

Buried Forests Could Provide Clues to Past

Paul Heinrich

During the time that I have been studying the geology of Louisiana, people that I have met have occasionally brought to my attention an ignored and unstudied aspect of Louisiana geology. Either while talking to landowners, handling requests for information, or studying the local geoarchaeology, I have collected reports of fossil forests buried deep beneath the surface of the Mississippi Valley and Delta Plain of Louisiana. Although part of the common knowledge and lore of the heavy-equipment operators, water-well drillers, and anyone else who dig deep holes in the surface of the Mississippi Valley and delta, these buried forests remain unstudied and undocumented.

Excavation of the Lemannville Cutoff Road Pit, which lies within Point Houmas and just northwest of Lemannville in St. James Parish, uncovered a spectacular example of these buried forests. Excavated for fill use in levee construction, this pit cut 7 to 8 meters (23 to 26 feet) into bluish-gray backswamp clays that overlie Mississippi River point-bar sands. Within this interval, the contractors excavating this pit encountered three levels of buried forests consisting of the standing trunks of trees. The trees in each of these buried forests consisted of upright standing trunks firmly rooted in the underlying sediment that occurred at well-defined levels. The oldest forest consisted of unidentified trees rooted in the point bar sands at the bottom of the pit. The middle and upper forests consisted of trees, identified as cypress, rooted in backswamp deposits. In these buried forests, about 1.5 to 2 meters (5 to 6.5 feet) of the trunks of the trees remained standing upright according to workers who dug the pit and local people. In the case of the uppermost forest, the tree trunks were truncated about a half to two-thirds meters (1.5 to 2 feet) below the surface of the modern floodplain. Unfortunately, by the time this buried forest was reported, work had stopped and the pit had flooded. As a result, only the uppermost forest bed could be observed.

Reports of another buried forest came from near Patterson, Louisiana in St. Mary Parish. In excavations for the parish landfill, local informants repeatedly reported the uncovering of a buried forest of cypress trees. According to these reports, the buried forest lay 8 meters (26 feet) below the surface of the natural levee of Bayou Teche and consisted of the upright standing trunks of cypress trees that were 1.2 to 1.5 meters (4 to 5 feet) in height. The depth at which this buried forest was found indicated that it likely rested on the delta plain of the Maringouin delta complex before it was buried with the forest by the Teche delta complex.



McGimsey and Heinrich (2002) reported another example of the buried forests underlying the delta and alluvial plains of the Mississippi River. Sometime during the late 2001 and early 2002 dredging of canals for the Bayview Point subdivisions, logs and in-place tree stumps were found buried 3.6 meters (12 feet) beneath the bottom of Atchafalaya Bay and 5.5 meters (18 feet) below the water's surface. A sample of live oak (*Quercus virginiana*) recovered by Earl Hebert of Jeanerette and dated with funds provided by the Chitimacha Tribe of Louisiana yielded an uncalibrated date of 1,220+/-40 years BP (Uga-9663). This date reflects the time at which the surface of this part of the Teche delta plain subsided beneath Vermilion Bay (McGimsey and Heinrich, 2002).

These examples and other reports from projects, such as the construction of Interstate Highway 10 across the Atchafalaya Basin, demonstrate that the alluvial and deltaic deposits of the Mississippi River of southern Louisiana contain innumerable buried forests. Unfortunately, because of the high water table that flood any abandoned pits, the ephemeral nature of excavations, and the time lag in obtaining reports of buried forests, secondhand reports are the only source of information now available about these buried forests.

The lack of information about these forests is unfortunate because detailed study of these features while they are exposed could provide significant information about Louisiana geology. This information could be used for refinements in the timing of switching of delta lobes within the Mississippi Delta, shifting of river courses and channels within the Mississippi Alluvial Valley, and subsidence of the delta plain.

