960's in the southeastern sugarcane region of Louisiana determined that shooting, trapping, and poisoning nutria would help minimize nutria damage in agricultural areas. It was also recognized that the problem could be solved through the development of a larger market for nutria pelts. A substantial market for nutria developed slowly during the early 1960's, and by 1962 over 1 million pelts were being used annually in the German fur trade. The nutria surpassed the muskrat in 1962 in total numbers harvested and has remained the backbone of the Louisiana fur industry since that time. As prices showed a slow rise during most of the 1970's and early 1980's, the harvest averaged 1.5 million pelts, and complaints from agricultural interests became uncommon. In 1976 the harvest peaked at 1.8 million pelts worth $15.7 million to coastal trappers.

The nutria market changed drastically during the early 1980's. The price paid per pelt dropped from $8.18 to $2.64 from one trapping season to the next. As a result of falling prices, many trappers ceased to trap nutria, resulting in decreased harvest numbers. Between 1988 and 1996, the number of nutria harvested annually remained below 300,000, and the price paid per pelt remained at or below a $3.00 average. With fewer nutria being harvested, the population began to rise. Reports of marsh vegetation damage from land managers became common again after 28 years of few reported problems.

A region-wide aerial survey, funded by the Barataria-Terrebonne National Estuary Program (BTNEP), was conducted in 1993 and again in 1996 in the Barataria and Terrebonne basins to determine the distribution of nutria damage along selected transect lines, the severity of nutria damage, the species of vegetation being impacted, and the status of recovery of selected damaged areas (Linscombe and Kinler 1997). During the December 1993 survey, 15,000 acres along the transect lines were impacted by nutria herbivory. In 1996, 20,642 acres along the transect lines within Barataria and Terrebone basins were damaged by nutria. By the 1996 survey, only 9% of the damaged sites identified in 1993 showed any signs of recovery. Nutria damage was documented in at least 11 Breaux Act project sites in the Barataria and Terrebonne basins during this survey.

State and federal agencies, reviewing the results of aerial surveys, considered and proposed a 5-year Breaux Act demonstration project. The project was approved as a part of the 6th Priority Projects List (PL-

Photo by Rex Caffey

*The invasive nutria (*Myocastor coypus*) has been called "the animal that ate Louisiana."*

101-646) and authorized by the Breaux Act Task Force on April 24, 1997. The project is being conducted by the Louisiana Department of Wildlife and Fisheries (LDWF) and includes three major components: (1) plan, develop, and conduct nutria meat marketing activities; (2) conduct a coast-wide nutria herbivory survey to assess the extent of habitat damage; and (3) provide incentive payments to trappers and nutria meat processors.

Many steps are being taken to achieve the first goal: to plan, develop, and conduct nutria meat marketing activities. Chef Phillippe Parola, President and CEO of the Louisiana Culinary Institute, has been contracted by LDWF to use nutria meat and develop gourmet recipes, available through the LDWF. Chef Parola also attended promotions at 16 Louisiana Winn Dixie supermarkets where he prepared and served nutria and pork sausage to shoppers. Nutria meat is higher in protein and lower in fat and cholesterol than chicken, beef, or turkey, making it a healthy alternative.

In 1999, promotion of nutria meat and fur was taken overseas. The Louisiana Culinary Institute was contracted to travel to Taiwan to feature nutria meat at the American Food Festival in the three largest cities in Taiwan. Immediately following the Taiwan festivals, the group traveled to Shanghai, China, to conduct a menu promotion at the grand opening of the *Bourbon Street Restaurant*, a Cajun-Creole restaurant. The focus of this effort was to develop interest in importation of nutria into Taiwan and to introduce nutria meat into Shanghai. In an attempt to develop Chinese export markets for Louisiana nutria meat and nutria pelts, a Chinese trade delegation and Canadian fur marketing consults were invited to Louisiana where they sampled nutria recipes and examined nutria pelts and fur products.

