

LSU Treads Lighter than Similar Schools When It Comes to CO₂

Louisiana State University's Baton Rouge campus is green compared to similarly sized universities across the country, according to a recent study.

Matt Moerschbaeher, who is working on his doctorate in the Department of Oceanography and Coastal Sciences at LSU, conducted a greenhouse gas inventory earlier this year as part of an assistantship funded by Louisiana Sea Grant. He looked at the whole of LSU's greenhouse gas output – from building energy use; faculty, staff and student commuter traffic; state vehicle usage; and methane from cattle grazing on campus pastures – and balanced this output against carbon sequestering by the lush and mature trees across campus.

"Students deciding to come to LSU are actually making a 'green' choice whether or not they're aware of it," said Moerschbaeher. "The university average is 6.7 metric tons of greenhouse gases produced annually per student. If you look in the northeast at schools with 20,000 or more students, the average is 10 metric tons annually."

The average American produces 20 metric tons of greenhouse gases a year. Location helps LSU contain its carbon footprint. "Heating plays a significant factor," said Moerschbaeher. "It's less energy intensive to cool a building than to heat one. So with fewer heating days, LSU comes out ahead compared with universities in more northern latitudes."

Additionally, the university's co-generation electricity power plant is highly efficient, decreasing LSU's reliance on purchased power and steam. Most students have a short commute – about four miles – meaning fewer tailpipe emissions. And building automation systems help keep energy consumption lower.

Still, as he is refining his report, Moerschbaeher believes the university needs to do more to limit its carbon footprint, in part because East Baton Rouge Parish's

carbon emissions amount to more than seven million metric tons annually – the highest in the state. Jefferson Parish, by comparison, has a carbon footprint of slightly more than two million metric tons per year.

"The chemical plants along the river have a lot to do with the parish's emissions," Moerschbaeher said. "But LSU can still take action to reduce its carbon footprint and create awareness of the issue." Moerschbaeher is working with the university's Campus Committee for Sustainability to formulate recommendations on ways to make LSU greener.

For example, student parking fees are among the lowest in the nation – creating an incentive for students to drive to campus even though most live within a few short miles of LSU. Raising parking fees, combined with bike lane construction and modifications to campus bus routes, could encourage students to use alternative transportation.

Creating a wetland to treat wastewater, while also sequestering carbon, could aid in reducing the university's carbon footprint. The city of Hammond, along with a host of other municipalities throughout southeast Louisiana, is using such a system to save energy and reduce wastewater treatment costs.

"There isn't enough space available on campus to create a wetland to treat all of LSU's effluent. But the university could treat some of its wastewater while using the wetland as an educational and demonstration facility," said Moerschbaeher.

By the end of the semester, he will finalize his report. From there the Sustainability Committee can make recommendations to the administration and a climate action plan can be developed and implemented.



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Wind Energy Potential Offshore



A wind turbine near Hooksiel/Wilhelmshaven, Germany. The prototype serves as a test and educational facility. Photo courtesy HDR.

kept the public comment process open through mid-November to enable final plan adoption by year's end.

"Developing wind energy along the coast is a complicated and often emotional process," said Charles "Chuck" Wilson, Louisiana Sea Grant executive director. "A number of Sea Grant programs are helping both local and state policy makers navigate the legal and regulatory issues, as well as aiding individual landowners and wind energy syndicates to determine if their sites are suitable for energy production."

"Studies show that land-based wind farming isn't practical along Louisiana's coast. Wind speeds and frequency aren't sufficient to make wind power economical. But other studies indicate that wind farming off Louisiana's coast has potential," Wilson added.

A 2003 Stanford University study suggested that several areas off Louisiana's coast are capable of up to Class 7 winds. According to the U.S. Department of Energy, Class 4 winds – between 15.7 to 16.8 mph at an altitude of 50 meters, the typical height of wind turbines – are a minimum requirement for commercially viable wind farms. Class 7 winds range from 19.7 to 24.8 mph.

