LOUISIANA AGRICULTURE

Assuring Our Future Through Scientific Research and Education

LSU AgCenter
Research & Extension

Spring 2004
Vol. 47, No. 2

Water Quality Issue

ON THE COVER:

This aerial photo was taken at about 20,000 feet in 1998 by a company called 3001 Inc. It was made available from the photo service company, GlobeXplorer. Water specialist Bill Branch says it's about a 10-square-mile area. The highway that runs across the bottom is Interstate 10. Highway 35 runs north and south. The city of Rayne is south of the interstate at its junction with 35. The meandering green line that crosses Highway 35 is Bayou Wikoff. The LSU AgCenter has a water quality research project there. See page 11. The tufted area on either side of the bayou is forest land. The curved lines in some of the blocks indicate contoured fields. The straight lines in fields, such as in the lower right-hand corner, are precision-graded to a uniform slope to improve water use efficiency. Most areas of the United States, as well as Louisiana, have north-south and east-west property lines. This particular spot is dominated by diagonal lines – probably because farmers traditionally drew boundaries at right angles with Bayou Wikoff.

LSU AgCenter Committed to Water Quality

In a survey taken several years ago, people were asked their familiarity with terms used in water quality discussions. Most people did not know the meaning of some of the most basic words, such as watershed. No, it's not a little building. It's a drainage area defined by a ridge or stretch of high land. There can be watersheds within watersheds. For the sake of research and extension projects described in this issue of *Louisiana Agriculture*, the state is divided into 12 major watersheds. See the diagram on page 37.

The reason it is important to understand water quality terms is that no subject is more critical to the economic future and quality of life in Louisiana. Water has been more or less taken for granted in this state of plentiful rainfall and humid conditions. However, two major events shook citizens out of their complacency. One was a federal declaration that more than 70 percent of Louisiana's freshwater bodies were impaired and something had to be done about it. The other was the drought conditions of 2000 and 2001, which left Louisianians amazed at the number of days that would go by with no rain. Kenneth Gravois, director of the Sugar Research Station, remarked that this was the first time he had seen sugarcane farmers irrigate.

The LSU AgCenter has led the nation in confronting the issue of water quality and agriculture. Many people were involved in developing research and extension projects. But much of the credit for determining the pathway to follow goes to Vice Chancellor Paul Coreil. The Master Farmer program grew out of his belief that farmers would voluntarily change their management practices to reduce and improve the water from their fields and pastures that runs into water bodies. Read more about Master Farmers on page 32.

Coreil's vision also led to the placing of watershed agents across the state to work with citizen groups on water quality issues. Read more about them on page 36.

New to the water quality research mix is Y. Jun Xu, a hydrologist in the School of Renewable Natural Resources. In one of his first studies, he discovered that water levels between Simmesport and Morgan City have been gradually flattening out, which is not a good sign. See page 38.

As you read these articles, you will find a lot of alphabet soup, because acronyms are used extensively by people involved in water quality issues. An example is TMDL, which stands for total maximum daily load. This means the amount of runoff a stream can receive and still meet water quality standards. The writers in this magazine do an excellent job of explaining the terms they use.

If you have questions or comments about water quality in Louisiana, please direct them to the watershed agents, any of the writers in this issue or Coreil. ■ **Linda Foster Benedict**

LOUISIANA AGRICULTURE
Assuring Our Future Through Scientific Research and Education

EDITOR: Linda Foster Benedict
DESIGNER: Barbara Groves Corns
PHOTO EDITOR: John Wozniak
CONTRIBUTORS: Rick Bogren, John Chaney, Mark Claesgens, Abby Jones, Randy McClain and Bruce Schultz

Published quarterly by the Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge, Louisiana. Subscriptions are free. Send requests to:

Linda Foster Benedict, Editor
Louisiana Agriculture
P.O. Box 25100
Baton Rouge, LA 70894-5100
phone (225) 578-2263
fax (225) 578-4524
lbenedict@agcenter.lsu.edu

www.lsuagcenter.com

LSU AgCenter
William B. Richardson, Chancellor

David J. Boethel, Vice Chancellor
and Director of the Louisiana Agricultural
Experiment Station

Paul D. Coreil, Vice Chancellor
and Director of the Louisiana Cooperative
Extension Service

Page 10

Page 13

Page 19

Page 23

Page 29

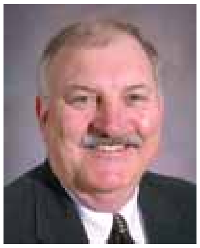
Page 31

LOUISIANA AGRICULTURE
Assuring Our Future Through Scientific Research and Education

Volume 47, Number 2, Spring 2004

Boethel named new research director

David J. Boethel, former associate vice chancellor at the LSU AgCenter, became vice chancellor for research and director of the Louisiana Agricultural Experiment Station effective April 19.



David J. Boethel

"He brings a strong research background to this job plus classroom teaching experience and a record of leadership in our extension and outreach program," said William B. "Bill" Richardson, LSU AgCenter chancellor.

Boethel, who has been with the AgCenter for nearly 30 years, had been associate vice chancellor since 2001. He was promoted to assistant director in 1997 and has continued his appointment as a professor of entomology.

Boethel has received international recognition for this research on insect pest management. More recently, he has led efforts to stop the spread of the Formosan subterranean termite and red imported fire ant in Louisiana and expand mosquito abatement to help tackle the threat of West Nile virus.

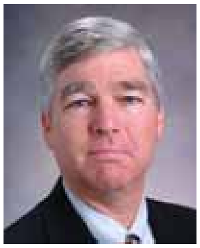
He replaces William H. Brown, who retired effective April 16 after three years as vice chancellor and more than 28 years at LSU. Brown came to LSU in 1976 to head what is now the Department of Biological and Agricultural Engineering. He has risen through the ranks from assistant director for grants and contracts, to associate director, associate vice chancellor and, finally, vice chancellor in 2001.

William H. Brown

A native of Weimar, Texas, Boethel received his bachelor of science and master of science degrees from Texas A&M University in College Station. He was awarded the Ph.D. in entomology from Oklahoma State University in 1974.

Before moving to the Baton Rouge campus in 1980, Boethel was at the LSU AgCenter's Pecan Research Station in Shreveport.

David Morrison, former LSU AgCenter assistant vice chancellor, has been promoted to associate vice chancellor and associate director of the Louisiana Agricultural Experiment Station also effective April 19. ■ **Linda Benedict**



David Morrison

LSU AgCenter establishes natural resource policy center

The Board of Regents and the LSU Board of Supervisors recently approved the establishment of the Center for Natural Resource Economics and Policy at the LSU AgCenter. Rex Caffey, a wetlands and coastal resources economist in the Department of Agricultural Economics and Agribusiness, has been named director.

"The center will be beneficial to the state and the nation because it will bring natural resource economists from many agencies together," said Gail Cramer, department head. "They will provide policy makers with economic analyses that should be beneficial to decision-making about resource use in Louisiana."

He said some areas of work could include water use, wetland valuation, farm programs and conservation programs.

"These are issues that could and should be addressed," Cramer said.

Caffey said economists look at the allocation of scarce resources among competing user groups, as well as location and ownership issues, such as property rights and market and nonmarket valuations.

He said a survey of more than 200 academic departments, centers and institutes in Louisiana colleges and universities showed none focus on policy, management and economics of natural resources.

Calling it a research cooperative and a center without walls, Caffey said the new center's purpose is to contribute to the sustainability of Louisiana's natural resources, including energy, coastal and inland wetlands, fisheries, forestry, wildlife, and soil and water.

"Louisiana is the terminus of one of the world's largest river systems," Caffey said.

Caffey said the center will host its first national conference, Challenges of Socio-economic Research in Coastal Systems, May 27-28 in Baton Rouge.

In addition to Caffey, other members of the center include Hamady Diop and Walter Keithly of the LSU Coastal Fisheries Institute; Jack Isaacs of the Louisiana Department of Wildlife and Fisheries; Michael Dunn, Steve Henning, Richard Kazmierczak, Krishna Paudel and John Westra of the Department of Agricultural Economics and Agribusiness; William Olatubi of the LSU Center for Energy Studies; and Richard Vlosky of the School of Renewable Natural Resources. ■ **Rick Bogren**

First sweet potato patents awarded

Two sweet potato varieties developed by the LSU AgCenter recently were awarded U.S. patents – the first ones given to sweet potatoes.

"The patents protect our varieties on behalf of the interests of our growers," said Don La Bonte, plant breeder who developed the new varieties. "Any funds derived from royalties would contribute to the enrichment of our program."

One of the patented varieties is Bienville, released in 2002. This variety is resistant to the southern root knot nematode.

The southern root knot nematode normally is found in lighter-textured, sandy soils in areas such as Morehouse and Bienville parishes, La Bonte said, adding that the pests have not been a problem in most sweet potato production areas of the state.

With its nematode resistance, the new variety allows growers to reduce costs by using less pesticide while maintaining product yield and quality, La Bonte said.

"Bienville fills a niche," La Bonte said. "But Beauregard will still be the standard."

Beauregard, developed by the LSU AgCenter and released in 1987, is considered by many to be the premier sweet potato variety in the United States.

The other variety that received a patent is named 96-117 and is mainly grown for baby food processors.

"It's a great processing sweet potato that makes good baby food puree and is attractive as a canned sweet potato," La Bonte said. "It's sweet and flavorful." ■ **Rick Bogren**

Rice farmers get more weapons to fight pests

Rice farmers soon will have two more weapons in their arsenals for fighting stink bugs and rice water weevils.

The U.S. Environmental Protection Agency recently approved gamma cyhalothrin for use in field, vegetable, tree and vine crops. It will be sold as Proaxis and in a higher-concentrated form called Prolex.

Farmers should be able to buy the products in early May.

"They're additional options for what we already have," said Boris Castro, an LSU AgCenter entomologist.

They will help replace such chemicals as Furadan and Icon, which both were used to combat rice water weevils. Furadan was removed from the market by the EPA, and Icon is no longer being made by the BASF Corp.

The new products are labeled to control adult rice water weevils, rice stink bugs, chinch bugs, grasshoppers and leafhoppers. Both are applied to the foliage of rice plants, Castro said.

LSU AgCenter entomologist Mike Stout said the newer chemicals should be used after seeing weevils in the field or after finding signs they have been feeding on rice plants. Although the AgCenter doesn't recommend pre-emptive treatment, many farmers use that approach, he said.

"In South Louisiana, you can almost guarantee you'll have weevils in the fields," Stout said. ■ **Bruce Schultz**

Technology center to emerge from barn site

Groundbreaking for the Louisiana Emerging Technologies Center will be sometime in June, with completion expected the following spring, said Paula Jacobi, CEO of the LSU System Research and Technology Foundation, which will oversee the center.

The center, which will be an incubator for start-up technology companies, will be built on the site of old, leaky barns that once housed the LSU AgCenter's annual state livestock show. After nearly 70 years on the LSU campus, that show was moved in February 2004 to the Lamar Dixon Expo Center in Gonzales, La.

"This is what visitors will see when they enter campus from the east," Jacobi said of the three-story building, designed in the Italian renaissance style of the LSU Master Plan. The lead designer is Dale Songy of Coleman & Partners of Baton Rouge,

The Louisiana Emerging Technologies Center will house the offices of the foundation as well the center. Jacobi said an executive director for the center should be hired within the next few months.

The center will provide offices, conference rooms, laboratory space and equipment for newly formed technology companies. The first tenant will be TransGenRx, a new company that has licensed technology from the LSU AgCenter to produce protein products in chicken eggs.

"The companies will be here temporarily until they expand and have enough money to move into larger facilities," Jacobi said.

The LSU Master Plan calls for a reconfigured intersection at the site, which is at East Parker and West Lakeshore. A proposal under consideration is for this intersection to become a major gateway to campus. This new entry would be called the East Gate to complement the North Gate and South Gate, which are the other main approaches to campus. ■ **Linda Foster Benedict**

Photo by Mark Claesgens

Barns adjacent to the LSU AgCenter's Livestock Exhibition Hall on campus have been torn down to make way for the Louisiana Emerging Technologies Center.

Illustration by Coleman & Partners

The new center, a three-story, 60,000-square-foot building, is expected to be completed in the spring of 2005 for an estimated cost of $12 million.

PERSPECTIVE

Water: Vital Link to Louisiana's Economic Future

Paul D. Coreil

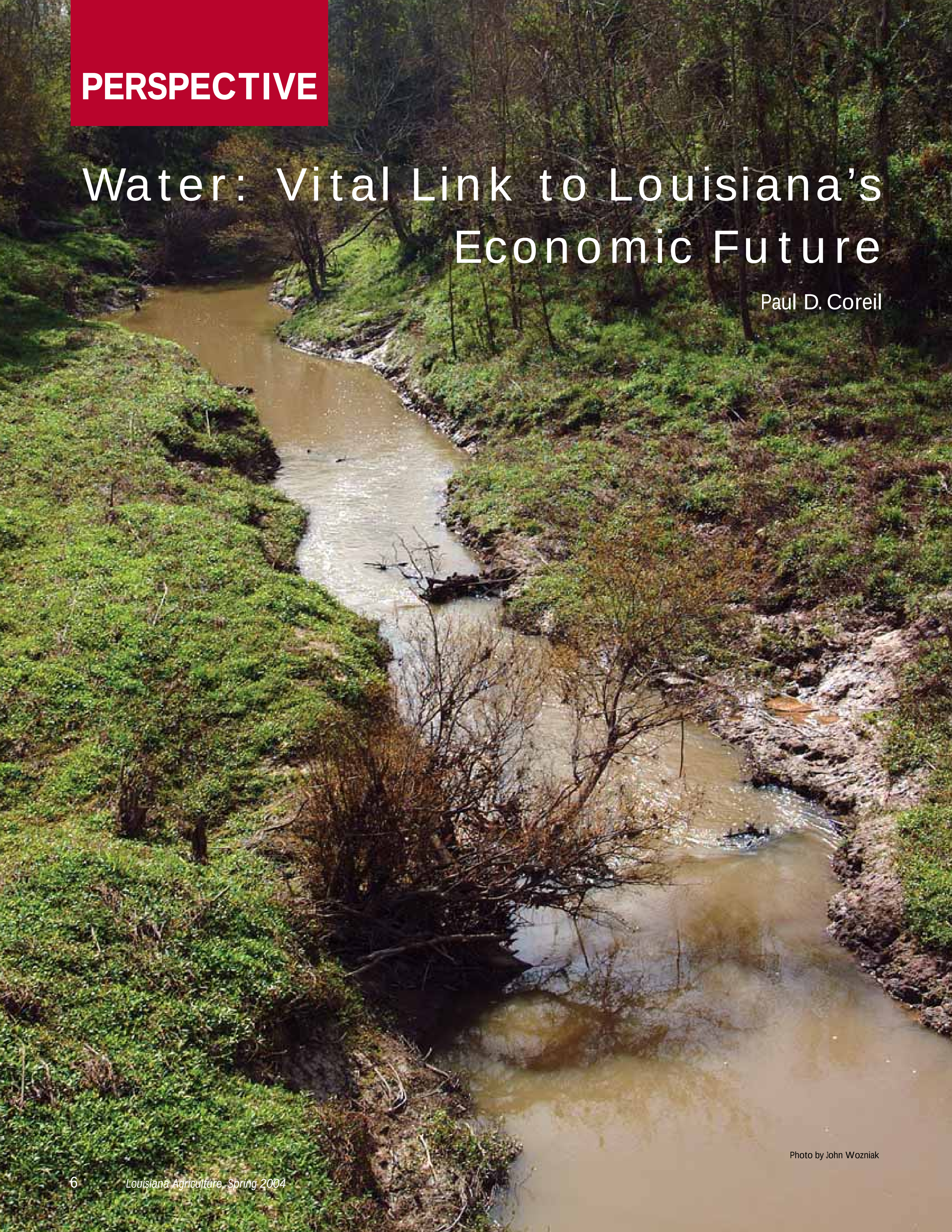


Photo by John Wozniak

From the rich coastal waters along the Gulf of Mexico to the freshwater rivers, streams and lakes north of the coastal zone, water resources are an integral part of life in Louisiana. Historically, the challenges pertaining to water have been linked to flooding of developed areas caused by excessive rainfall or increased flow from the Mississippi River. Fresh water management began with massive efforts to protect citizens from Mississippi River floods. The supply of water from wells, rivers and bayous was considered inexhaustible.

Today, however, the focus has shifted from flood protection to declining groundwater levels and increasingly complex water quality issues. The use of water for agricultural purposes has come under closer scrutiny.

The availability of both surface and groundwater for crop irrigation helped develop the agricultural-based economies in many Louisiana parishes. Recent U.S. Geological Survey estimates indicate that the amount of groundwater used in Louisiana is approximately 1.6 billion gallons per day – with agricultural uses representing more than 50 percent of this volume. Surface water use is estimated to exceed 8.6 billion gallons per day with 4 percent representing agricultural interests. Most of the surface water pumped is used for power generation and in industry.

In recent years, irrigated cropland acreage has been increasing because marginal land is taken out of production and the most productive land is more intensively managed for maximum yields and reduced drought risks. Today, more than 1 million acres of cropland are irrigated in Louisiana with rice being the dominant crop at approximately 500,000 acres. Cotton is second representing approximately 200,000 acres. Next are corn and soybeans, each representing about 150,000 acres in irrigation.

After the record droughts of 2000 and 2001, many policymakers began paying more attention to groundwater sustainability issues. As a major user of groundwater, agriculture also became much more directly involved in water conservation policy decisions including water well registration and permitting, helping to develop a statewide groundwater management plan, and helping to develop alternatives to groundwater use.

Public interest in maintaining water quality has also increased with major emphasis on nonpoint-source pollution or general runoff from the landscape. Agriculture (crop and livestock production) and forestry have been identified as contributing to surface water impairment in some streams where watersheds are dominated by these land uses.

