WaterMarks

Louisiana Coastal Wetlands Planning, Protection and Restoration News

April 2004 Number 25

A Sharp Eye on Progress

The Role of Monitoring in Saving Louisiana's Coastal Wetlands

Case in Point: Bayou LaBranche

CRMS-*Wetlands:* A New Approach to Wetlands Monitoring

Watermarks Interview: Charles Sasser, Ph.D.

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Louisiana Coastal Wetlands Planning, Protection and Restoration News

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 enhancement projects nationwide designating approximately $50 million annually for work in Louisiana. The State contributes 15 percent of the cost of the project construction.

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About the Cover

The Great Horned Owl is a common resident of forested wetlands. Largely silent during much of the year, the owl's distinctive resonant hooting can be heard in wetland areas during the fall and winter.

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Special recognition and thanks to Rick Raynie, Louisiana Department of Natural Resources Coastal Restoration Division, and Greg Steyer, U. S. Geological Survey National Wetlands Research Center, for their assistance in this issue of WaterMarks.

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 web:

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MONITORING:

The Measure of Success in Saving Louisiana's Coastal Wetlands

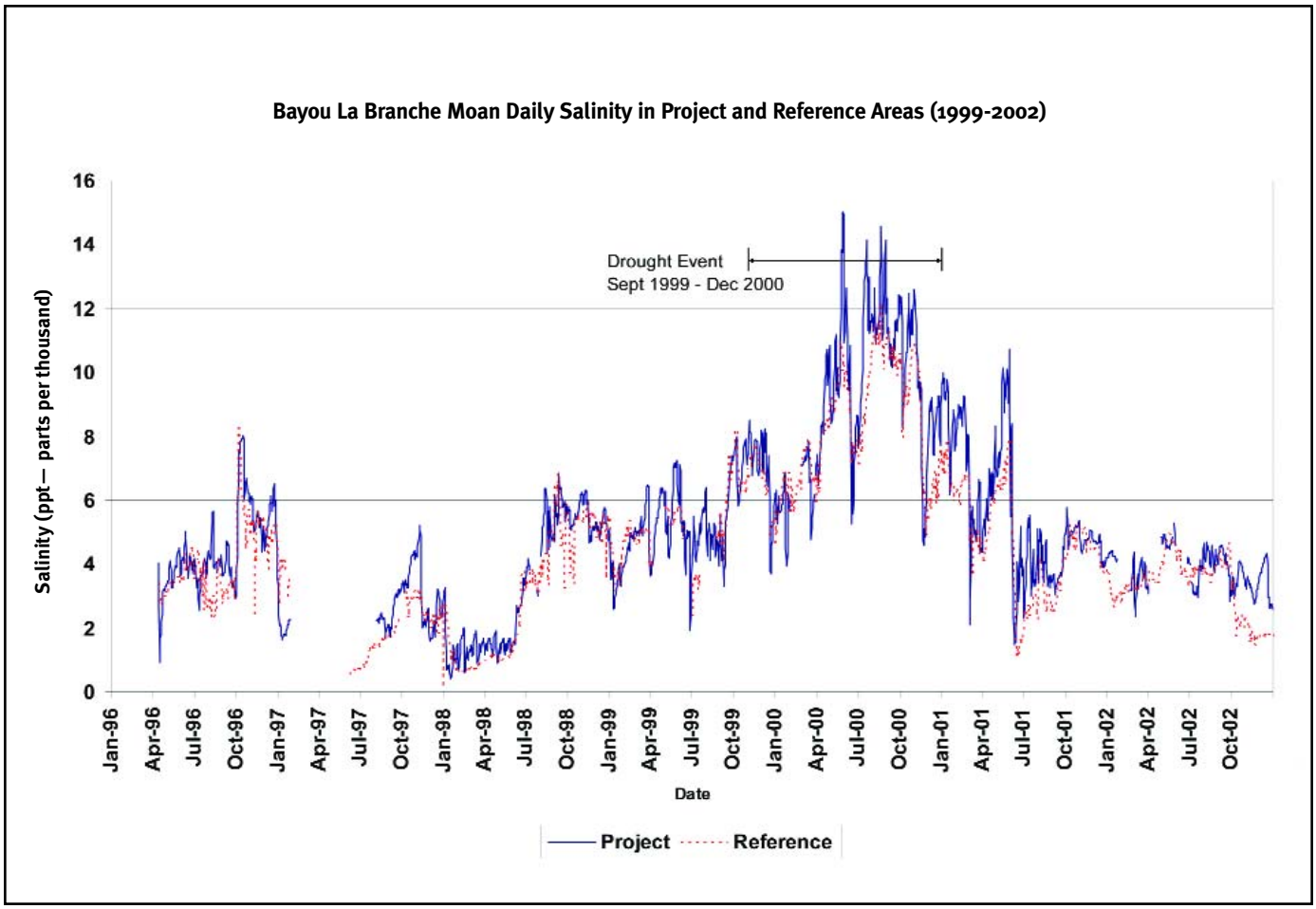
The partnership that was formed in 1990 when Congress passed the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) has been working on multiple fronts to protect and restore Louisiana's coastal wetlands—developing and implementing ecological and engineering solutions and testing new restoration techniques. CWPPRA authorized 147 projects on 13 annual priority project lists during the first 13 years of the program. However, the current loss rate of 24 square miles a year is still significant, and represents 90 percent of the coastal marsh loss in the contiguous 48 states.

