WATER MARKS

Louisiana Coastal Wetlands Planning, Protection and Restoration News

September 2009 Number 41

www.lacoast.gov

Moving sands

Ten Years of Barrier Island Restoration

Inside:

September 2009
Number 41

WaterMarks is published three times a year by the Louisiana Coastal Wetlands Conservation and Restoration Task Force to communicate news and issues of interest related to the Coastal Wetlands Planning, Protection and Restoration Act of 1990. This legislation funds wetlands restoration and enhancement projects nationwide, designating approximately $60 million annually for work in Louisiana. The state contributes 15 percent of total project costs.

***WaterMarks* Editor**
Adele Swearingen
3737 Government Street
Alexandria, LA 71302
(318) 473-7687

ABOUT THIS ISSUE'S COVER . . .

Louisiana's birds, fish and human population all benefit when barrier islands thrive. Numerous CWPPRA projects over the past decade have contributed to the survival of this fragile, dynamic system, rescuing some islands from demise and bolstering the longevity of others.

Photo credit: Rex Caffey
Louisiana State University

WaterMarks
Louisiana Coastal Wetlands Planning, Protection and Restoration News
September 2009 Number 41

CONTENTS

For more information about Louisiana's coastal wetlands and the efforts planned and under way to ensure their survival, check out these sites on the World Wide Web:

www.lacoast.gov **www.btnep.org**
www.lacpra.org **www.crcl.org**

Subscribe

To receive *WaterMarks*, e-mail lacoast@condor.nwrc.gov

Moving? The post office will not forward *WaterMarks*. To continue delivery, send your change of address to lacoast@condor.nwrc.gov

For current meetings, events, and other news concerning Louisiana's coastal wetlands, subscribe to the Breaux Act Newsflash, our e-mail newsletter, at

www.lacoast.gov/newsletter.htm

A LIFELINE OF SAND

Restoration Turns Back the Clock for Louisiana's Barrier Islands

When coastal scientist and native Mississippian Karen Westphal needs to regain her perspective on life, she heads to Louisiana's barrier islands. "It's where I feel most connected to the environment," she says. "To stand in the wind, walk the beach, wade in the waves — it's a spiritual as well as a scientific experience."

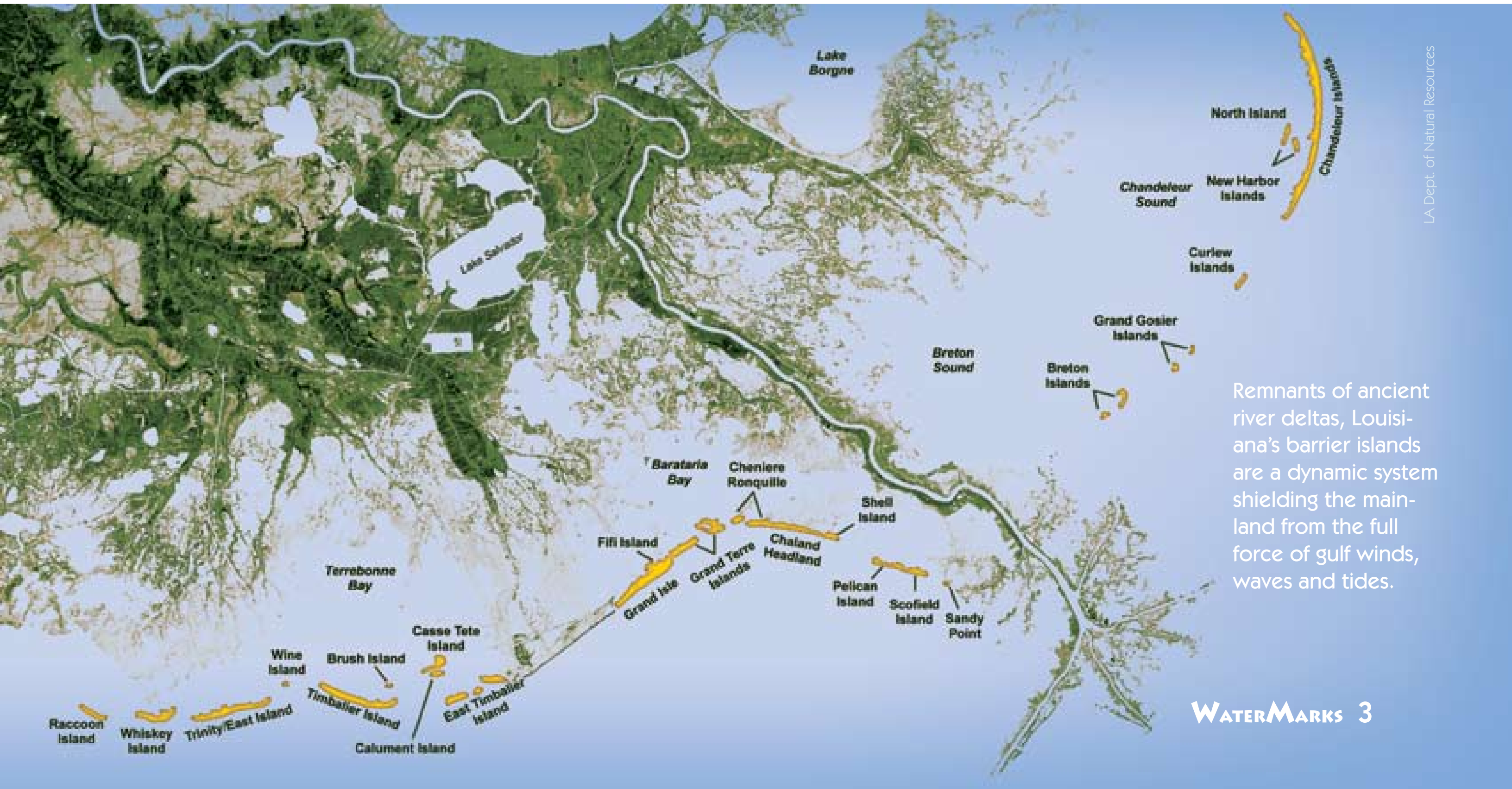
Westphal, now with the National Audubon Society after working years on coastal change and hurricane studies as a university research associate, has known these small scraps of land flung into the Gulf of Mexico since she herself was little. Typically, she says, a Louisiana barrier island consists of salt marsh fronted by a narrow beach that may crest in a small dune. The largest of the islands is less than a thousand acres; the highest unrestored island rises no more than eight feet above sea level. Yet these islands play a giant's role in coastal Louisiana's ecology and geography.