Under the current water quality guidelines, more than 70 percent of the state's assessed freshwater bodies and 50 percent of the assessed estuarine (coastal influenced) water bodies are classified as impaired (not meeting water quality standards). The required Total Maximum Daily Load (TMDL) runoff reductions (the amount of runoff that a stream can receive and still meet water quality standards) needed to meet U.S. Environmental Protection Agency (EPA) standards will be challenging. In fact, many LSU AgCenter scientists and water quality specialists have serious concerns about our ability to meet these goals with the current research-based technology.

The loss of Louisiana's coastal wetlands has averaged 25-35 square miles per year. Besides having a major effect on the economy and welfare of coastal communities, agricultural interests have experienced increased saltwater intrusion. This threatens the continued availability of freshwater for rice irrigation and crawfish production in southwest Louisiana. Additionally, the saltwater content in several north Louisiana groundwater aquifers has also limited irrigation capacity for many landowners attempting to irrigate cotton, corn and soybeans.

To address our deteriorating coastal wetlands, the LSU AgCenter has led the way in investigations using innovative plant genetic and biotechnology research. Many biologists and plant scientists see this research as a viable option in the development of natural plant varieties that can be used in coastal restoration-related vegetative plantings that will help restore eroding coastal marshes and shorelines.

To meet the challenge of sustainable use of our water resources, the LSU AgCenter has embarked on several key initiatives directly linked to attaining efficiencies in groundwater use and improving water quality. Increased research and technology transfer efforts have helped develop agricultural best management practices (BMPs) that effectively reduce cropland and animal agriculture-related runoff. Initiatives such as the Master Farmer program and the recently unveiled Master Cattle Producer program represent AgCenter-led research and outreach efforts that result in voluntary BMP applications leading to improved surface water quality.

Society can have a safe, plentiful and affordable food and fiber supply and continue to enjoy the economic, social and environmental benefits of water resources. That is our goal and the goal of the farmers and farm families living and working the land throughout the state. Working together, we can achieve these objectives and help Louisiana see the full economic benefits of an abundant water supply critical to sustainable economic development.

In this issue of *Louisiana Agriculture*, we highlight many of the LSU AgCenter research and extension initiatives directly linked to maintaining a sustainable, high-quality water supply important to all Louisiana citizens. We delineate work being conducted on reducing runoff from agricultural landscapes, the benefits of conservation tillage, water quality challenges associated with invasive plant species and river water-linked economic development activities.

Through strong research and extension programs, the LSU AgCenter is committed to the state's goal of achieving safe and sustainable water resources for the future. ■

Photo by John Wozniak

Paul D. Coreil

Paul D. Coreil, LSU AgCenter Vice Chancellor and Director, Louisiana Cooperative Extension Service

Health of Louisiana's Waters

Patrick K. Bollich

Louisiana is known as a sportsman's paradise and the bayou state. When people think Louisiana, they think cypress trees, alligators, seafood, fishing, hunting and trapping. The common thread that runs through all of these images is water. When talking about the quality of Louisiana's surface waters, we are referring to its "health." Are these waters meeting their designated uses such as recreation, fish and wildlife habitat, and irrigation? If these waters are ailing, what is needed to improve their health?

The Louisiana Department of Environmental Quality (LDEQ) is the state arm of the Environmental Protection Agency. One of its responsibilities is quality assessment of the state's surface waters. Sources of pollutants that affect the ability of the water body to meet its designated use are identified. Management plans will ultimately be implemented to mitigate these water quality problems.

How do these management plans evolve? The LSU AgCenter has been involved in research and demonstration projects since the early 1990s to address concerns related to agricultural nonpoint-source pollution. One of the first projects involved the mitigation of sediment-laden rice field floodwater discharges in southwest Louisiana. The traditional practice of "mudding in" of rice fields consists of seedbed preparation under flooded conditions. This is a cultural method used to control red rice, a noxious weed, which until the past couple of years could not be controlled by chemical means. Although effective, this practice results in the suspension of soil particles and other particulate matter in the floodwater. To encourage rice stand establishment, these fields are typically drained within days of mudding in, and the sediment flows into receiving streams.

Photo by John Wozniak

Patrick K. Bollich

To address the water quality concern in Southwest Louisiana, a number of conservation tillage practices were evaluated for their effectiveness in reducing sediment loss. The Rice Research Station had already initiated conservation tillage research as an alternative to traditional production methods to increase yields, reduce costs and develop more environmentally friendly production practices. A cooperative project was developed among the LSU AgCenter, LDEQ and the Natural Resource Conservation Service to determine whether implementing these conservation tillage or "best management practices" (BMPs) would be effective in reducing sediment loading but at the same time be viable alternatives to the rice producer. This has certainly turned into a success story for Louisiana rice producers. In less than 15 years what began as a few hundred acres of conservation tillage production has turned into 32 percent of the state's acreage, a figure approaching 200,000 acres.

The Southwest Louisiana rice project is just one of many examples of research conducted by the LSU AgCenter that has addressed water quality issues. Projects either have been conducted or are ongoing with sugarcane, soybeans, crawfish aquaculture, forestry and pastures. Animal industries such as poultry, swine, beef and dairy also have the potential to affect water quality, and LSU AgCenter research is addressing these issues.

The backbone of all water quality research is the development and implementation of BMPs. Regardless of the issues, the approach AgCenter scientists have taken is to develop alternative practices or procedures that solve the problem and at the same time keep the agricultural enterprise sustainable economically. A key component of the BMP implementation process is to encourage a high level of participation by stakeholders through education and demonstration. This encourages voluntary participation in an attempt to avoid regulation, which potentially has a crippling effect on the industry.

This issue of *Louisiana Agriculture* includes a summary of activities that address water quality problems our industries face. The research cuts across economic, municipal, recreational, agricultural, aquaculture and forestry concerns. What you will find is a concerted effort to tackle the complicated issues of water quality in Louisiana. Water quality problems didn't develop overnight and solving them takes time. ■

Patrick K. Bollich, Professor and Director, Central Stations, Baton Rouge, La.

Water quality research focuses on best management practices

LSU AgCenter research teams are evaluating water quality in the Cole Gully area on the Bayou Plaquemine-Brule in Acadia Parish and in Bayou Wikoff north of Lafayette. Each study area comprises a watershed identified and selected by the Louisiana Department of Environmental Quality.

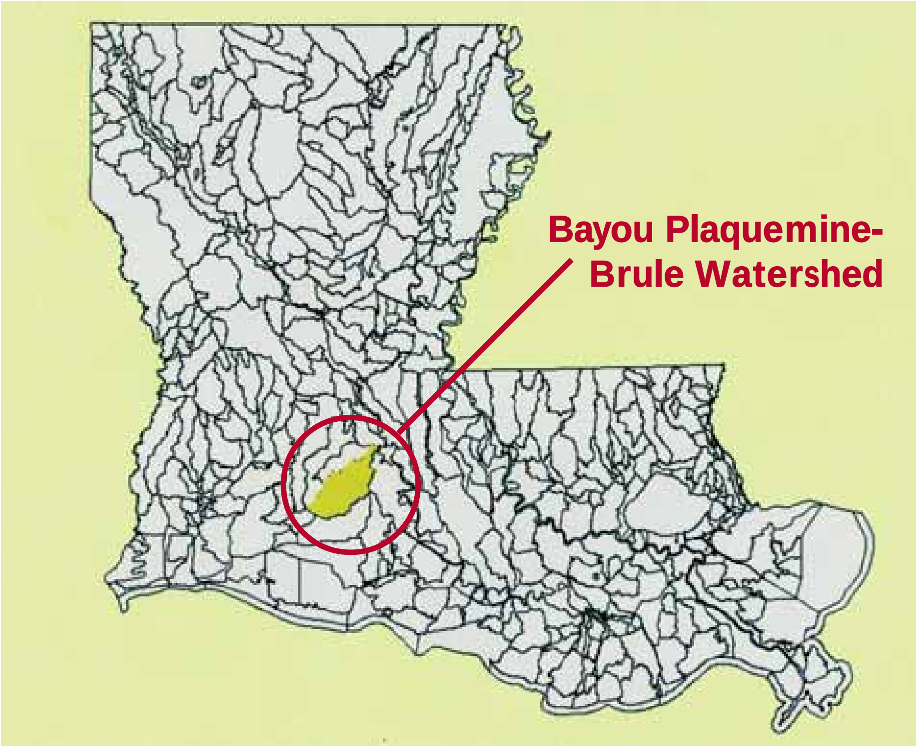
"We'll look at different management practices and determine which are most effective and least burdensome," said Lewis Gaston, associate professor in the Department of Agronomy. "It's an implementation demonstration project."

Gaston said that cooperating farmers implement pre-determined best management practices (BMPs) designed to improve water quality. Then the researchers intercept water coming off designated fields and measure the amounts of sediment, nutrients and other pollutants in the water.

Magdi Selim, professor in the Department of Agronomy, said the researchers want to quantify how to manage sediment losses and agricultural chemical losses reaching water bodies.

The researchers are installing sampling stations between the edges of each field and the bayous.

"We want to look at the edge of the field and see what comes out," Selim said, explaining they expect to see reductions in sediments, nutrients and dissolved carbon in fields where best management practices have been implemented.



Watersheds are increasingly becoming the primary planning unit for natural resource management. Louisiana uses a set of 475 sub-segment watersheds in 12 river basins as a framework for surface water quality assessment. The Plaquemine-Brule watershed is a sub-segment of the Mermentau River drainage basin.

In another project, AgCenter researchers monitor water discharges from crawfish ponds as well as water in streams, bayous or canals to compare the pond water with normal surface water.

Robert Romaire, director of the LSU AgCenter's Aquaculture Research Station in Baton Rouge, said the project is evaluating three crawfish ponds on the Bayou Plaquemine-Brule watershed. The researchers are looking at different sets of BMPs to evaluate their effect on water discharged from the ponds.

"Ponds are managed to mimic nature," Romaire said, explaining how crawfish farmers empty the ponds in the spring to force the crawfish into burrows to lay eggs. Then, after a summer of growing vegetation that will be food for the crawfish, farmers fill the ponds to bring the crawfish out of their burrows in the fall. AgCenter researchers will use the study results to evaluate current BMPs and recommend modifications, if necessary. ■ **Rick Bogren**

Meeting Standards for Rice and Soybeans

Lewis A. Gaston and Patrick K. Bollich

Because the land is so flat, water flow in Bayou Plaquemine Brule and its tributaries, including Cole Gully, is sluggish and reaeration potential is low. Consequently, inputs of oxygen-depleting materials, such as dissolved or suspended organic material or ammonical nitrogen, are expected to aggravate this naturally oxygen-poor condition. Agriculture is the predominant land use, and rice, soybean, grain sorghum and crawfish are the principal crops in the Cole Gully watershed. Surface runoff, flood release and storm overflow from these production systems are the major sources of flow in Cole Gully, and agricultural production is the likely origin of water quality problems.

In 2003, LSU AgCenter scientists initiated a project that monitors differences in the quality of water released from a pair of fields used for rice, soybean and grain sorghum production. One field is under best management practices (BMPs), and the other is not. Water quality is being monitored both in edge-of-field comparisons and in Cole Gully itself.

The objectives of this demonstration project are to measure the effectiveness of in-field conservation practices, quantify their benefits on water quality at the production-field scale and provide watershed-scale data on improved water quality in Cole Gully following widespread adoption of BMPs. Results from the study will also assist efforts by the Louisiana Department of Environmental Quality (LDEQ) and the U.S. Department of Agriculture Agricultural Research Service in validating what is termed the Annualized Agricultural Nonpoint Source water quality model for low-relief landscapes and rice production systems.

The approximately 6,000-acre Cole Gully watershed is a mosaic of leveed fields separated by a network of drainage ditches that feed into Cole Gully. The extensive human-made drainage system is ideal for this project because individual production fields are hydrologically isolated from one another. Because the volume and composition of both runoff and discharge water are needed to determine edge-of-field sediment and nutrient losses, the first task was to locate adjacent rice row crop fields small enough to each be drained by a single pipe.

The U.S. Environmental Protection Agency (EPA) provides funds under the Clean Water Act to implement approved nonpoint-source management programs. These programs include a variety of components, including technical assistance, education, training, technology transfer, demonstration projects and regulatory programs.

Agricultural producers in the Cole Gully area have been extremely supportive of the project. A majority of the production acreage in the watershed and essentially all acreage upstream of the water-quality samplers in the Cole Gully channel are now in some form of BMP manage-ment. Edge-of-field water quality data are expected to demonstrate the potential of BMPs, and stream samples are expected to show that the prescribed reduction in oxygen-depleting materials is being met. Early data on both points are encouraging. ■

Lewis A. Gaston, Associate Professor, Department of Agronomy and Environmental Management, LSU AgCenter, Baton Rouge, La., and Patrick K. Bollich, Professor and Resident Director, Central Stations, Baton Rouge, La.

The agricultural crop in Louisiana that uses the most water is rice because it requires flooded fields to grow. LSU AgCenter scientists are helping determine which methods of rice production use the least amount of water and save the farmer the most money.

Reducing Pollution from Sugarcane and Pasture Fields in Bayou Wikoff

H. Magdi Selim, Michael R. Lindsey, Brian J. Naquin and Brad Venuto

A major objective of the Clean Water Act and the Coastal Zone Management Act is to evaluate, demonstrate and implement best management practices (BMPs) to improve water quality. Because applied agricultural chemicals and sediment are potential contributors to nonpoint-source pollution, it is essential to quantify each commodity's contribution to water quality problems and evaluate BMPs that can improve water quality.

The Clean Water Act and the U.S. Environmental Protection Agency's (EPA) water quality regulations require all states to identify and designate beneficial uses for each water body and adopt standards that protect those beneficial uses. Water quality standards may be either numerical, such as the amount of dissolved oxygen, or narrative, such as no toxic materials. Water bodies that do not meet water quality standards are listed as impaired. Nationally, EPA has concluded that agriculture has contributed nearly 60 percent of the impaired river miles and half of impaired lakes.

The Louisiana Department of Environmental Quality (LDEQ) is developing and implementing a monitoring and management approach to identify sources of pollutants that place specific water bodies at risk. The management scheme is based on the Total Maximum Daily Load (TMDL) of a pollutant that a stream or water body can tolerate before its use is compromised. The pollutants identified as being of concern in Louisiana surface waters are suspended sediments, nutrients (nitrate and phosphate) and organic matter enrichment.

LDEQ selected the Bayou Plaquemine-Brule sub-basin in South Louisiana for initial implementation of a number of BMPs expected to reduce TMDLs. This region is characterized by somewhat sloping topography and highly erodible soils, which are a potential source of sediment if not managed properly. While pasture, sugarcane, soybeans, corn and rice are the major agricultural activities, pasture acreage exceeds 50 percent of the watershed. Sugarcane has only recently been introduced into the southern region of the drainage basin, whereas soybeans are grown throughout the sub-basin, often in rotation with corn or sugarcane.

H. Magdi Selim, Professor; Michael R. Lindsey, Instructor; and Brian J. Naquin, Research Assistant, Department of Agronomy and Environmental Management, LSU AgCenter, Baton Rouge, La.; and Brad Venuto, Associate Professor, Southeast Research Station, Franklinton, La., and now Research Agronomist, USDA-ARS Grazinglands Research Lab, El Reno, Okla. Lindsey is now a soil scientist with USDA-NRCS, Carencro, La.

Photo by John Wozniak

For both treatments in this study – burn and no-burn – a combine harvester that cuts the cane stalks into billets, which are directly loaded into wagons for transport to the mill, is used.

Photo by John Wozniak

Two areas adjacent to Bayou Wikoff were selected for sugarcane BMP comparison. The first area is a 14-acre tract of land where standard sugarcane practices, including burning of standing cane, will be monitored. A mulch and no-burn BMP treatment will be implemented on an adjacent area of a similar size.

In 2003, LSU AgCenter researchers initiated a study to quantify control measures for implementation of best management practices that reduce nonpoint-source pollution in the Bayou Wikoff watershed region of the Bayou Plaquemine-Brule sub-basin. Sampling and water and soil analysis will continue through 2004 and 2005. Three local farmers agreed to participate in the study.

Control site

A 5-acre area adjacent to Bayou Wikoff was selected to serve as a control area. Land-use operations consist of a minimum-input tree farm. The grassed areas are never grazed and only infrequently mowed. This land-use scenario closely mimics the pre-settlement natural prairie ecosystem of the region, and monitoring should yield an estimate of pre-settlement nonpoint-source values before settlement.

Sugarcane sites

Two areas adjacent to Bayou Wikoff were selected for sugarcane BMP comparison. The first area is a 14-acre tract of land where standard sugarcane practices, including burning of standing cane, will be monitored. A mulch and no-burn BMP treatment will be implemented on an adjacent area of a similar size.

For both treatments – burn and no-burn – a combine harvester that cuts the cane stalks into billets, which are directly loaded into wagons for transport to the mill, is used. Extractor fans in the combine separate leaf material from billets. The plant residue or mulch falls to the soil surface averaging 6 to 8 tons per acre.

The selection of the no-burn BMP will have the additional benefit of eliminating air pollutants (smoke and ash) associated with sugarcane harvest in addition to the anticipated benefits of pollution reduction from mulch residue retention, sediments and applied agricultural chemicals.

Pasture sites

We identified two areas in which to monitor different forage BMPs and their influence on water quality and sediment runoff. The first site is a 12-acre pasture that borders Bayou Wikoff in the central part of the sub-watershed. The treatment here is minimum input with low maintenance and involves continuous grazing at recommended stocking rates, supplemental feeding and minimum tillage. Summer forage consists of perennial grasses, and winter forage is sod-seeded annual ryegrass.

The second site for BMP monitoring is a 10-acre section of pasture adjacent to the first site but separated by a road. In this treatment, the BMP consists of a rotational grazing system wherein duration, intensity and frequency of grazing is managed to enhance nutrient cycling. This requires monitoring manure distribution and fertilizer inputs and minimizing soil compaction and erosion. Forages in these treatment areas consist of perennial summer grasses and winter ryegrass.