Monitoring can take a variety of forms, depending on the nature of the restoration project. Here, a wetlands ecologist with the Louisiana Department of Natural Resources uses a rake to sample submerged aquatic vegetation in an open water pond.

The Breaux Act, as CWPPRA is commonly known, recognized the importance of learning from each project to improve the selection, engineering and design, and construction of new projects. To accomplish this, it would be critical to gain knowledge and experience about each project's environmental impacts. The act mandated, in addition to project selection and construction, that a monitoring program be developed to provide "…an evaluation of the effectiveness of each coastal wetlands restoration project in achieving long-term solutions to arresting coastal wetlands loss in Louisiana." Second, it called for "…a scientific evaluation of the effectiveness of the coastal wetlands restoration projects carried out under the plan in creating, restoring, protecting and enhancing coastal wetlands in Louisiana."—that is, evaluation of all the projects as a whole. These mandates were accompanied by a long-term (20-year) funding commitment for monitoring in habitats that may be slow to respond to project features; in contrast, most other wetlands restoration projects typically feature significantly shorter periods of monitoring.

Tackling the complex challenges of making sure restoration solutions succeed and learning which solutions work best in various situations, scientists turned to the fundamentals that have guided science for hundreds of years, the scientific method: stating questions, developing hypotheses, and collecting and analyzing data to test the hypotheses.

To ensure that data collected were scientifically valid, the Louisiana Department of Natural Resources, Coastal Restoration Division, teamed with the U.S. Geological Survey National Wetlands Research Center to develop standard procedures, or protocols. These protocols were developed in collaboration with coastal wetland scientists from federal and state agencies, and from academia experienced in collecting and analyzing wetland data. The protocols have become the backbone of the project-specific monitoring.



Scientists use monitoring data to better understand complex interactions in the wetlands. This chart presents data collected on salinity and water level over the course of a year at one monitoring station. Too much salinity causes marsh to erode into the ocean.

USGS performs spatial monitoring and assessment, such as aerial photography and interpretation, while primarily DNR collects other data for project monitoring.

Biological monitoring at CWPPRA projects includes the collection of a wide range of data that vary according to the type of restoration project and its specific goals. DNR uses continuous recorders for hourly measurements of water depth, salinity and temperature for projects such as river diversions and hydrologic restoration. These projects often also require samplings of fisheries, vegetation, water discharge and suspended sediments. Other types of projects, such as sediment and nutrient trapping, marsh creation and vegetative plantings, require measurements of vegetative health, sediment buildup and shoreline change.

The CWPPRA monitoring program was initially developed to evaluate individual projects, case-by-case. Each project-specific monitoring plan was developed through a Technical Advisory Group review process that included representation from DNR, USGS, the federal sponsor building the project, any interested CWPPRA agency, and an independent ecologist and statistician. USGS met the spatial data needs, while DNR provided all other data collection needs. CWPPRA currently continues to conduct project-specific monitoring, although the program is preparing to shift to a monitoring strategy that will provide a much broader analysis of the effects of restoration projects.

Adaptive Management: A System for Continuous Improvement

In 2002, CWPPRA scientists conducted an adaptive management review of constructed projects to (1) improve the linkages among planning, engineering and monitoring, (2) document changes made to projects during development and implementation, (3) recommend improvements for specific projects, and (4) learn from implemented projects so that future projects can be improved.

In CWPPRA's first large-scale attempt of this kind, engineers, environmental scientists, hydrologists and others worked to institutionalize the feedback and use of project monitoring information to benefit all projects, existing and future ones. Constructed projects were studied as they evolved from the concept stage through construction and several years of monitoring. This review identified 51 project-specific recommendations and 94 lessons learned for individual projects, and made 25 recommendations by project type. The review demonstrated the value of comprehensive information at multiple scales, from project-specific, to project-type, to ecosystem-wide.

Louisiana Department of Natural Resources

In addition to collecting data on the variety of vegetation in certain projects, ecologists also gather data on the height of the dominant species in a given site to gauge the health of the vegetation.