Finally, the detailed study of these buried forests could provide a better understanding of the processes that created forests of upright standing trees commonly associated with ancient coal deposits like those described by Gastaldo (1990) from the Pennsylvania coal deposits of the Black Warrior Basin of Alabama.

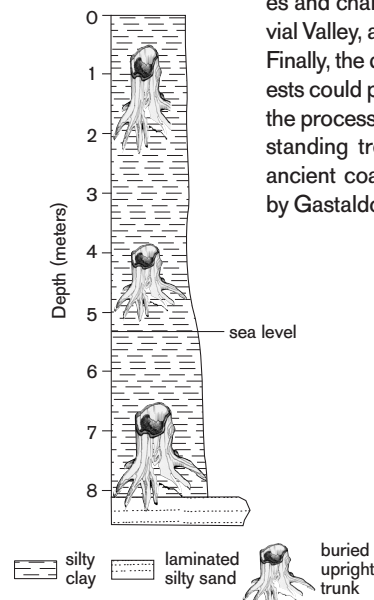


Figure 1. Section of Holocene Mississippi River Alluvium once exposed in Lemannville borrow pit in St. James Parish, Louisiana.

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- Gastaldo, R.A. 1990, Early Pennsylvania swamp forests in the Mary Lee coal zone, Warrior Basin, Alabama, in R.A. Gastaldo et al., eds., Carboniferous coastal environments and paleocommunities of the Mary Lee Coal Zone, Marion and Walker Counties, Alabama: Guidebook for the Field Trip VI- Tuscaloosa, AL: Alabama Geological Survey, p. 41-54.
- McGimsey, C. and P.V. Heinrich 2002, A buried forest at Cypremont Point, Iberia Parish: Louisiana Archaeological Society Newsletter v. 29, #2, p. 16.

The Louisiana Geological Survey News

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LGS Mission Statement

The goals of the Geological Survey are to perform geological investigations that benefit the state of Louisiana by:

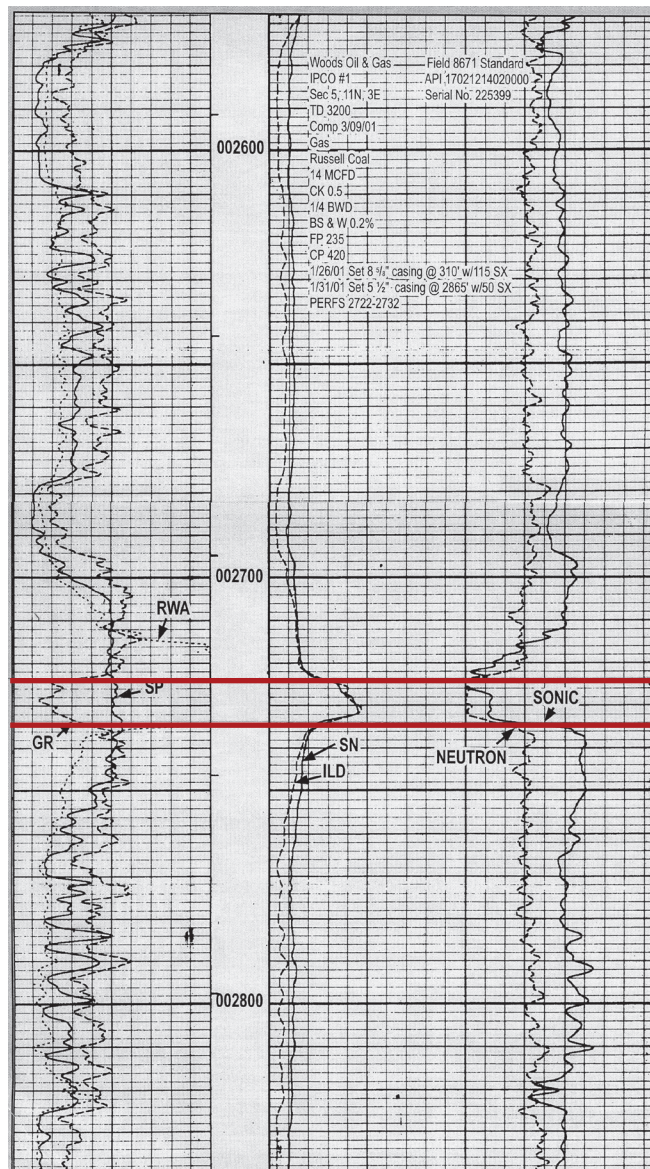
- (1) encouraging the economic development of the natural resources of the state (energy, mineral, water, and environmental);
- (2) protecting the state and its citizens from natural, geological, and environmental hazards; and
- (3) insuring the effective transfer of geological information.