Monitoring and sampling equipment have been placed at edge-of-field locations to facilitate evaluation of all treatment options. In addition, there is in-stream monitoring of the changes in the water quality, both upstream and downstream. The upstream location is not influenced by the various treatments, whereas the downstream location captures total runoff from all treatments in Bayou Wikoff.

This study is among the first in Louisiana to quantify the impact on water quality within a watershed from application of recommended BMP's to specific agricultural cropping systems. These results will help direct future implementation and adoption of BMP's and lead ultimately to cleaner water for everyone. ■

Improving Water Quality in Crawfish Aquaculture

Robert P. Romaire, Landon D. Parr and W. Ray McClain

Aquaculture operations worldwide have come under scrutiny because of potential environmental degradation caused by the discharge of water from production facilities. The U.S. Environmental Protection Agency (EPA) is reviewing aquaculture as an industry for regulatory activity. Most of Louisiana's 129,000 acres of crawfish ponds are located in southwestern and south central Louisiana in water basins identified by the Louisiana Department of Environmental Quality (LDEQ) as impaired. Nearly half the acreage is in the Mermentau and Vermilion-Teche river basins.

Many farmers cultivate crawfish in rotation with field crops such as rice and soybeans. They have to flush the ponds intermittently in fall and spring to maintain oxygen at acceptable concentrations for crawfish. This results in effluent discharge. Effluent also is released from crawfish ponds into streams and rivers during rainfall events. Ponds are drained annually in late spring or early summer to induce crawfish to burrow for reproduction and to establish a forage crop. The quantity and quality of effluent from crawfish farming operations and the impact on stream water quality in these impaired water basins is not known.

LSU AgCenter researchers are assessing how effluent from commercial crawfish farms contributes to water quality in southern Louisiana streams, with focus on the Mermentau and Vermilion-Teche river basins. Best management practices (BMPs) aimed to improve stream water quality and conserve natural resources, especially water, are being evaluated. Although pond management affects the characteristics and quantity of substances discharged from crawfish ponds, few data are available on water management practices used by the state's crawfish farmers. Water management practices, and subsequent effects of effluents, may differ depending on factors such as type of culture system (single-crop crawfish, double-crop rice/crawfish or double-crop rice/crawfish rotation), source of water (surface or groundwater), size of farming operation, forage (rice or volunteer vegetation) and crawfish harvesting decisions.

The acreage and geographical locations of crawfish ponds in southern Louisiana parishes are being determined using geographical information systems (GIS) technology and Natural Resources Conservation Service (NRCS) databases. After validation of the data, crawfish production areas will be described by water basin and watershed. A survey is being conducted to identify crawfish farmers' existing water and pond management practices to estimate the frequency and magnitude of effluent releases, as well as the potential for adoption of crawfish aquaculture BMPs.

Three commercial farming operations in the Bayou Plaquemine-Brule Cole Gully watershed in Acadia Parish, which are being used in the rice-soybean BMP project (see page 16), are also being used as study sites for the crawfish BMP project. As with the rice-soybean project, the quality and quantity of water released from paired crawfish ponds under BMP and non-BMP management are being monitored. BMPs include increasing pond water storage capacity to capture rainwater, thereby reducing effluent release during precipitation events, and altering late-season harvesting practices and end-of-season pond draw-down procedures to reduce sediment and nutrient loads in the effluents. These data will be used with information from the rice-soybean BMP project and other data to calibrate and validate LDEQ's water quality computer model for different levels of conservation BMPs implemented in the Bayou Plaquemine Brule watershed.

Best management practices have been determined to be an effective and practical means for reducing point and nonpoint water pollutants to levels compatible with environmental quality goals. In addition to providing a highly valued and desirable seafood product, crawfish ponds serve as favorable wetland habitat to many species of waterfowl, wading birds and furbearers. Often land that is marginal for traditional row crops is used in crawfish production. Integration of crawfish aquaculture with traditional agricultural land uses serves as a practical means of land and water conservation. ■

Robert P. Romaire, Professor and Resident Director; Landon D. Parr, Research Associate, Aquaculture Research Station, Baton Rouge, La.; and W. Ray McClain, Professor, Rice Research Station, Crowley, La.

Photo by Randy McClain

Both rain and the flushing of crawfish ponds produce effluent.

Saving Water in Louisiana Rice Production

Johnny Saichuk, Bill Branch and Shane Theunissen

Figure 1. A Summary of Water Use by Leveling Method for Monitored Rice Fields in Louisiana, 2002 and 2003.

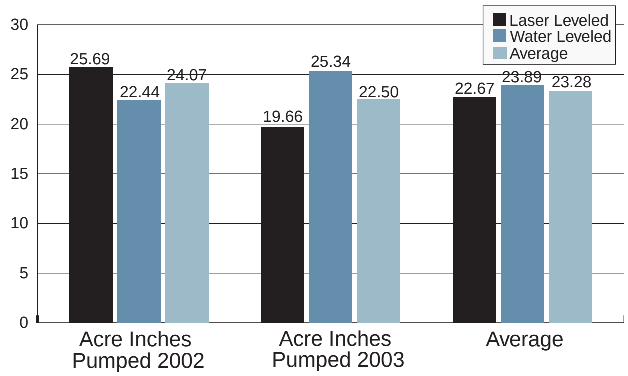


Figure 2. A Summary of Water Use by Soil Type for Monitored Rice Fields in Louisiana, 2002 and 2003.

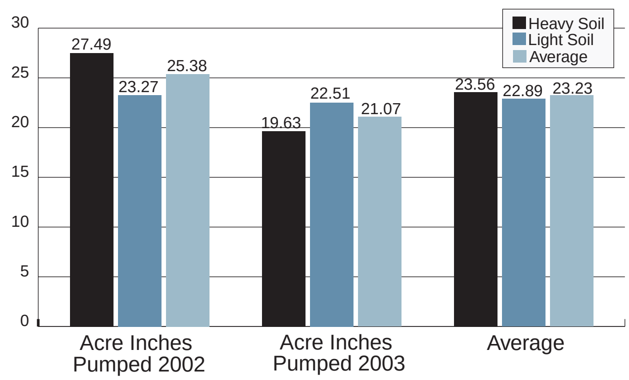
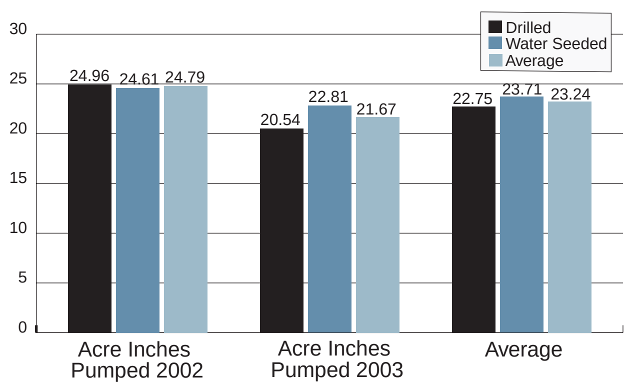


Figure 3. A Summary of Water Use by Planting Type for Monitored Rice Fields in Louisiana, 2002 and 2003.



When drought hit Louisiana in 2000 and 2001, along with the construction of a power plant in the heart of the rice-growing area, interest in water consumption reached a peak among farmers and other water consumers. To find out how much water was used and needed for rice production, a team of LSU AgCenter scientists and extension agents began a study funded by the Rice Research Board.

To conduct the study, the team took advantage of an AgCenter program already in place, the Louisiana Rice Research Verification Program. This program involves working with a group of about a dozen rice farmers spread over several parishes each year to advise them on the latest recommendations on rice production and to validate that the recommendations actually work.

Eight rice fields with a single inlet supplying a known acreage were located, and equipment to measure water flow was purchased and put into place. Even though the fields were not systematically chosen to provide a perfect randomized research design, comparisons could still be made.

One comparison involved locating farmer fields leveled by different methods to see which used more water, a field leveled with laser equipment or one leveled in the traditional manner. In laser-leveling, a laser beam receiver is mounted on the tractor and an emitter at a stationary location. The beam guides the implement to raise or lower for precision leveling. This can be done in a dry or flooded field. (See photo on back cover.)The traditional way to level involves dragging the leveling implement through a flooded field and guessing by eyesight.

In 2002, five fields were laser-leveled, and three were water-leveled in the traditional manner (Figure 1). Likewise, comparisons were made between heavy soil (clay loam) and light-textured soil (silt loam) (Figure 2), and between drill-planted and water-seeded operations (Figure 3).

Photo by Johnny Saichuk

A flow meter inside this delivery pipe stationed in Beauregard Parish gathers data on water use throughout the growing season.

Johnny Saichuk, Professor, Rice Research Station; Bill Branch, Professor, Department of Biological and Agricultural Engineering, LSU AgCenter, Baton Rouge, La.; and Shane Theunissen, Extension Associate, Rice Research Station, Crowley, La.

The study on water use in rice production was conducted on rice fields in the verification program, including this one in Beauregard Parish. Ten rice fields with a single inlet supplying a known acreage were located, and equipment to measure water flow was purchased and put into place. Even though the fields were not systematically chosen to provide a perfect randomized research design, comparisons could still be made.

Photo by Johnny Saichuk

The apparently obvious does not always happen. Those knowledgeable about rice production expected laser-leveling of land to reduce water usage. Based on the data collected in 2002, this was not true. Although the difference between laser-leveling and traditional water-leveling that year was small, slightly more water was used in laser-leveled fields.

One possible reason for the small difference in 2002 was a laser-leveled field in Concordia Parish. It was a heavy clay field and plowed in the spring. At the time of plowing, that location was excessively dry. The initial flooding of the field required more water than if it had been plowed in the fall and allowed to seal over the winter. Additionally, this field had to be flushed twice to get the rice up to a good stand.

In 2003, an expected difference was found between water used in water-leveled fields and laser-leveled fields. Results showed water-leveled fields required 5 inches more water than laser-leveled fields.

In 2002, more water was required on heavy soils (remember the heavy soil in Concordia Parish). But in 2003, this was not the case. Instead of a simple association between soil type and water usage, there is an interaction between soil type, rainfall, time of field preparation, degree of field preparation and possibly other factors that might influence the amount of water required on a given soil type.

Method of planting rice also makes a difference in water usage. Drill seeding by tractor on dry land requires less water than water seeding, which is done by airplane into flooded fields. But in areas where the noxious weed red rice is a problem, drill seeding had all but been eliminated as a method of planting rice. This is because flooding a field can help suppress the growth of red rice.

However, with the advent of Clearfield technology in 2002, this changed. This technology, based on the herbicide resistance of rice, allows for the spraying of rice to kill red rice without destroying the commercial rice, which is a close relative. With the possibility of drill seeding making a comeback, especially in south Louisiana, we decided to compare water use in drill-seeded versus water-seeded fields, where possible. In both years, we found less water required in drill-seeded fields than in water-seeded fields.

While the reduction in water use is laudable, it is the financial bottom line that will ultimately drive farmers to change practices, as long as water is relatively abundant and relatively cheap. So far, Louisiana has not had the serious water use issues of some of the other rice-growing states. In the process of collecting economic data for the verification program, we learned that water costs were among the most difficult to collect because most farmers did not know them. Therefore, we estimated the costs (Table 1).

Table 1. Summary of water use cost for monitored rice fields of Louisiana in 2002 and 2003.

Year	Acre-Inches Pumped	$/Acre	$/Acre-Inch
2002	26.36	24.43	0.93
2003	21.35	32.23	1.52
Average	23.86	28.33	1.22

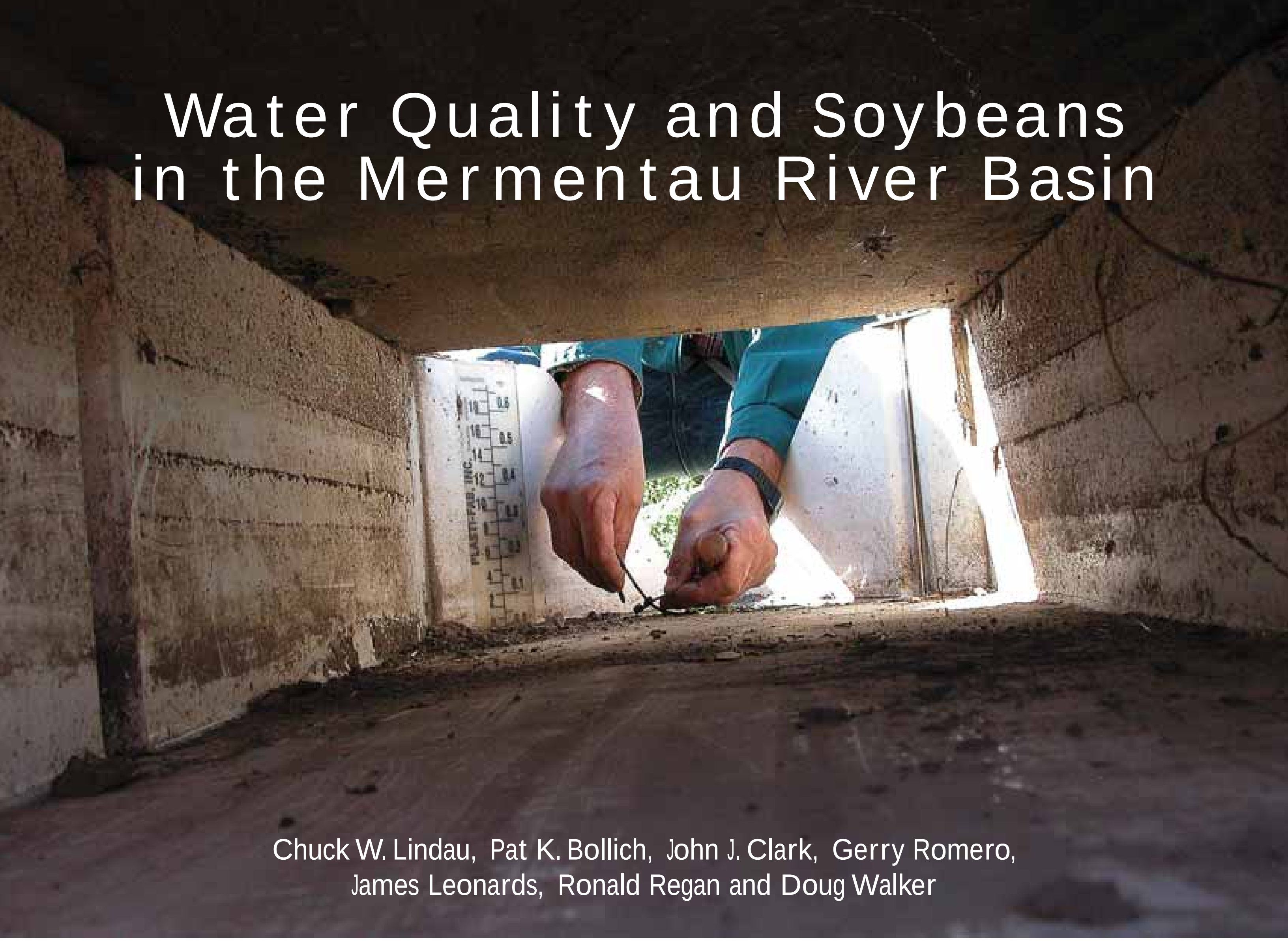
The difference in acre-inches pumped between 2002 and 2003 reflects the differences in rainfall between the two years. Rainfall data were collected as part of the study but not shown here because we have no capability of measuring overflow from fields, which will negatively affect the information. For example, if a farmer had just finished pumping a field to capacity, then had a thunderstorm roll in and produce 2 inches of rain, that rainfall would count against the water budget, even though nearly all of it would have run out through the field overflows.

The cost per acre to irrigate rice in 2003 was higher than in 2002, even though less water was pumped. This is reflected in both the dollars per acre and the dollars per acre-inch columns. Much of this was accounted for in the increase in fuel costs, because diesel prices rose dramatically from one year to the next.

Two years of study of this type of input is clearly insufficient. The intention is to carry on the study for at least five years to gather enough data to be able to make reasonable estimates of water use with sufficient confidence to help rice farmers be more conservative in their water use. ■

Water Quality and Soybeans in the Mermentau River Basin

Chuck W. Lindau, Pat K. Bollich, John J. Clark, Gerry Romero, James Leonards, Ronald Regan and Doug Walker



The tubing is installed inside the H flume.

Photos by Bruce Schultz

LSU AgCenter scientists have joined with scientists from the LSU Wetland Biogeochemistry Institute and the Louisiana Department of Environmental Quality (LDEQ) to conduct a research project to determine and demonstrate which soybean tillage practices are most effective in reducing pollution. Reducing the amount of runoff from soybean fields means less

The instrumentation is placed around the test plots. At left is Chuck Lindau. At right is Gerry Romero.

Chuck W. Lindau, Professor, Wetland Biogeochemistry Institute, Baton Rouge, La.; Pat K. Bollich, Professor, Rice Research Station, Crowley, La., and now Resident Director of Central Stations, Baton Rouge, La.; John J. Clark, Environmental Scientist, Louisiana Department of Environmental Quality, Baton Rouge, La.; Gerry Romero, James Leonards, Ronald Regan and Doug Walker, Research Associates, Rice Research Station, Crowley, La.

Photos by Bruce Schultz

This H flume is installed in a levee surrounding a soybean field at the South Farm of the LSU AgCenter's Rice Research Station, Crowley.

Chuck Lindau, principal investigator, is trying to determine which soybean tillage practices are most effective in reducing pollution. Reducing the amount of runoff from soybean fields means less sediment, fertilizer and pesticide entering local waterways.

sediment, fertilizer and pesticide entering local waterways.

The project is part of LDEQ's plan to restore waterways in the Mermentau River Basin designated impaired because of poor water quality. In 1999, the U.S. Environmental Protection Agency (EPA) designated all 20 watersheds in the basin impaired.

For every impaired water body, the Federal Clean Water Act requires development of a total maximum daily load (TMDL). A TMDL for a waterway is the maximum amount of pollutant that a waterway can receive on a daily basis and not violate its water quality standards. TMDLs have been developed for 11 of the Mermentau River Basin watersheds with pollutant load reductions ranging from 30 percent to 95 percent.