Holding the line between sea and shore

Day-to-day, the islands mitigate waves and tidal currents eroding the mainland's fringe of wetlands. During calm weather, they regulate characteristics such as waves, currents, circulation, salinity and nutrient retention in the estuarine bays lying landward of the barrier system. The islands provide stop-overs for migratory birds; rookeries for brown pelicans and other seabirds, shorebirds and waders; and fertile marine habitat for fish and shellfish. For all their beauty and biological richness, however, the islands may be most prized by Louisianans as the first line of defense against storms.

Functioning as speed bumps, islands slow waves and surge advancing over the gulf's open water. Depending on the height of the island and the size of the storm, an island may reduce its surge. Even overtopped islands dampen a storm's wave energy.

Large storms can batter a barrier island, cutting new tidal inlets through it, flattening



Remnants of ancient river deltas, Louisiana's barrier islands are a dynamic system shielding the mainland from the full force of gulf winds, waves and tides.

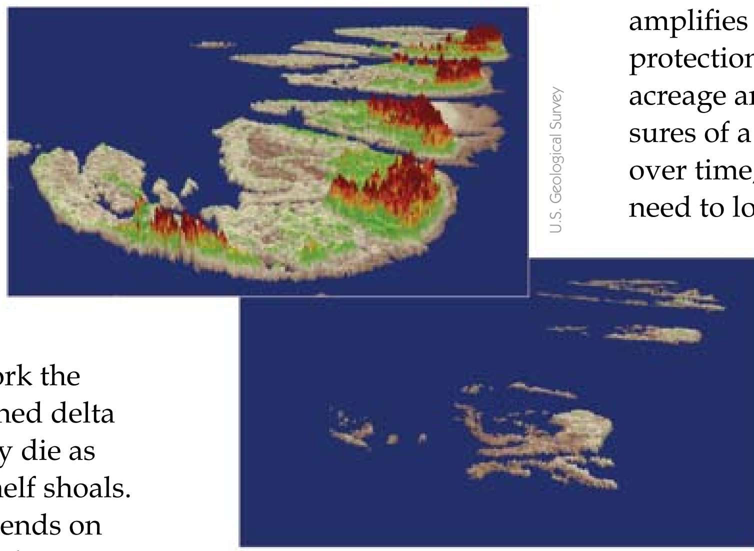
its dunes and scrubbing its beach of sand. But the islands, having evolved in concert with the forces of nature, are generally very resilient. "They move with the waves, eroding in one area and rebuilding in another," says Westphal. "As long as there is adequate sediment in the system, given time without severe storms an island can recover — although perhaps reduced in size and in a different place."

Sand the lifeblood of barrier islands

Barrier islands do, however, have a life span. They are born when wind and water currents rework the sands of an abandoned delta into shorelines. They die as submerged inner-shelf shoals. Their longevity depends on the availability of sediment to regenerate and repair storm damage and counter subsidence.

"Because restricting the Mississippi River to its present course has halted the delta cycle," says Michael Miner, a coastal geologist at the University of New Orleans, "there is no natural process forming new Louisiana barrier islands. But we can extend the life spans of existing islands by reintroducing sand to the central parts of the barrier chains and building large sand reserve sites in the back barrier marsh. This provides the means for islands to be self-sustaining for longer periods of time, even as they face accelerated sea-level rise."

Over the past decade CWPPRA has conducted more than a dozen projects on barrier islands. The majority of these imported sediment to rebuild beaches and create back barrier marshes. Acquiring suitable sediment is the biggest obstacle to island restoration. "We can get some



U.S. Geological Survey

By depicting changes in elevation, LiDAR technology reveals how Hurricane Katrina pushed the Chandeleur Islands toward becoming submerged shoals.

sand from old, submerged islands, shorelines and relict river channel deposits on the inner continental shelf," Miner says. "Larger deposits are abundant on the outer continental shelf and shelf edge, but we have yet to develop the technology to mine it and transport it in a cost-effective manner."

