SPECIAL ISSUE

WATER MARKS

Louisiana Coastal Wetlands Planning, Protection and Restoration News

February 2003 Number 22

GLOBAL CLIMATE CHANGE and Louisiana's *Coastal Wetlands*

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WaterMarks is published quarterly 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 enhancement projects nationwide, designating approximately $35 million annually for work in Louisiana. The state contributes 15 percent of the cost of project construction.

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ABOUT THIS ISSUE'S COVER . . .
October 2, 2002: Hurricane Lili bears down on the wetlands of Louisiana.

Courtesy of NOAA

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Acknowledgments

We gratefully acknowledge the time and assistance of Drs. Shea Penland, Denise Reed and Robert Twilley in providing extensive background information, photographs and expert advice for this special issue of *WaterMarks*. We also thank the Union of Concerned Scientists, the Environmental Protection Agency, the National Oceanic and Atmospheric Administration, the U.S. Army Corps of Engineers, the U.S. Geological Survey and the National Aeronautics and Space Administration for supplying images.

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.savelawetlands.org
www.crcl.org

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Global Climate Change and Its Impact on Louisiana's Coastal Wetlands

HEAT, HEAVY RAINS and occasional storms, floods and droughts have always been part of coastal Louisiana's climate. But global climate change could intensify this historical pattern, damaging the region's vital but already stressed wetlands.

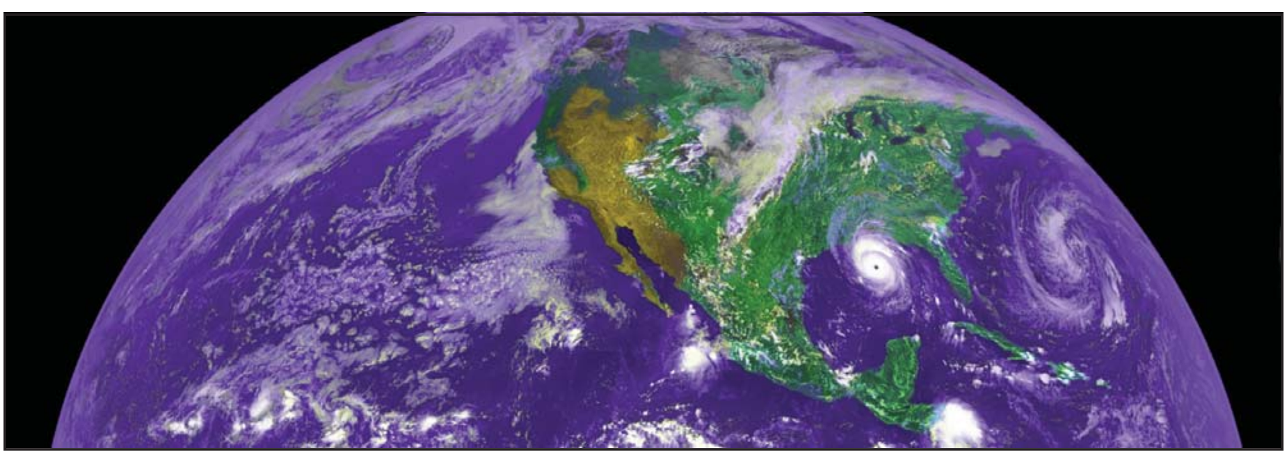
In this special issue of *WaterMarks*, we examine this emerging, and at times controversial, subject. We ask questions, talk to scientists, look at models, and explore how this worldwide phenomenon may harm the fragile estuaries, marshes and mangroves that form the largest delta in the United States. We also consider how global climate change could affect current and future efforts to restore these coastal resources.

International Concern

Natural and human forces drive climate. Although Earth's climate has been evolving naturally for millions of years, evidence suggests that human activities such as burning fossil fuels and clearing forests are altering global climate at an alarming rate.

Because changes in global climate — warming temperatures, rising sea level, and variations in rainfall and storm patterns — could have tremendous human and ecological impacts, scientists

Courtesy of NASA

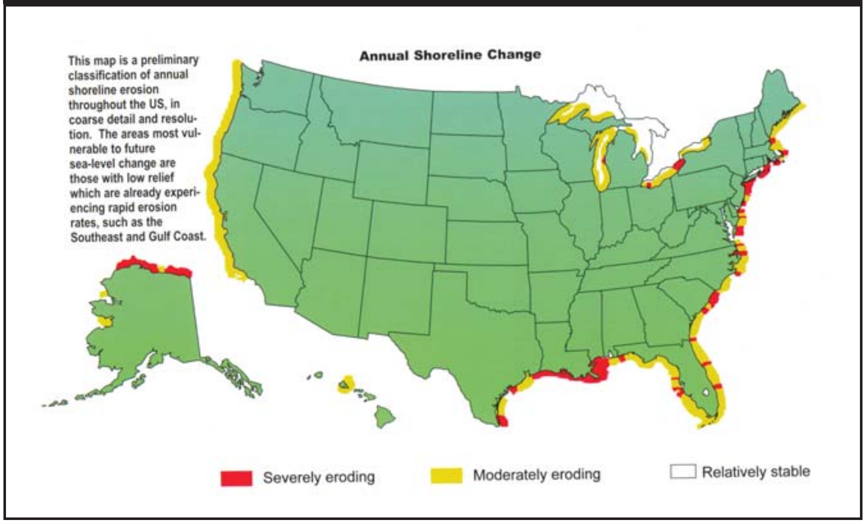


Hurricane Andrew as it makes landfall on the Louisiana coast.

and policymakers around the world have embarked on an unprecedented effort to study and address this issue.

Leading this effort is the Intergovernmental Panel on Climate Change (IPCC), an international consortium of scientists established by the United Nations in 1988. Charged with the task of reviewing and assessing the state of climate change science, the IPCC has published three comprehensive reports, in 1990, 1996 and 2001. Seventeen national academies of science, including the U.S. National Academy, recognize the IPCC assessments as the most comprehensive and objective reports on this controversial subject.

Areas of Coastal Erosion



Courtesy of NOAA

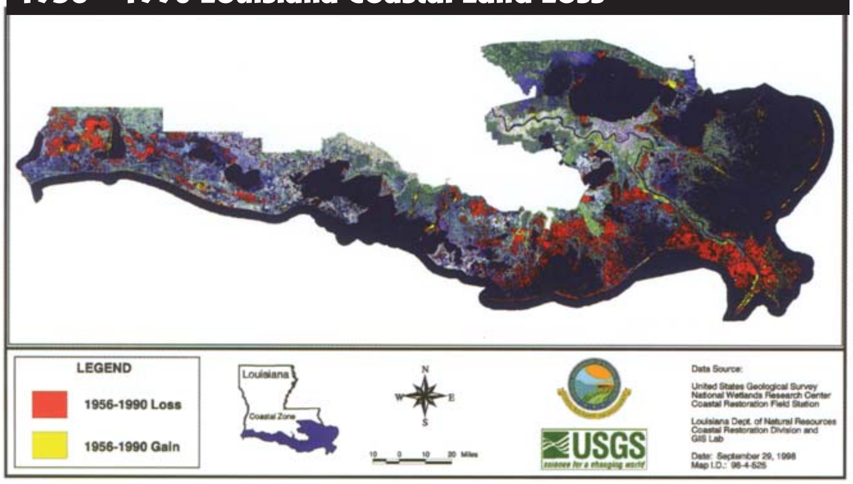
Louisiana's coastline is eroding more rapidly than any other coastal area of the United States.

