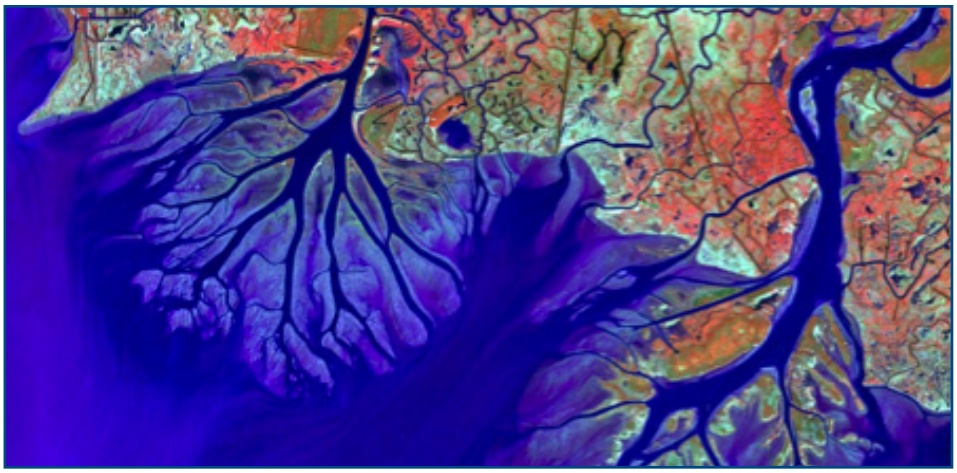
Louisiana EPSCoR
EXPERIMENTAL PROGRAM TO STIMULATE COMPETITIVE RESEARCH VOL.11 NO.2

Coastal Research Buoyed by Waves of Sustainable Funding

"The Mississippi River, with its sand and silt, has created most of Louisiana, and it could not have done so by remaining in one channel. If it had, southern Louisiana would be a long narrow peninsula reaching into the Gulf of Mexico. Southern Louisiana exists in its present form because the Mississippi River has jumped here and there within an arc about two hundred miles wide, like a pianist playing with one hand—frequently and radically changing course, surging over the left or the right bank to go off in utterly new directions."

—John McPhee, "Atchafalaya," New Yorker Magazine



Satellite image of Wax Lake Delta (left), a growing delta at the mouth of the Atchafalaya River. The delta is being closely studied because it has created over 38 sq. mi. of surface area since 1980 as an unintended consequence of a flood control project. Image: R. Twilley, et. al.

Ever since Europeans settled in Louisiana, the river industries and flood control have been, and continue to be, the top priority. Massive engineering projects have helped tame the river to create bustling industry and growing cities. Over time, more and more channels have been cut through the delta wetlands to improve access for industry. Over 3,500 miles of levees and diversions have been built along the Mississippi River to reduce flooding in urban areas. These engineering feats are impressive, however, mankind has inadvertently interrupted the natural influx of sediment that has built the delta over millennia.

Without movement of the river banks and influxes of silt, Louisiana is now experiencing massive wetland losses that are escalating every year. The United States Geological Survey estimates that Louisiana is losing land the size of a football field every hour. Multiply this effect with global sea level rise, and Louisiana is disappearing into the Gulf of Mexico.

While we can't restore the Mississippi river delta back to what it was, we can try to find ways to safely re-introduce sediment into the equation. This is precisely the objective of a team of Louisiana State University (LSU) researchers who are studying the delta and its wetland ecosystems.

Sediment dynamics and environmental processes for the Mississippi River are inordinately complicated because the drainage basin covers more than 1,245,000 square miles of land in the United States and Canada. Studying and modeling data on this magnitude requires a supercomputer to account for the highly variable spatial and temporal scales at play.

Enter the **Coastal Resilience Collaboratory**. A team of LSU researchers led by Dr. Robert Twilley, Executive Director of the Louisiana Sea Grant College Program and Professor of Oceanography and Coastal Sciences, and Dr. Qin Jim Chen, Professor of Civil and Environmental Engineering, have received a $6.4 million award from the National Science Foundation (NSF) Cyber-Innovation for Sustainability Science and Engineering (CyberSEES) program to establish the collaboratory.

The Coastal Resilience Collaboratory brings together top researchers in coastal science, computer science, engineering, hydraulics, oceanography, geology, and more. The team will use Louisiana's high performance cyberinfrastructure to analyze the huge amounts of data collected for every natural and man-made factor affecting the delta. Programmers will then develop computer models that will ultimately help to provide the analysis needed to design effective and sustainable hazard mitigation approaches that can be implemented in the future.

Louisiana is not alone in this plight, as river deltas all over the earth are

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vulnerable to global sea level changes. The collaboratory has established international partnerships that will extend the impacts of this research across the oceans to reach the entire international coastal scientific community.

"Our research lab has focused on developing fundamental understanding of the successional development of coastal deltaic floodplain ecosystems to assist in designing restoration projects for coastal Louisiana. These ecological studies are connected to high-performance computing analysis of delta growth and how storm surges can be reduced as delta ecosystems grow along the coastal zone. Such comprehensive analyses of delta growth, storm surge reduction, and restoration design help to improve public safety value of restoration and protection investments lead by our coastal master planning process," said Dr. Twilley.

Since 2002, the leaders of this research team have successfully expanded the impact of their research by building upon and leveraging a series of prior grants. The 2010 Northern Gulf Coastal Hazards Collaboratory (NGCHC), a research collaboration between 11 universities in Louisiana, Mississippi, and Alabama, was funded by an NSF EPSCoR Track II award of $6 million, and successfully developed a framework and strategies for organizing resources in the region and enabled rapid sharing of available data resources and simulation tools. Expanding on the successes of the NGCHC, the team was awarded a $970,000 NSF award in 2014 to develop the Scalable Toolkit for an Open Community Supporting Near Real-time High Resolution Coastal Modeling (STORM). This project will upgrade the 20-year-old industry standard software for tide and storm surge modeling. Speed, flexibility, and accuracy will be improved with new algorithms and the move to a high performance computing platform.

Dr. Robert Twilley

Dr. Qin Jim Chen

"The continued expansion of cyber-enabled coastal research in Louisiana is directly based upon the work of the NGCHC. Our researchers' strengths in coastal engineering and science combined with high performance computing have enabled the team to continue to leverage additional awards, including a $15 million NSF Coastal Science, Engineering and Education for Sustainability (Coastal SEES) award in 2014 and this new CyberSEES award," said Dr. Michael Khonsari, LA EPSCoR Project Director and Assoc. Commissioner for Sponsored Programs Research and Development at the Louisiana Board of Regents.

Computer-generated image of the possible results of a 50-year Mississippi River delta restoration scenario. Image: Dr. Wonsuck Kim.

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