The Louisiana Department of Natural Resources commissioned offshore wind resource maps from the renewable energy consulting firm AWS Truwind of New York in 2007. The results predict mean annual Class 4 winds at a 50-meter altitude from nearshore to about 50 miles out along the state's western coast. Class 4 winds tend to be 30 miles out – or further – along the central and eastern coasts.

"I can envision Louisiana Sea Grant's Law & Policy Program helping navigate wind farm regulatory issues," Wilson said. "Topics the legal program could help address include getting power across public and private property to the grid, turbine blade flicker (rotating shadows) and vibration that might disturb natural shell and finfish habitat, and general liability if a storm results in a turbine damaging the environment or private or public property."

On the Web:

AWS Truwind Final Report:
http://dnr.louisiana.gov/sec/execdiv/techasmt/energy_sources/wind/Offshore_Louisiana_Final_Report_2007.pdf

Louisiana Energy Topic, December 2004:
http://dnr.louisiana.gov/sec/execdiv/techasmt/newsletters/2001_2005/2004-12_topic.pdf

Sea Grant International

A select group of five Sea Grant personnel from across the United States – including Louisiana Sea Grant Research Coordinator Dave Nieland – had an opportunity recently to share with and learn from their counterparts in Korea.

Niland gave a presentation on the Undergraduate Research Opportunities Program (UROP) during Korea Sea Grant Week, which was held in late October-early November. UROP provides talented undergraduate students interested in pursuing advanced studies in marine-related disciplines with hands-on research experience.

Staffers from Korea Sea Grant – which was established in 2000 – will participate in NOAA's Sea Grant Week next fall in New Orleans.



Pictured top: From left, Joon-Baek Lee, director of Jeju Sea Grant; Kwang-Sik "Albert" Choi, professor, Jeju National University; Darren Okimoto, extension leader, Hawaii Sea Grant; Dave Nieland, Louisiana Sea Grant research coordinator; Nam-Soo Cha, Jeju Provincial Assembly; Sung-yoo Ko, director of Kosan Fishing Village; Byung-Gul Lee, professor, Jeju National University. Left: A squid jigging boat. Harvesters fish at night and use the bright lights strung across the boat to attract squid. Above: A commercial abalone aquaculture operation, which includes algae tanks where food for the juvenile shellfish is grown.



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Restoration on a Roll



The LSU Coastal Roots Program has its own set of wheels thanks to two LSU College of Education alumni. Placed in service in June, the new van has already logged over 5,000 miles. It is customized with interior shelves and a sliding deck to accommodate live plants and supplies, and the vehicle's exterior wrap serves as a rolling billboard for the coastal stewardship program.

"This couple's generosity is really saving wear and tear on personal vehicles," said Pamela Blanchard, assistant professor in the College of Education and the director of Coastal Roots. "But more than that, our equipment can be left in the van where it's safe and protected. I can haul plants without them getting wind damaged in the bed of my truck. This allows us to get out to

the schools so much easier and represents a cost savings because we no longer have to reimburse employees for mileage."

Coastal Roots now has students in 36 schools across 16 parishes growing native wetland plants in school-based nurseries and transplanting these young plants in restoration sites across the state. Blanchard said the program continues to expand and is expected to include 43 schools in 19 parishes by the end of the current academic year. Blanchard noted with pride that a Coastal Roots Program has also been established in Mississippi.

The donors wish to remain anonymous, but their generous contribution, which was facilitated by the LSU Foundation, will help other projects in the College of Education as well.

Continued calls for energy independence and green power have sparked government and private industry interest in offshore wind energy. However, harnessing the resource isn't as simple as erecting a windmill and plugging into the power grid.

Extensive planning that takes into account not only engineering challenges but also federal and state regulations – as well as potential user group conflicts – is a must. And while many coastal states are well into the process of regulating offshore and near-shore wind farms, others are only beginning to get their feet wet.

"The biggest legal issue that I see arising in relation to offshore wind energy projects is a lack of pre-planning – determining in advance what are the most appropriate, most productive locations for wind energy facilities," said Melissa Daigle, Louisiana Sea Grant Law & Policy Program legal coordinator.