Consensus Among Scientists

There is widespread consensus today in the international scientific community that the world's atmosphere is warming. The IPCC reports that global average temperature has increased by about 1 degree F in the last 140 years, and is expected to rise by 2.5 to 10.4 degrees F by the end of this century.

Scientists also agree that sea level is rising. Studies show that sea level has increased by 10 to 25 cm — 3.9 to 9.75 inches — in the last hundred years. The IPCC predicts that sea level will continue to rise into the

1956 – 1990 Louisiana Coastal Land Loss



Courtesy of USGS

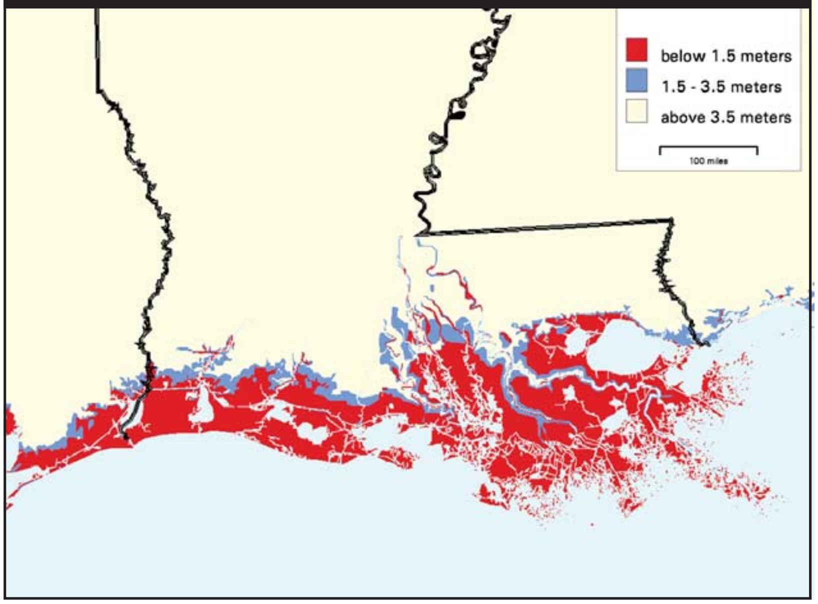
Looked at in detail, the red areas of this map show those parts of Louisiana that were lost between 1956 and 1990.

next century, a crucial factor for Louisiana's coastline and wetlands.

Uncertainty remains, however, regarding patterns of precipitation. The two climate models generally used by scientists differ dramatically on projections of rainfall. Because fresh water is an essential ingredient for the survival of wetlands, this will be a key issue for future restoration projects.

Predictions of storm patterns are also uncertain. Even if the frequency and intensity of storms remain constant, those considered minor by current standards could have major consequences in Louisiana as rising sea levels intensify tidal surge, erosion, flooding and saltwater intrusion.

Potential Inundation of Louisiana



Courtesy of EPA

A 20-inch rise in sea level would have devastating consequences for the Louisiana coastline, much of which would be inundated (area in red).

Summary of Articles

In the following articles, we explore what climate change could mean for Louisiana's coastal wetlands.

First, we look at the science behind climate change projections and provide predictions for the region in our article **"Grappling with the Unknown."**

In **"Defining the Threat,"** we describe how Louisiana's low elevation, high rate of subsidence and deteriorating wetlands make it more vulnerable to the effects of climate change than any other part of the U.S. We consider how Breaux Act projects such as barrier-island marsh restorations and river diversions may help address the consequences of climate change in our article **"Searching for Solutions."**

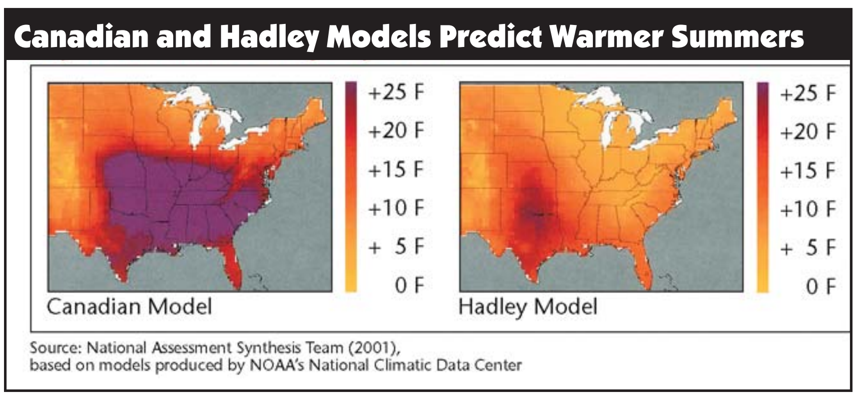
Finally, in the **"WaterMarks Interview,"** we talk with Dr. Robert Twilley, a biologist at the University of Louisiana in Lafayette and a leading expert on climate change in the Gulf Coast. Twilley emphasizes the need and value for decision-makers to include climate change as they plan and fund future projects.

Grappling with the Unknown: How Much of a Change Do Climate Models Project?

HUMANS HAVE BEEN tampering unwittingly with the climate of their planet for at least 100 years, and with grim results. The level of carbon dioxide has increased dramatically, causing the atmosphere to trap solar heat. Fortunately, today's computer-based climatic models allow scientists to examine and "experiment" with the Earth's climate without real-world consequences. Their climate projections may point toward solutions to the problems humans have caused.

Because Earth's climate is formed by an intricate combination of many geological, chemical and biological processes, global climate simulations require an extensive array of data. Natural data sources include air temperatures, rainfall patterns and ocean currents, while data sources that reflect human activities include greenhouse gas emissions, population growth and changes in land use.

With computer models, it is possible to reconstruct past climates, simulate today's climate and, most importantly, predict future climatic change. An immensely difficult task, climate modeling requires supercomputers with vast amounts of memory and experts possessing a sophisticated understanding of climate processes. So far, the two models most commonly cited are the Hadley model, produced at the Hadley Centre in the United Kingdom, and the model in use at the Canadian Climate Centre, known simply as the Canadian model.