The first coast-wide nutria herbivory survey was conducted in the spring of 1998. This effort represented the first attempt at quantifying the impact of nutria herbivory on a coast-wide basis. North-south transects were flown throughout the fresh, intermediate and brackish marshes of coastal Louisiana. Portions of Cameron, Calcasieu, Vermilion, Jefferson Davis, Iberia, St. Mary, Terrebonne, Lafourche, Jefferson, Plaquemines, St. John, St. Charles, St. Bernard, Orleans, St. Tammany, and Tangipahoa parishes were included in the survey. Transects were spaced approximately 1.8 mi apart, starting at the swamp-marsh interface and continuing south to the beginning of the salt marsh. Location of each site was determined with Global Positioning System equipment, size of each damaged site was recorded, damage severity was classified into categories, dominant plant species in the damaged area were identified and recorded, the age of damage and condition was determined, and the number of nutria observed at each site was estimated. Damaged sites were revisited in late 1998, and a prediction of vegetative recovery was estimated for these sites.

This survey showed an estimated total of 23,960 acres were impacted by nutria feeding activity along the transects. Due to the 1.8-mi distance between survey lines, all areas impacted by nutria herbivory could not be identified. When extrapolated, the coast-wide damage is estimated to approach 100,000 acres. Terrebonne, Lafourche, and Jefferson parishes were the most heavily damaged with a combined total of 19,953 acres of damaged marsh identified along the transect lines. Coastal marshes in southwest Louisiana had relatively fewer damaged sites when compared to southeast Louisiana.

Photo by LDNR

Area grazed by nutria (called an "eat out") where the only vegetation remaining is within abandoned crab traps that the nutria could not access.

The degree of nutria herbivory in the damaged sites was rated as moderate or severe for 80% of the damaged acres in the survey. As the impact of nutria feeding activity progresses to moderate and severe vegetative damage, the less likely an area is to fully recover, even if nutria populations are dramatically reduced.

The age of damage and condition rating was utilized to characterize each of the damage sites. During the 1998 survey, 30% of sites were classified as having current, ongoing nutria herbivory impacts. In total, 37% of sites were classified as old damage sites which were recovering; however, 13% of sites were classified as old damage and not recovering. These areas will probably not recover and are converting from vegetated wetlands to open water ponds. Only 18% of sites were classified as recovered. Over half of these recovered acres were accounted for by one fresh marsh site in Lafourche Parish.

In 1999, the nutria survey was repeated with the same methods; however, only previously identified damaged sites were visited. During this survey, 27,356 acres were identified as impacted by nutria feeding activity along the transects, which is a 14% increase in the number of damaged acres from the 1998 survey. Nutria damage was most prevalent in Terrebonne, Lafourche, and Jefferson parishes where damage totaled 21,376 acres. All three of these parishes showed an increase in nutria damage from 1998 to 1999. Intermediate and fresh marshes were the most affected by nutria herbivory, and both marsh types showed a 16% increase in damage from 1998 to 1999. In total, 79% of damaged acres were

characterized as having moderate and severe vegetative damage, and only 34 sites accounting for 611 acres were classified as recovered in 1999.

Nutria herbivory may be minor compared to the other factors causing wetland loss, but the additional stress placed on the plants by nutria herbivory may be very significant in Breaux Act projects sites. Research since the 1970's has documented the effects of nutria herbivory on coastal marsh vegetation and has suggested a relationship between nutria grazing and marsh loss (Foote and Johnson 1993). Of great concern is that only a small fraction of damaged sites are recovering. These fragile wetlands may not be able to withstand this continued stress in years to come. When combined with other stressors such as altered hydrology or increased salinity, the effects of herbivory may be magnified, making marsh recovery even more difficult. Survey results strongly support the need for continued development of a trapping system which will facilitate significantly higher nutria harvest. The Louisiana Fur and Alligator Advisory Council and the Louisiana Department of Wildlife and Fisheries will continue with projects to develop markets for nutria meat and fur, which will also result in improved prices for trappers.

Photo by LDNR

*As a way of controlling this invasive species, Louisianians are marketing nutria (*Myocastor coypus*) for their fur and low-fat meat.*

Lessons Learned

Lesson 1. It will take a large-scale ecosystem level approach to sustain Louisiana's wetlands.