"Several wind energy projects have faced massive opposition, especially from people who reside in the area and fear a loss of aesthetic appeal," she said. "Additionally, lack of advance planning can lead to haphazard placement that does not consider effects on fisheries and bird migration patterns."

Several state governments are approaching the legal aspects of wind farming through the Marine Spatial Planning (MSP) process.

MSP coordinates state and local governments' ecological, economic and social goals and sets limits on when and where human activities can occur near and offshore. The lengthy process – which can take months to years to complete – takes into account various coastal community stakeholders' fisheries, recreational, real estate and conservation interests.

Three states have already produced or are developing MSPs. North Carolina, Rhode Island and Massachusetts have created detailed plans to designate zones for wind farms and other economically important ocean uses.

Rhode Island's Ocean Special Area Management Plan establishes ocean use zones through research and public input. North Carolina Sea Grant and the North Carolina Division of Coastal Management have produced an ocean policy study report that explores growing ocean issues, including wind energy. Massachusetts completed its draft ocean management plan this summer, held public hearings in September and

Envisioning the Next Storm Surge

Louisiana Sea Grant and the LSU AgCenter's successful outreach program "The Next Storm Surge" is incorporating more data to improve its accuracy and better account for existing conditions and changing environmental factors.

Maurice Wolcott and Thomas Hymel first created storm surge maps in 2005 to aid in the region's recovery from Hurricane Rita. In the field, they located high-water marks from the surge, and used hand-held Geographical Positioning Systems (GPS) to record the coordinates of selected points. These coordinates were used with Geographical Information System (GIS) computer methods to generate maps of areas flooded by the surge and superimpose them on maps of land use. The resultant displays identified areas of sugarcane production affected by storm-caused flooding, and aided the area's sugarcane farmers seeking federal disaster aid. Wolcott is an instructor and GIS specialist with the LSU School of Biological and Agricultural Engineering and Louisiana Sea Grant (LSG), and Hymel is a watershed educator with LSG and the LSU AgCenter.

GIS employs computers to bring together, analyze and display a variety of spatial data. This information quickly became popular with area governments and citizens. In response, the pair created maps and models for other locations that showed the extent of actual storm surge from Hurricane Rita alongside "what-if" scenarios from ADCIRC storm surge models demonstrating what could happen under alternate conditions, such as a more powerful storm strike or a shift in the location of a hurricane's landfall.

The work grew into the series of presentations dubbed "The Next Storm Surge," which is making municipalities and citizens more aware of the threats they face. To help residents visualize their vulnerability to flooding, LSU AgCenter graphic artist Matt Faust digitally manipulated photographs of local landmarks to superimpose water on them at predicted heights.

Scenarios for nine coastal parishes have been prepared: Cameron, Calcasieu, Iberia, Lafourche, St. Mary, St. Tammany, Tangipahoa, Terrebonne and Vermilion. Excluding television appearances, Wolcott and Hymel have addressed as many as 2,000 people.

Pat Skinner, a disaster recovery and mitigation specialist with the LSU AgCenter and LSG, also helped participants at the public forums use the Internet to access personalized information on their property's elevation and flood zones.

She additionally presented information on flood insurance and building to avoid risk.

To provide a more accurate picture of potential surge impacts, Wolcott is compiling information on existing drainage systems and protective levees and working with DeWitt Braud in LSU's Coastal Studies Institute to determine what relative sea level rise will mean for prone parishes.

"Sea level has been rising since the last ice age," Wolcott said. "We have seen land loss in coastal Louisiana as a result of relative sea level rise. Relative sea level rise includes sea level rise and subsidence, and in south Louisiana, the subsidence is worse. This is one factor in our vulnerability to storm surge. The land is getting lower, and the Gulf of Mexico is coming closer. Coastal parishes have less land and vegetation separating them from the Gulf, so the storm surge doesn't have as far to travel and meets less resistance."

Wolcott's is also integrating lessons learned from the 2008 hurricane season.