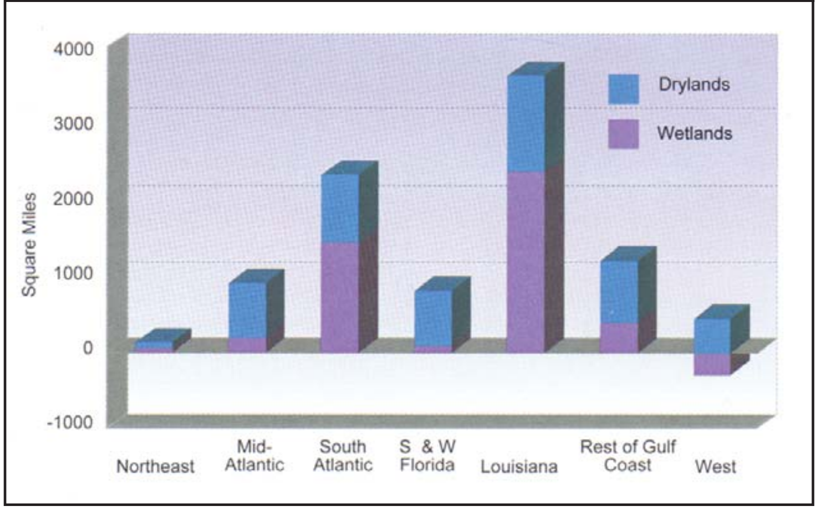


Courtesy of Union of Concerned Scientists

The Canadian and Hadley climate models both point toward hotter summer temperatures, with the Canadian model projecting a sweltering 20-degree F change in the July heat index for coastal Louisiana.

The future climate scenarios projected by these two simulation models (see *Temperatures, Sea-level Rise, Precipitation, Weather Patterns*) are not identical. However, despite some differences, both strongly indicate that the Gulf Coast, and Louisiana in particular, will become significantly warmer and that the coast faces a serious threat from rising sea levels.

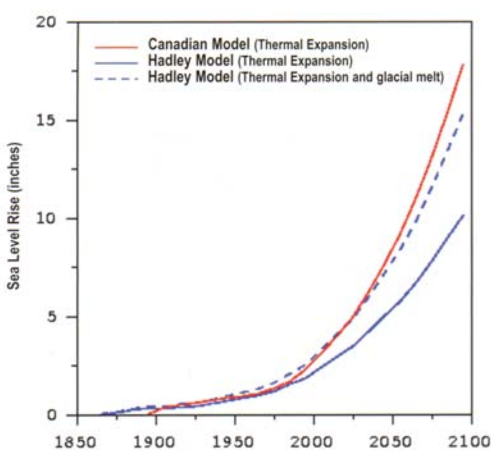
Louisiana Land Loss Projected Largest in Nation



Courtesy of NOAA

Sea level rise is a serious threat for Louisiana, which stands to lose more land than any other coastal area in the nation.

Models Predict Worldwide Sea-level Rise

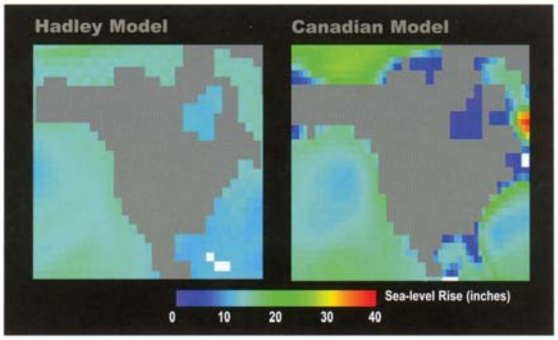


Historic and projected changes in sea level based on the Canadian and Hadley model simulations. The Canadian model projection includes only the effects of thermal expansion of warming ocean waters. The Hadley projection includes both thermal expansion and the additional sea-level rise projected due to melting of land-based glaciers. Neither model includes consideration of possible sea-level changes due to polar ice melting or accumulation of snow on Greenland and Antarctica.

Courtesy of NOAA

Although differing in amount, both of the leading climate models predict significant increases in sea level by the end of this century.

Louisiana Among Highest Risks in North America



The Hadley model projects that ocean warming and melting of mountain glaciers will cause between 8 to 12 inches (20 to 30 cm) of sea-level rise by 2100 for much of the Atlantic and Gulf coasts of the US, depending on changes in winds and ocean current patterns. Projections for the Northeast US and the Pacific coast range from 13 to 16 inches (32 to 40 cm). Any effects of the rising or sinking of the coastal lands must be added to these numbers.

The Canadian model projects a more complex pattern of sea-level rise by 2100. Because of its larger warming estimate, sea level is projected to rise 20 to 24 inches (50 to 60 cm) along parts of the US Atlantic and Pacific coastlines. The orange peak in the Labrador Sea is the result of shifts in the location and intensity of ocean currents.

Courtesy of NOAA

The leading climate models predict that Louisiana will experience one of the highest sea-level rises in North America.

Summary of Climate Model Projections

Temperature

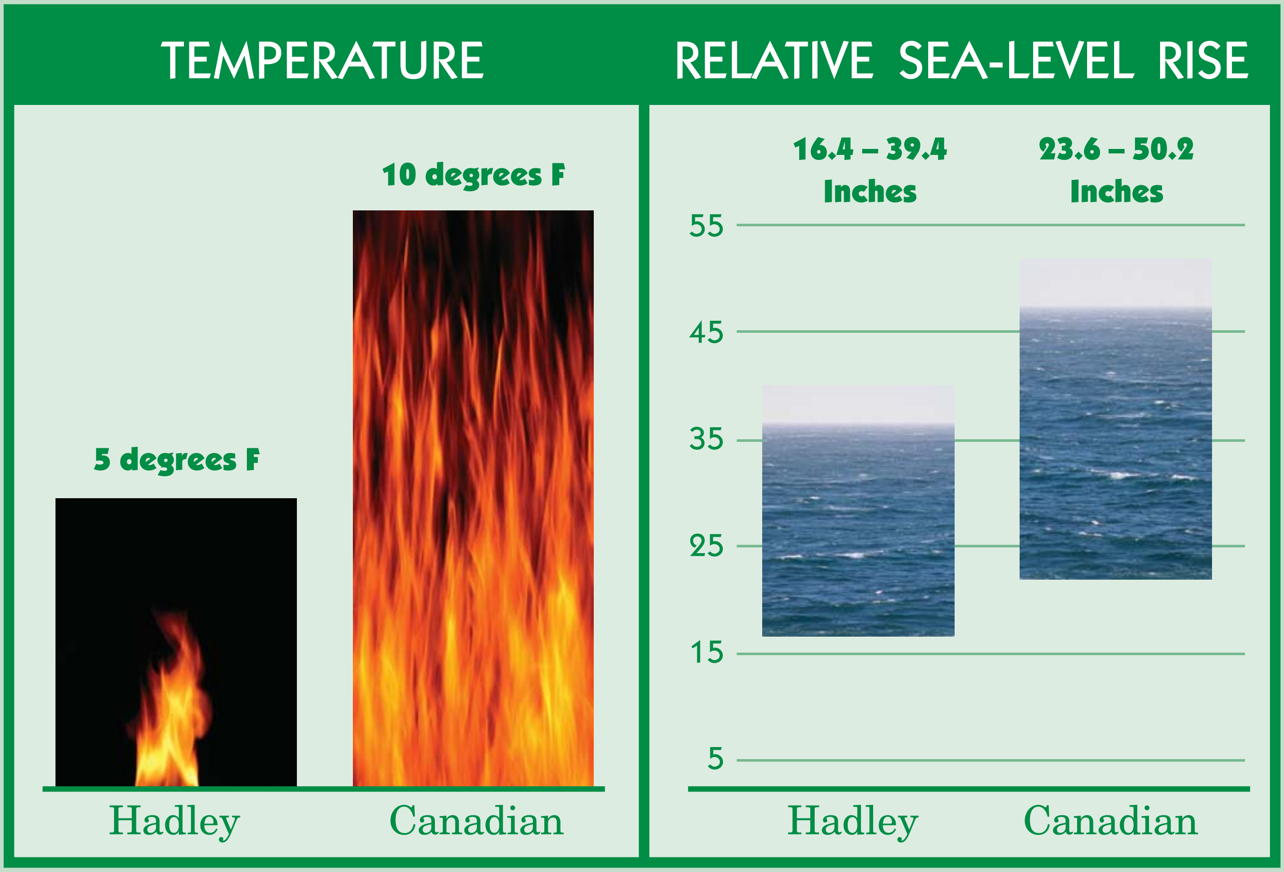
Both the Hadley and Canadian climate models predict a warmer Louisiana in the future, differing only in how much warmer. The Hadley model projects an overall temperature rise of 5 degrees F with a July heat index increasing 8 to 15 degrees F. The Canadian model's forecast is more extreme, predicting a 10 degrees F temperature rise and a sweltering July heat index more than 20 degrees warmer by the end of the century.