Wetland Loss: A Significant Trend

The rate of wetland loss peaked almost 30 years ago at over 40 square miles per year. A staggering 1,900 square miles of Louisiana's coastal wetlands have been lost since 1932 due to human and natural causes—an area larger than the state of Delaware. The stakes at risk include significant cultural, ecological and economic resources whose losses could severely impact the entire nation. The Breaux Act provides federal funds to slow the rate of land loss in a cost-sharing arrangement (85 percent federal/15 percent state) among the state of Louisiana and five federal agencies.

Gauging the Value of Monitoring

Monitoring provides more than a means to assess individual projects' effectiveness. Monitoring data can also be aggregated from multiple projects of the same type,

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CASE IN POINT: Bayou LaBranche

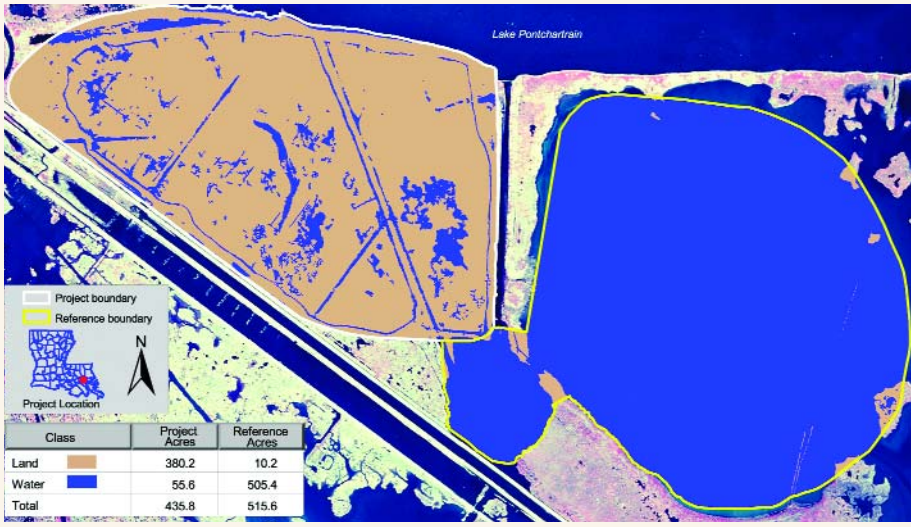
To understand the role monitoring plays, consider the example of an early CWPPRA project by the U.S. Army Corps of Engineers: Bayou LaBranche Wetland Creation, constructed in 1994 in St. Charles Parish. This project succeeded at creating 380 acres of wetlands using approximately 2.7 million cubic yards of sediment dredged from Lake Pontchartrain.

The project's monitoring plan called for tracking several key indicators, such as elevation and the ratio of land to water. Other variables included the percent of organic matter in the soil, vegetation composition and abundance, water level and salinity. This was to provide a more comprehensive understanding of the interactions and processes influencing marsh development in the project area.

Monitoring documented the dredge material's average elevation as it settled and compacted, from 1.6 feet in 1994 to 0.7 feet NAVD 88 (North American Vertical Datum of 1988) by 2002. Coinciding with the drop in elevation was a shift in vegetation from woody species that thrive in uplands to herbaceous species better suited to wetlands. Also, there was a shift in the land-to-water ratio from 18:82 immediately prior to construction to a more desirable 87:13 ratio eight years later. Knowing the rate of settling and change in vegetation species helped set construction targets for future dredge material projects.