Water pollution can result from point sources (primarily industrial) and nonpoint sources (primarily agricultural) located within a watershed. Sediment has been identified as one of the major pollutants of Louisiana surface water. Most sediment originates from agricultural practices that leave bare soil exposed to rain and wind. Runoff of sediment increases turbidity of surface water, which limits light penetration and restricts photosynthesis. Excess sediment alters oxygen production and consumption and limits the food supply for certain aquatic organisms, including fish. Increased sediment also fills streams and lakes affecting drainage capacity. Surface runoff of sediment can carry dissolved nutrients and pesticides into bayous, rivers and lakes, which may significantly affect local ecosystems.

The major crops grown in the Mermentau River Basin are soybeans and rice. The goal of this project is to determine and demonstrate which soybean tillage practices reduce surface runoff, sediment amount and nutrient levels to surface waters.

Soybean plots were established at the South Farm of the LSU AgCenter's Rice Research Station in Crowley. The demonstration site was designed to compare three different soybean tillage practices: conventional tillage, stale seedbed and no tillage. Conventional tillage consists of six to eight trips across the field with various implements in the fall and spring to prepare a smooth, bare and weed-free seedbed. Stale seedbed tillage consists of the same general tillage practices, but after fall preparation there are no more soil-disturbing activities. No tillage is the

Photos by Chuck Lindau

This is called an H flume. They are installed in the levees and used in the project to collect runoff. Note the tubing that runs to the collection container.

The equipment includes an automated runoff collection sampler, bubble flow meter and solar panel and battery for equipment power.

direct seeding of a crop into previous crop residue or native vegetation. In this study the no-tillage practice consisted of soybeans planted into wheat residue.

The field site was designed to have each tillage practice separated into individual plots (0.71 acres) and replicated three times for statistical analysis. Each of the nine plots was isolated from remaining plots with earthen levees. Roundup Ready soybeans were planted in the spring, and weeds were controlled with Roundup applied at approximately three and six weeks after planting. Other pest control was practiced according to LSU AgCenter recommendations.

Runoff from experimental plots was collected six times during the 2003 soybean season, and data is being evaluated. The project is scheduled to be completed in December 2004. Scientists hope to determine whether stale seedbed and no-tillage soybean practices are more effective than conventional tillage based on the nonpoint-source loading (sediment and nutrients) and runoff flow. Project information will then be disseminated to Mermentau River Basin soybean producers to encourage implementation of best management practices. ■

Scientists collect water samples in these jars, which are placed inside the equipment. The runoff is collected from stale seedbed, conventional and no-till soybean plots.

Keeping Invasive Aquatic Plants at Bay

Dearl E. Sanders and Seth Johnson

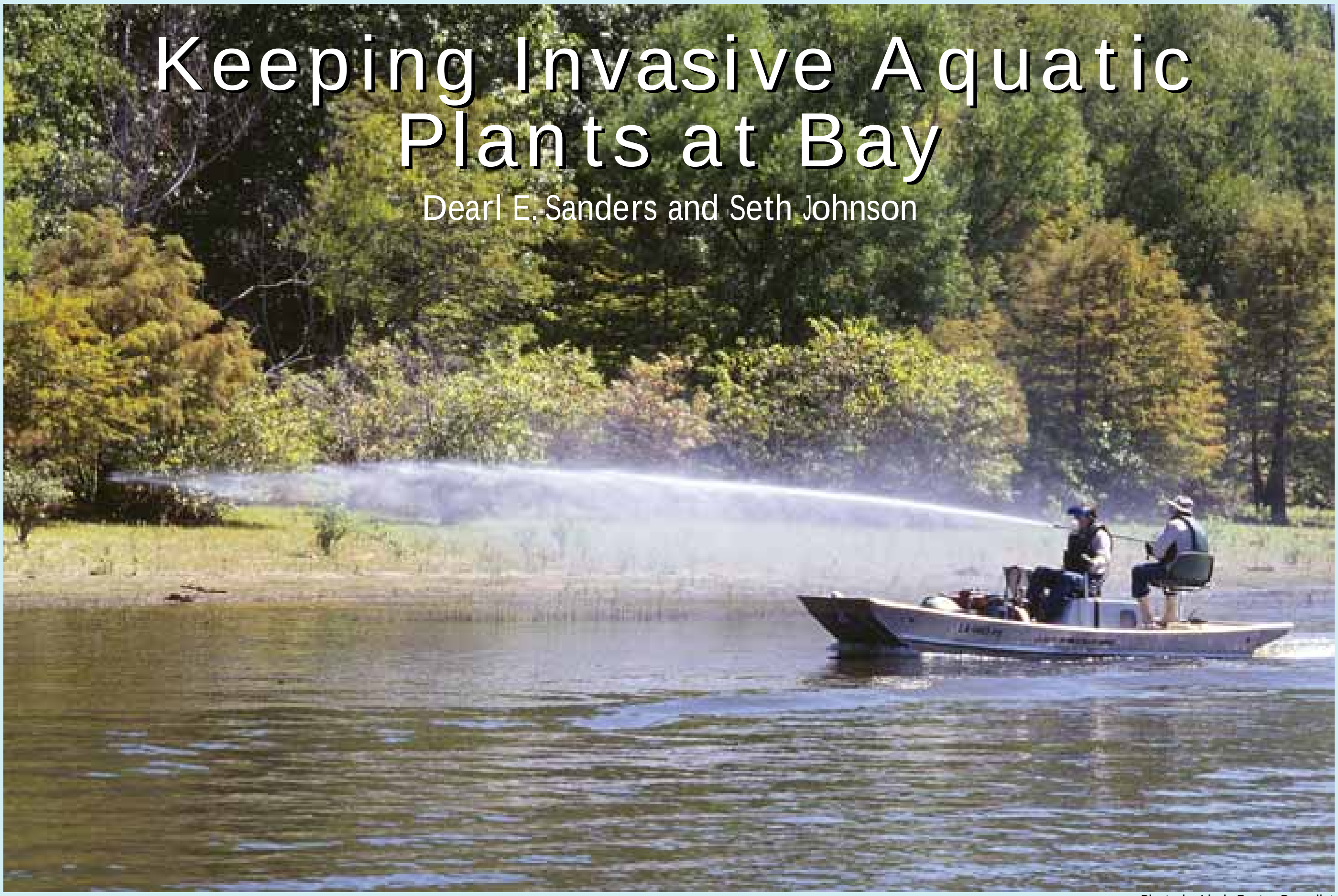


Photo by Linda Foster Benedict

Herbicides are successfully controlling the giant salvinia problem in Toledo Bend. The disadvantage of chemical sprays is the high cost.

Plants are a part of any healthy aquatic environment. They release oxygen into the system, provide cover and reproductive sites for fish and invertebrates and can even serve as a type of filtration system to remove unwanted contaminants. Native plants have developed in harmony with the systems in which they are naturally found.

Most native plants develop a balance in their environment with natural constraints, such as turbidity, loss of fertility, forage feeding fish and insects, that over time usually prevent the plant from becoming a burden on the system. Problems occur, however, when non-native plants are introduced into the system free from their native pests and predators. If the introduced plants out-compete and displace the native plants and become a burden the system, they are considered invasive.

Invasive aquatic plants can and do harm water quality. When left unchecked, these plants tend to form dense mats of vegetation. This impedes natural water flow, which can directly influence flooding, fish migration and displace native plants that depend on regular seasonal water fluctuations.

Dense mats of floating invasive plants such as water hyacinth or giant salvinia produce low-oxygen conditions in the water by blocking sunlight from oxygen-producing algae and submerged plants. Low-oxygen conditions can lead to fish kills and loss of many desirable invertebrates. Naturally occurring decay of plant material from these dense mats further decreases oxygen levels to the point that few desirable fish can inhabit the area.

Recent research has shown that dense mats of floating vegetation can create favorable breeding conditions for mosquitoes and make their control more difficult by sheltering them from pesticides.

Introducing water hyacinth

Unfortunately, Louisiana has had a long history of dealing with invasive aquatic plants. One of the first and still one of the most troublesome of these plants, water hyacinth, was intentionally introduced into the state at the World's Industrial and Cotton Centennial Exposition of 1884 in New Orleans. This event attracted people from all over the state and country. Water hyacinth plants imported from their native South America were given away as gifts at the exposition. Visitors admired the showy violet flowers of the plant and took their plants home, where they were placed in ponds and lakes throughout the South. Nearly 120 years after this introduction, local, state, federal and private agencies in Louisiana spend millions of dollars each year trying to control approximately 200,000 acres of water hyacinth-infested water that directly affects navigation and water quality throughout the state. Nearly 1 million additional

Dearl E.Sanders, Floyd S. Edmiston Professor and Resident Coordinator, Idlewild Research Station, and Seth Johnson, Professor, Department of Entomology.

Photo by John Chaney

Giant salvinia is easily spread. Boats that have touched it must be carefully cleaned before being placed in another waterway. Otherwise, they can spread this noxious weed.

acres go untreated because of lack of funds.

The U.S. Geological Survey (USGS) lists more than 30 non-native aquatic species in Louisiana water bodies. Some have been around for decades and remain fairly rare, such as Asian duck lettuce. Others, like common salvinia, have covered hundreds of thousands of acres in the past 20 years.

Of the 30 non-native species, the six most troublesome are alligatorweed, water hyacinth, hydrilla, torpedograss, water lettuce and common salvinia. They are found throughout the state and usually displace native vegetation. The most recent introduction, giant salvinia, escaped from the water garden trade in 1998 and spread to several lakes within two years. Continuing worldwide trade along with Louisiana's numerous ports of entry and a favorable climate make it highly likely additional species will be introduced.

Chemical control

Herbicides provide adequate-to-good control of most of the troublesome weeds. The LSU AgCenter, in cooperation with the Louisiana Department of Wildlife and Fisheries and the U.S. Army Corps of Engineers, has maintained a screening program for new weeds and herbicides for more than 20 years. An aquatic weed research site established at the LSU AgCenter's Idlewild Research Station in Clinton in 1999 performs aquatic herbicide assessment.

The positive aspects of herbicide-control programs are efficacy and rapid response. More than 100,000 acres of water hyacinth are controlled each year through herbicide spray programs. Other herbicide programs target giant salvinia, hydrilla, alligatorweed and several others. The negative aspects of herbicide programs are expense and potential non-target injury.

The list of available approved aquatic herbicides is limited, and herbicide costs range from a low of $12 per acre to as much as $500 per acre. Application costs often equal or exceed the cost of the herbicide, and relief may be temporary. Often, the more effective the chemical control, the sooner other more herbicide-resistant or herbicide-tolerant weeds may fill the vacant niches.

Biological control

Biological control of aquatic invasive weeds is relatively recent. The alligatorweed flea beetle, *Agasicles hygrophila*, from water near Buenos Aires, Argentina, was introduced and established in the southeastern United States from 1964 to1970. This first use of an insect as an aquatic weed control agent was an effort of the U.S. Department of Agriculture's Agricultural Research Service (ARS). Larval and adult leaf feeding destroys both leaves and stems, and the latter become waterlogged after repeated perforations with adult emergence holes, causing the mats to sink. This is still considered the most successful example of biological control of an invasive aquatic weed in the United States.

Biological control has also been used with some success to control water hyacinth in Louisiana. Two weevils and a moth were introduced into the United States from Buenos Aires, Argentina, in the early 1970s by the U.S. Army Corps of Engineers. One of the weevils, *Neochetina eichhorniae*, has probably been the major contributor to the level of control of water hyacinth that has been reported. The female weevil chews holes in the leaf petiole and inserts her eggs. The larvae tunnel beneath the epidermis and work their way down to the base of the petiole or rhizome and chew their way out of the stems.

The most successful use of an insect to control an aquatic weed occurred

Photo by Kevin Savoie

Before this canal in Cameron Parish was treated, a person could stand on the giant salvinia because of its thickness.

outside the United States in Africa, Australia and New Guinea. The aquatic fern, giant salvinia, *Salvinia molesta*, has infested areas in many countries, covering nearly 100 square miles in one lake. It was successfully controlled in a couple of years by the weevil *Cyrtobagous salviniae* from Brazil.

Since 1998, several bodies of water in Louisiana have become infested with giant salvinia. LSU AgCenter scientists have released the Brazilian salvinia weevil in both Toledo Bend Reservoir and a drainage canal in Cameron Parish. But herbicides are successfully controlling the giant salvinia problem in Toledo Bend, and draining and flushing the Cameron canal with salt water from the Gulf of Mexico has been the preferred control strategy by the Cameron Parish Drainage Control Board. However, the USDA-Animal and Plant Health Inspection Service (APHIS) and the Louisiana Department of Wildlife and Fisheries released thousands of eggs, larvae, pupae and adults of the Brazilian weevil in three canals in Houma in 2003 to create a field nursery to supply additional releases as required. We will know more about their progress in 2004.

LSU AgCenter scientists initiated a biological control project against common salvinia with Florida and Brazilian populations of the salvinia weevil in collaboration with USDA-ARS and USDA-Animal Plant Health Inspection Service (APHIS). We established a colony of the Florida weevil in a greenhouse for year-round production of weevils and salvinia. Common salvinia and the weevils have been present in Florida for more than 50 years, but common salvinia isn't considered a problem there. Common salvinia has been in Louisiana for at least 20 years without the weevil and is a serious problem, covering hundreds of thousands of acres of water surface.

In July and August of 2003, we released from 100 to 200 weevils of each of the Brazilian and Florida populations in different plots on common salvinia at Henderson, St. James Parish, Joyce Wildlife Management Area and Maurepas Wildlife Management Area. The Brazilian weevils were provided by the USDA-APHIS laboratory in Mission, Texas. Over the next couple of years, as we monitor water quality, plant growth and plant damage, we are hopeful the weevils will reduce the common salvinia to the nonpest status it has in Florida. ■

Photo by Kevin Savoie

Dearl Sanders, weed scientist, has been conducting research projects on how to rid Louisiana of giant salvnia. This project is in Cameron Parish.

Acknowledgments
Personnel involved in control of invasive aquatic plants include Keith Whitehead, Ron Strahan, Don Henne, Kevin Savoie, Phillip Tipping and Daniel Flores.

Surface water provides supply option

Louisianians need to reduce consumption of groundwater and the depletion of aquifers.

"Water levels in parts of the Sparta, Chicot and Southern Hills aquifer systems are declining at rates greater than 1 foot per year," said Bill Branch, LSU AgCenter water resources specialist. "Concern for sustainability of these aquifers is driving the current effort to establish groundwater management policy in Louisiana."

Branch said citizens in the city of New Orleans have been drinking water from the Mississippi River for years – and the water has won blind taste tests.

"Most large users who can shift from using groundwater to surface water sources should consider doing so," Branch said.

To help address groundwater issues in the state, LSU AgCenter watershed agents conduct water conservation programs and help cities, businesses and the public develop new water supply strategies.

LSU AgCenter county agent Robin Bridges said officials in Webster Parish developed a water alliance to help the 32 water districts in that area improve and better use water resources. Now they are looking for ways to take advantage of available surface water and reduce demands on the Sparta Aquifer.

Educating the public to conserve water in the home and landscape is another outreach effort of the LSU AgCenter, said Mimi Stoker, watershed agent in Many. She has also developed a strategy to help families test their private wells for contamination.

"Using surface water can be good for water quality and the economy, and it allows aquifers to recharge," said Branch.

Louisiana is blessed with an abundance of surface water resources in its rivers, lakes and streams. These surface water resources can greatly reduce our dependence on groundwater, said Branch. ■ **John Chaney**

Photo by Eddie P. Millhollon

Youth from Shreveport Green, a community organization, together with personnel from the Natural Resource Conservation Service and the LSU AgCenter's Red River Research Station in Bossier City helped collect native plants for the constructed wetland.

Constructing a Wetland To Improve Water Quality in Northwest Louisiana

Eddie P. Millhollon, James L. Rabb, Russell A. Anderson, Jose F. Liscano, Danny F. Martin, Steven G. Nipper, Scott D. Edwards and Richard W. Adams

Louisiana's coastal waters, lakes, rivers and bayous are the lifeblood of the state. They have provided economic survival and year-round recreation, earning the state the well-deserved title of "Sportsman's Paradise."

Recognizing the need to protect the state's most precious natural resource, Louisiana's agricultural producers have adopted practices that aid in protecting water quality, such as conservation tillage. Although these practices reduce nonpoint-source discharges from agricultural fields into the state's water bodies, new practices are being recognized that may offer additional improvements.

One such practice is the use of a constructed wetland, because it has long been known that the biological and physical properties of natural wetlands are beneficial in improving water.

The LSU AgCenter's Red River Research Station consists of 573 acres of agricultural land in the Red River Basin of northwest Louisiana. Runoff water from the station drains into the Flat River, which is less than one-third mile away. Approximately 400 acres of discharge water from the station flows to the southeastern corner where it enters Lay's Bayou, then Flat River. The southeast corner of the station is, therefore, an ideal location to investigate the potential of a constructed wetland for improving the water quality of discharge from agricultural fields.

In 2003, a research team at the Red River Station was awarded a grant from the Louisiana Department of Environmental Quality (LDEQ) to construct a wetland at the station. The effectiveness of this system will be determined by sampling water at various points along the path of the system, from the point where runoff enters the wetland to the point where it leaves. In addition to gathering data, grant money will be used to develop and implement an educa-tional outreach program to inform agricultural producers of the benefits that can be derived from the construction of a wetland.

An area in the southeast corner of the Red River Station was surveyed by personnel of the Natural Resource Conservation Service (NRCS) to identify the best location for a constructed wetland. The wetland consists of three sections. Runoff from 400 acres will enter the wetland through three drainage ditches. At the point where the drainage ditches enter the shallow portion of the wetland, soil will be excavated so that each will have a depth of approximately 6 feet. This depth will allow most sediment to fall out before water enters the shallow wetland.

The shallow wetland will be approximately 3 acres and range in depth from zero to 18 inches. Native aquatic plants have been collected and placed in a nursery until they can be transplanted to the shallow wetland.