Sea-level Rise

The Canadian climate model projects a sea-level rise of 15.6 to 19.2 inches by the turn of the century. The Hadley model is more conservative, predicting a rise of only 8.4 inches. While this would be unsettling for residents of almost any coastline, it is particularly bad news for Louisiana. The state will not only endure a sea-level rise but will suffer subsidence rates (natural compaction of coastal soil) ranging from 8 to 31 inches if past history is an accurate predictor.

When the projected rise in sea level is added to this natural subsidence, the predictions for relative sea-level rise become alarming:

- Canadian model — 23.6 to 50.2 inches
- Hadley model — 16.4 to 39.4 inches
- Average of the two models — 20 to 44.8 inches



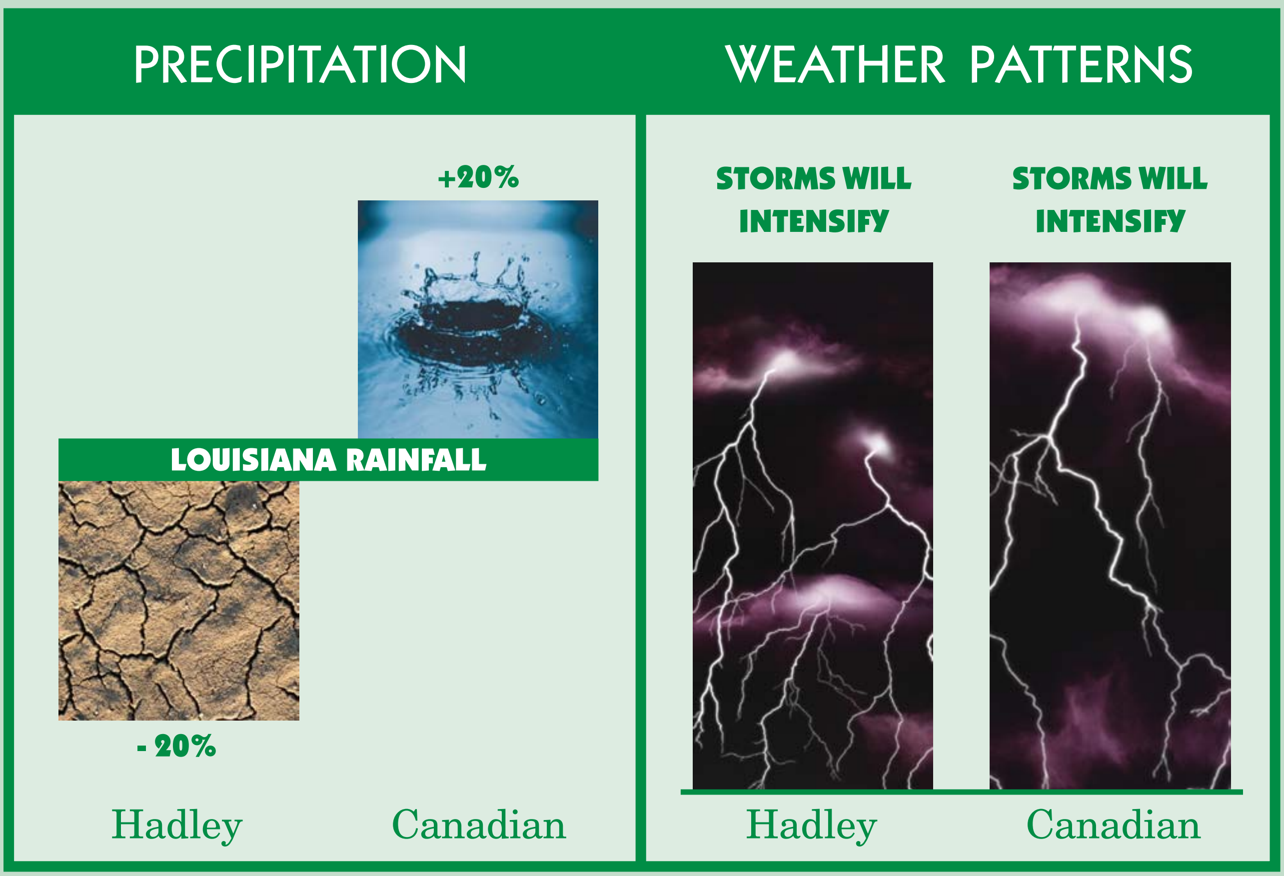
Precipitation

It is extremely difficult to project future precipitation patterns for the southeastern U.S. because of the unpredictable influences of the mid-atmospheric jet stream and high-pressure weather systems originating over Bermuda. Not surprisingly then, the two climate models present opposite scenarios for precipitation. The Canadian model suggests that Louisiana rainfall will decrease by 20 percent; the Hadley model predicts that rainfall will increase by 20 percent. While the predicted change in rainfall for the upper Mississippi drainage basin is not so extreme, only a 5 percent increase or decrease, any changes there will dramatically affect the Mississippi's water levels in Louisiana.

Weather Patterns

The frequency and intensity of future storms and hurricanes is difficult for the models to project. However, both the Hadley and Canadian models indicate that perhaps storms may be more intense, with longer dry periods in-between.

The Hadley and Canadian model projections for the southeast United States are remarkably similar. Both models predict significantly warmer temperatures, higher sea levels and the possibility of more intense storm systems. The primary difference between the two models is in the amount of rainfall predicted, the Hadley model pointing to a drier climate and the Canadian model indicating a wetter climate.



Defining the Threat: How Will Climate Change Affect Already Weakened Wetlands?