The Louisiana Geological Survey was created by Act 131 of the Louisiana Legislature in 1934 to investigate the geology and resources of the State. LGS is presently a research unit affiliated with the Louisiana State University and reports through the Executive Director of the Center for Energy Studies to the Vice Chancellor for Research and Graduate Studies.

Coalbed Methane Project Continues

Clayton Breland

The project to determine the potential for producing coalbed methane (CBM) in North Louisiana, is continuing in collaboration with the U.S. Geological Survey (USGS). The project team consists of Peter Warwick and Charles Barker from the USGS and Clayton Breland from the LGS. The project, to date, has been deemed a success to the extent that the goal of drilling a couple of exploratory wells with a private industry group was accomplished. One of the objectives of the project was to test the Russell coalbed of the Paleocene-Eocene Wilcox Formation. The Woods Oil and Gas IPCO#1 was the first CBM well in the state to establish gas production from the Russell coalbed (see figure). Data and results of the test will be published upon expiration of the confidentiality agreement entered into by the consortium partners to drill the wells. Because the USGS had drilling funds left over at the end of the project term, the USGS and the LGS hope to drill at least one more well in the near future. The LGS has been having discussions with private industry groups interested in CBM in the general area of study in North Louisiana with the purpose of drilling other CBM test wells and plans are firming up with one of these companies to drill at least one well in January. The USGS has recently funded a graduate student (Kevin Brahm from the University of Louisiana at Lafayette) to work on CBM in Louisiana. The LGS will be helping to direct his research. Brahm's major professor is Gary Kinsland of the University of Louisiana at Lafayette Department of Geology, who has done research on coal depositional systems in North Louisiana in the past and had expressed an interest in working with LGS on the CBM project.



Woods Oil & Gas IPCO #1
Caldwell Parish, Louisiana

Chicot Aquifer Characterization Studies

Bradford Hanson

The effort to create a high-resolution, numerical groundwater model for all parishes in southwest Louisiana served by the Chicot Aquifer, a three-year (January 2002 - December 2005) project initiated last year is progressing well. The first year of the project extends the aquifer characterization and modeling phase from Acadia Parish (completed earlier as a feasibility study) into Jefferson Davis and the eastern portion of Calcasieu parishes. The second year covers the western portion of Calcasieu Parish plus the parishes of Cameron and Beauregard and the southern part of Vernon Parish (Figure 1), while the third year encompasses the remaining parishes.

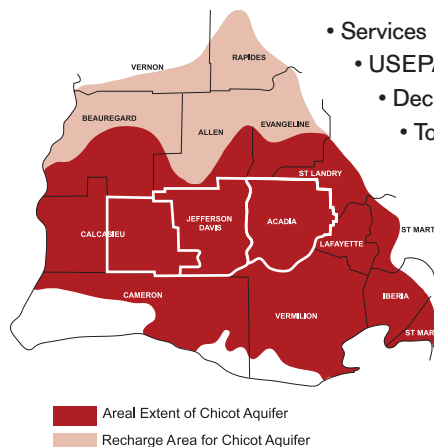
The purpose for developing a high-resolution groundwater model for the Chicot Aquifer is to be able to evaluate the ground water flow and to have a mechanism by which to predict changes in water levels in the aquifer. While short-term withdrawals impact flow of groundwater primarily on a local scale, a long-term, high-volume withdrawal of groundwater has the potential to impact an aquifer on a regional scale. Thus the objective of this three-year study is to create a modeling framework that will allow for both local-and regional-scale investigations. This can be accomplished by embedding a high resolution parish-scale ground water model inside a lower-resolution aquifer-scale model by using the Telescopic Mesh Refinement (TMR) technique.