From the shallow wetland, water will enter a 2.25-acre wetland that will be approximately 6 feet deep. The deeper wetland serves as a "polishing" pond that provides anaerobic conditions necessary for denitrification of nitrates and breakdown of pesticides. Water will

Eddie P. Millhollon, Associate Professor; James L. Rabb, Professor; Russell A. Anderson, Research Associate; and Jose F. Liscano, Research Associate, all at the Red River Station, Bossier City, La.; Danny F. Martin, Civil Engineer; Steven G. Nipper, Water Quality Specialist; Scott D. Edwards, Plant Materials Specialist; Richard W. Adams, Soil Conservationist, all with the Natural Resource Conservation Service.

Photo by Eddie P. Millhollon

These workers then transplanted the vegetation into the constructed wetland, which is in the southeast corner of the Red River Research Station. This wetland will serve as a filter for the runoff from the station's agricultural production fields to the Flat River.

then pass through the deep wetland to a ditch leading to the Flat River through two 48-inch culverts.

Water quality changes through the system will be monitored by three automatic water sampling stations. The first will be near one of the three ditches that drains run-off from the 400 acres immediately before it enters the constructed wetland system. Samples from this location will be analyzed to determine quality of water entering the constructed wetland system.

A second sampling station will be located on the levee separating the shallow and deep wetland. This station will sample water in the shallow wetland to determine improvements in water quality at this stage of the constructed wetland system. The third sampling station will be located at the levee that separates the deep wetland from its point of egress. This station will collect water samples from the deep wetland to determine improvements in the quality of water at the final stage of the constructed wetland system.

Construction of the wetland began in December 2003, and the system should be operational by the summer of 2004. The project is presently funded for three years. In addition to the research component of this project, there is an extension component that will provide educational programs that will demonstrate the benefits of a constructed wetland in improving and preserving Louisiana's precious natural resource. ■

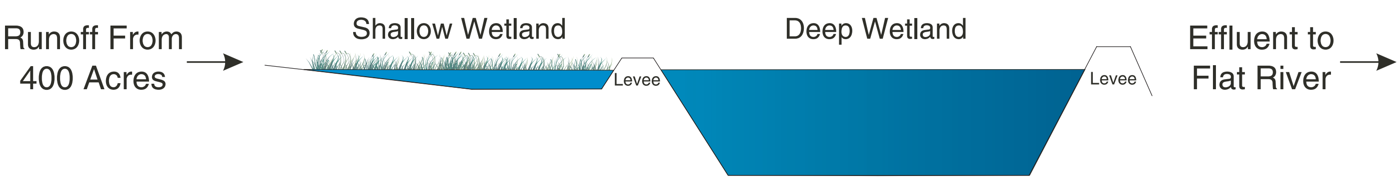


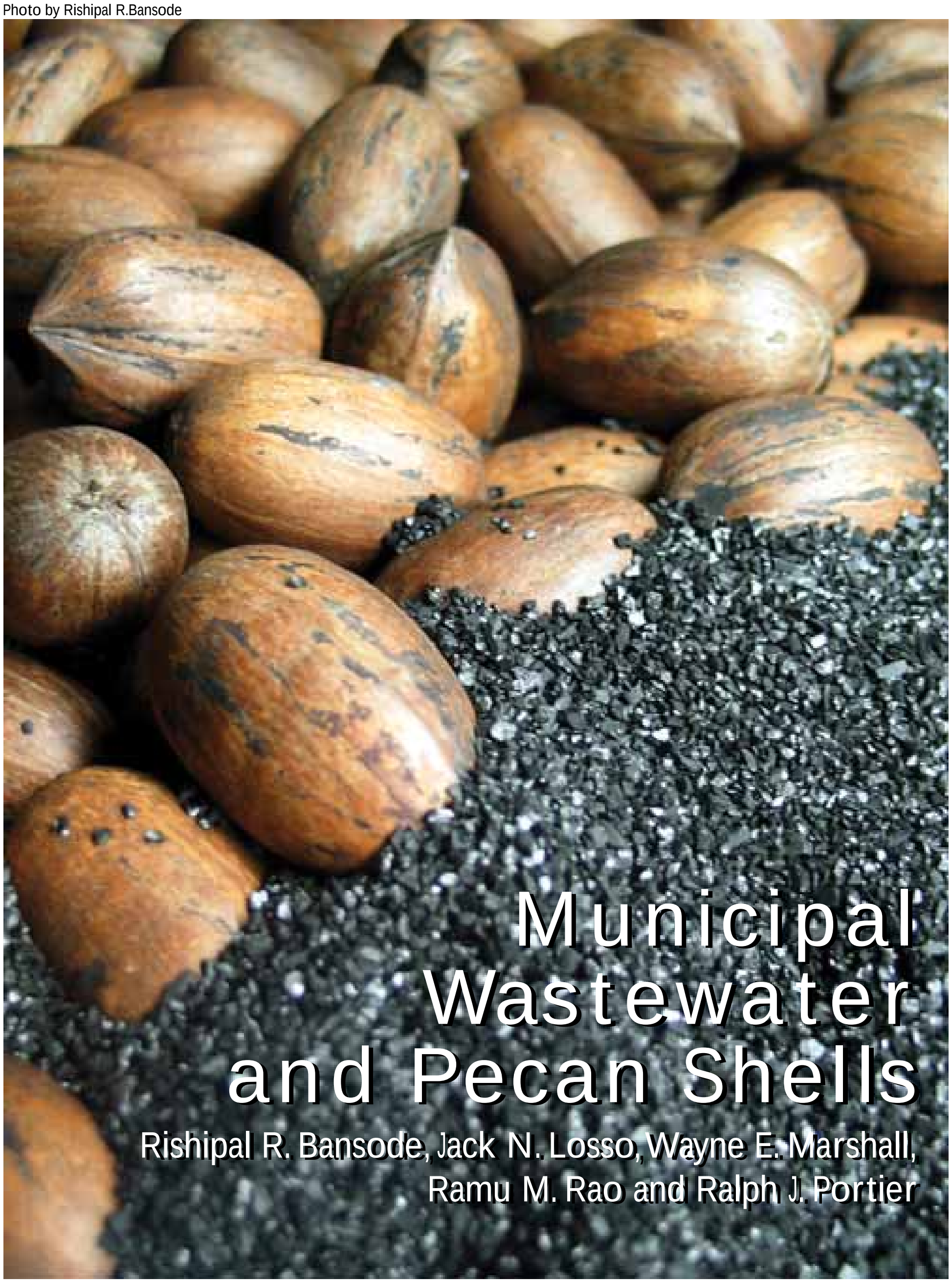
Photo by Russell A. Anderson

This is one of the drainage ditches carrying runoff from the 400 acres of agricultural production at the Red River Research Station to the constructed wetland between the fields and the Flat River.

Photo by Eddie P. Millhollon; model by Russell A. Anderson

This is a photo of a model of the constructed wetland showing the shallow and deep cells and drainage ditches that carry runoff over the 400 acres.

Photo by Rishipal R.Bansode



Municipal Wastewater and Pecan Shells

Rishipal R. Bansode, Jack N. Losso, Wayne E. Marshall, Ramu M. Rao and Ralph J. Portier

Increased water demand in the face of an essentially fixed fresh water supply and increased pollution of existing supplies by inadequately treated waste discharge have been identified as problems in Louisiana. The purpose of this study was to determine the effectiveness of treating contaminated water such as municipal wastewater with a by-product of tree nut production in Louisiana, namely, pecan shells.

Municipal wastewater is characterized by its physical attributes as well as its organic and inorganic contaminants. Physical attributes include color, odor and turbidity caused by dissolved or suspended solids. Organic contaminants include dissolved volatile organic compounds (VOCs), which include phenols, chlorobenzene, hydrocarbons and dissolved or non-dissolved non-volatile organic compounds designated as chemical oxygen demand (COD). Inorganic contaminants may include compounds of trace metals such as copper, zinc and lead.

Production and processing of pecans in Louisiana is estimated to generate nearly 6 million pounds of shells annually. Although some pecan shells have found limited applications in landscape mulch, most are discarded, creating a significant environmental problem.

LSU AgCenter research has demonstrated that pecan shells can be converted to granular activated carbons, which can be used to effectively treat contaminated water such as municipal wastewater and can be manufactured at a competitive price of $1.20 to $1.40 per pound compared to more than $2 per pound for some coal-based commercial carbons, which are widely used in water purification.

Adsorption

The process of adsorption as practiced by activated carbons involves attraction of the molecules to be adsorbed to the inner surface of the carbon pores. Since activated carbons have considerable surface area, they can attract a significant quantity of adsorbing material.

The advantage of using agricultural by-products as raw materials for manufacturing activated carbon is that these raw materials are renewable and potentially less expensive to manufacture. Furthermore, the use of Louisiana's pecan shells as feedstock for carbon production would add value to the shells, turn the shells into value-added commodities and reduce waste disposal costs for the shellers.

Commercial granular activated carbons, which are mostly produced from bituminous coal, are extensively used as filter beds in treatment of municipal wastewater. The wastewater flows through these filter beds, and organic and some inorganic pollutants are adsorbed on the surface of the carbon. When the carbon becomes loaded with the adsorbed molecules and loses its adsorptive ability, it is removed from the filtration beds and regenerated. The advantages of using activated carbons in treatment of wastewater as opposed to conventional biological treatment include less land used in the treatment process, a higher level of treatment efficiency, reduced sensitivity to daily flow variations, and greater flexibility in design and operation of the treatment facility.

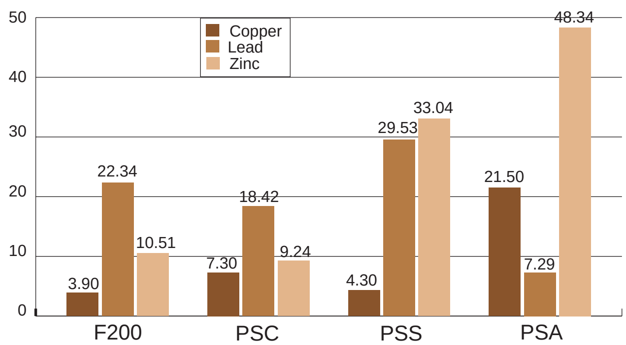
Rishipal R. Bansode, Graduate Student, and Jack N. Losso, Assistant Professor, Department of Food Science, LSU AgCenter, Baton Rouge, La.; Wayne E. Marshall, Research Chemist, USDA-ARS, Southern Regional Research Center, New Orleans, La.; Ramu M. Rao, Professor, Department of Food Science, LSU AgCenter, Baton Rouge, La.; and Ralph J. Portier, Chairman, LSU Department of Environmental Studies, Baton Rouge, La.

The objective of this research was to compare the effectiveness of pecan shell-based granular activated carbons, activated under different activation conditions, to a commonly used coal-based, commercial granular activated carbon (F200) for the removal of various contaminants commonly found in municipal wastewater. The activated carbons were pecan shells activated with phosphoric acid (PSA), pecan shells activated with carbon dioxide (PSC) and pecan shells activated with steam (PSS). The four carbons were compared for removal of inorganic contaminants (lead, copper, zinc), volatile organic compounds (VOCs) (compounds of health concern and known toxic compounds, such as bromodichloromethane, benzene, carbon tetrachloride, 1,1,1-trichloroethane, chloroform, and 1,1-dichloroethane) from a laboratory prepared solution, and COD (chemical oxygen demand) from a municipal wastewater.

Metal adsorption

The adsorption studies on a multi-component metal mixture consisting of copper, lead and zinc ions (Figure 1) indicated that PSA had the highest adsorption efficiency for zinc and copper ions followed by PSS when compared to commercial carbon. PSC had the lowest adsorption efficiency among the carbons studied.

Figure 1: Percentage adsorption of metals (0.5 mM each metal) by experimental and commercial granular activated carbons. A 100 mL solution was treated with 1 g of carbon for 24 hours.



Commercial carbon: F-200 = Filtrasorb 200; Experimental carbons: PSA = pecan shell-based, acid-activated; PSC = pecan shell-based, carbon dioxide-activated; PSS = pecan shell-based, steam-activated.

VOC adsorption

Results from Table 1 indicate that PSS was generally better than the other experimental carbons and the commercial carbon in adsorption of select VOCs, inferring that the method of activation and precursors selected for the preparation of activated carbons affect the adsorption of VOCs and hence are factors to be considered in any adsorption process. All the carbons studied exhibited efficient adsorption of benzene. Acid-activated experimental carbon (PSA) showed higher adsorption of 1,1,1-trichloroethane compared to all the other carbons.

COD adsorption

Primary treated municipal wastewater was collected from the Central Municipal Processing Plant at Baton Rouge, La., for removal of organic contaminants measured as COD. The results from Table 2 indicate that steam-activated and acid-activated pecan shell-based carbons had higher adsorption for COD organics than carbon dioxide-activated pecan shell-based carbon or coal-based carbon at the carbon dosage used during the experiment. The higher adsorption may be related to surface area because the two carbons with the highest surface area (PSA and PSS) also had the highest COD adsorption. These results show that granular activated carbons made from agricultural waste (pecan shells) can be used with greater effectiveness for COD removal from municipal wastewater than a coal-based commercial carbon.

Results show promise

Based on the overall results of the study concerning organic (COD and VOCs) and inorganic metals, it is suggested that experimental carbons could be a viable and cost-effective option compared to commercial carbons in municipal wastewater treatment systems. Future plans include testing the experimental carbons in real-world situations in municipal wastewater treatment plants followed by commercialization of the product. Several rural and small city municipalities, pecan shellers, as well as entrepreneurs from within Louisiana and adjacent states have expressed interest and offered support and cooperation. ■

Acknowledgments

The U.S. Department of Agriculture Agricultural Research Service for financial support under a cooperative agreement and Technology International Incorporated of Virginia, LaPlace, La., for consultations with its water treatment technical staff.

Table 1: Percentage adsorption of volatile organic compounds (VOCs) by experimental and commercial granular activated carbons

Carbon	Bromo-dichloro-methane	Benzene	Carbon tetra-chloride	1,1,1 trichloro-ethane	Chloroform	1,1 Dichloro-ethane
F200	72.0	88.3	77.5	88.9	74.9	75.0
PSC	75.7	78.2	68.5	73.1	54.6	76.8
PSS	85.4	87.0	80.6	92.5	77.9	82.7
PSA	68.1	76.4	57.0	93.1	58.4	54.3

100 µg/L of each analyte was treated with 0.01 g of carbon for 24 hours.

Commercial carbon: F-200 = Filtrasorb 200; Experimental carbons: PSA = pecan shell-based, acid-activated; PSC = pecan shell-based, carbon dioxide-activated; PSS = pecan shell-based, steam-activated.

Table 2: Percentage removal of Chemical Oxygen Demand (COD) by experimental and commercial granular activated carbons.

Carbon	% COD reduction
F200	82.0
PSC	75.5
PSS	92.5
PSA	95.0

Average initial concentration of COD was 53.25 mg/l with treatment time of 2 hours and a carbon dosage of 1.5 g in 100 mL municipal wastewater.

Commercial carbon: F-200 = Filtrasorb 200; Experimental carbons: PSA = pecan shell-based, acid-activated; PSC = pecan shell-based, carbon dioxide-activated; PSS = pecan shell-based, steam-activated.

New Strategies for Rural Development
Red River Waterway

Deborah Tootle

In today's changing global economy, traditional agricultural enterprises and industrial recruitment can no longer be depended on to bring jobs to rural Louisiana. Social and economic forces that once encouraged industry to relocate to the rural South now lure manufacturing out of the country. The rural economy is increasingly dependent on retail trade and services. The activities that encouraged rural development 10 or 20 years ago are not effective today.

Recognizing these challenges, the Red River Waterway Commission (RRWC) approached the LSU AgCenter with questions about the potential for economic development opportunities among the properties owned by the Red River Waterway District and bordering the Red River Waterway. The Red River Waterway District was formed by the State of Louisiana in 1965 and consists of all the "territory located with the Parishes of Avoyelles, Rapides, Natchitoches, Red River, Grant, Bossier and Caddo," according to the Red River Waterway Navigation Project Revised Statutes.

The commission was created to operate and maintain the Red River Waterway, a navigable waterway system extending from the confluence of the Red River with the Atchafalaya and the Mississippi rivers to the state boundary in Shreveport, La. During the process of developing the waterway, the commission acquired the 15,000 acres along the Red River banks within the seven parishes forming the district.

The RRWC's goal was to develop a comprehensive, diverse and sustainable economic development plan for the waters of the Red River and the acquired tracts of land. The commission wanted the LSU AgCenter to determine the potential for recreational, agricultural and industrial economic activities.

A team of specialists from the LSU AgCenter identified questions to address: What do the land values tell us about the best uses of the land? What are the local land practices? How effective are these land practices? What do the physical characteristics of the sites and their surrounding areas suggest about the best land uses? What are the social, demographic, historical and economic conditions in the parishes?

The team began by defining sustainable development as not sacrificing the needs of the future for the needs of the present. Investigators collected and analyzed state and national data and their own field research, often working in areas accessible only by boat. Two strategies emerged as promising: asset-based development and natural amenities-based development.

> The activities that encouraged rural development 10 or 20 years ago are not effective today.

Asset-based development is inherently sustainable because it builds on the capital and resources (economic, social, physical, natural, cultural) of a community. Asset-based development is less vulnerable than agriculture and manufacturing to rapid economic change. Building from within also means wealth generated in the process tends to remain within the community.

Amenity-based development is a type of asset-based development. Research from the U.S. Department of Agriculture's Economic Research Service demonstrates that amenity-based economic development is a sound platform for sustainable development. Natural amenities and recreational tourism appear to be a driving force behind population growth and sustainable economic development in rural areas throughout the country. Much of this new rural population growth is due to retirees.

Investigators were impressed by the wealth of natural resources and amenities in the Red River Waterway District, including the Atchafalaya Basin, the Cane River National Heritage Area, Kisatchie National Forest, and an abundance of timber land and lakes.