Over the past 10 years, the Breaux Act has increased the awareness of coastal wetland loss both in Louisiana and across the nation. We are not only learning about individual projects and what works or does not work within certain areas, but arguably, our most important lesson is that it will probably take large-scale ecosystem level approaches to sustain Louisiana's wetlands. If recent loss rates continue, even taking into account current restoration efforts, coastal Louisiana will still lose more than 395,000 additional acres of coastal marshes by 2050. At the current funding levels, the Breaux Act alone will only be able to address a small part of the problem, and it will take much greater efforts and a much larger financial commitment over the next 50 years to save these diminishing, nationally significant resources. In recognition of the magnitude of wetland loss problems, the Coast 2050 Plan aligned the efforts of the Breaux Act with other restoration efforts to develop a unified effort with the goal of establishing a sustainable coastal wetland ecosystem in Louisiana.

Lesson 2. Environmental variability differentially affects different types of restoration projects. Consequently, management of wetlands must be flexible, adaptive, and within the constraints of local landscape conditions and available resources and can often lead to a trade-off between environmental conservation and restoration and human needs.

Coastal Louisiana is extremely dynamic and greatly influenced by natural variability. We have learned that environmental variability differentially affects certain types of restoration projects and can confound our ability to distinguish project effects. Projects designed to manage hydrology, such as marsh management and hydrologic restoration projects, are greatly influenced by large shifts from normal weather patterns both on a short term (days to weeks; i.e., frontal passage) and on a longer term (weeks to months; i.e., floods and droughts). These climatological events can be positive, such as the case of a frontal passage assisting in a water level drawdown, or detrimental, such as a large rainfall event coupled with strong southerly winds leading to long duration flooding events. Because water control and water regulating structures have not typically been designed to endure these events, the influences from these events can be amplified. Thus, greater contingency will have to be embedded into future structure designs.

Because of this environmental variability, management of wetlands must be active, flexible, adaptive, and within the constraints of local landscape conditions and available resources. This lesson requires managers to invest in intensive operations on marsh management projects, which typically have not been budgeted but need to be in the future. It also requires flexible operation schedules that are not constrained by permit requirements. Monitoring has demonstrated that inflexible operations and permit constraints can have negative ecological impacts. For example, in the East Mud Lake marsh management project there was drought in 1996 that required management to trade off between reducing salinity intrusion, which could be fatal to the vegetation, and maintaining water on the marsh surface. Structures prevented stressful salt water from entering the project area, but, with the added effects of a drought, the water levels became too low and the project area and parts of the reference area completely dried, resulting in the death of some of the marsh vegetation, fish mortality, and marsh sediment consolidation in both areas. Future comparisons with the Hopedale Hydrologic Restoration project (a similar project in the deltaic plain) will help determine if these findings are site-specific or apply in different areas.

Climate also influences the effectiveness of freshwater and sediment diversion projects; however, local landscape features are just as critical. Three primary factors influencing the effectiveness of these projects are local winds and tides, water-level difference between the river and the wetland, and the configuration of the receiving bays. In low river years such as 1999, freshwater and sediment loads available for restoration are extremely limited, whereas in high river years such as 1997, water and sediment are generally plentiful and can result in more rapid accumulation of available sediment. An important lesson is that once a project is constructed, results are not immediate. Effectiveness of many coastal restoration projects is truly dependent on nature.

Project effectiveness also depends on what the landscape provides. Many project types such as beneficial use of dredged material and terraces require specific sediment substrate characteristics in order to create emergent marsh in a subsiding environment. The Breaux Act has been successful at creating wetlands with dredged material; however, fine-tuning is sometimes necessary to attain proper elevations, sediment characteristics, compaction rates, subsidence, and desired elevation

for the project life must be considered. The evaluation of geotechnical data across projects is critical and provides engineers tighter guidance on overfill ratios and subsidence expectations to achieve the desired results.

Our ability to evaluate restoration projects and to understand the natural processes influencing these projects drives the improvement of our restoration activities in Louisiana. Monitoring of Breaux Act projects, as well as data from a long history of similar state and federally funded restoration and research projects, has provided information across project types and environmental settings that can guide future management decisions.