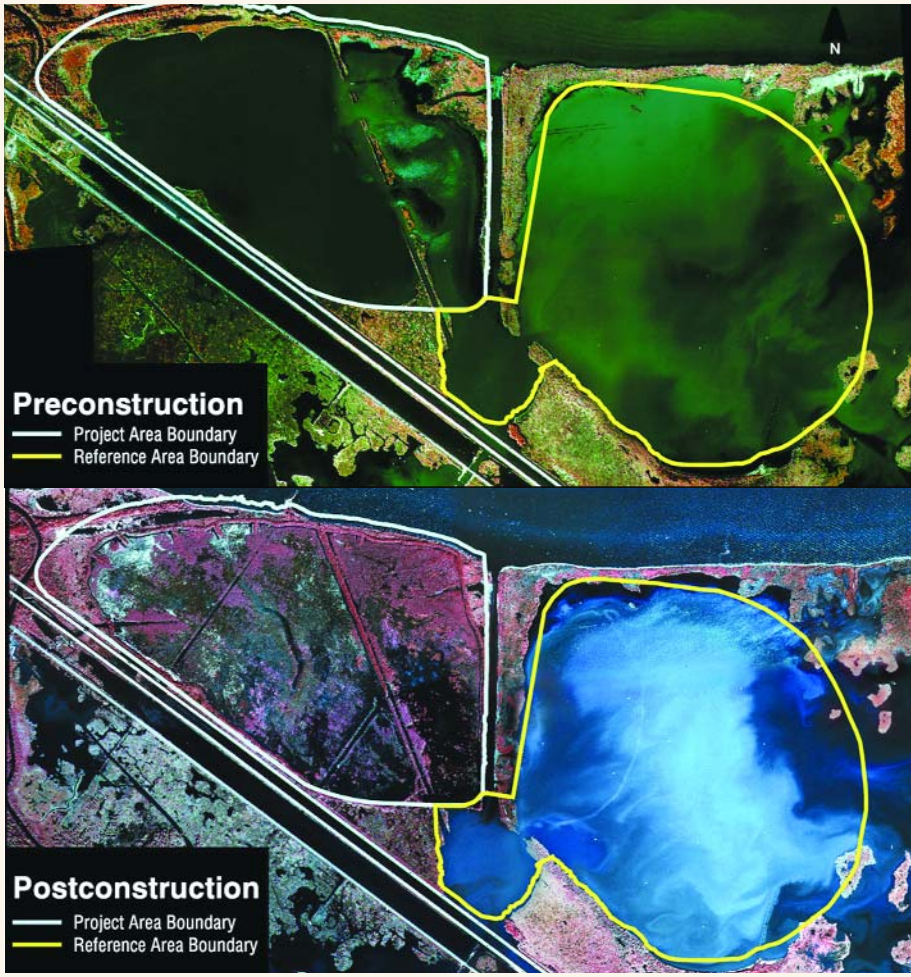
Allen Ensminger, a consultant for the LaBranche property owner, notes, "The Bayou LaBranche project is now in its 10th year, and the results are right on target with what we anticipated. In fact, we have another 2-3,000 acres of water adjacent to this site that we think would be suitable for another dredge and fill project." **WM**

Bayou LaBranche Wetland Creation (PO-17) Coastal Wetland Planning, Protection and Restoration Act 2001 Land-Water Analysis



USGS National Wetlands Research Center

Bayou LaBranche Wetland (PO-17) Aerial Photography from 1993 and 1997



USGS National Wetlands Research Center

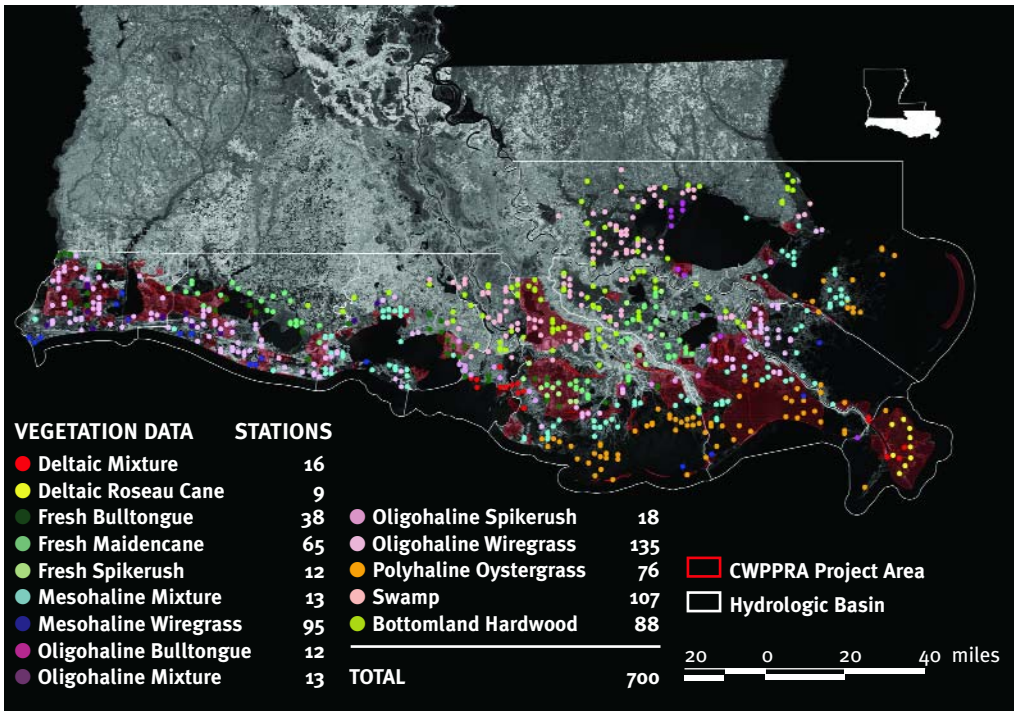
TOP IMAGE: Data from aerial photography are analyzed to assess progress toward specific project goals. This graphic, based on data collected seven years after marsh creation in Bayou LaBranche on the south shore of Lake Ponchartrain, quantifies the change in the ratio of land to water.