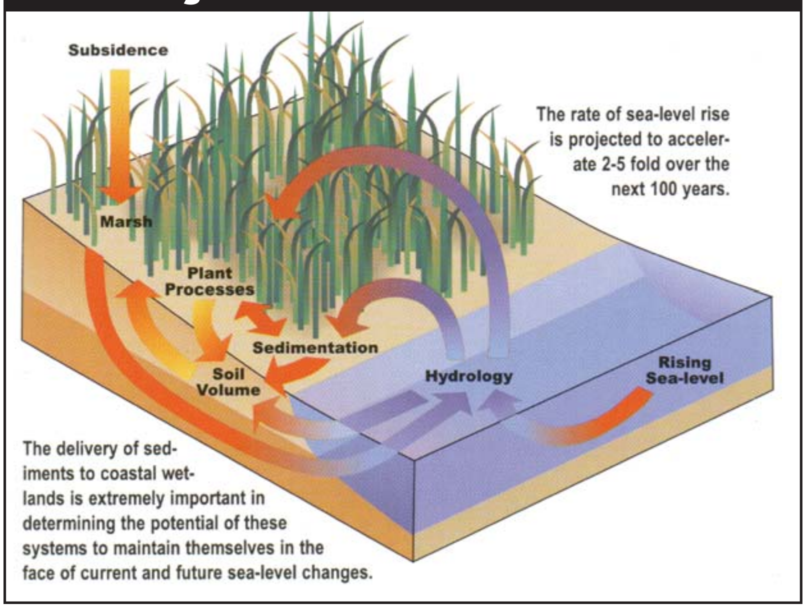
COASTAL LOUISIANA is more vulnerable to the effects of global climate change than any other region in the United States. It's low elevation, high rate of subsidence and rapid loss of wetlands expose this area to the worst consequences of climatic change — a rising Gulf, possibly stronger storms, unpredictable rainfall and warmer weather.

Louisiana has already lost more than 1,500 square miles of coastal wetlands in the past century due to human and natural causes. These causes range from saltwater intrusion along industrial and navigational canals and flood-control levees to the natural settling of muddy soils and erosion of the coastline.

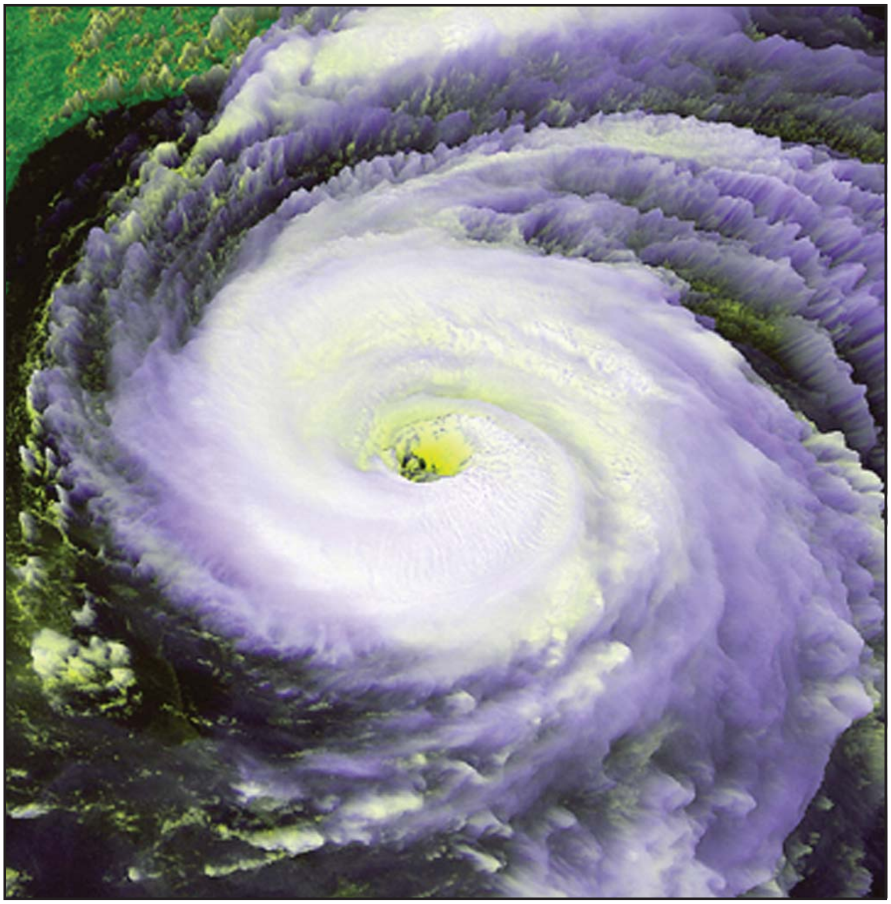
Sea-Level Rise

Rising seas, produced by melting glaciers and warming and expanding oceans, could contribute to further loss of wetlands. In the last 100 years, water levels along the state's coast have increased by as much as 40 inches from a combination of rising oceans and sinking land known as "relative sea-level rise." In fact, Louisiana has the highest rate of relative sea-level rise in the nation. What's more, scientists predict sea level could rise another 20 to 44 inches by the year 2100. Because most of the state's coastal areas are flat, even a conservatively estimated 20-inch rise in sea level would put more than 3,500 square miles of Louisiana underwater. In marsh and mangrove habitats, rising seas would submerge land, waterlog soils, threaten plants and

Marsh Changes as Sea-level Rises



Courtesy of NOAA



Courtesy of NASA

A powerful hurricane can devastate a coastline, destroying barrier islands, eroding beaches and flooding freshwater marshes. Climate models predict that such storms are likely to increase in intensity during this century.

possibly reduce fish and shellfish productivity.

Hurricanes and Storms

Although climate models disagree on how often hurricanes and tropical storms will strike, evidence suggests that future storms may be more powerful. Rising sea levels will magnify the tidal surges, further eroding beaches and flooding interior marshes with salt water. Such forces could undermine ongoing efforts to protect and restore the coastline and its wetlands.

Consider the devastation inflicted by the dual blows of Tropical Storm Isidore and Hurricane Lili, which struck Louisiana within a two-week period last fall. The combined impact of the storms caused more damage to Louisiana's barrier islands than Hurricane Andrew did in 1992, said Dr. Shea Penland, a geologist with the University of New Orleans and an expert on Louisiana's coastal wetlands. Isidore and Lili caused severe erosion, sediment overwash and extensive damage to Breaux Act restoration projects, such as those in the Isle Dernieres barrier islands, said Penland. Trinity Island, the largest in the chain, lost 231 feet of beach — roughly 30 percent of the island — unraveling much of the restoration work done after Andrew stripped 160 feet from the beach 10 years ago. "Without these Breaux Act barrier-island restoration projects in place, the destruction to the Isle Dernieres would have been much greater," said Penland.

Rainfall and Runoff

In addition to the harmful effects of rising seas and perhaps stronger storms, Louisiana's wetlands face the threat of

Courtesy of Dr. Shea Penland

Prior to Hurricane Lili, East Island, part of the Isle Dernieres barrier island group, was a strong barrier with wide beaches, accumulating sand on its eastern end and protecting the marshes and waters behind it.