First, the water resources of the Red River are valuable not only as a major navigational waterway but as a source of water for agricultural and industrial activities. Water transportation is economical and energy-efficient as well as environmentally friendly. Moreover, as Louisiana's sources of ground water are depleted, the use of surface water becomes more critical.

Second, the natural resources found in the lands adjacent to the Red River, such as timber and minerals, provide inputs for increased value-added activities.

Third, natural resource-based rural development will help communities along the Red River take advantage of tourism and retirement destination activities. The Red River Waterway District is in the midst of two heritage areas, the Atchaflaya Trace Heritage Area, which is a state heritage area, and the Cane River National Heritage Area. The state is working to attain national heritage area status for the Atchafalaya Trace area. The state is also in the process of developing the Louisiana Great Gulf Coast Birding Trail that will join the Great Texas Coastal Birding Trail, the proposed Mississippi birding trail, the Alabama birding trail and the proposed Florida birding trail. Retirement communities, rapidly becoming a growth sector in many parts of the South, are springing up in parishes adjacent to the Red River parishes.

The findings from this study underscore the value of an asset-based approach to sustainable rural development. Economic development activities that do not build on the assets within a community or region may appear successful in the short-run but do not contribute to sustainability. Natural resources, particularly those with amenity value, may provide rural regions with a new source of competitive advantage. ■

Deborah Tootle, Associate Professor, Department of Agricultural Economics and Agribusiness, LSU AgCenter, Baton Rouge, La.

Attention to Atrazine

Dearl E. Sanders and James L. Griffin

Atrazine is a herbicide commonly used for the control of broadleaf weeds in corn, grain sorghum, sugarcane and turfgrass. Although widely used in Louisiana since the early 1960s, atrazine has recently become the center of controversy in south central Louisiana. Even when used according to label instructions, a small amount of atrazine can move from a treated field into runoff water – usually associated with a heavy rainfall shortly after application.

As with all pesticides, the U.S. Environmental Protection Agency (EPA) has established maximum allowable levels of atrazine residues in food and water. Recently published EPA guidelines indicate no problems with atrazine residue in the national food supply; however, problems with excessive levels have been identified in 34 of the nation's community water systems, including Iberville Water District #3 in Iberville Parish in Louisiana.

EPA has established the maximum allowable level of atrazine at 12 parts per billion (ppb) as a quarterly average in finished drinking water. Finished drinking water is defined as the water leaving a community water system after all sedimentation, filtration and chemical treatments have been completed. During the past 10 years of intensive monitoring of the national water supply, EPA has identified only 34 systems in which the 12 ppb limit has been exceeded. The majority are in the Midwest.

> Problems with excessive levels of atrazine have been identified in 34 of the nation's community water systems, including Iberville District #3.

An area defined by EPA as the Upper Terrebonne Basin comprising most of the parishes of Point Coupee, West Baton Rouge and Iberville contains approximately 50,000 acres of sugarcane and varying acreages of corn. Both crops are historically significant users of atrazine. Because of constraints by a series of levees and canals, all of the drainage from the Upper Terrebonne Basin – including runoff from sugarcane and corn fields – leaves the area via the Intracoastal Waterway in lower Iberville Parish. The Iberville Water District #3 established a water system in the early 1990s and chose for its sole source of water the Intracoastal Waterway. Monitoring by several governmental agencies has shown atrazine levels exceeding the 12 ppb limit at the Iberville Water District #3 water treatment plant during February and March for several years.

Since 1997, LSU AgCenter researchers have studied herbicide runoff from sugarcane and corn fields. Monitoring of runoff indicates that between 80 percent and 90 percent of the atrazine that leaves a treated field during a growing season does so after the first rainfall event sufficient to cause runoff. This corresponds with results of monitoring efforts conducted at the water treatment plant where high levels of atrazine have been recorded following heavy rains in February, followed by declines through March and, finally, low or nondetectable levels through the summer and fall.

EPA has continued reregistration of atrazine since 2001. An agreement between EPA and Syngenta Crop Protection (the primary atrazine registrant) in 2003 states that unfinished or "raw" water will be monitored on a weekly basis for five years beginning in 2004 for seven systems, including Iberville Water District #3. If the atrazine levels there exceed 37.5 ppb as a rolling 90-day average in the unfinished water during the five-year period, then all uses of atrazine will be banned in the Upper Terrebonne Basin.

Anticipating the possibility of a partial or complete atrazine ban, LSU AgCenter researchers in 1997 began projects aimed at either reducing atrazine runoff or replacing atrazine with other weed control strategies in the basin. Corn acreage in the basin fluctuates greatly, based primarily on annual grain prices and federal government grain price supports. Corn acreage has steadily declined since 1997, corresponding to a decline in use of atrazine.

Studies indicate that while runoff from corn fields contributes to the overall atrazine problem, it is only a lesser part of the problem because runoff from corn fields usually occurs in April. This is after the peak levels have passed at the water plant. Additional studies have shown that alternative weed control strategies in corn can reduce or even eliminate the use of atrazine without sacrificing weed control. Unfortunately, all of the alternative programs investigated were significantly more expensive than the programs using atrazine.

> LSU AgCenter researchers in 1997 began projects aimed at either reducing atrazine runoff or replacing atrazine with other weed control strategies.

The peaks in atrazine levels in February and March at the Iberville Water District #3 water plant appear more related to atrazine use in sugarcane, the major crop grown in the Upper Terrebonne Basin. LSU AgCenter researchers have found that sugarcane residue remaining on fields from harvest of the previous year's crop can reduce both herbicide and soil loss from fields. Research efforts in sugarcane have led to the development of best management practices (BMPs) to reduce the potential

Dearl E. Sanders, Floyd S. Edmiston Professor and Resident Coordinator Idlewild Research Station, and James L. Griffin, Lee F. Mason LSU Alumni Association Professor, Department of Agronomy and Environmental Management

for herbicide loss from sugarcane fields. As in corn, research in sugarcane has concentrated on weed control alternatives to atrazine. Currently labeled herbicides, including Dupont K4, Spartan, Sencor and Direx, can serve as alternatives to atrazine; however, these herbicides are more expensive than atrazine. Because of concerns over atrazine, the AgCenter emphasis has been to educate growers on efficient use of atrazine and the alternatives available.

Should atrazine levels exceed the newly established 90-day average in unfinished water at the Iberville Water District #3 site, the implications are significant. Atrazine use will be banned in the basin. If this occurs, both corn and sugarcane could still be produced in the basin but at an increased cost to growers. Alternative weed control programs will be more expensive, reducing the net return for the grower. ■

Acknowledgments

Richard Bengston, Reed Lencse, Magdi Selim and Ron Strahan for their research contributions and the Louisiana Soybean and Grain Research and Promotion Board and the American Sugar Cane League for their funding support.

Irrigation pond saves on groundwater use at Macon Ridge Station

Researchers at the LSU AgCenter's Macon Ridge Research Station at Winnsboro have found a way to irrigate their fields during the summer without resorting to pumping water from wells. They've created a 16-acre pond they fill with surface water during the winter and use for irrigation in the summer.

The pond came about because of necessity. The irrigation water from wells on the station had become relatively high in salt content. Cotton is tolerant of this salinity, said Bob Hutchinson, LSU AgCenter Northeast Region director, but other crops, such as corn, soybeans and rice, are not.

"We're blessed to have a lot of water and not too deep," Hutchinson said of the irrigation wells at the station.

Although groundwater is available, some wells produce salty water because of salt domes. For farmers in the area, "the choices are don't farm or develop other sources of water," Hutchinson says.

An alternate source of water is a pond.

The pond at the Macon Ridge station was constructed in conjunction with a wetland that couldn't be farmed. A permit from the U.S. Army Corps of Engineers allowed the wetland to be included inside the levee. Researchers dug a trough around the wetland and used the soil to build a levee. A nearby canal drains several thousand acres and flows heavy with water following periods of intense rain during the winter and early spring. Using lift pumps, the research station captures a portion of this water and fills the pond.

"Research has shown the benefits of supplemental irrigation to crop production on the Macon Ridge," Hutchinson said. That's despite an average annual rainfall of around 53 inches. "We get periods of excess rain and periods of inadequate rain."

The Macon Ridge, for which the station was named after, is a geological formation that runs through northeast Louisiana and into Arkansas. Soils along the ridge are droughty soils over a fragipan – a natural ground layer that's low in organic matter and extremely hard when dry. It's root-restricting, too. Hutchinson said farming in these conditions is difficult.

Irrigation replaces rain during the hot, dry summer months. Farmers generally apply 6 to 7 inches of water for cotton during the course of a growing season. "It's not a tremendous amount, but it's water that's critical," Hutchinson said.

Hutchinson said early research showed the value of irrigation on the Macon Ridge. "You usually get a statistically significant increase in yield with irrigation," he said.

Hutchinson said that when land values and production costs were lower, a farmer could sustain a bad year now and then. But not any more. "We have to even out production and eliminate the low-yield years," he said.

Northeast Louisiana farmers typically use furrow irrigation, where water is piped across one end of a field and allowed to flow between rows. As it moves down the furrows, some water is absorbed by the soil, and the remaining water drains out the other end of the field.

"Our local silt loam soils have an infiltration rate that's not too fast and not too slow," Hutchinson says. "And the soils don't waterlog."

Although the quantity of irrigation water is rather low, farmers could capture the runoff from the fields and pump it back into the pond for later use. This could be most advantageous for rice farmers, who use larger quantities of water for flooding.

"This allows us to be more efficient with what Mother Nature gives us," Hutchinson said.

To get water from the pond to fields, researchers at Macon Ridge use two techniques – pumps and gravity, said Wink Alison, an agronomist at the station.

One side of the pond features a pump that lifts water out of the pond and sends it into a pipe alongside a field. A field on another side of the pond is fitted for gravity flow from the pond. Risers in both fields distribute water for furrow irrigation. Allison said it's imperative for the water level inside the levee to be high enough to allow adequate flow in the gravity-flow system throughout the irrigation season.

Using ponds for storing irrigation water can have both crop production and environmental benefits, Allison said. And it can provide leisure benefits for operators as well as the potential for a recreational business enterprise. ■ **Rick Bogren**

Photos by Bruce Schultz

A rice farmer between Eunice and Crowley water-levels his field before planting. This is the traditional method. The alternative is laser-leveling, which is more accurate but more expensive.

Master Farmer Program:
Learning Best Management Practices

Richard Latiolais of Parks explains the advantages of laser-leveling on a wheat field. He and his father are using the precision-leveling technique on farmland near Palmetto for sugarcane and wheat.

Richard Latiolais gazed over the emerald field of an emerging wheat crop near Palmetto in St. Landry Parish.

"This is all fresh ground," he said. "We precision-leveled it last summer."

Laser-leveling and irrigation are primary components of Latiolais' farm plan.

"We're trying to let Mother Nature give us her benefits," Latiolais said.

Latiolais said the Master Farmer program's class confirmed he is on the right path with many of the best management practices (BMPs).

"You have no control over the weather, but it gives you the best preparations," he said.

In the short term, he said, the measures are expensive, but they should be viewed as long-term investments in the land. "I can see it's a work in progress. If a farmer thinks about it, he's actually saving money. You're farming more efficiently, and that's the name of the game."

Latiolais has his own farmland near his home in Parks in St. Martin Parish, and he sharecrops 2,500 acres near Palmetto. In all, Latiolais grows sugarcane on 4,000 acres, an enterprise that has him on the go constantly, rolling up almost 30,000 miles a year on his pickup. He's so busy he hasn't had time to keep track of his age. "I'm 34 or 35. I'll have to ask my wife."

This year's wheat crop rotation at the Palmetto farm is his first grain crop ever. "This is a cover crop for erosion control in the winter months," Latiolais said, pointing to 250 acres of the lush growth.

The grain will be harvested but it's also planted to add organic material to the sandy loam that has only .3 percent organic material, he said. At that level, he said, soil compaction becomes a problem after heavy rains.

Irrigation has paid off after planting cane, he said.

"Had I taken a chance with weather, I wouldn't have gotten a stand."

A weir retains runoff water in a canal that can be used for irrigation until the dry summer months when water has to be pumped.

Latiolais said his father, Chris Latiolais, was one of the first farmers to start irrigating cane in the mid-1980s in St. Martin Parish. He still grimaces at the memory of spending long summer days stringing out sections of heavy, aluminum pipe. The collapsible poly pipe he uses now is simply unrolled, then punctured where water is intended.

Latiolais' father has retired from farming but he runs the laser-leveling operations, averaging 350 acres a year of leveling on the Palmetto farm. Latiolais said once the Palmetto land is completed, the leveling work will shift to his farm at Parks.

Latiolais said he learned that a 1 percent slope allows irrigation water to flow too quickly through poly pipe on a 350-acre cane field, so this year he expects to build a small levee across the field to impede the flow enough for better dispersion.

"This precision leveling is a learning process," he said.

In subsequent years, the grade on more recently modified fields was reduced to .5 percent, he said, requiring an average of 300 cubic yards of soil per acre to be moved.

"You want to enhance the natural slope of the property," he said. "This is the highest part of the property where the pump is located."

Latiolais fights Bermudagrass, the bane of cane farmers, with herbicide, but said he realizes it's a campaign that will require several battles. Once Bermudagrass is controlled, he said, he wants to foster a growth of nonharmful greenery that will act as a filter bed, reducing the amount of sediment carried in runoff. He also plans to install a runoff collection system at the end of his fields, but he said time and cooperation from the weather have yet to coincide.

Photo by Bruce Schultz

Kenneth LaHaye of Vidrine explains his underground irrigation system. LaHaye rotates rice and pasture on 220 acres, and he plans to use soybeans in rotation once he builds up the soil quality.

Latiolais grew a seed plot for cane, but this year he burned it because it probably had infestations of insects and fungus and he wants to minimize his use of chemicals. "My philosophy is I want to try to let nature control the insects and weeds," he said.

Kenneth LaHaye of Vidrine said the Master Farmer course was another green light to continue what he started on his farm 12 years ago.

LaHaye said he almost quit farming in 2002, after several bad years, but a friend persuaded him he had too much effort and money involved, so he persevered. "I'm glad I did, because my first love is production agriculture."

LaHaye has used laser-leveling since 1992. Skeptics warned him that he would have poor harvests because the topsoil had been disturbed.

"My yields have not suffered," he said. "I have not missed a crop yet."

His land has a .01 percent slope, a tenth of an inch for every 1,000 feet.

"That's the minimum you can do," he said.

The obvious benefit from laser-leveling a rice field has been a reduction in the amount of water needed to flood a field, he said. LaHaye said the extra benefit has been a reduced fleet of equipment because the land requires only minimum maintenance.

"I used to have three tractors, and now I have one that does everything," he said.

Because the fields slope uniformly, less plumbing is needed for drainage, he said.

LaHaye said he has been able to reduce the number of levees, creating large fields, and that also makes irrigation much simpler. An underground 12-inch pipeline provides water to all of his fields.

"All of this acreage is flooded with that well, a mile away," he said.

LaHaye said he soon realized the potential for laser-leveling extended beyond agriculture, and he now has a company to level land for large projects, such as the new Evangeline Downs racetrack at Opelousas.

He wants to build a tailwater reservoir to store runoff water for irrigation.

LaHaye said every year he rotates his 220 acres between rice and pasture for his 75 head of Brangus cattle. He plants ryegrass

Photos by Bruce Schultz

Kevin Berken of Lake Arthur, left, explains to Eddie Eskew, Jefferson Davis Parish county agent, how a drop pipe prevents erosion of levees when rice fields are flooded. Berken sold real estate in California several years before returning to Louisiana to farm with his brothers, Clarence and Stephen Berken.

Bryan Leonards Jr. of Crowley drill-seeds Clearfield rice in a stale seedbed. Leonards, a third generation farmer, said he was pleased with 2003 results of Clearfield, developed at the LSU AgCenter Rice Research Station.

to provide needed organic material to build up the soil, and he uses composted chicken litter for extra nitrogen.

He said it will take several years before the soil will be suitable for rotation with soybeans.

In fields that have been plagued by red rice, he is planting Clearfield rice, a herbicide-resistant line developed by the LSU AgCenter.

LaHaye and fellow rice farmer Kevin Berken of Lake Arthur rely heavily on stale seed beds. That reduces the amount of sediment in runoff water because the fields are plowed weeks or even months before planting, then treated with herbicides.

"We try to do it far enough in advance to minimize sediments," Berken said.

The fields are planted, then flooded to suppress red rice, which requires oxygen for germination, then drained.

"That's a big improvement on water quality right there," said Eddie Eskew, Jefferson Davis Parish county agent for rice in Southwest Louisiana.

A stale seed bed also allows for an easier harvest because the field isn't rutted, Berken said. He said the first years of using stale seed beds required some adjustment because he wasn't doing much in his fields during the winter months.

Berken has implemented several other BMPs, including a tailwater recovery system. He relied on that in the drought of 2000 when many farmers in the area didn't dare pump salt-laden water from canals onto their rice fields. Berken also has a deep well that he used in 2000, but it hadn't been required since his father used it in 1953.

Berken said he plans to buy a laser-leveling system, but for now he uses water leveling. That requires large 4-wheel drive tractors to work the soil into a soupy consistency that spreads evenly over a field.

Berken plans to try Clearfield rice this year to fight red rice, and he's also going to gamble this year on 120 acres of soybeans. He lets 200 acres sit idle every year, and cultivates the remaining 400 acres.

Many of the BMPs not only make sense from a conservation standpoint, they also save cents, Berken said.

Some of the practices are cheap and simple, but save labor and money, in addition to conserving soil. For example, Berken has installed a series of drop pipes that allow him to convey water from one field to another. The plastic pipes prevent the flow of water from eroding soil.

But Berken, who sold real estate in California before returning to his roots, said taking care of the land is a priority.

"We have to be good stewards of the soil and environment because otherwise we take a beating," he said.

Eskew said the value of a voluntary program became evident several years ago at a meeting held by environmental regulators who revealed tighter restrictions were under consideration for farmers in South Louisiana. The proposals were not being considered for the timber industry because of the voluntary Master Forester program that stressed BMPs, Eskew said.