BOTTOM IMAGES: Aerial photography plays a critical role in the monitoring process. These before and after aerial photographs of Bayou LaBranche show the growth in marsh from Nov. 7, 1993 to Nov. 17, 1997.

Monitoring *continued from page 3*

allowing analysts to measure the success of that type of project and recommend ways to improve the implementation of similar projects. For example, the majority of rock shoreline protection projects have decreased, and in some cases reversed, shoreline erosion. Monitoring data have also provided guidance on operating freshwater diversions and water control structures.

Monitoring is also essential to the practice of adaptive management—the use of procedures to ensure that "lessons learned" are employed to improve the effectiveness of future work. This approach is critical to CWPPRA's continued success, says John Foret, wetland ecologist at NOAA Fisheries. "Restoration of systems at the scale we're attempting is unprecedented," says Foret. "It's a huge challenge to get a handle on what's going on across the landscape. We have a great deal of engineering and science theory to back up our decisions, but we're still learning."



R. Greg Linscombe, Louisiana Department of Wildlife and Fisheries

The CRMS-*Wetlands* program will feature 700 monitoring stations located throughout coastal Louisiana.

The Need for Broader Analysis

Yet, while project-specific monitoring has been very effective for small-scale programs, it was recognized as early as 1995 that a more comprehensive approach was needed to evaluate cumulative effects on a larger, basin, or coast-wide scale.

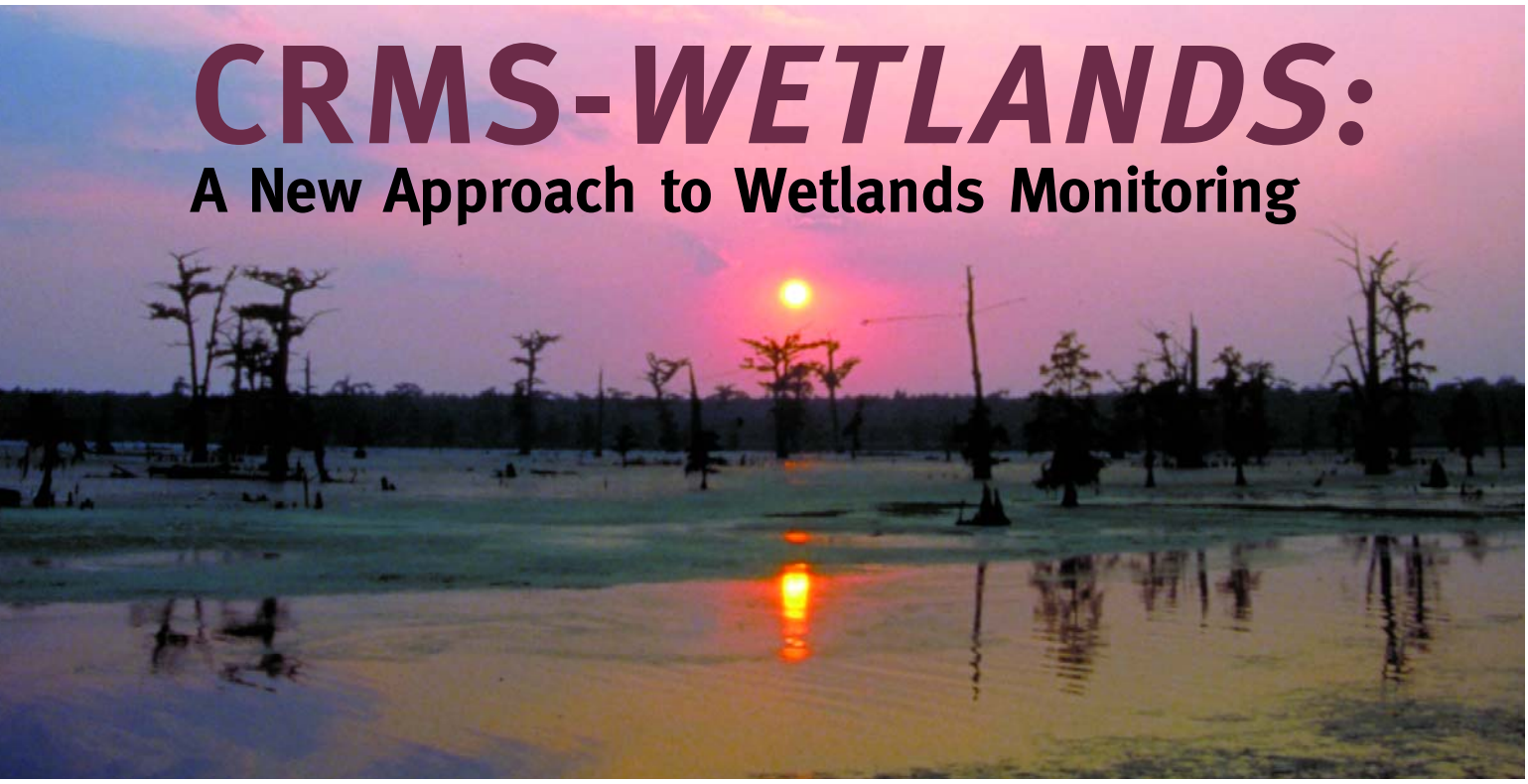
In addition, project-specific monitoring required that data be collected both within each project area as well as in an adjacent reference or control area—that is, a site sharing the same condition of the project area prior to (or in absence of) some restoration action. Reference areas were also intended to distinguish natural system variability from the actual effects of restoration.