Restoration resets the clock

Monitoring a restored island through even a single hurricane season may raise questions about the wisdom of funding barrier island projects. Why pour money into a place that is by nature mobile and impermanent, that can be reduced to a fraction of its size overnight?

Darin Lee, a coastal resource scientist in Louisiana's Office of Coastal Protection and Restoration, points out that any increase in an island's height amplifies its efficacy as storm protection. "Elevation and acreage are appropriate measures of a project's success over time," says Lee. "But you need to look at the project's influence on the entire system, not merely at its footprint. On East Island, for instance, the footprint shrank, but overall the system gained acreage. Sediment was transported down-drift to fill the cut that the 1974 hurricane Carmen made between East Island and Trinity Island. As project sites erode, the sand we added moves to build land in another area."

But the most important thing that restoration delivers, Lee says, is time. "In the early 1990s East Island had dwindled to less than 100 acres. It was expected to disappear approximately within 10 years. CWPPRA projects restoring Isle Dernieres more than tripled the island's area and extended its life by 20 to 25 years. How valuable are the years of storm protection that it's providing? What's the worth of its fish and wildlife habitat?"

Miner points out that the frequent storms of the past decade have tested existing barrier island restoration projects. "Following hurricanes Gustav and Ike, the effectiveness of sand placement on barrier islands such as Timbalier Island and Chaland Headland was apparent," says Miner. "Compared to other locations, the sandy beaches were able to sustain the storm impacts. Much of the unrestored portions of the coast were reduced to a marshy shoreline."

However, there is a threshold, or a tipping point, at which islands become so deteriorated that there is insufficient structure to restore. But Miner believes that programs working with the natural forces of water and waves and moving sands could extend the life of Louisiana's barrier islands by as much as 150 years. "Our logical goal should be to turn back the clock and prevent robust barrier islands from crossing the threshold to becoming submerged shoals," Miner says. "We have already bought some time with the existing CWPPRA projects along the Isles Derniere, Timbalier, Barataria and Plaquemines shorelines. But increasing sea-level rise and storm frequency are accelerating the trend toward loss. We don't have much time left to keep these islands from disappearing."
WM

IMPERILED ISLANDS SAND-STARVED, STORM-BATTERED

Death Watch for the Chandeleurs?

Looking at maps and aerial photographs taken after the 2008 hurricane season, there doesn't appear to be much left of the Chandeleur barrier islands. Their gleaming beaches have disappeared. Waves wash sand away from their flattened dunes. Water nibbles at the remaining marshy patches. The end could be near for the Chandeleurs.

Down and counting

Once forming a 44-mile arc in the northern Gulf of Mexico, the centuries-old island chain has provided habitat and services essential to the coastal ecosystem. Birds and other wildlife have found seasonal sanctuary on the Chandeleurs. Until the end of the 19th century, people lived and worked on the islands. Scientists, fishermen, artists and campers favored them as a destination. Even lying off shore 70 miles east of New Orleans, the islands contributed protection to the city and its surrounding parishes by quelling the waves and surge of advancing storms.

Throughout the 20th century, storms, subsidence and sediment deprivation weakened and fragmented the island chain. However, even diminished, the islands continued to perform crucial functions in Louisiana's coastal landscape.

Rex Caffey, Louisiana State University

Chandeleur Islands Marsh Restoration (PO-27), NMFS. Approved 2000. St. Bernard and Plaquemines parishes. To capture sediment and stabilize the islands, this project planted vegetation in overwash areas left bare by a 1998 hurricane. Although recent storm damage may prove irreversible, keeping sediment within the overall system provides material for recovery.

After Hurricane Georges struck in 1998, CWPPRA acknowledged the chain's importance by implementing project PO-27, Chandeleur Islands Marsh Restoration. The project's objective was to increase vegetative cover and stabilize overwash areas, thereby trapping sediment and contributing to the maintenance and expansion of back barrier marshes.

Although the islands were showing signs of recovery, nature did not give PO-27 time to accrete much hurricane-resistant land. In the years following the project's implementation, the islands were pummeled by storms, each time becoming more vulnerable to lesser storms. In 2005 Hurricane Katrina dealt the islands a severe body blow, destroying as much as 85 percent of their surface area, sweeping away sandy beaches and breaking up marshes. Three years later another hurricane, Gustav, punched the islands again.

The return on restoration

Recent images of the islands portray a dismal situation. Like an ice cube on a summer day, the chain is dwindling and vanishing in the surrounding waters. But photographs of tattered islands awash in a sea do not tell the whole story of PO-27. Michael Miner, a coastal geologist at the University of New Orleans (UNO), is among the scientists who believe in the project's success. "Without PO-27," says Miner, "the barrier island footprint might be even more diminished today."

Important as that footprint is, Miner thinks the project's greatest value lies not in the waters of the gulf but in the body of coastal engineering knowledge. "A major benefit of this CWPPRA project is a better understanding of where to put sand for effective, long-term island maintenance," he says. "If we place the sand landward of protective marsh rather than of overwash channels, storm events are less likely to move it about."