"It was not long after that meeting that Paul Coreil recognized we should be proactive," Eskew said.

Coreil, now LSU AgCenter vice chancellor, at that time was the AgCenter's assistant director of environmental programs. He said the voluntary program was devised to allow farmers to adopt soil and water conservation measures.

"It's self-determination of your future," Coreil said.

Producers quickly realized the benefits and signed up for the program, he said.

"The farmers in the southwest part of the state have been a big part of why this got off the ground," Coreil said. ■ **Bruce Schultz**

Master Farmer Program makes sense, saves cents

Carrie Castille

In January 2001, the LSU AgCenter offered the first Louisiana Master Farmer training session in Vermilion Parish. More than 60 producers attended to become more knowledgeable about Louisiana environmental regulations, specifically water quality and nonpoint-source standards. Since then, the program has offered 38 training sessions and has enrolled more than 1,300 producers in half of Louisiana's 64 parishes.

The program began as a result of the implementation of the Clean Water Act's Total Maximum Daily Load (TMDL) provision. This provision sets standards for the amount of any pollutant that can enter a water body. The provision, regulatory by nature, allowed for agricultural producers to use the best available technology that they have to develop their own solutions on a voluntary basis. The goal of the Louisiana Master Farmer program is to address the environmental concerns related to production agriculture, as well as enhance production and management skills critical for the continued viability of Louisiana agriculture.

The Master Farmer program consists of three phases. In the first, a producer attends eight hours of environmental stewardship training on issues such as the Clean Water Act, Total Maximum Daily Loads (TMDLs), best management practices and conservation programs. The second phase includes a visit to a commodity-specific model farm demonstrating the implementation of best management practices in their watershed.

In the third phase, the producer must develop a farm-specific, comprehensive conservation plan.

Though voluntary, the program has an incentive-based structure. Producers ultimately make the decisions on the best management practices they will implement. Upon successful completion of all three phases, a producer will be presumed in compliance with Louisiana soil and water conservation requirements. This presumption-of-compliance incentive was passed unanimously in the 2003 legislative session and offers producers another reason to become certified.

Co-sponsors of the Master Farmer program include the Louisiana Farmer Bureau Federation, the Natural Resources Conservation Service (NRCS), the Louisiana Department of Agriculture and Forestry (LDAF), the Louisiana Department of Environmental Quality (LDEQ) and the state Department of Natural Resources (DNR).

State and federal partners of the program include the American Sugar Cane League, Louisiana Association of Conservation Districts, Louisiana Cattlemen's Association, Louisiana Rice Grower's Association, Louisiana Soybean Association, National Oceanic and Atmospheric Administration and the Potash & Phosphate Institute.

Louisiana leads the nation in its efforts to address environmental challenges in agriculture and has signed an agreement with Arkansas and Mississippi to develop a Master Farmer tri-state initiative.

The Master Farmer program already has a spin-off in the works — the Master Cattle Producer program.

If you are interested in signing up to become a Master Farmer or Cattle Producer, you may contact any LSU AgCenter local parish extension office. ■

Carrie Castille, Extension Associate, LSU AgCenter, Baton Rouge, La.

Salt Water and Irrigation in Louisiana

Bill Branch

The salinity of ground water and surface water used for irrigation will always be a concern for Louisiana farmers. Analyses of long-term data on Red River water quality collected by the U.S. Geological Survey (USGS) and of water samples collected by farmers and county agents and analyzed by the LSU AgCenter indicate the Red River can safely be used as a source of irrigation water. Recent USGS studies of water levels and salinity in the Chicot Aquifer of southwest Louisiana and the Mississippi River Alluvial Aquifer in Franklin Parish indicate little change. The LSU AgCenter will continue to analyze irrigation water samples and strongly encourages growers to use this service. Monitoring of soil salinity will also continue.

Salt is one of Louisiana's natural resources. We not only mine salt for export and store national strategic oil reserves in salt domes, but we find salt in water pumped from our aquifers. Salt water is present at lower depths in all of Louisiana's aquifers.

In the mid-1980s, the LSU AgCenter began a water testing service to measure salt levels in irrigation water being used by farmers. County agents and farmers collected and the LSU Agronomy Lab analyzed about 100 samples per year. In the past few years, this number has doubled because of increased awareness and concerns about the salinity of irrigation water. The routine water test package gives the levels of calcium, chloride, iron, magnesium, manganese, nitrate, potassium, sodium, sulfur, pH and electrical conductance and classifies the levels from very low to very high.

Irrigation water containing salt can increase soil salinity. Each year, farmers throughout the world lose cropland because of increasing soil salinity. In the United States, as many as 48 million acres of cropland are adversely affected by salt. Farmers in many western irrigation-dependent states routinely apply more irrigation water than the crop needs so that salts in the soil will be leached down below the root zone.

Louisiana crops sensitive to soil salinity include strawberries, blackberries, sweet potatoes, corn, rice, sugarcane, peaches and citrus. Soybean tolerance varies by variety. Ryegrass, wheat, bermudagrass and cotton are highly tolerant of soil salinity.

Bill Branch, Professor, Department of Biological and Agricultural Engineering, LSU AgCenter, Baton Rouge, La.

Photo by Bruce Schultz

A Mowata Flying Service airplane water-seeds a field at Mowata, La. Water-seeding rice is the traditional method of seeding rice in Southwest Louisiana. Airplanes drop the seed over flooded fields. Farmers are gradually changing to ground-seeding of rice because of the savings in seed cost and water use.

Most irrigation in Louisiana is for rice. Most of the water used for rice irrigation comes from wells drilled in two major aquifers. Many southwest Louisiana rice growers depend on the Chicot Aquifer while those in northeast Louisiana depend on the Mississippi River Alluvial Aquifer. Both aquifers store high-quality water; however, wells near the bottom of the aquifers in some areas can produce high levels of salt.

Because of concerns about irrigation water quality, many farmers have investigated surface water resources, which are rarely affected by salinity and cost less to pump than ground water. The U.S. Geological Survey (USGS) has conducted several studies of ground and surface water in cooperation with the Louisiana Department of Transportation, area farmers, the Rice Research Board and the LSU AgCenter.

Red River salinity

Farmers in the Red River Valley of northwest Louisiana have long been interested in surface water for irrigation. In addition to concerns about ground water quality and the higher cost of pumping, well capacity is frequently inadequate for typical agricultural irrigation applications.

The largest source of surface water in northwest Louisiana is the Red River. Water in the Red River may have come from New Mexico, Texas, Oklahoma or Arkansas before arriving in Louisiana. Efforts to regulate the river's flow started more than 50 years ago with the construction of numerous water control structures in Texas, Oklahoma and Arkansas. More recently, a series of five locks and dams have been constructed on the Red River in Louisiana. All of these structures help even out the flow. Some were also designed to reduce the amount of salt coming from natural salt deposits, brine seeps and petroleum waste in the upper basin.

LSU AgCenter county agents from Caddo, Red River, Natchitoches and Rapides parishes have submitted numerous samples of Red River water for lab analysis. Samples collected from Red River Parish from 1996 to 1998 indicated total salts ranged from 218 ppm to 937 ppm, with an average value of 451 ppm. Chlorides ranged from 10 ppm to 146 ppm with an average value of 89 ppm. These values are considered low to medium.

In a study that began in 1999, AgCenter personnel sampled a 176-acre cotton field in Red River Parish. The field had never been irrigated. The installed system irrigated 126 acres of the 176-acre field. Soil samples were taken from both irrigated and non-irrigated portions of the field and were analyzed for a wide range of soil chemical parameters, including sodium and total salts.

In 2002, after three years of irrigating cotton, the field was sampled again. The average sodium levels increased from 14 ppm to 19 ppm on the non-irrigated area and increased from 20 ppm to 27 ppm on the irrigated area. Average total salts on the non-irrigated area decreased from 173 ppm to 162 ppm and on the irrigated area increased from 178 ppm to 204 ppm. These changes were not considered significant. These sites will be sampled again in 2005.

The U.S. Geological Survey (USGS) reported in 1997 that Red River water quality improves as it flows south and east. Total salts decreased from 367 ppm at Hosston in Caddo Parish to 187 ppm at Simmesport in Avoyelles Parish. Sodium decreased from 66 ppm to 33 ppm and chloride from 91 ppm to 50 ppm at those same sampling sites.

Water from the Red River and from almost any other surface water resource in Louisiana can and should be used for irrigating crops. Water quality for irrigation purposes is usually much better than that of the available ground water in the area. In addition, much less energy is required to lift the surface water, and surface-water pumps are usually much less expensive to install. During a dry growing season, salt and sodium levels in the soil may increase. Winter rains should remove some of the increased salinity.

Chicot Aquifer levels and salinity

Rice has been the main crop grown in southwest Louisiana for generations. Rice requires more water for irrigation than other crops and is more sensitive to salinity than most crops. Much of the water used in southwest Louisiana rice fields comes from the Chicot Aquifer, although some rice is irrigated with surface water.

Because of a drought in 1999 and 2000, the salt content of some of the surface water near the Gulf Coast became too high for irrigating rice. Some growers had to activate old wells, pump more water than usual, limit rice acreage and recycle existing water supplies. This led to concerns over both the levels of water in wells and the salinity of water pumped from the Chicot Aquifer.

In 2000, the LSU AgCenter and the Louisiana Rice Research Board entered into an agreement with the USGS for a three-year study of well water levels and salinity.

The highest water levels in the Chicot Aquifer are usually found in northwest Beauregard Parish wells at about 160 feet above sea level. Lower levels are found in Acadia, Calcasieu and Jefferson Davis parish wells at 50 feet below sea level and in southern Evangeline Parish at 60 feet below sea level.

Ground water generally flows from areas of higher elevation to areas of lower elevation and to areas where water is being heavily pumped. Flow is generally towards rice-growing areas of Acadia, Jefferson Davis, southern Evangeline and eastern Calcasieu parishes. In the northern part of the aquifer, flow is generally towards the south and southeast. In the southern part of the aquifer, flow is to the north, away from coastal areas and toward rice-growing areas. Along the eastern edge of the aquifer, flow is generally to the west.

From 1990 to 2000, the USGS reported water levels in wells dropped from 1 foot per year to 2 feet per year. They found water levels rising slightly between 2000 and 2003. This rise presumably came from higher rainfall in 2002 and 2003, compared with the rainfall in 1998 to 2000, and from reduced pumping because of fewer acres of rice grown in 2002 and 2003.

Seasonal water use for rice irrigation is typically from February to June. The lowest water levels in wells are usually found in June and the highest levels in January. Water levels in the rice-growing areas generally rose less than 15 feet between June 2000 and January 2001. From June 2002 to January 2003, water levels rose as much as 25 feet throughout most of the rice-growing areas.

Water levels were measured hourly at five wells, and the levels in these wells typically declined from 10 to 25 feet. This decline began in February or March and continued through May or June. After June, water levels usually began to rise in recovery. The largest range of water-level fluctuations, about 25 feet, was noted at a well in Jefferson Davis Parish. Water levels fluctuated only about 10 feet annually at wells in Evangeline and Cameron parishes, which are located near the edge of the rice-farming area. From 2001 to 2003, water levels at the five wells often recovered to the same or higher level than in the previous year.

In the Beauregard, Allen and Rapides parish area of the Chicot Aquifer, specific conductance (converted to ppm total salts) is typically below 64 ppm. Values typically increase south and east and generally range from 97 ppm to 320 ppm in rice-growing areas of northern Jefferson Davis, western Evangeline and eastern Lafayette parishes. Total salts generally range from 320 ppm to 640 ppm in most of the rest of the rice-growing areas, except in an area along the border between Calcasieu and Jefferson Davis parishes near Iowa, La., parts of northeastern Cameron Parish, parts of Vermilion Parish, northwestern and central St. Landry Parish and several areas along the eastern boundary of the study area where the Chicot Aquifer system merges with the Atchafalaya River Alluvial Aquifer. In these areas, total salts often exceed 640 ppm and range as high as 7,872 ppm.

More than 500 water samples were analyzed from 164 wells during the 2000 and 2003 seasons in the rice-growing areas of the Chicot Aquifer. Most of the wells were used for irrigation, but some were used for other purposes. Samples were collected by farmers, well owners, county agents and USGS personnel and analyzed at the USGS lab in Baton Rouge. Total salts exceeded 640 ppm in water samples from wells in Cameron, Vermilion, St. Landry, St. Martin and St. Mary parishes and in several wells near Iowa. Total salts exceeded 1,320 ppm in only two wells – an irrigation well about two miles south of Iowa and a USGS observation well used to monitor salt water encroachment in central Vermilion Parish.

One irrigation well in Calcasieu Parish and one in Cameron Parish were checked hourly while pumps were running. Total salts were above 640 ppm in both wells. Salts fluctuated within a range of about 96 ppm at both wells. Levels increased from 32 ppm to 128 ppm during individual pumping events, usually within the first few of hours of pumping, and then usually stabilized with a range of 6 ppm to 13 ppm. No long-term trends in specific conductance, or total salts, were evident in either well over the three-year period of the study.

Groundwater levels and salinity in Franklin Parish

When the LSU AgCenter conducted Futures Forums in all parishes in 1999, residents were asked to identify issues of concern. Franklin Parish residents identified groundwater as one of their primary concerns. USGS data indicated a wedge of salty ground water extending north and south through the Winnsboro area. Water from an irrigation well on the LSU AgCenter's Scott Research and Extension Center in Winnsboro produces a high salt level. Many farmers in the area have had the same experience.

A water resource committee requested the USGS to study the status of parish ground water levels and salinity. In 2002, the USGS collected and analyzed water samples for salinity from about 25 wells during the peak of the irrigation season. During the off-season, water levels were measured in 75 wells.

Preliminary results indicated little change from previous USGS studies. Specific areas in Franklin Parish have high levels of salinity. Water levels in wells declined slightly during the irrigation season but recovered during the off-season. ■

Manuals help farmers learn to protect water resources

The LSU AgCenter has developed a series of manuals to help farmers learn new ways of farming that are more protective of natural resources, especially water. These farming practices are designed to save farmers money, also. The publications are free for the asking, although some are out-of-print.

All are available online at www.lsuagcenter.com. The print publications are given to farmers who sign up for the Master Farmer program. See page 32 for more information about the Master Farmer program.

Rice Production Best Management Practices (online only)
Poultry Production Best Management Practices (#2806)
Agronomic Crops Best Management Practices (#2807)
Dairy Production Best Management Practices (#2823)
Sweet Potatoes Best Management Practices (online only)
Sugarcane Best Management Practices (#2833)
Swine Production Best Management Practices (online only)
Beef Cattle Production Best Management Practices (online only)
Aquaculture Production Best Management Practices (online only)

Watershed specialists work to improve Louisiana water quality

Michael Liffmann

Because of the importance of environmental issues in Louisiana, the LSU AgCenter created a Watershed Education Initiative in 2001. Several extension faculty members were reassigned as watershed educators, and in 2002, the program was launched to assist in the conservation and restoration of the state's aquatic ecosystems and protection of human health. The program's basic organizational premises are that most water quality and related problems are best solved at the watershed level and that, by definition, watersheds do not conform to any political boundaries, such as parishes or states. We share several watersheds with our neighboring states of Mississippi, Arkansas and Texas and even beyond their borders.

Watersheds are also referred to as drainage areas or river basins and are comprised of the land area that directs and then drains rainfall and other forms of precipitation through a particular river system or systems. On a national scale, managing water resource programs on a watershed basis makes good sense – environmentally, financially and socially. Louisiana has 12 major watersheds or river basins composed of several hundred smaller sub-watersheds. The Ouachita and Red River basins, for instance, are considered major ones that drain numerous smaller tributary rivers and bayous that eventually flow into the Mississippi River system above Baton Rouge. In fact, the Mississippi River has the world's second largest drainage basin, encompassing 48 percent of the mainland United States. Waters from 30 states and two Canadian provinces pass through our state as they drain to the Gulf of Mexico through the Mississippi River system.

Unfortunately, more than 350 stream segments in Louisiana have been listed as impaired, meaning that the waters do not meet certain quality standards set by the state. As a consequence, Louisiana is establishing so-called TMDLs or Total Maximum Daily Loads that will set a maximum amount of a pollutant that each water body can receive and still meet water quality standards.

To solve the water quality problems in our streams, the amount of point- and nonpoint-source pollutants that enter Louisiana's waters must be reduced. Point-source pollutants are those collected in and discharged through pipes, such as sewage treatment plants, and the effluents from food processing operations. More problematic and complex to solve are the nonpoint sources of water pollution, that is the pollution that originates from human land uses, including runoff from urbanized areas, poor forest and agricultural management practices, failing septic systems and discharges from boats.

The primary charge of the watershed educators is to deliver educational programs on nonpoint water quality issues. Since the outset, these educators have conveyed information to numerous audiences on how watersheds function and how water and pollutants move through them. As with all extension efforts, these educators promote a high level of key stakeholder involvement and actively work at integrating solutions that make use of the expertise and authority of government agencies.

Considering the magnitude of the overall challenge, all watershed educators use a comprehensive and focused educational approach that targets specific priority areas and groups within the watersheds. The educational campaigns have initially targeted several audiences, notably agricultural and aquacultural producers, marinas and recreational boaters, municipal and parish officials and planners, business and industry, rural and urban residents, and youth. Watershed educators have, for example, worked closely with the Louisiana Master Farmer and Master Cattle Grower certification programs. They provide a classroom-style environmental stewardship training for the participating producers which entails an overview of the environmental regulatory climate, and information on how the agricultural community and society at large can benefit from good stewardship practices.