The US Geological Survey finite difference groundwater flow model, MODFLOW (McDonald and Harbaugh, 1988) is being utilized for the project because of the objectives of the study and because of the groundwater system characteristics. MODFLOW is a block-centered, finite-difference code developed with a modular structure, is well documented, and solves three-dimensional problems of groundwater flow through porous media. The TMR technique is being used to embed a local, high-resolution MODFLOW model of the Chicot Aquifer inside a Chicot Aquifer regional model. The calibrated regional aquifer model will be used to simulate groundwater flow in the regional Chicot Aquifer with the results used to set the boundary conditions for each high-resolution parish model. Once these three-dimensional, high-resolution parish models are calibrated, they can be used to simulate both short- and long-term impacts of high-volume, point-source withdrawals throughout the Chicot Aquifer.

The project involves two interrelated tasks: a detailed geologic aquifer characterization study of the Chicot Aquifer underlying each parish followed by the development of the high-resolution parish-scale groundwater model. The first component, geologic characterization and analysis of the aquifer, becomes the primary source of inputs for the development of the second phase of this project which is the high-resolution model.

The geologic characterization of Jefferson Davis and the eastern portion of Calcasieu parishes are near completion with the remaining effort devoted to entering the geologic analyses into RockWorks™ – an earth science and GIS software product designed to handle large geologic datasets.

The Chicot Aquifer regional groundwater model developed by Dale Nyman and others (1990) has been calibrated for the Acadia Parish region and is being calibrated for the remaining parishes utilizing pump-test data, information from published sources, and water-use data from commercial, industrial, agricultural, and municipal supply wells. The high-resolution model for Acadia Parish



- Services 650,000 people in 15 parishes
- USEPA designated Sole Source Aquifer
- Declining water levels 0.5-1 ft/yr
- Total 797 MGD withdrawn

Year 1: Jefferson Davis
Eastern Calcasieu
Acadia

Year 2: Western Calcasieu
Beauregard
Cameron
Vernon

Figure 1. Relationship of Beauregard, Cameron, Vernon, and the western portion of Calcasieu parishes (study area for Year 2) to the entire Chicot Aquifer located in southwestern Louisiana.

has been calibrated using the boundary conditions, estimated parameters from pump tests and literature, and matching water levels from observation wells located throughout the parish. Groundwater simulations have been performed in Acadia Parish using hypothetical water-well flow rates. Work continues on the calibration of the high-resolution models for Jefferson Davis and the eastern portion of Calcasieu parishes.

An essential component to the management of ground water systems is knowing beforehand the response of an aquifer system to the implementation of contemplated decisions. Depending upon the nature of the management problem, decision variables, objective functions, and constraints, the response may take the form of future spatial distributions of water levels. Prediction of an event may be the most useful tool to groundwater managers because scenarios can be simulated and results analyzed before embarking on a particular course of action. The tool most useful in the management of groundwater systems is the numerical ground water model of the type being developed in this study.

References

- McDonald, M.G., and A.W. Harbaugh, 1980, A modular three-dimensional finite difference groundwater flow model. U.S. Geological Survey, Techniques of Water Resources Investigations, Book 6, Chapter A1, 570p.
- Nyman, Dale J., K. J. Halford, and A. Martin Jr., 1990. Geohydrology and simulation of flow in the Chicot aquifer system of southwestern Louisiana. U.S. Geological Survey, Water Resources Technical Report No. 50, 58p.