"Gustav and Ike provided additional 'teachable' moments," he explained. "The two storms were identical with regard to wind speed at landfall, but with very different tracks, forward speed and size, resulting in very different storm surges. Ike provided a real-world example of the devastation that the storm surge produced by a Saffir Simpson Category 2 storm can cause, if the factors are right."

In addition to enhancing the program's existing maps and models, Wolcott is working with LSU AgCenter GIS applications developer Henry Capello to develop an interactive mapping Web page depicting various storm surge scenarios.

"It's not a question of when another storm surge will hit," Wolcott said.

"It's a question of when, and we want people to have a better understanding of these events."



Maurice Wolcott discusses the mechanics of storm surge at a hazard mitigation workshop in New Orleans earlier this year.

The Law of Change

What limits should government place on land use when resiliency of that land is expected to diminish over time? How can government balance its duty to preserve public trust lands such as beaches and water bottoms while protecting the interests of private landowners? What is the government's liability for acting or failing to act? With an eye on climate change, Sea Grant legal professionals in Texas, Louisiana, Mississippi, Alabama and Florida are exploring this quandary in a cooperative research project titled "Implications of Takings Law on Innovative Planning for Sea Level Rise in the Gulf of Mexico."

A taking occurs when government ousts an owner from his or her property, destroys private property or severely interferes with the owner's use and enjoyment of the property. The Fifth Amendment to the U.S. Constitution bars government takings of private possessions for public use without fairly compensating the owner for the loss. State laws can offer greater protection to property owners, but not less than what federal law requires, and most land use regulation occurs at the state or local level.

"Local planners and governmental officials are often fearful they will face takings claims when they attempt to protect the public from natural hazards such as sea level rise by regulating the use of private property," said Jim Wilkins, Louisiana Sea Grant Law & Policy Program director. "We hope the study will clarify the law of takings

so government and property owners know the acceptable limits of hazard mitigation regulations and land use planning."

There is some debate about when property owners are entitled to compensation, and many legal scholars believe that the authors of the Constitution intended only the physical occupation or seizure of property to constitute a taking. Sea Grant has found that planning officials are often paralyzed by the implications of takings law when creating land use regulations in areas threatened by erosion and encroaching seas. This issue is particularly relevant in the Gulf of Mexico states where populations are concentrated in coastal zones during a time when sea level is conservatively estimated to rise two feet in the next 100 years.

"Local governments are scared of being sued for takings if they impose limits," said Melissa Daigle, Louisiana Sea Grant's legal coordinator. "The other side of the issue, however, is if governments don't regulate, will they be sued for letting the landowner build where they know the property could be in danger?"

The Sea Grant project seeks to address this fear through an analysis of existing laws and court decisions on takings; the development of legal arguments that consider the imperative of sea level rise; and by identifying and developing novel land use policies and mitigation tools designed to withstand takings claims.

"Our message to local officials is that in many cases you don't need to be scared of a taking, but you should be concerned about possible liability for granting a permit or allowing construction in a vulnerable area," Daigle explained.

As technology increases government's understanding and knowledge of coastal susceptibility, it likely will leave municipalities more prone to lawsuits for failing to regulate development or failing to at least make property owners aware of potential hazards.

"There's no guarantee that sea level rise will happen, but the strong scientific evidence should be

intimidating to local governments," Daigle said. "Is sea level rise one of these unique concerns that allows more government regulation without having to compensate property

owners? Local governments don't want to and can't afford to pay people."

Innovative land management strategies, such as rolling easements in Texas, are one solution considered by the project. Under this "managed retreat" scenario, people are allowed to build along prone waterfronts with the understanding that residents must surrender or move structures once the ocean reaches them. It is hoped that the process of erosion will be slow and not create undue burden on property owners while at the same time discouraging development in hazardous areas and allowing government to avoid regulations that could amount to a compensable taking.

"Some owners are taking steps to armor their own property, but scientific evidence has shown that when you don't allow the beach to migrate naturally, you can lose the intertidal zone, which is one of the most productive ecosystems on earth and a prime destination for public recreation," Daigle said. "While some people say property owners have the right to protect themselves, government has to protect the public's property and resources such as the intertidal area."