Gregory Stone, a professor of coastal geology and director of the Coastal Studies Institute at Louisiana State University (LSU), says such site-related information is essential to effective restoration. "How do you put sand on a barrier island that is rapidly sinking?" he asks. "How can you enhance a project's longevity? The depth of surrounding water, the fetch over which waves travel, the average speed of wind, the character of the sea floor — there are scores of factors to consider. Scientists and doctoral students at LSU are tackling these problems to help design and engineer projects suited to very specific local conditions."

Islands on the brink

Some heard in Gustav's winds a death knell for the barrier

The Chandeleurs' lighthouse became a marker to measure the islands' waxing and waning: Some years the lighthouse would rise from a bulking shoulder of land; other years it would stand perilously close to the water's edge. In 2005, Hurricane Katrina toppled the 102-year-old lighthouse into the Chandeleur Sound.

All photos: Karen Westphal

island chain. But others heard only the ageless rhythms of decay and renewal, attack and retreat, hope and despair.

In the islands' patchy remnants Miner sees the sites of future beaches. "These vestiges of marsh become the nucleus for building sandy shorelines during periods of calm weather." he says. Further, sediment for Chandeleur restoration projects is readily available. "Unlike the barrier islands of Louisiana's central coast, tidal currents flow around the flanks of the Chandeleurs," says Miner. "Sand from the central portion of the islands is transferred laterally to the tips of the chain and lost to deepwater sinks. By mining these sinks and reintroducing the sand updrift, we can turn back the clock and extend the life of the Chandeleurs for generations."

Stone also is optimistic about the islands' chances. "We've studied the Chandeleurs' recovery following Camille — a monstrous hurricane — in 1969," he says. "Although the chain has been devastated by recent storms, we still have hope that the Chandeleurs will recover."

Still, looking at the shreds of the Chandeleurs that remain today, some doubt that continuing to invest in the island chain is justifiable. According to a study conducted by UNO and the U.S. Geological Survey, storms have moved so much sand out of the system that, without the introduction of new sand, the islands will convert to shoals within 25 years.

Stone believes that intervening to enable the islands' recovery is essential. "We have to look at wetlands and barrier islands as a unified system," he says. "You can restore all the marsh you want, but without barrier islands, the effort is useless. Without barrier islands, the wetlands' demise will accelerate."

"The Chandeleurs are crossing the threshold from barrier islands to ephemeral shoals right now," Miner says. "When do we decide that restoring a barrier island system is just not feasible? Basically it comes down to economics and the will of the people.

"I believe we don't abandon them until all sediment and monetary resources are exhausted, estuarine productivity is considered unimportant, and we are prepared to retreat from population centers that depend on a wetland buffer for storm protection. If we manage barrier islands as naturally moving systems rather than trying to stabilize them in one place, the islands can virtually maintain themselves until it is time again to turn back the clock." WM

To learn the story of the Chandeleur Islands, visit a site developed by LSU's Sea Grant program at www.laseagrant.org/lighthouse/index.html

REFINING BARRIER ISLAND RESTORATION TECHNIQUES

Ten Years of CWPPRA Projects Advance Science and Design

Furthering the frontier of knowledge isn't measured in acreage or tracked on a map, yet it profoundly benefits the work of protecting and restoring Louisiana's coast. Scientists cite the following as prominent among the lessons learned from a decade of CWPPRA island restoration projects.

Barrier islands are not discrete land masses but parts of a complex system.

A barrier island system is under water as well as above water and includes submerged sand and water flowing around and behind islands. Currents, tides and storms that move an island are part of the system and essential to its long-term evolution, providing natural mechanisms for island migration, reformation and recovery.

Managing sand already within the system can produce short-term advantages, but for true restoration new sand must be introduced into the system. Even if sand fails to stay within a project's footprint, it benefits another part of the overall system.

On each CWPPRA project the state of Louisiana partners with a federal agency. Lead federal agencies for CWPPRA'S barrier island projects include the Environmental Protection Agency (EPA), the National Marine Fisheries Service (NMFS), the Natural Resources Conservation Service (NRCS), and the U.S. Army Corps of Engineers (USACE).

Barrier islands and coastal wetlands are interrelated systems.

The volume of tidal waters moving through barrier island passes — the tidal prism — increases as bay areas expand over engulfed wetlands. "The greater the tidal prism, the larger the passes become to accommodate its daily movement," says Darin Lee, a coastal resource scientist in Louisiana's Office of Coastal Protection and Restoration. "By rebuilding wetlands we decrease the size of bays and reduce the volume of water flowing through the passes. The result is smaller passes and more robust islands that provide stronger protection to the wetlands."

Every feature of a barrier island's morphology is essential for the island's survival.

Timbalier Island Planting Demonstration (TE-18), NRCS. Approved 1991. Terrebonne Parish. Using sand fences and vegetative plantings to trap and stabilize wind-borne and overwash sediments, this project demonstrated the importance of correct orientation, placement and material composition of fences, and the value of regular maintenance.