New Publications

Snead, J., Heinrich, P., and McCulloh, R.P., 2002, DeRidder 30 x 60 Minute Geologic Quadrangle: Louisiana Geological Survey, Baton Rouge, Scale 1:100,000.

Snead, J., Heinrich, P., and McCulloh, R.P., 2002, Ville Platte 30 x 60 Minute Geologic Quadrangle: Louisiana Geological Survey, Baton Rouge, Scale 1:100,000.

Heinrich, P. Snead, J., and McCulloh, R.P., 2002, Lake Charles 30 x 60 Minute Geologic Quadrangle: Louisiana Geological Survey, Baton Rouge, Scale 1:100,000.

Contact Patrick O'Neill to order LCS publications (phone: (225) 578-8590, e-mail: pat@lgs.bri.lsu.edu)

Pipeline Mapping

John Snead

Since the current state of published pipeline maps in Louisiana is poor, the Cartographic Section of the Louisiana Geological Survey has successfully sought sponsored funding to continue site-specific pipeline mapping efforts. However, a comprehensive mapping program remains elusive.

An effort to make a national pipeline geographic information system (GIS) was undertaken in 1999 by the federal Office of Pipeline Safety. Although the LGS was a part of that three-year effort, cooperation from the pipeline industry was less than 100 percent, so the digital data on Louisiana pipelines remain incomplete. Security restrictions from the pipeline operators and the government regulators since the terrorist attacks on September 11, 2001 have complicated the issue with legitimate concerns over public access to some of the data.

Louisiana is unique among oil and gas states in not having a dedicated pipeline mapping program. LGS once served in this capacity when it was part of the Louisiana Department of Natural Resources (DNR) from 1934-92. The pipeline regulators in DNR's Office of Conservation enjoyed pipeline-mapping support from LGS in this period, and the LGS published the Oil and Gas Map of Louisiana, the Offshore Louisiana Oil and Gas Map, and the Intrastate Gas Pipeline Map of Louisiana at regular intervals. The good maps are out of date and small-scale, however, while the newer digital maps are incomplete and inconsistent. The Louisiana Geological Survey last published the Oil and Gas Map of Louisiana in 1981—a product that is steadily becoming outdated.

Unfortunately, the DNR/LGS budget for pipeline mapping was eliminated in 1992 and the LGS subsequently moved to Louisiana State University (LSU) in 1997. Funding for pipeline mapping did not accompany this move. As a result, Louisiana is now in a circumstance where the pipeline regulators at DNR no longer have pipeline mapping support and the pipeline mappers at LSU/LGS no longer retain funding for such work.

Accurate, statewide pipeline mapping is a massive and complicated task. Years of cumulative cartographic errors exist in the currently available reference maps. The pipeline industry is volatile with numerous mergers and acquisitions and with frequent name changes. Parts and pieces of pipeline systems are bought and sold every day. Pipelines are abandoned without fanfare. Field investigations with global positioning system (GPS) equipment are essential as is digital compilation of data in a GIS supported by aerial photography and including engineering plans provided by pipeline operators.

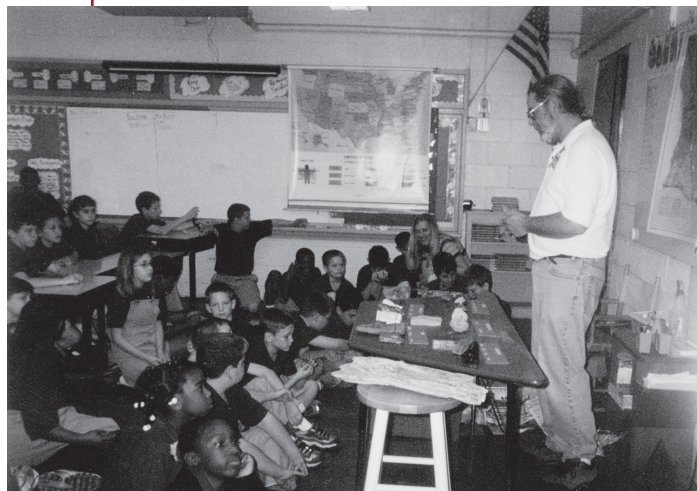
In finding sponsorships for resuming pipeline-mapping efforts, the key has been to seek site-specific projects that address the individual pipeline information needs of the cooperating agencies. Keeping the projects at smaller sizes that can be approved and awarded in a single funding period has provided several benefits. The clients get the data quickly, research and production tasks remain "doable", and multiple studies can be conducted at the same time.