Daigle said planners and lawyers are carefully watching the "Stop the Beach Renourishment" litigation, which is headed to the U.S. Supreme Court. In this case, Florida landowners are suing to stop the state from restoring eroded beaches bordering their property in a dispute over who will own the recreated land.

"Because sea level rise is so closely linked to takings, it will be interesting to see how the court decides that case. Everybody is talking about it," Daigle said.

NOAA Promotes Climate Literacy

Weather events exist over relatively short periods, while climate conditions encompass weather patterns and trends over longer time frames – months, years or even centuries. The National Oceanic and Atmospheric Administration (NOAA) is long-known for studying and predicting weather, but now the agency's Climate Program Office is creating teaching tools to help people understand how climate influences them and how they influence climate.

The Earth naturally undergoes roughly 100,000-year cycles of warming and cooling in which the temperature varies about 9 degrees F, bringing the planet into an ice age and back out again. Our climate is influenced by a number of factors, from the movement of tectonic



Climate change and sea level rise will impact Louisiana's coastal communities, such as Grand Isle.

plates, to solar radiation, to land surface properties, to variations in the planet's orbit. Perhaps the most discussed of all influences is greenhouse gases. Water vapor, along with this trio of carbon dioxide, methane and nitrous oxide, cause our atmosphere to retain heat rather than release it into space, resulting in overall warming that is effecting long-term climatic changes.

These gases occur on their own in nature, but their levels have increased dramatically since the Industrial Revolution sparked widespread use of coal and other fossil fuels. Forests have the ability to mitigate excess carbon dioxide, but deforestation for farming, logging and other land uses has reduced this positive impact. Earth's oceans also sequester carbon, but at the price of acidification, making our seas less hospitable for species like coral. The Intergovernmental Panel on Climate Change reports that there is a "very high confidence" that human activity since the 1750s has warmed the planet. NOAA reports that our climate had been stable for roughly 10,000 years but has undergone dramatic changes as civilization has become increasingly energy hungry in recent centuries.

The influence of such anthropogenic or human-influenced change was noted in 1957 in an educational brochure by the National Academy of Sciences, which stated that people were pouring carbon dioxide into the atmosphere at a rapid rate. Instrumentation to measure climate has existed for about 150 years. Earlier climate is studied using tree rings, coral skeletons, sedimentary layers and ice cores in a field of science called paleoclimatology.

The climate debate is multi-faceted and often contentious. Different climate change models may disagree on the scale of temperature change and resulting sea level rise, but most scientists agree that a worldwide transformation is underway and that the current flux is influenced by human actions. While the overall effect of global warming is one of a mean surface temperature increase, regional climates are expected to shift and change in a variety of ways. For instance, dry zones may see increased rainfall while traditionally wet areas may experience drought. More extremes of cold and heat are predicted. Sea level is expected to rise from the expansion of warmer oceans and the melting of glaciers and ice caps. These changes have the potential to push habitats from their ordinary ranges of temperature and moisture, which may force humans, animals and even viruses to adapt, relocate or die.

The United States Global Change Research Program reports that the southeastern states have experienced an annual average temperature increase of 2 degrees F since 1970. Climate change here is expected to manifest itself in the form of increased coastal flooding, drought, greater hurricane intensity, declines in agricultural production, reduced species diversity and harmful declines in oxygen levels in streams and lakes. Economic fallout may come in the form of damage to infrastructure, such as buckling roads, and increases in the cost of insurance for prone properties.

"NOAA is mandated by Congress to advance understanding of how the climate system works, to forecast future climate scenarios, and to share its information with the public," said David Herring, Communications Program Director with NOAA's Climate Program Office. In turn, the public is increasingly coming to NOAA seeking information about climate variability and change to help them make more informed decisions in their lives and livelihoods. With this in mind, the agency is developing a new Climate Services Portal to make its data and information more accessible as well as more extensive."

The portal is designed to be a central entry point into a clearinghouse of credible, unbiased information from NOAA and a variety of agencies and is targeted to four specific audiences: scientists, policy leaders, educators and students, and the general public. It is in the testing phase now and is expected to become operational in 2011.