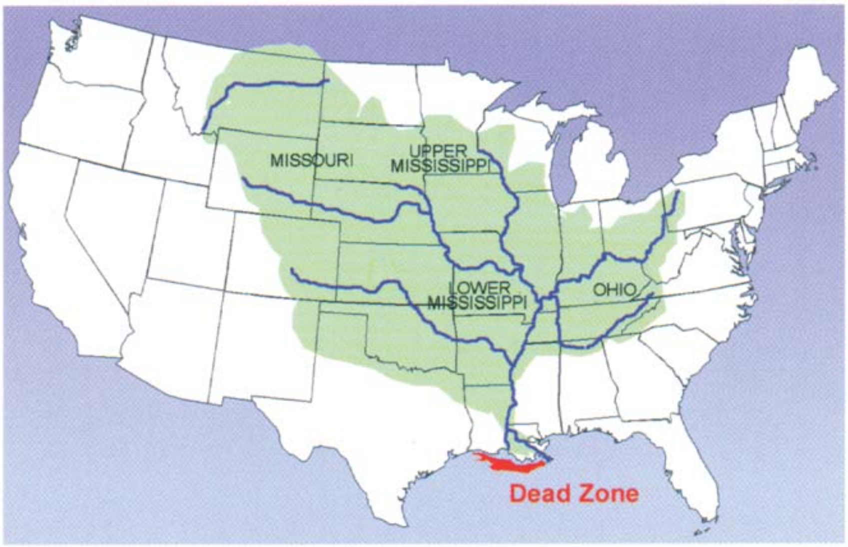
Courtesy of Dr. Shea Penland

After Hurricane Lili's devastation, much of the eastern end of this barrier island is gone, gouged out by the hurricane's wind and waves. The hurricane almost split the island in two parts, nearly breaching it at the point indicated by the arrow.

serious changes in precipitation. The two climate models project opposite scenarios for both rainfall and river runoff in the state's coastal zone.

Courtesy of NOAA

Drainage from the Continent to the Gulf



The Mississippi River Basin, the source of nutrients causing the 6,000- to 7,000-square-mile "dead zone," or hypoxia in the Gulf of Mexico.

"The more recent droughts may be signatures of global climate change," said Penland. Dry conditions, such as those experienced during the drought that extended from 1998 – 2000, could increase the dieback of marshes as a result of the "brown marsh" phenomenon. Reductions in rainfall and river flow would degrade water quality, altering food webs in estuaries and increasing the risk for harmful algal blooms and the accumulation of contaminants in animals and humans.

Increases in freshwater runoff to the Mississippi River, on the other hand, could exacerbate conditions like the "dead zone" off Louisiana's coast, where fertilizer-rich runoff has formed an 8,500-square-mile area of oxygen-starved marine life. Such conditions could decrease yields of shrimp and other catches.

Higher Temperatures

Warmer weather would pose another threat to the state's wetlands. A rise in temperature of even a few degrees could be deadly for the larval forms of many ocean species that spend the early stages of their lives in estuaries.

An acceleration of wetlands loss due to changes in global climate would have significant consequences, exposing the region to more damage from storms and threatening navigation, industry, agriculture, fishing and the people of Louisiana. WATER MARKS

Searching for Solutions: Planning for Climate Change Critical for Breaux Act Projects, Experts Say

LOUISIANA'S COASTAL wetlands are rapidly disappearing, and scientists predict that rising seas and possible changes in storms, rainfall and temperature could further damage these fragile ecosystems. Although no Breaux Act projects have been specifically designed to address the adverse effects of climate change, some projects, such as barrier-island marsh restorations and river diversions, may help.

Courtesy of NOAA Restoration Center, Erik Zobrist

Workers planting cordgrass on the Chandeleur Islands.

Courtesy of NOAA Restoration Center, Erik Zobrist

The growth of cordgrass after one year is already acting to trap sediment on the Chandeleur Islands.

Barrier-island Restorations

Breaux Act marsh restoration efforts on the Chandeleur Islands provide a case in point. In 2001 some 81,000 sprigs and pots of smooth cordgrass (*Spartina alterniflora*) were planted along 6.6 miles of back barrier-island salt marsh to alleviate the damage caused by Hurricane Georges in 1998. When Tropical Storm Isidore and Hurricane Lili ripped through the gulf last fall, this marsh, now lush with cordgrass, caught sediment that was washed and blown from the beach —

Courtesy of Dr. Shea Penland

Mature cordgrass on the Chandeleur Islands, prior to Hurricane Lili.

crucial soil that, otherwise, would have been lost to the sea.

Although Isidore and Lili packed the cumulative punch of a Category 4 hurricane, the back barrier-island marsh remained "relatively unscathed," said Dr. Shea Penland, director of the Pontchartrain Institute for Environmental Sciences at the University of New Orleans and a long-time authority on coastal Louisiana. "The back barrier-island salt marsh restoration project was the key to building a storm-resistant island," said Penland.

During hurricanes, barrier islands play two essential roles: shielding coastal communities from tidal surge and wind; and guarding productive wetlands and estuaries that support a $10 billion-per-year fishing industry. As sea levels rise, and future storms perhaps intensify, barrier islands and projects to restore them will become increasingly important to these communities and wetlands.

River Diversions

River diversions, another Breaux Act approach to coastal restoration, may soften the combined impact of rising seas and subsidence. For example, the West Bay Sediment Diversion Project will unleash sediment-rich water from the Mississippi — restoring more than 10,000

Courtesy of Dr. Shea Penland

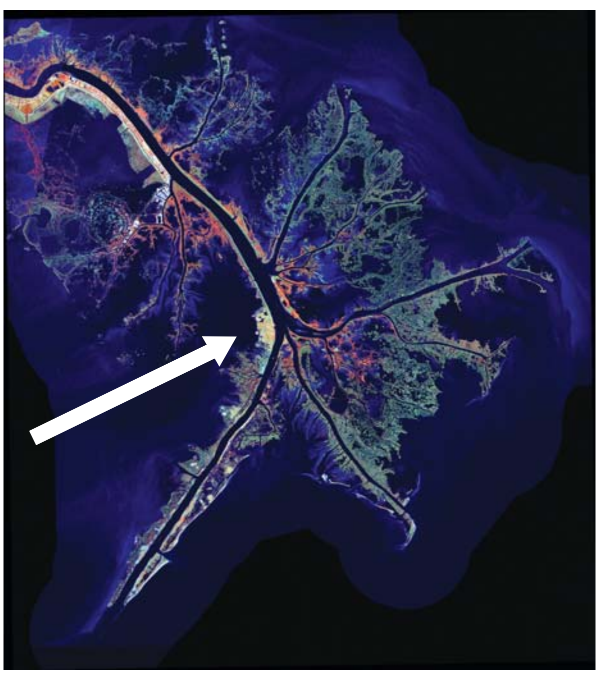
The grassy portions of the Chandeleur Islands prevented a devastating loss of land during Tropical Storm Isidore and Hurricane Lili.

acres of marsh that have been lost to erosion by the gulf. The U.S. Army Corps of Engineers and Louisiana Department of Natural Resources will share the cost of the $22.3 million project. Construction will begin in spring 2003.