Albertine Kimble

East Timbalier Island Sediment Restoration, Phase 1 (TE-25), approved 1993; and East Timbalier Island Sediment Restoration, Phase 2 (TE-30), approved 1994. NMFS, Lafourche Parish. Although battered, East Timbalier Island has survived recent hurricanes because of these projects. A petrochemical facility on the island presents the opportunity to cooperate with private interests to continue restoration efforts.

Above: ***Isles Dernieres Restoration East Island (TE-20), approved 1991; and Isles Dernieres Restoration Trinity Island (TE-24), approved 1992. EPA, Terrebonne Parish.*** These restoration projects were early models for the coordinated use of dredged sediment, sand fencing and vegetative plantings to stabilize and prolong the lives of Louisiana's barrier islands.

Whether it is a beach berm capturing sand, a dune storing sand or a back barrier marsh providing a platform to hold sand pushed to the back of the island during storms, each component is indispensable to a dynamic, sustainable barrier island.

In rebuilding beaches, dunes and marsh, grain size matters.

To the untrained eye, sediment here might look just like sediment there, but engineers have learned that how different sediments stack and settle has a huge influence on the success of barrier island restoration.

"Finding appropriate sand is a continuing challenge," says Brad Miller, a project manager with the Louisiana Office of Coastal Protection and Restoration. "Not only do we deal with factors such as depth, sediment characteristics, distance from project sites and burial beneath layers of unsuitable sediment, we have to cope with thousands of miles of oil and gas pipelines that may prevent access to a sediment source."

Advances in geotechnical investigations have improved the chances of finding suitable sediment. Among them is employing acoustic and seismic technologies similar to those used in searching for oil. Over the past decade, collaborative and project-specific activities have mapped hundreds of acres of water bottoms and profiled their sands, increasing the efficiency of sediment searches.

In placing sand fences, inches and angles matter.

Sand fences' structure and function are pretty simple: slat fencing is erected on a beach to knock down wind-blown sand and cause its accumulation into dunes. But experience has refined this simple concept to maximize its efficacy by determining

- the most effective angle of fence to shoreline
- the optimum spacing of fence slats and fence rows to slow wind and capture sand
- the best materials to use to mitigate the hazard a storm-damaged fence poses on the beach or in the water

In planting newly implemented projects, species and timing matter.

Selecting the correct plants to revegetate different island habitats is essential, as is planting them quickly to hold sediment on newly rebuilt islands. And if an island is a host to invasive vegetarians such as nutria, a trapper may become indispensable to project success.

East/West Grand Terre Islands Restoration (deauthorized) (BA-30), NMFS. Approved 2000. Jefferson Parish. Designed under CWPPRA, the project to expand dune and marsh acreage will be funded through the Coastal Impact Assistance Program (CIAP). CWPPRA at times serves as an incubator, developing projects that other funding authorities can construct quickly.

LA Dept. of Natural Resources

Whiskey Island Restoration (TE-27), EPA. Approved 1993. Terrebonne Parish. Built to a lower elevation than previous barrier island projects, TE-27 has endured several storms without breaching, demonstrating the importance of width in island restoration.

CWPPRA

Barataria Barrier Island Complex Project: Pelican Island and Pass La Mer to Chaland Pass Restoration (BA-38), NMFS. Approved 2002. Plaquemines Parish. In 2008 the hurricanes Gustav and Ike proved the effectiveness of placing sand at locations such as Timbalier Island and Chaland Headland. The sandy beaches weathered the storms well when compared to unrestored portions of the central coast, which were reduced to marshy shoreline.

Timbalier Island Dune and Marsh Creation (TE-40), EPA. Approved 2000. Terrebonne Parish. Dredged sediment, sand fencing and plantings increased dune and marsh acreage; unconfined beach fill added sediment to the nearshore system to dampen wave energy and provide additional material for the island's natural migration.

CWPPRA

Innovations in technology improve restoration on the ground

Within the past 10 years, notable innovations have advanced the data collection, mapping and modeling technologies used in coastal restoration.

Geographic Information System (GIS)

GIS integrates hardware, software and data to capture, manage, analyze and display all forms of geographic information. It can map locations, enable analyses of temporal and spatial patterns and relationships and model conditions under differing circumstances to depict possible future scenarios. Compiling, analyzing and comparing data that previously has been available only through laborious surveying, drawing and manual manipulations, GIS provides detailed information about even quite remote locations and improves understanding of changes in the coastal system. Such information contributes to customizing designs for specific conditions at project sites, increasing the success of restoration projects.

Regional Sediment Management (RSM)

To change the approach to managing sediment from individual projects to a regional framework, the U.S. Army Corps of Engineers initiated the RSM program. Using a GIS system, RSM tracks the location, quantity, removal, transport and placement of sediment and provides the information that planners, managers, engineers and other participants require to match sediment need to availability. By facilitating collaboration among regional stakeholders, RSM reduces duplicative efforts and optimizes the use of precious resources.