However, adequate reference areas were difficult to find, and in many cases unavailable. This project-reference monitoring approach also prohibited the assessment of cumulative, indirect influences on processes that impact the entire landscape, hydrologic basin, or coastal ecosystem. Data collection stations were distributed within and adjacent to project areas, while no information was collected from vast areas unaffected by restoration activity. The need to characterize habitats across their full range of conditions in coastal Louisiana and establish reference standards and targets prompted the development of a new ecosystem-scale monitoring approach—one that would come to be known as the Coast-wide Reference Monitoring System–*Wetlands*. **WM**

Monitoring and Modeling: Two Keys to Success

In 2003, a U.S. General Accounting Office report on ecosystem restoration in southern Florida highlighted two key tools needed for effective adaptive management: a comprehensive plan for monitoring key indicators of ecosystem health, and mathematical models to simulate aspects of the ecosystem. The GAO concluded that without these tools, the ability to understand how an ecosystem responds to restoration actions would be severely limited. GAO's report reaffirms CWPPRA's direction towards adaptive management and CRMS-*Wetlands*.

CRMS-*Wetlands*:
A New Approach to Wetlands Monitoring



Louisiana Department of Natural Resources

Nearly a decade ago, the CWPPRA monitoring program began to develop a new monitoring strategy. This new strategy, known as the Coast-wide Reference Monitoring System-*Wetlands* (CRMS-*Wetlands*), was developed to assess the cumulative effects of all the coastal projects by establishing a network of reference sites across the coast. It was also designed to provide information needed to ensure current and future efforts would work at recreating a sustainable coastal ecosystem.

Data collected through CRMS-*Wetlands* will provide ecologists with a better understanding of how natural and human processes interact in each of Louisiana's coastal habitat types.

The CRMS-*Wetlands* approach was developed by DNR in collaboration with scientists at USGS, University of Louisiana at Lafayette and Louisiana State University. A key strategy is to establish a reference standard, or target, as a goal for restoration projects. Planners also seek to better understand the variability in the environment and the collective effectiveness of the entire restoration program.

Selecting Sites

Developing a comprehensive monitoring program across 3.67 million acres of coastal wetlands is a daunting task. The interplay of geology, biology, hydrology and possible climate change results in a highly variable and dynamic system that is complicated even further by human impacts (construction of canals and levees, for example). One major challenge was to determine how many monitoring stations were necessary to cost-effectively assess this complex landscape.

A team of ecologists and statisticians, working with historic data on coast-wide salinity and vegetation, determined it would take 700 sampling stations to install an effective and robust monitoring program. Central to this plan were the coast-wide vegetation surveys conducted by Robert Chabreck of LSU and Greg Linscombe, Louisiana Department of Wildlife and Fisheries. Using their transects (sample areas in a continuous strip) as a starting point, the CRMS-*Wetlands* system of sampling stations was expanded to cover habitats representing swamp, bottomland hardwood, and fresh, intermediate, brackish and saline marsh. Sites along these transects were randomly selected within each habitat classification as CRMS-*Wetlands* stations.

This design offered added values in that many of the selected stations

represent a 35-year history of vegetation change, and that the transects on which the design was based have been used by LDWF not only for vegetation surveys, but also for alligator, nutria, muskrat and water bird surveys. The monitoring variables that will be collected, combined with LDWF, Corps of Engineers and USGS coast-wide datasets, will provide information on vegetated wetlands and the habitats they support. This flexible design will allow resource managers to better understand ecological change, from the project scale to the entire coast; they will also be able to compare the effects of a specific type of restoration effort—diverting fresh water or sediment, for example—in a certain basin, or across the coast. The plan is to have monitoring equipment installed and people in place to begin collecting data under CRMS-*Wetlands* early in 2005.