Funding for such projects has been obtained from government clients such as the federal Minerals Management Service, and the Louisiana Office of Emergency Preparedness, the Department of Natural Resources, and the Oil Spill Coordinator's Office. Specific projects have addressed subjects such as field investigations of the pipeline crossings of major Louisiana waterways, pipeline GISs of several state metropolitan areas, mapping of federal pipelines crossing the state coastal zone, and investigation of abandoned and undocumented pipelines in specific study areas.

While these are no substitute for a comprehensive, statewide pipeline-mapping endeavor, sponsored pipeline projects conducted by LGS cartographers and GIS specialists constitute vital tiles in the complex mosaic of the Louisiana oil and gas pipeline infrastructure.

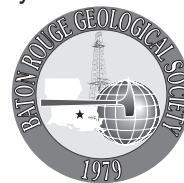
School Outreach

Research Associate Riley Milner was invited back to the St. Amant Primary School in Ascension Parish on September 19, 2002 to give a geological talk to the fourth and fifth grade science classes. He presented general geologic information such as the geologic history of Louisiana and had samples of rocks, minerals, and fossils for the students to see. These samples were very interesting to the students, who asked many questions about them. A Louisiana Rock and Mineral kit was presented to the teacher on behalf of LGS at the end of the presentation.



2003 GCAGS Convention to Be Held in Baton Rouge

The Baton Rouge Geological Society (BRGS) will host the 2003 GCAGS Annual Convention October 22-24 in Baton Rouge at the Radisson Hotel. Convention planning is underway and many LGS staff members are actively involved in this process. Abstract forms and convention details are posted on the BRGS website (www.brgs-la.org). Last date to submit abstracts is January 15, 2003. David Pope is the general chairman of the convention, Ron Zimmerman is the chair of the Exhibits Committee, Riley Milner is in charge of the Information Brochure Committee, and Chacko John is the GCAGS President. Volunteers are needed and welcome. Please contact Dave Pope for details at 225-578-3452 or 225-578-5320.



Gulf Coast Association of Geological Societies Annual Convention, Austin, Texas. October 30-November 1, 2002

The following papers were presented by LGS researchers and were also published in the GCAGS Transactions:

- "Dominant Structural and Stratigraphic Characteristics Influencing Hydrocarbon Production Distribution in Louisiana's Livingston Field." Co-authors for this paper were Donald Goddard (Center for Energy Studies), Ronald Zimmerman (LGS,) and Maurice Birdwell (TMR Exploration Inc., Bossier City, La.)
- "Reservoir Characterization of the Chicot Aquifer in Acadia Parish, Louisiana." Riley Milner was the author of this poster presentation.
- Clayton Breland made a presentation titled "Assessment of Coalbed Methane Potential in Louisiana" at a short course on coalbed methane held in conjunction with the GCAGS Convention.

LGS Exhibit at GCAGS

LGS had an exhibit booth at this GCAGS Convention staffed by Riley Milner and assisted by Chacko John and Ron Zimmerman. The booth displayed LGS publications and maps, illustrations from presented papers and materials from other ongoing LGS research projects.