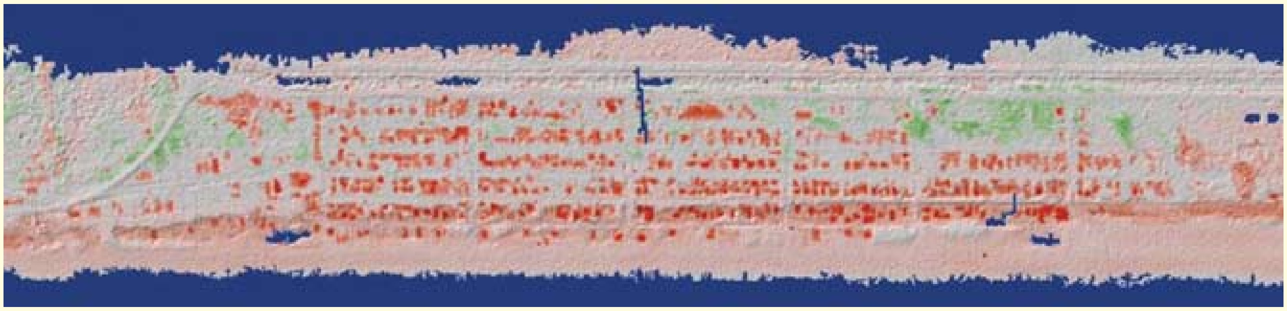
Light Detection and Ranging (LiDAR)

Often flown after hurricanes to assess morphological changes on barrier islands, LiDAR is a surveying technique that measures distances and angles. Shooting out laser light pulses that reflect off the earth's surface and return to equipment aboard an airplane, LiDAR rapidly collects information over large areas. By matching flight information from LiDAR with ground data from the global positioning system (GPS), a technician can determine the location, elevation and topography of the surface recorded. LiDAR is especially useful in assessing long, linear, sandy shorelines and levees in remote locations and in determining changes caused over time by subsidence or storms.

ADvanced Multi-dimensional CIRCulation model (ADCIRC)

A system of computer programs, ADCIRC models water levels and currents in two or three dimensions over various time frames. Simulating tidal, wind, and wave-driven circulation in coastal waters, ADCIRC is used to study hurricane storm surges, inlet dynamics, levees' hydrological effects in wetlands, feasibility of sediment dredging, effects of sediment disposal and larval transport. Unlike some other models, ADCIRC is not based on a structured grid and thus avoids introducing potential errors when modeling large, complex areas that encompass many different geometries, from deep oceans to shallow estuaries. The system is capable of collecting data on factors such as wind speed, atmospheric pressure and water depth and velocity. **WM**

Comparing pre- and post-storm elevations recorded by LiDAR shows the erosion (in red) and the accretion (in green) caused by Hurricane Rita at Holly Beach.



New Cut Dune and Marsh Restoration (TE-37), EPA. Approved 2000. Terrebonne Parish. This project demonstrated that large, shallow breaches can be filled to close a tidal inlet — but time is of the essence. Once waters passing through the breach increase in depth and velocity, repair becomes much more problematic.

Ship Shoal: Whiskey West Flank Restoration (TE-47), EPA. Approved 2002. Terrebonne Parish. This project was the first to propose using sediment dredged from Ship Shoal, a body of sand lying approximately eight miles from the project site in the Gulf of Mexico. A major expense of restoration, dredging operations can use as much as 10,000 gallons of diesel fuel a day.

Raccoon Island Shoreline Protection/Marsh Creation (TE-48), NRCS. Approved 2002. Terrebonne Parish. Although many scientists think that hard structures do not remedy the underlying causes of island decline, one of CWPPRA's most successful barrier island projects, Raccoon Island, has used rock breakwaters to slow the rate of shoreline erosion and increase acreage within the project footprint.

Whiskey Island Back Barrier Marsh Creation (TE-50), EPA. Approved 2004. Terrebonne Parish. Currently under construction, TE-50 will protect the island's longevity by building a marsh platform to increase its width and capture sediment from storm overwash.

Enhancement of Barrier Island Vegetation Demonstration (TE-53), EPA. Approved 2006. This project will test cost-effective technologies and products for establishing and growing key barrier island and salt marsh vegetation. The study will take place in labs at the University of Louisiana at Lafayette and in field locations on the coast.

Restoration works.

After a decade of implementing barrier island projects, CWPPRA agencies can point to numerous successes.

"Projects are lasting reasonably well," says Lee. "Even with the storm activity of the past several years, projects are generally on track to attain the 20-year life span that they are designed for."

"We are continually using our experience to improve our design criteria," Lee says. "The more we understand about the material we use, where we put it and where it goes, the more precise our modeling becomes. That allows us to match restoration practices to an island's unique characteristics such as its evolutionary age, its location within the sand transport system and the terrain of the adjacent ocean floor."

Time for island restoration is running out.

As barrier islands become smaller and narrower, current restoration technology becomes less effective. "Islands are changing in the time taken between proposing a project and implementing it," Lee says. "We need to make the most of what we've learned over the past decade, the advances in modeling, and increase our geotechnical information, to speed up our work. The islands aren't waiting for us." WM

Barrier island, barrier headland — what's the difference?

In some places along Louisiana's coastline, the first line of defense isn't an island but a barrier headland. Both barrier islands and headlands have sandy seashores; both protect the mainland from tidal infiltration, storm surges and other gulf forces. Although less dynamic than islands, headlands display the same phenomenon of rolling back on themselves — storms may push their shoreline sands over and behind their dunes — but, attached to the body of the mainland, they do not migrate as islands do.