In conjunction with several other agencies, NOAA has produced the 17-page guidebook *Climate Literacy: The Essential Principles of Climate Sciences* as a framework for understanding and evaluating issues related to climate change. It calls for an integrated approach to decision making that will affect climate, tells how information about the climate is collected, and discusses some of the long- and short-term implications of a changing climate. The second version of the guide was released in March and is found online at www.globalchange.gov.

The Essential Principles of Climate Science:

1. The Sun is the primary source of energy for Earth's climate system.
2. Climate is regulated by complex interactions among components of the Earth system.
3. Life on Earth depends on, is shaped by, and affects climate.
4. Climate varies over space and time through both natural and man-made processes.
5. Our understanding of the climate system is improved through observations, theoretical studies and modeling.
6. Human activities are impacting the climate system.
7. Climate change will have consequences for the Earth system and human lives.

Source: National Oceanic and Atmospheric Administration Climate Program Office: http://www.climate.noaa.gov/index.jsp?pg=/education/edu_index.jsp&edu=literacy

Coastal Sustainability Studio Launched

Coastal residents have endured the combined perils of hurricanes and subsidence for generations. Now they face the additional challenge presented by global climate change and related issues such as rising sea levels. To better protect Louisiana's coast from all these threats, LSU has launched the Coastal Sustainability Studio.

The Studio responds to LSU's Coastal Sustainability Agenda (CSA), which seeks to engage the university community in scholarly activities that inform public policies and advance both environmental and economic sustainability in coastal Louisiana.

"The Studio is a multi-disciplinary effort that will use the challenges of restoring and protecting the Mississippi River Delta to develop new approaches to building more resilient communities," said Robert Twilley, associate vice chancellor of research and economic development at LSU, director of CSA and professor in the LSU Department of Oceanography and Coastal Sciences. "The physical studio will be situated on LSU's campus, but the expertise will be drawn not only from LSU faculty but from coastal experts around the world."

The Studio's executive committee will include representatives from various disciplines including hurricane research,

engineering, art and design, landscape architecture, geography, and law, among others. The Studio will also be supported by an advisory committee that includes representatives from various private and public sectors, including energy, navigation, port authorities, engineering, parishes, foundations and state government.

"The concept behind the Studio is to build the capacity necessary to convert concepts into construction by designing and developing blueprints for sustainability," said Charles Wilson, Louisiana Sea Grant executive director. "Sea Grant's initial participation will be through our Law & Policy Program director Jim Wilkins and resource economist Rex Caffey. When the time comes to present decision makers with best sustainability options, I'm sure we'll also be involved. Sea Grant, after all, is about technology and information transfer."

Guidelines Studio members will employ as they formulate plans for a resilient/sustainable coast include:

- Community goals and desires must be included in the process.
- The planning/resiliency horizon – unless otherwise noted – is 100 years.
- Plans developed should have a goal of reducing present and future losses.
- Nature-based protection strategies will always be considered and attempted first.

The Studio already is working on its first test case – a plan to restore and connect Bayou Bienvenue and the central wetlands with the Lower Ninth Ward-Holy Cross neighborhoods in New Orleans. The project should be completed in the coming months.

A recent \$300,000 gift from the America's Wetland Foundation was instrumental in establishing the Coastal Sustainability Studio. The grant was made possible by support from Chevron, which is a partner in the foundation's America's Energy Coast initiative.

"Building capacity in science and engineering is critical for the Gulf states – especially for Louisiana and its ability to plan and implement large-scale ecosystem restoration and protection projects – that's why this is so important," said King Milling, chairman of the America's Wetland Foundation. "The Coastal Sustainability Studio will help support the development of best practices in coastal engineering through a multi-disciplinary approach to complex design challenges. Through this innovative concept, we will be able to gauge the sustainability of projects under consideration."

On the Web:

The Coastal Sustainability Agenda:
www.research.lsu.edu/csa/
America's Wetland Foundation:
www.americaswetland.com/