Because coastal Louisiana is such a complex and dynamic system, the application of a particular technique is likely to produce results that vary depending on the project location. "A significant improvement in the CRMS-*Wetlands* design," says USGS ecologist Greg Steyer, "is that it will allow us to better understand the influence of each project type at specific locations in the landscape." This understanding will in turn aid in the site selection and engineering of future restoration projects.

Like the monitoring conducted to date, CRMS-*Wetlands* will monitor such critical variables as water level, salinity, sedimentation, elevation and the variety and abundance of vegetative species within a site. Data will also be gathered on land-to-water ratios to evaluate how the landscape is changing. CRMS-*Wetlands* data will be assessed to test hypotheses of how these variables interact to support healthy and sustainable wetlands, and further the understanding of vegetation and landscape dynamics.

During the last few years, several events have impacted coastal Louisiana that scientists would better understand today had CRMS-*Wetlands* been in place.

All of these data will be collected at each site and provide a snapshot to allow comparison with all other sites. "One of the benefits of CRMS-*Wetlands*," says Rick Raynie, monitoring program manager with DNR, "is that each site will have the same suite of variables, giving us the flexibility to aggregate stations in a variety of ways to answer many different questions. We'll have more flexibility to answer questions relative to individual projects as well as collective effects at much larger scales." The data will also provide clues into understanding how the coastal environment is changing. Scientists will be able to map each site's "trajectory"—where it is headed in terms of health and stability.

USGS/NWRC

CRMS-*Wetlands* monitoring will help scientists better understand the causes and impacts of periodic events such as the "brown marsh" phenomenon of 2000. The aerial view of Bay Junop in June 2000 shows the first stage of the die-off; in less than 10 months, affected areas had deteriorated to mud flats.

continued on next page

Something for Everyone

The CWPPRA monitoring program is also providing information in increasingly user-friendly formats.

CWPPRA has evolved over the years to meet changing needs. The Coast 2050 initiative, developed under CWPPRA in 1998, provided long-term habitat goals and strategies. This was the start of coastal restoration in Louisiana at the ecosystem scale. Because CWPPRA has recognized that small-scale projects will not completely remedy a large-scale problem, more effort has been placed into ecosystem-scale planning. With this evolution of scope came a parallel evolution in monitoring: from small-scale, project-specific to ecosystem-scale for the entire coast.

During the last few years, several events have impacted coastal Louisiana that scientists would better understand today had CRMS-*Wetlands* been in place. Examples include the "brown marsh" phenomenon that killed thousands of acres of coastal Louisiana salt marshes in 2000, and Tropical Storm Isidore and Hurricane Lili in 2002. Data from CRMS-*Wetlands* will contribute to the body of knowledge so that scientists can better evaluate and understand such periodic events.

CRMS-*Wetlands* will also help in developing simulation models for coastal Louisiana that predict environmental reactions of the landscape to various management alternatives. Up to now, modelers made assumptions based on their best professional judgment because of limited data on wetland hydrology and ecology. CRMS-*Wetlands* will provide much of the data to validate and fine-tune these models so that predictions of future impacts will be more accurate. CRMS-*Wetlands* will also provide information to CWPPRA planners and project designers in areas of the coast where currently no information exists, and should help identify areas needing restoration and expedite the design and construction of future projects.

What's Ahead

It is increasingly clear that monitoring serves more purposes than project evaluation alone. The evolution of the CWPPRA monitoring program from the project specific scale to CRMS-*Wetlands* will benefit project planners, designers and resource managers. The new monitoring capabilities offered by CRMS-*Wetlands* will allow scientists and coastal experts to better understand the problems that Louisiana's coastal wetlands face, and determine which types of solutions are the most effective. The data collected will lead to more accurate projections about how these invaluable habitats will change in the coming years, and aid in the evaluation of progress toward meeting the specific objectives of Coast 2050.

To facilitate the ongoing feedback of information and the evaluation of cumulative project effects, the CWPPRA monitoring program is also providing information in increasingly user-friendly formats. Raw data are available on the Web (www.saveLAwetlands.org; www.nwrc.usgs.gov), as are all of the project-specific and programmatic monitoring reports. Beginning later this year, annual project-specific operation, maintenance and monitoring reports will combine monitoring data with other information for a holistic view of project performance and effectiveness. In addition, these reports will be merged into a hydrologic basin-level report that will evaluate the collective effectiveness of all of the projects within each basin. This information will provide insight to resource managers evaluating ecosystem-scale problems and CWPPRA's solutions to them. **WM**

Blue Ribbon Panel Review

In 2000, the CWPPRA task force recommended that a blue ribbon panel of experts be convened to review the CRMS-Wetlands plan. Chaired by Dr. James Gosselink, LSU, panelists included Dr. Thomas Fontaine, Environmental Monitoring and Assessment Division of the South Florida Water Management District, Dr. Kevin Summers, Environmental Protection Agency, Dr. Dennis Whigham, Smithsonian Environmental Research Center, and Richard Novitzki, owner of R.P. Novitzki and Associates Inc., a wetlands consulting firm.