Many of the same techniques for restoring barrier islands are used to restore headlands: beach nourishment, dune creation, vegetative planting and, in some cases, rock breakwaters. CWPPRA project CS-31, Holly Beach Sand Management, used such techniques to rebuild approximately 300 acres of beach and dune. More than five miles long, the renourished beach provides essential protection to Highway 84, the only evacuation route for western coastal Louisiana.

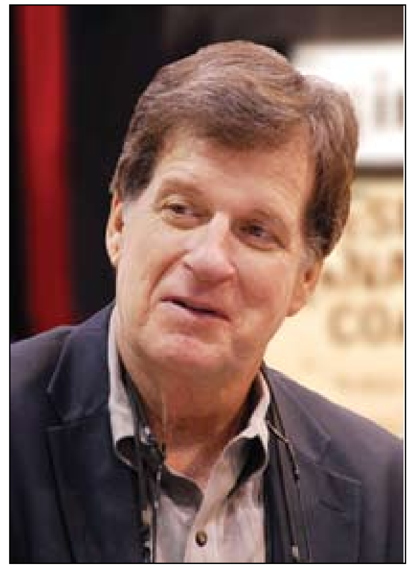
Currently in the engineering and design phase of project development, West Belle Pass Barrier Headland Restoration (TE-52) will rebuild the western end of the Chenier Caminada headland. This project, led by the National Marine Fisheries Service, complements a Louisiana Coastal Area proposal undertaken by the Louisiana Office of Coastal Protection and Restoration and the U.S. Army Corps of Engineers to restore 10 miles of the headland's shoreline. When complete, the contiguous projects will offer protection to Port Fourchon and points inland. WM


CWPPRA

Holly Beach, Cameron Parish

WaterMarks Interview with Abby Sallenger

Unique and Universal, Islands Deliver Lessons for the Future



Abby Sallenger is an oceanographer who received his PhD from the University of Virginia. He's the former chief scientist of the U.S. Geological Survey's Center for Coastal Geology and presently leads the USGS Storm Impact research group in St. Petersburg, Florida. Recently Sallenger published *Island in a Storm: A Rising Sea, a Vanishing Coast, and a Nineteenth-Century Disaster that Warns of a Warmer World.* Written for non-scientists, the book relates the history of the Isles Dernieres' hurricane disaster.

WaterMarks: Barrier island systems front many of our states' shorelines. Are Louisiana's barrier islands different from those in other places?

Sallenger: Barrier islands everywhere are susceptible to erosion and sea-level rise, but because of their geological foundation, Louisiana's barrier islands are sinking at an unusually high rate. Over time, the Mississippi delta's sediments compress and the land subsides. This is driving the remarkably rapid disappearance of Louisiana's islands.

If Louisiana's coastal processes were functioning naturally, new sediment would be entering the system and countering the delta's subsidence. But Louisiana suffers the consequences of engineering the environment. By controlling floods with levees, we have limited the Mississippi River's function of building the delta vertically. Accreting land fails to replenish land lost to erosion and submergence. Total land loss in Louisiana occurs far faster than at most other coastal locations in the U.S.

WaterMarks: Comparing current maps with those from a few decades ago demonstrates how rapidly Louisiana's barrier islands are shrinking and sinking. Can such diminished islands offer any meaningful degree of storm protection?

Sallenger: As islands lose surface area and elevation and as their inlets widen, they become more vulnerable to inundation by storm surge and to accelerated erosion. As a result, their capacity to reduce storm energy before it reaches the mainland shore declines.

WaterMarks: Is it realistic to think we can succeed in preserving Louisiana's barrier islands?

Sallenger: In the early 1990s scientists calculated that the barrier islands known as Isles Dernieres would vanish by 2015. But those islands were rebuilt with dredged sediments, increasing their height and width and closing many of their tidal inlets. Because of that effort, they are still surviving, still providing valuable habitat for fish and wildlife and still helping to shield the mainland from storms.

However, we must realize that restoration of barrier islands is not a one-time solution. The islands will continue to erode as they have in the past. To preserve barrier islands over the long term, periodic maintenance is essential. Otherwise the islands will degrade and ultimately disappear.

Further, we cannot depend on new barrier islands forming as they have in the past. The engineering structures built to hold the Mississippi River in its present course do not allow the natural shift of the river's position nor the introduction of sediments that could be fashioned into new barrier islands. With the river fixed in place, barrier islands cannot form in the same way as they have for thousands of years.

WaterMarks: Are there islands that have become seriously degraded?

Sallenger: The Chandeleur Islands on the eastern flank of Louisiana were severely degraded during Hurricane Katrina — ripped into marshy patches and stripped of sand. Normally in the weeks and months following a storm, beaches naturally rebuild to some extent, with sand migrating back on shore. In contrast, although some parts of the islands have shown signs of recovery, over 50 percent of the length of the Chandeleurs continued to erode rapidly in the first few years following Katrina. Restoring islands like the Chandeleurs will require innovative approaches. The strategies employed must incorporate what we've learned about operative processes on the islands since Katrina.

WaterMarks: What would happen if Louisiana's barrier islands vanished?