Another example of LSU AgCenter involvement in nonpoint water quality education is in the Lake Pontchartrain Basin, where land use changes are taking place at a breakneck pace, and agricultural lands are being converted to urban uses such as residential and

Watershed Educators

Margaret Frey
1065 Hwy 749 Ste. A
Opelousas, La. 70570
(337) 948-0561, fax (337) 948-0564
E-mail: mfrey@agcenter.lsu.edu
Major Program Areas: Youth education, Master Farmer

Thomas Hymel
Iberia Research Station P.O. Box 466
Jeanerette, La. 70544
(337) 276-5527, fax (337) 276-9088
E-mail: thymel@agcenter.lsu.edu
Major Program Areas: Geographic Information Systems, Master Farmer

Brian LeBlanc
P.O. Box 2440
Covington, La. 70434
(985) 893-4449, fax (985) 893-6269
E-mail: bleblanc@agcenter.lsu.edu
Major Program Areas: Agriculture, land development, marinas and recreational boating

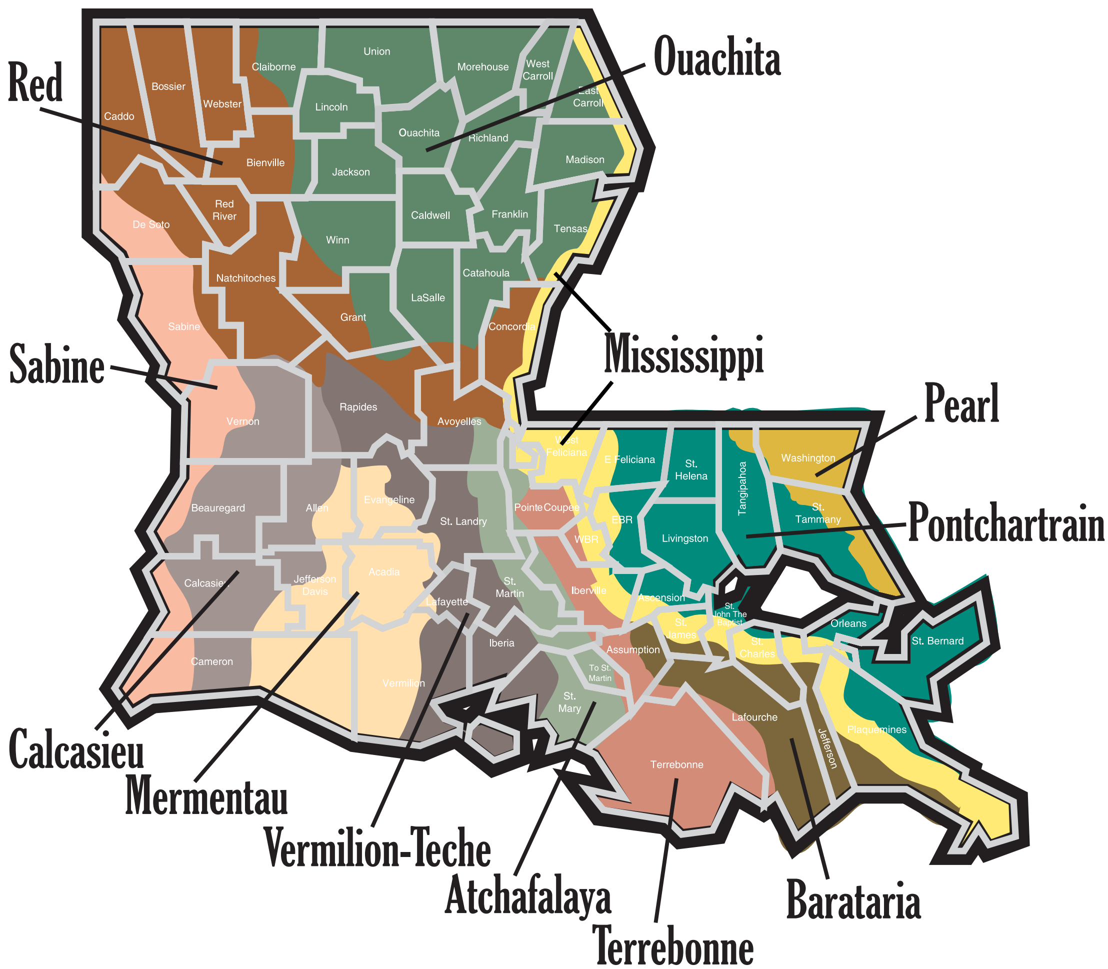
Kevin Savoie
1225 Hodges St.
Lake Charles, La. 70601
(337) 491-2065, fax (337) 475-8812
E-mail: ksavoie@agcenter.lsu.edu
Major Program Areas: Coastal wetlands, fisheries, watersheds, aquatic weed control, nonpoint education for municipal officials

Margaret Stoker
820 W. Main St.
Many, La. 71449
(318) 256-3406, fax (318) 256-6339
E-mail: mstoker@agcenter.lsu.edu
Major Program Areas: Landscaping, drinking water safety, Master Farmer, water conservation, conflict resolution, youth education, erosion control

Michael Liffmann, Associate Director, Louisiana Sea Grant Program, LSU AgCenter, Baton Rouge, La.

Louisiana's 12 Drainage Basins

Watersheds are also referred to as drainage areas or river basins and are comprised of the land area that directs and then drains rainfall and other forms of precipitation through a particular river system or systems. Louisiana is divided into 12 watersheds or drainage basins.



commercial centers. Over the years, the area's population has grown faster than that of any other part of the state, and part of the region's appeal is its easy access to lakes Pontchartrain and Maurepas and their tributaries. The region has become a recreational boating mecca, and boaters and the facilities that serve their needs also contribute to nonpoint source pollution. A watershed educator in the area helps the recreational boating community, including marinas, boat launch and boatyard operators, improve environmental practices that will reduce any contribution to the basin's overall pollution problem.

Environmental stewardship education for youth groups has been the focus of several watershed educators. Several thousand young Louisianians have received water education at 4-H and environmental camps, weekend sessions, special events and club meetings. Special summer programs such as "Wild Woods Wandering" in the Tensas River Basin, "Marsh Maneuvers" in coastal Louisiana, and "4-H Summer Camp" in the lower Red River near Pollock have provided in-depth water quality education to future leaders from throughout the state.

Watershed educators also verify the effectiveness of certain agricultural best management practices. For instance, a project is under way in the Mermentau Basin to compare the quality of the water discharged from rice fields managed in different ways. Some use the traditional way of seeding by air over flooded fields. Others are seeded on dry land.

Municipal and parish governments are also an important audience for watershed educators. Geographic Information System (GIS) technology is being used in the Calcasieu River and Vermilion-Teche river basins to advise local governments regarding urban land use effects on water quality, and how agricultural and aquacultural land use practices can help reduce pollutant inputs. Two watershed educators are implementing a Louisiana NEMO program, an acronym for the Nonpoint Education for Municipal Officials program established at the University of Connecticut in the early 1990s.

The LSU AgCenter's watershed education program is a relatively recent initiative designed to help address Louisiana's environmental challenges, specifically those that relate to water quality. Most of the attention will continue to be devoted to the priority contributors of nonpoint sources. Although there are some distinct differences among the watersheds, overall the most significant contributors in our state can be categorized under agricultural, forestry and municipal sources. In coastal areas, households and boating and navigation-related services and activities can also contribute significantly to the problem.

The LSU AgCenter's watershed educators are helping build a stronger foundation for addressing the many stressors that affect the state's watersheds and ultimately hope to contribute to the protection or restoration of resources for the future. ■

Assessing Louisiana's Surface Water Quality

Y. Jun Xu

Louisiana is naturally blessed with an abundance of bayous, rivers, lakes and aquifers, which provide Louisiana's citizens with fishing, hunting, boating and recreational opportunities and contribute to the state's wealth and economic growth. While the state has more surface water available (84 percent) than any other state in the United States, rapid urbanization and intensive agricultural and forestry practices have increased the potential for deterioration of the quality of the state's surface waters.

Watersheds are increasingly becoming the primary planning unit for natural resource management. Louisiana uses a set of 475 sub-segment watersheds in 12 river basins as a spatial framework for its surface water quality assessment (See page 37). The Louisiana Department of Environmental Quality (LDEQ) maintains a statewide water quality database that compiles data collected from more than 600 locations across the state's 475 sub-segment watersheds. The state agency collects and analyzes chemical, physical and biological properties of water, sediment and tissue samples from Louisiana's bayous, streams, rivers and lakes.

In addition to the LDEQ's surface water surveillance, the U.S. Geological Survey (USGS) collects water quality samples across the state and maintains a statewide streamflow monitoring network. This network ensures continuous measurements in hundreds of bayous, streams and rivers. Using the datasets provided by these agencies, LSU AgCenter researchers are conducting several studies on surface water quality at the watershed scale.

Variation among landforms

LSU AgCenter researchers are synthesizing water quality data collected from Louisiana's bayous, streams and rivers. The goal of the project is to assess long-term water quality changes across the five major landforms in the state – coastal marsh to the coastal plain, Mississippi alluvial valley, upland terrace and upland hills. The research will provide insights into the interrelationships between hydrological conditions, land use and the water quality of inland streams, wetlands and coastal estuaries in Louisiana. The knowledge gained from the research will contribute to developing site-specific water quality standards and facilitating assessment of the effectiveness of farm management practices in water quality protection.

Preliminary results show that Louisiana's coastal streams have considerably higher nutrient but lower dissolved oxygen levels during much of the year, compared to those in the upland drainage basins. Over the past 24 years, average dissolved oxygen levels in all studied drainage basins remained relatively consistent. The relationship between dissolved oxygen and water temperature in the coastal streams was closer than that of the upland streams. These results accentuate the need for site-specific water quality standards.

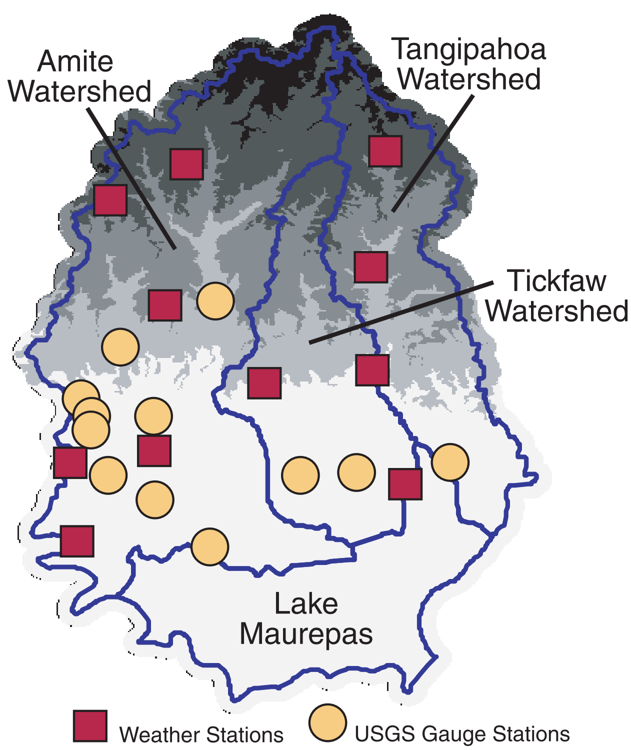
Climate, land use and Lake Pontchartrain

Freshwater and sediment from upland tributaries are critical to the development of the diverse wetland, marsh and aquatic ecosystems in the Lake Pontchartrain Basin. There is concern that the combination of climate and land use changes may dramatically affect the freshwater input and that the changes, therefore, may pose a threat to the stability of ecosystems in southeast Louisiana. LSU AgCenter researchers are conducting a study on long-term changes in discharge and sediment from the Amite, Tickfaw and Tangipahoa river watersheds (Figure 1). The research focuses on two questions:

- To what extent will a potential change in air temperature and precipitation affect water and sediment yields from the tributaries to Lake Pontchartrain?
- How will these changes be modified by urbanization and land use changes in the basin areas?

Figure 1. Weather and stream gauge stations in the Amite, Tickfaw and Tangipahoa river watersheds.

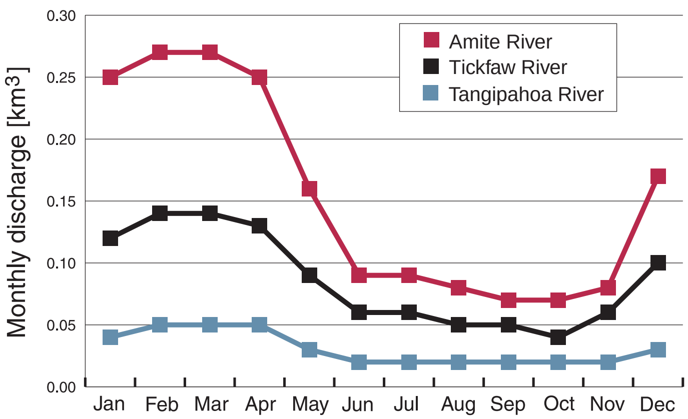
The gray tones designate elevation, with darker being higher. LSU AgCenter researchers are conducting a study on long-term changes in discharge and sediment in these three watersheds, which flow into Lake Maurepas and Lake Pontchartrain.



Y. Jun Xu, Assistant Professor, School of Renewable Natural Resources, LSU AgCenter, Baton Rouge, La.

Figure 2. Average stream discharge during a year.

LSU AgCenter researchers are conducting a study on long-term changes in discharge and sediment from the Amite, Tickfaw and Tangipahoa river watersheds. The discharge in these watersheds was highest from January to May and lowest from July to October.



The study shows that, on average, the three watersheds delivered 5 cubic kilometers of freshwater each year into Lake Pontchartrain. The discharge in these watersheds was highest from January to May and lowest from July to October (Figure 2), indicating a potential threat of high nutrient runoff into Lake Pontchartrain during the springtime.

Nitrogen removal and the Atchafalaya Basin

Nitrogen enrichment from the upper Mississippi River basin has been cited as the major cause for the hypoxia (lack of oxygen) in the Gulf of Mexico. The hypoxia, also called the "dead zone," threatens Louisiana's fishery industry among other problems. Although freshwater diversion from the lower Mississippi River into the region's wetlands has been considered an effective method of reducing nitrogen loads, it is largely uncertain how much nitrogen actually can be retained from the overflowing waters. Generally, there is a knowledge gap in what tools are available for accurate assessment of nitrogen inflow, outflow and removal potential for those diverse coastal floodplain systems.

A study addressing this question for the Atchafalaya River basin is being conducted by LSU AgCenter researchers. Long-term nitrogen inflow at Simmesport and outflows at Wax Lake Outlets and Morgan City (Figure 3) are being analyzed. Nitrogen input and output budgets will be established to assess total nitrogen mass removal rates of the Atchafalaya River basin under different hydrologic regimes.

Results from this initial study show that annual average inflow of the Atchafalaya River basin was about 10 cubic kilometers higher than its average outflow. Monthly average inflow of the Atchafalaya was higher than its monthly average outflow from December to June, but lower than its monthly average outflow from August to October (Figure 4).

Over the past 68 years, the river's hydraulic gradient between Simmesport and Morgan City decreased steadily at an average rate of 4.8 centimeters per year. This means the river is becoming flatter, probably due to sediment build-up. We are not sure what the consequences of this situation may be. These results suggest that the nitrogen removal capacity of the Atchafalaya River basin is likely dependent on the inundation extent of the basin area and that establishing a spatial relationship between the river stage and inundation extent can be useful for the basin's management. ■

Figure 3. Seasonal differences between inflow and outflow of the Atchafalaya River.

The inflow is much higher than the outflow in the spring months.

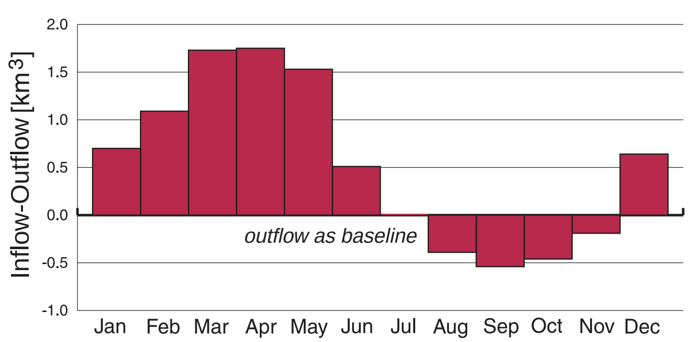


Figure 4. Long-term decline of hydraulic gradient (m) between Simmesport and Morgan City.

The difference between the elevation at Simmesport and Morgan City has gradually been flattening out. Scientists are not sure of the consequences of this. These results suggest that the nitrogen removal capacity of the Atchafalaya River basin is likely dependent on the inundation extent of the basin area and that establishing a spatial relationship between the river stage and inundation extent can be useful for the basin's management.

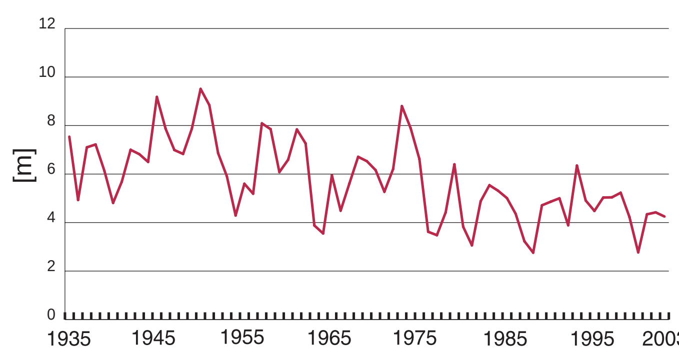


Photo by Bruce Schultz

Laser-leveling saves water

The technique of laser-leveling is used on a rice field at the Rice Research Station near Crowley. Because rice is grown under flooded conditions, it is best produced on land that is nearly level. In laser-leveling, a laser beam receiver is mounted on the tractor and an emitter at a stationary location (foreground). The beam guides the leveling implement, being pulled by the tractor, up and down to eliminate high and low spots. Laser-leveling can be done in a dry or flooded field. Rice farmers incorporate a slight grade into the field (0.2 foot or less) to help water move out quickly as needed.

Inside:

LOUISIANA AGRICULTURE

Assuring Our Future Through Scientific Research and Education

LSU AgCenter
P.O. Box 25100
Baton Rouge, LA 70894-5100

Non-profit Org.
U.S. Postage
PAID
Permit No. 733
Baton Rouge, LA