Lesson 3. Certain project types are only effective under certain environmental settings.

The monitoring data collected to date clearly document the effectiveness of certain project types in certain environmental settings. Vegetation plantings in low energy environments (Boston Canal/Vermilion Bay Bank Protection, PTV-18), shoreline protection projects along navigational canals (Cameron Prairie Refuge Protection, ME-09; Vermilion River Bank Protection Cutoff, FTV-03), and sediment diversions in the Mississippi River delta (Delta-Wide Crevasses, PMR-10) have consistently shown positive results. Beneficial use of dredged material (Bayou LaBranche Marsh Creation, PPO-10) and terraces (Little Vermilion Bay Sediment Trapping, PTV-19) appear to be effective if engineering constraints can be overcome. Despite a long history of wetland management and research in Louisiana, there is less certainty in the evaluation of marsh management and hydrologic restoration projects due to the complexity of wetland functions and the reaction of wetlands to climatic events, such as the recent droughts in Louisiana. With our current monitoring effort, statements of effectiveness can only be made on a project-by-project basis, and they can only be made after many years of data have been collected and examined. Gradual changes within a dynamic system make evaluations of effectiveness difficult. Large-scale, complex projects should be evaluated along a trajectory of improvement and should embed the testing of ecological or engineering questions to improve management at this scale.

Monitoring the effectiveness of projects is an important part of the Breaux Act process. An equally important part is a determination of what projects do not work and why, and what we do not know regarding the functioning of our coastal environment and our influence through management. Some vegetation planting and shoreline protection demonstration projects have been unsuccessful. The monitoring data have been proven to be essential in learning and understanding the stress thresholds and limitations of certain vegetation species to wave energy, salinity, and water depth. We have also learned about the design constraints regarding degree of porosity and structural integrity for shoreline protection structures in order to achieve desired goals. The results of these projects were greatly influenced by seasonal effects and disturbance events, further illustrating the variability of response of our restoration efforts. It also forces us to acknowledge that the science of restoration is still relatively new and is vulnerable to climatic and meteorological events.

Lesson 4. The challenge of restoration science is to use ecological and geological forces to our own advantage to restore the coast, while at the same time optimizing the resources for the maximum benefit of all user groups.

On the Louisiana coast, the interaction of the Mississippi River and the Gulf of Mexico drives the ecology of the coastal wetlands and controls the three strategic goals of Coast 2050. Vertical accumulation results from a build-up of sediments derived from the river and from the shallow gulf, in conjunction with vegetative growth. Estuarine gradients result from the southward flow of the fresh river water, mixing in the estuaries with the northern flow of tides from the gulf. Ecosystem linkages are maintained by the continually changing river flow, tidal forces, and living creatures dependent on the coastal wetlands. The challenge is to use these forces to our own advantage to restore the coast, while at the same time optimizing the resources for the maximum benefit of all user groups. While the Breaux Act has shown that we can modify processes at the local level, the cumulative effects of many projects can have a larger impact. The future of the Breaux Act in Louisiana is concerned with the larger-scale impacts of projects that best utilize the available natural resources to maximize the benefits to the coast for all user groups.

With the growing contributions that the Breaux Act is making to restoration science, we are increasingly better equipped to implement future projects which incorporate these lessons learned. Monitoring efforts have shown that many Breaux Act projects have been very successful, creating and preserving acres of marsh that would have otherwise been lost forever.

Photo by LDNR

Fishing and sailing are popular recreational activities on scenic Lake Pontchartrain.

VI–Conclusions

Coastal land loss in Louisiana has reached catastrophic proportions. Within the last 50 years, land loss rates have exceeded 40 mi^2/yr, and in the 1990's, the rate was estimated to be between 25 and 35 mi^2/yr. This loss represents 80% of the coastal marsh loss in the entire continental United States.