Sallenger: Without barrier islands to stop them, marine waters from the Gulf of Mexico would infiltrate the estuarine bays between the islands and the bayous on the mainland, impacting the extraordinarily productive fisheries in the zone where fresh water and sea water now mix. Barrier island bird habitats would disappear, with untold consequences for the migratory birds that depend on that flyway stopover.

On the Mississippi River delta, human activity has interceded in natural processes. Given that the survival of Louisiana's barrier islands depends on our continuing to intercede through restoration, I believe we do so guided by the goals of returning the environment to a more natural condition.

WaterMarks: Can Louisiana's experience be of value to other barrier island restoration projects?

Sallenger: Louisiana approaches beach nourishment in ways very different from how it's done in the rest of the country. In part it's because of the state's history. Louisianans remember a great tragedy that happened more than 150 years ago when the resort on Isle Dernieres was destroyed in a hurricane. Half of the island's population lost their lives. The survivors decided to abandon the island and it was never again developed with permanent structures. Many of Louisiana's other barrier islands have remained undeveloped as well. The response to storms on barrier islands elsewhere in the country has been different; destroyed island communities have been rebuilt bigger and more elaborately. As a consequence, when nourishing these resort beaches, the goal is to use pure sand to make an appealing bathing beach.

In contrast, the Isle Dernieres has been rebuilt with mud, shells and sand from sources close by to maintain the island's integrity. The restored islands serve as a line of defense against storms and as a habitat for wildlife. In considering barrier islands as a system and endeavoring to maintain them, Louisiana may be leading the way for how the rest of the country approaches coastal restoration over the next 100 years, when climate change may accelerate worldwide sea-level rise and coastal erosion. WM

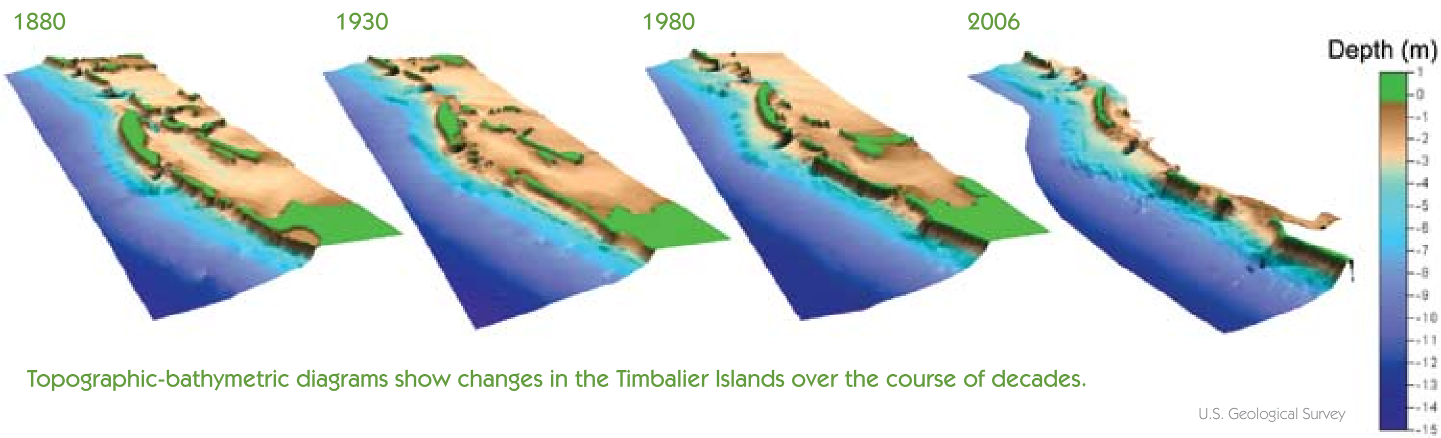
Rex Caffey, Louisiana State University

BARRIER ISLAND COMPREHENSIVE MODELING (BICM)

Program surveys coastal changes, delivers data essential to projects' success

Constant change is the nature of Louisiana's coast — and presents myriad challenges to project designers dependent on accurate and up-to-date site descriptions. To trace the evolution of barrier islands and observe the effectiveness of restoration projects, the Barrier Island Comprehensive Monitoring (BICM) program takes an inventory of the state's coastline every five years. The program uses historical, aerial, marine and Light Detection and Ranging (LiDAR) surveys to model the entire coastal system, from the barrier islands to the beaches and shorelines. This seamless representation of the area can be used to track changes in topography, bathymetry and shorelines; to assess the effects of storms; to check for alterations in habitat; and to evaluate the characteristics and movement of sediment.

The program is funded through the Louisiana Coastal Area Science & Technology Program, which is a partnership of the Louisiana Office of Coastal Protection and Restoration (OCPR) and the U.S Army Corps of Engineers and is implemented by OCPR, the Pontchartrain Institute of Environmental Studies at the University of New Orleans, and the U.S. Geological Survey. WM



Topographic-bathymetric diagrams show changes in the Timbalier Islands over the course of decades.

WATERMARKS
Louisiana Coastal Wetlands Planning, Protection and Restoration News
September 2009 Number 41

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

OFFICIAL BUSINESS

Presorted Standard
Postage & Fees Paid
U.S. Army Corps of Engineers
New Orleans District
Permit No. 80