The panel determined that the CRMS-*Wetlands* proposal was a feasible and important improvement to the current CWPPRA monitoring program. The panel's report concluded that implementing the proposal would greatly strengthen the program by:

- Improving the state's ability to assess the success of individual projects;
- Facilitating coast-wide assessment of cumulative effects of the individual restoration projects;
- Increasing the understanding among state scientists of the fundamental principles governing coastal system dynamics; and
- Helping the state predict future changes in the coastal ecosystem more accurately and guide future management decisions.

WaterMarks Interview: Charles Sasser, Ph.D.

Professor-Research, Louisiana State University, Coastal Ecology Institute, School of the Coast and the Environment

Dr. Charles Sasser has conducted coastal wetland research at LSU for more than 25 years, and has been highly active in the field. He has served as principal investigator and in other capacities on numerous grants and contracts involving wetlands conservation and monitoring, and has authored or co-authored dozens of publications on related topics.

Dr. Sasser is a member of the Technical Advisory Group and the Academic Advisory Group that support the CWPPRA task force.

Could you describe your involvement with CWPPRA and the CRMS-*Wetlands* initiative?

Along with others, I provide ecological assistance to the CWPPRA program. In regards to monitoring, I'm a member of TAG, on which I serve as a wetland ecologist. We meet as necessary to review and discuss topics such as monitoring plans for CWPPRA projects.

As situations arise that might benefit from the participation of academic scientists, I am also in a group of academic folks who provide assistance. An example of an activity that our academic group has been involved with is reviewing projects and project data from an adaptive management point of view. More recently, many of the people in this group have been involved in supporting Louisiana Coastal Area study activities, analyzing information related to the LCA effort, and assisting in the preparation of various ecological documents required.

You've been in this field for a fairly long time. What it's like to be involved in your current capacity?

Louisiana's coastal wetlands are a very complex system, with a lot of important variables. Working to understand details related to our coastal wetlands loss and the processes that are important drivers of the system, and implementing effective solutions is challenging work. But there are also rewards when you see some of the significant accomplishments that are being made.

It's exciting to be a part of a program that's moving forward in many ways toward the overall goal of coastal restoration. CRMS-*Wetlands* is a very good example. We've been working toward developing this approach and getting it set up for a number of years. Though we're not quite there yet, we're on the verge of seeing it implemented.

In your experience, does the public understand the need for monitoring?

Although I interact directly with landowners only on occasion, overall the people I talk with are appreciative and supportive of coastal restoration efforts. However, I do sometimes hear questions and concerns about monitoring. Some may have a desire to get more projects on the ground and running, as opposed to spending any time and effort monitoring.

But it's important to think also in terms of the benefits we'll get down the road by gaining a better understanding of the system with which we're dealing. We need to know more completely how the system works, why it's changed over time, and which types of restoration projects work better. Data collected and analyzed through the monitoring program help us understand our coastal wetland ecosystem at a level where we can be much more effective in restoring the entire system. If that means that we have to learn some things before we can go full steam ahead, I think it's time well spent.

How will CRMS-*Wetlands* data improve our understanding?

The monitoring systems in place until now are tied to individual projects, and have done what they were designed to do. But that type of monitoring does not provide the data to make larger-scale evaluations and comparisons that are also important. The goal of CWPPRA is to restore the coast, so it's important to determine what's happening not just on a specific project, but on a much larger scale as well—across an entire basin, for example, or across the entire Louisiana coastline. CRMS will allow us to do that, and enable us to look at how ecological conditions are changing over time.

Like previous monitoring, CRMS-*Wetlands* data will provide a snapshot of where a particular site is at a given time, in terms of certain variables. But it will also provide data about the ecological condition of the Louisiana coast over time, and as enough data are collected, the data will also allow comparisons of the trajectories of change between different projects, whether grouped by project type, basin, or other factors. Because coastal marshes are dynamic, we can expect variation to exist even in natural or non-project areas. Evaluating and comparing the trajectories of project sites along with reference sites will provide a better view of how the coastal marshes are responding, and will be of great use in determining the success of restoration efforts. **WM**

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ABOVE: Scientists use a Global Positioning System device to survey a shoreline at specific intervals. This determines changes in the contour of the shoreline. Headphones muffle the noise of the airboat engine.