Breaux Act Accomplishments

In total, 77 Breaux Act projects (excluding 14 deauthorized projects) were authorized for funding in Louisiana through the first eight priority project lists. An additional 19 projects were authorized on the ninth list for construction funding consideration after preliminary studies are completed. Of the 77 projects on the first eight lists, 33 have been constructed and are in the monitoring, operation, and maintenance phase. The remaining projects are in various phases of design and construction. These projects are anticipated to create, restore, or protect over 70,000 acres of wetlands during their 20-year lives, at a total fully funded cost of $319,411,042. Without restoration efforts, Louisiana is projected to lose as much as 515,000 acres of marsh over the next 50 years. The current Breaux Act (PPL 1-8) and WRDA (Caernarvon and Davis Pond) restoration efforts are estimated to prevent 23% of the projected marsh loss (about 120,000 acres).

One important accomplishment of the Breaux Act in Louisiana has been the recent development of the Coast 2050 Plan. The initiative that created this plan was a progressive step, and it was built on the growing body of knowledge of which the Breaux Act is a significant contributor. The Coast 2050 initiative brought together local, public and private interests, academia, and state and federal government representatives to develop a vision of what we need to do to sustain our natural resources. The resulting strategic plan received unanimous support from all 20 coastal parishes in Louisiana, as well as support from both the state Wetlands Conservation and Restoration Authority, and the Louisiana Coastal Wetlands Conservation and Restoration Task Force. This unified plan aligns coastal restoration efforts to maximize collective project benefits. The

Photo by Rex Caffey

*The spotted seatrout (*Cynoscion nebulosus*), locally known as speckled trout, is a popular catch of recreational anglers.*

Photo by Jim Carver

*Louisiana's coast is home to many wildlife species such as this juvenile great-horned owl (*Bubo virginianus*).*

ecosystem management strategies outlined in the Coast 2050 Plan carry a price tag near $14 billion over the next 30 years. While costly, the benefits of the natural resources that Louisiana's wetlands produce for the nation are 10-fold the investment.

Another major contribution of the Breaux Act has been increasing the knowledge base of wetland restoration. This knowledge has benefitted not only Louisiana, but is also available to other wetland restoration efforts. As the Breaux Act moves into the 21st century, the focus is evolving towards large-scale ecosystem sustainability, and the lessons learned through construction and monitoring of Breaux Act projects will guide the future design of large-scale restoration efforts both in Louisiana and elsewhere, while continuing to provide smaller-scale protection where needed.

Photo by Rex Caffey

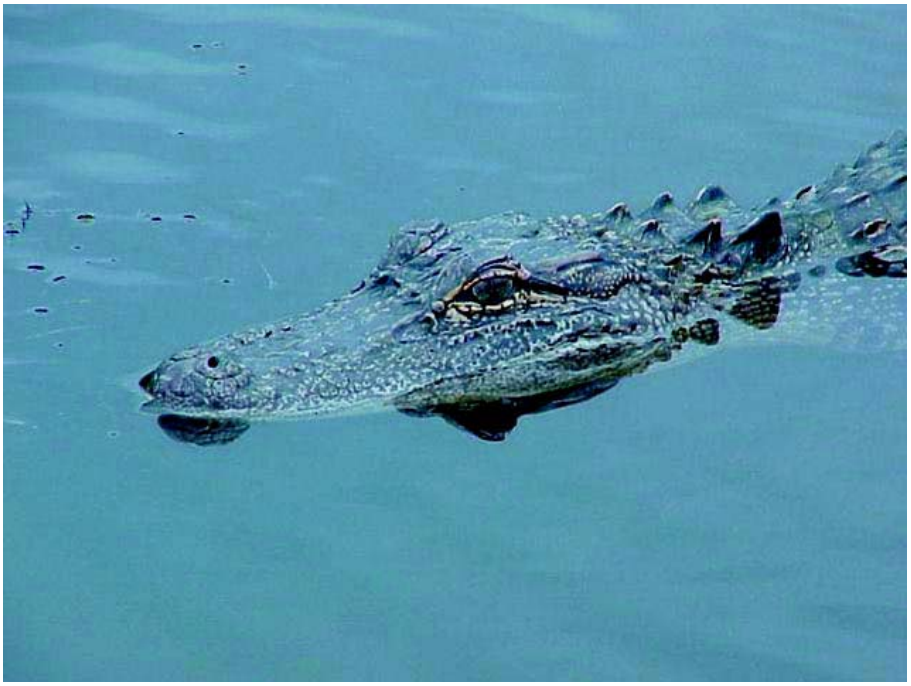
Louisiana's coastal estuaries support recreational and commercial fishing industries.