LGS Advisory Board Meeting

At the LGS Advisory Board meeting held on October 23, 2002 in the LGS Conference Room, Chacko John presented a summary of LGS activities that was followed by short presentations on the Chicot Aquifer studies, (Brad Hanson), coalbed methane project with USGS (Clayton Breland), geologic mapping (Rick McCulloh), cartographic projects (John Snead), and the TMR project (Ron Zimmerman). Chairman Frank Harrison and other board members expressed their satisfaction at the general progress being made by the LGS and Senator Max Malone said he would investigate sources of funding for LGS.

State Geologic Mapping Advisory Committee

Rick McCulloh co-ordinated the annual meeting of the committee before preparing the LGS proposal to the USGS to continue the state Geologic Mapping Project. This committee consists of the following ten members:

- James Coleman (Committee Chairman), Boyd Professor, LSU Coastal Studies Institute, Baton Rouge
- George Cardwell (USGS retired, Baton Rouge)
- Jerry Daigle, Louisiana State Soil Scientist, USDA NRCS
- Joe Holmes, Louisiana Department of Environmental Quality
- Darwin Knochenmus (USGS retired, Baton Rouge)
- Bill Marsalis, Louisiana Department of Natural Resources, Office of Mineral Resources
- James E. Rogers, Consulting Groundwater Hydrologist (USGS retired, Alexandria)
- Bill Schramm, Louisiana Department of Environmental Quality
- Charles Smith, Consulting Geologist (Baton Rouge)
- Dan Tomaszewski, USGS Water Resources Division, Louisiana District

The attendees voiced a consensus echoing that of last year's meeting- increasing the publicly available coverage of surface geology at the 1:100,000 scale is a top priority. It was further agreed that new 7.5-minute coverage can be strategically chosen to cover the areas expected

to require additional attention during the preparation of particular 1:100,000-scale geologic quadrangles. Finally, broad support was voiced for shifting primary emphasis to the production of digital datasets as opposed to traditional hardcopy map products, because other agencies' experience suggest that more than 70 percent of the customer base for map products now prefer this. The recommendation was that production of traditional maps be retained as an option, but that it become contingent upon external funding to support the additional cartographic work needed to provide coverage of specific areas in that format.

Cartographic Awards

An e-commerce poster titled "Plugging Rural America into E-Commerce Technologies" designed and produced by Lisa Pond (LGS) and authored by Gary Kennedy, Phil Hamilton, O.J. Nwoha, and K.W. Rea of Agricultural Sciences at Louisiana Tech University in Ruston, Louisiana, won first Place at the annual meeting of the American Agricultural Economics Association in Long Beach, California.

The "Louisiana Coastal Zone Map 2002" designed and produced by LGS cartographers Robert Paulsell, John Snead, and Lisa Pond was selected for notable mention in this year's international MAPublishers Map Competition, organized by Avenza Systems. Last year, the LGS entry "Official Map of Louisiana" won first place in this competition.

Personnel News

Douglas Carlson, who obtained the doctoral degree at the University of Wisconsin-Milwaukee, has joined LGS as an assistant professor-research in hydrogeology and will work in the Water and Environmental Section of LGS. Before coming to LGS he worked as a hydrologist for three years at the U.S. Geological Survey in Middleton, Wisconsin, where he was awarded a USGS STAR award for his work associated with the Southeastern Wisconsin and Menominee River Modeling Groundwater Projects. He later taught hydrology in the Department of Geology at the University of Wisconsin-Milwaukee. He has a number of publications to his credit and is a member of many professional societies.

Jeanne Johnson joined LGS as accountant technician replacing Carla Domingue, who left LGS upon obtaining a higher civil service position with another state agency.

Brian Harder, research associate 5, completed 15 years of service with LGS/LSU and was presented with the LSU Service Award Certificate by LGS director Chacko John.

Chacko John was installed as the president of the Gulf Coast Association of Geological Societies (GCAGS) at the executive board meeting held on October 30, 2002 in Austin, Texas. In addition, he is the president of the Baton Rouge Geological Society and the president-elect of the Energy Minerals Division of the American Association of Petroleum Geologists.



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