"Diversions give the marshes a fighting chance," said Dr. Denise Reed, a geology professor at the University of New Orleans, whose research includes coastal marsh response to sea-level rise. By allowing fresh water, sediment and nutrients to flow in from the river, "coastal marshes can build themselves up," she said.

Courtesy of NOAA Restoration Center, Erik Zobrist

On East Timbalier Island, sediment is being pumped onto the marsh platform.



Courtesy of USACE

The West Bay Diversion will build sediment on the western side of the Mississippi Delta.

Planning for the Future

As Breaux Act decisionmakers design and fund new projects, they now face the challenge of adjusting for climate change. "Every project, no matter what the size, will have to deal with the consequences of global climate change," said Dr. Robert Twilley, a biologist at the University of Louisiana in Lafayette and a leading expert on climate change. "We have to plan the sustainability of projects if we want to maximize taxpayers' investments," said Twilley.

A concept called "adaptive management" is gaining momentum among Breaux Act planners today. The idea is to learn from past projects and incorporate

Courtesy of NOAA Restoration Center, Erik Zobrist

A dustpan dredge, the “Beach Builder”, used in the restoration of East Timbalier Island.

more comprehensive understanding into future ventures. “Our No. 1 goal is to get the civil engineers to talk to the ecologists in the design phase,” said Twilley. “They need to ask basic questions like, ‘Will your plants be able to keep their heads above water in 10 years, given what we know about sea-level rise?’ ”

Courtesy of NOAA Restoration Center, Erik Zobrist

In the Atchafalaya Sediment Delivery Project, dredged sediments were pumped through a pipeline toward the marsh creation disposal area.

“When we first started wetlands restoration projects, we didn’t have much data on global climate change,” said Penland. “But in the last decade, we have seen that global climate change is a reality — something we absolutely must include in future Breaux Act planning.”

Sample CWPPRA Projects Mitigating Sea-level Rise

Project Number	Project Title	Description of Project Work	Net Acres at 20 years	Completion Date	Construction Status
AT-2	Atchafalaya Sediment Delivery	Channel dredging to enhance natural sediment delivery	2,232	21-Mar-98	Construction complete; Monitoring in progress
AT-3	Big Island Sediment Distribution	Channel dredging to enhance natural sediment delivery	1,560	8-Oct-98	Construction complete; Monitoring in progress
AT-4	Castille Pass Channel Sediment Delivery	Channel dredging to enhance natural sediment delivery	589	Unscheduled	Engineering and design phase
BA-3c	Naomi Outfall Management	Construction of weirs with boat bays to maximize sediment retention and nutrient uptake	633	7-Jul-02	Construction complete
BA-21-2	Pass Chaland to Grand Bayou Pass Barrier Shoreline Restoration	Creation of marsh platform and six, one-acre ponds to be seeded aerially	161	1-Aug-04	Engineering and design phase
BA-24	Myrtle Grove Siphon	Installation of eight siphon pipes and vacuum pipe; construction of leveed outfall channel to facilitate distribution of water and sediments	1,119	Unscheduled	Engineering and design phase
BA-25	Bayou Lafourche MR Reintroduction	Installation of pump/siphon system, a receiving intake structure, discharge settling pond/sediment basin, weir structures and bank stabilization	988	Unscheduled	Engineering and design phase
BA-28	Vegetative Plantings on Grand Terre Island	Vegetative plantings; degradation of retention dikes to enhance fisheries; construction of fencing to reduce grazing	127	1-Jul-01	Construction complete; Monitoring in progress
BA-30	East/West Grand Terre Island Restoration	Construction of 40 acres of dune, which will be planted with vegetation	472	1-Aug-04	Engineering and design phase
BA-33	Delta-building Diversion at Myrtle Grove	Installation of five gated box culverts and a conveyance channel; construction of a pump station	8,891	Unscheduled	Engineering and design phase
BA-34	Small Freshwater Diversion to Northwestern Barataria	Installation of two small siphons, gap spoil banks and culverts	*	Unscheduled	Engineering and design phase
BS-3a	Caernarvon Diversion Outfall Management	Construction of six armored plugs and maintenance of one plug; install culverts in seven existing plugs; restoration of spoilbanks to enhance freshwater flow and retention	802	19-Jun-02	Construction complete
BS-10	Delta-building Diversion North of Ft. St. Philip	Installation of a new diversion channel and cuts made into the channel will divert water and sediments into adjacent open waters	2,473	1-Apr-04	Engineering and design phase
MR-3	West Bay Sediment Diversion	Construction of a conveyance channel for diversion of sediments from the Mississippi River	9,831	30-Oct-04	Engineering and design phase
MR-6	Channel Armor Gap Crevasse	Crevasse widening to enhance flow of fresh water and sediment	936	2-Nov-97	Construction complete; Monitoring in progress
MR-9	Delta Wide Crevasses	Crevasse widening to enhance flow of fresh water and sediment	2,386	31-Dec-14	Construction phase
MR-13	Benny's Bay Diversion	Installation of a conveyance channel for an uncontrolled sediment diversion	5,828	Unscheduled	Engineering and design phase
PO-27	Chandeleur Island Marsh Restoration	Vegetative plantings	220	1-Sep-03	Construction phase
PO-29	Diversion into Maurepas Swamp	Construction of two box culverts, a receiving pond reinforced with riprap and a deep outflow channel to run from the Mississippi River to U.S. Interstate 10	N/A	30-Nov-08	Engineering and design phase
TE-20	Isle Dernieres Restoration, Phase 0	Use of existing sand for dune build-up; closure of breaches and construction of side dikes; suction dredging to fill areas within structures; vegetative plantings	9	15-Jun-99	Construction complete; Monitoring in progress
TE-24	Isle Dernieres Restoration, Phase 1	Dune build-up, breach closures, construction of side dikes; suction dredging; elevated-marsh platform creation; vegetative plantings	109	15-Jun-99	Construction complete; Monitoring in progress
TE-25	East Timbalier Island Restoration, Phase 1	Placement of dredged sand to create wetland habitats; addition of rock to existing breakwater to reduce wave-induced erosion	1,913	1-May-01	Construction complete; Monitoring in progress
TE-27	Whiskey Island Restoration	Placement of dredged materials for wetland creation; closure of the breach at Coupe Nouvelle; vegetative plantings	1,239	15-Jun-00	Construction complete; Monitoring in progress
TE-30	East Timbalier Island Restoration, Phase 2	Pumping of dredged sand to create dune and intertidal wetland habitats	215	01-Sep-02	Construction complete; Monitoring in progress
TE-32a	Lake Boudreaux Freshwater Introduction	Dredging and installation of sluice gates and outfall management structures for freshwater introduction; flood protection measures	619	1-Jan-03	Engineering and design phase
TE-37	New Cut Dune/Marsh Restoration	Closure of the breach between Trinity and East Islands through direct creation of dune and marsh habitat	102	Unscheduled	Engineering and design phase
TE-39	South Lake DeCade Freshwater Introduction	Installation of a water control structure in the southern bank of Lake DeCade; provision of shoreline protection; weir removal	201	1-Sep-04	Engineering and design phase
TE-40	Timbalier Island Dune/Marsh Restoration	Creation of dune and marsh to restore the eastern end of Timbalier Island	273	Unscheduled	Engineering and design phase
TE-47	Ship Shoal: Whiskey West Flank Restoration	Pumping of dredged sand to create dune and intertidal wetland habitats; vegetative plantings	182	Unscheduled	Engineering and design phase
TE-48	Raccoon Island Shoreline Protection/Marsh Creation	Construction of breakwaters; placement of dredged sand to create wetland habitats; vegetative plantings	167	Unscheduled	Engineering and design phase

*No net acres are calculated for swamp projects. This project would benefit 5,134 acres.