The Future of the Breaux Act in Louisiana

With the implementation of the Coast 2050 Regional Ecosystem Management Strategies, the restoration projects constructed to date and under development will contribute to the larger framework of ecosystem sustainability. Other authorities, such as WRDA, will be utilized to fund projects beyond the funding limits of the Breaux Act. The Breaux Act team in Louisiana is developing an understanding of how these projects will collectively affect the hydrologic basins and the Coast 2050 Regions on an ecosystem-level scale. The benefits realized from Breaux Act projects themselves, the monitoring program developed to evaluate project effectiveness, and partnerships between federal, state, and local agencies, landowners, and academia are essential for the future efforts to create a sustainable ecosystem.

There is a recognized need to continue the study of the coastal wetland ecosystem, to continue to learn from those measures which are already in place, to learn from the successes and failures of this and other coastal restoration programs, and most importantly, to enter the future with a unified effort and a common goal for all restoration efforts in Louisiana. The Coast 2050 Plan is the start of coastal wetland restoration in Louisiana at the ecosystem scale, and it has the flexibility to grow and adapt as new knowledge and restoration technologies become available. The Breaux Act has been a catalyst for the development of partnerships among federal, state, and local entities and for the development of large-scale wetland restoration strategies and will remain a vital factor in solving Louisiana's wetland losses. It is the leader in Louisiana's restoration efforts and will guide future endeavors towards the long-term goals to preserve and protect the nationally significant resources that are the Louisiana coastal wetlands.

Photo by Rex Caffey



*The American alligator (*Alligator mississippiensis*) is an important resource, both ecologically and economically.*

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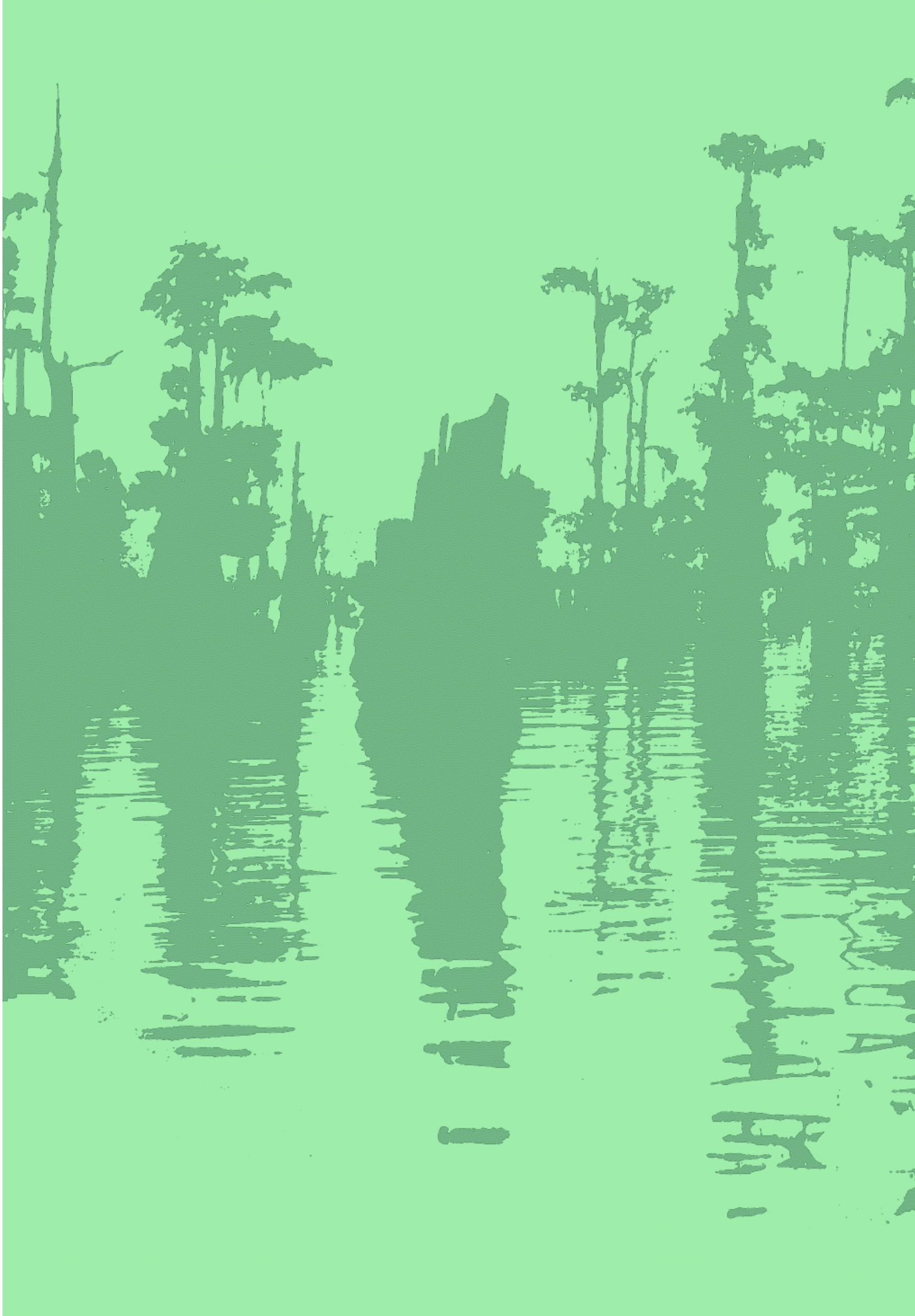
VIII–Acronyms

AAHU	Average annual habitat unit
BBW	Barataria Bay Waterway
BMS	OCRM/CRD's Biological Monitoring Section responsible for the development and implementation of monitoring plans to determine the effectiveness of restoration projects relative to their specific goals and objectives.
BSFS	Barrier Shore Feasibility Study
BTNEP	Barataria-Terrebonne National Estuary Program
CMD	Coastal Management Division of the Louisiana Department of Natural Resources
CPG	Citizen's Participation Group which provides public review and input into the plans and projects being considered for authorization by the Breaux Act Task Force.
CRCL	Coalition to Restore Coastal Louisiana
CRD	Coastal Restoration Division of the Louisiana Department of Natural Resources
CWPPRA	Coastal Wetlands Planning, Protection and Restoration Act (also known as the Breaux Act)
GIS	Geographic information system
GIWW	Gulf Intracoastal Waterway
GPS	Global Positioning System
HICP	Hydrologic Investigation of the Chenier Plain
HNC	Houma Navigation Canal
ICP	Inside the Conservation Plan boundary
IEI	Industrial Economics Incorporated
LCA	Louisiana coastal area
LCWCRTF	Louisiana Coastal Wetlands Conservation and Restoration Task Force
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LMOGA	Louisiana Mid-Continent Oil and Gas Association
LSU	Louisiana State University
MRGO	Mississippi River Gulf Outlet
MRSCI	Mississippi River Ship Channel Improvement reconnaissance study
MRSNFRS	Mississippi River Sediment, Nutrient, and Freshwater Redistribution Study
NEPA	National Environmental Policy Act
NGVD	National geodetic vertical datum of 1929
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWRC	USGS National Wetlands Research Center
OCRM	Office of Coastal Restoration and Management (includes CMD and CRD)
OCZ	Outside of the coastal zone boundary
QMP	Quality management plan
SAV	Submerged aquatic vegetation
SONRIS/2000	Strategic Online Natural Resources Information System
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOC	U.S. Department of Commerce
USDOI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USL	University of Southwestern Louisiana, now ULL, University of Louisiana at Lafayette
WRCA	Wetlands Conservation and Restoration Authority
WRDA	Water Resources Development Act
WVA	Wetland Value Assessment; a quantitative, habitat-based assessment developed to estimate anticipated environmental benefits for proposed restoration projects.




COASTAL WETLANDS PLANNING, PROTECTION, AND RESTORATION ACT
Breaux-Johnston Act