WaterMarks Interview with Robert Twilley

Dr. Robert Twilley is a professor of biology and director of the Center for Ecology and Environmental Technology at the University of Louisiana in Lafayette. He is also lead author of "Confronting Climate Change in the Gulf Coast Region," a report of the Union of Concerned Scientists and the Ecological Society of America.

WATERMARKS: Let's begin with the basic question — is global climate change real?

TWILLEY: I can assure you, it's real. We have empirical evidence from highly credible sources showing that there's been an increase in the earth's air and water temperatures, a rise in sea level and shifts in patterns of precipitation. The debate in the scientific community isn't whether there is global climate change, but about the specific mechanisms that control change and what the magnitude of change will be in the future.

Dr. Robert Twilley

WATERMARKS: Isn't it possible that the climate change you're seeing is part of a natural cycle that will eventually reverse itself?

TWILLEY: Unfortunately, the human impact on our natural cycles is what is most disturbing. Let's use the example of CO_2 concentrations. Core samples taken in Antarctica give us a definitive history of the level of CO_2 in the atmosphere going back 170,000 years and covering four major climactic cycles. Up until recently, the very highest concentration of CO_2 over that 170,000-year history was

280 parts per million. In 1954, however, concentrations were measured at 300 parts per million, an amount unprecedented until then. Today, the concentrations have jumped to 360 parts per million, an additional 20 percent increase over the previous high in less than 50 years. It's that kind of empirical evidence that has convinced the scientific community that what we're seeing is human adjustments of natural cycles.

Courtesy of NOAA Restoration Center, Erik Zobrist

A reminder that water levels change over time.

WATERMARKS: Is it true that Louisiana is in greater danger from global climate change than other coastal states?

TWILLEY: Global climate change represents a greater risk for southern Louisiana than anyplace else in the nation. Because of the sedimentary composition of our deltaic plain, deeper regions of our marshes are sinking at the same time that the sea level is rising. So Louisiana can expect a combined, or relative, sea-level rise of at least 15 inches in the next 100 years — and up to 44 inches in some places. There's been a 2-inch relative sea-level rise in some regions over the last 10 years, which, given the flat slope of the coast, has put millions of dollars of taxpayer and corporate investments at risk because of the potential loss of infrastructure.

WATERMARKS: Does the private sector recognize the financial threat of sea-level rise in Louisiana?

TWILLEY: For the most part, the private sector can certainly appreciate the nature of the problem; it is a matter of whether they are willing to pay the costs inherent in the risks. But risk assessment is certainly familiar territory to the corporate world. British Petroleum just spent an additional $10 million in the construction of its new pipeline, partly because of the risk associated with sea-level rise. So the private sector knows what it means to protect an investment.

R. King Milling, president of Whitney

National Bank and chair of the Louisiana Governor's Commission on Coastal Restoration and Conservation, has built tremendous awareness of the corporate risks to wetland loss and the need for immediate action. The equity that is lost each year with the disappearance of wetlands, and the risks to business investments has reached the highest levels of the private sector. Mr. Milling, and others like him, take this threat seriously.

WATERMARKS: What about a threat to CWPPRA's efforts to restore the coast? Is sea-level rise a factor?

TWILLEY: I think the most important word in the CWPPRA acronym is "planning." Every project, every design, every bit of engineering has to account for sea-level rise. It absolutely has to be one of the critical factors. If it's not, then I don't think there's been a buy-in to the idea of sustainability … to the idea that a project has a 20- or 30-year life span. Any project started today and intended to be producing results 10 years from now will be affected by sea-level rise.

WATERMARKS: But aren't you talking about additional costs?

TWILLEY: When British Petroleum spent $10 million to account for future sea-level rise, it was adding value because the investment will significantly extend the life and therefore profitability of the new pipeline. CWPPRA projects will function in the same way. When you account for sea-level rise, then, and only then, can you calculate a cost-to-benefit ratio based on a 20- or 30-year life expectancy. The additional cost is really an investment in sustainability.

Courtesy of LA Department of Tourism

The oil and gas industry is a big factor in the future of Louisiana's coastal wetlands.

WaterMarks: How do you respond when people say that the issue of global climate change is so complex that there's really nothing we can do to address it?

TWILLEY: I certainly agree that the issue is complex and oftentimes overwhelming. The bad news is that humans are part of the problem. The good news is the same — we are part of the problem. But it's only because we are connected to the problem that we have the capacity to deal with it. If global climate change were a force wholly outside of us, as suggested by the idea that it is only a 'natural cycle', then I'm afraid I'd see the situation as hopeless.

But because the human signature is all over global climate change, we aren't powerless. In fact, we've already demonstrated that we can correct serious problems in our global environment. For example, we recognized the symptoms of a depletion in our ozone levels, we diagnosed the problem, prescribed a cure, and guess what — the atmosphere responded.

Courtesy of LA Department of Tourism

"... like the human body, the earth has a great resiliency — far greater than many give it credit for. It's that remarkable resiliency that encourages me — it's where I find a great deal of hope."

I find it useful to compare our search for solutions to global climate change with our search for cures for the human body. We made great strides in medicine once we understood our own physiology. The same holds true for the earth. Once we understand the physiology of the earth, known as earth system science, we'll be much better at diagnosing its problems and finding the right planetary treatment to bring about a solution.

And like the human body, the earth has a great resiliency — far greater than many give it credit for. It's that remarkable resiliency that encourages me — it's where I find a great deal of hope. What we need now is the political and corporate will to become engaged in the problem. WATERMARKS

Forum to Focus on Goals and Practices of Restoration

THE FIRST NATIONWIDE forum focused solely on the goals and practices of coastal and estuarine habitat restoration will be held April 13 – 16, 2003, in Baltimore, Maryland.

The non-profit group Restore America's Estuaries will host the Inaugural National Conference on Coastal and Estuarine Habitat Restoration at the Hyatt Regency Inner Harbor Hotel.

Incorporating the non-profit, government, business and academic sectors, the conference will foster networking and communication throughout this growing movement.

Conference themes will include: best practices in restoration; information and resource needs; community outreach; national and regional policy strategies; funding opportunities; partnerships; and restoration science and practice, including monitoring, evaluation and adaptive management.

To sponsor a session, contact Rick Bates, development director, at (703) 524-0248 or rickbates@estuaries.org.

For more details about the conference, check the Restore America's Estuaries Web site: www.estuaries.org. WATER MARKS

WATER MARKS

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