Research Works

As a leading public research university, LSU faculty focus on finding solutions to some of the greatest challenges of our time.

Their expertise spans a wide range of topics from chronic disease to coastal land loss. Through science, engineering, scholarship, and discovery, our faculty and students use the latest tools and technology to advance knowledge and improve quality of life.

In the following pages, you will get to meet four LSU professors who conduct large-scale research that can be applied to disaster-resilient housing, air quality and environmental health, safer cities, and the future of our coast.

LSU AR

Download the LSU AR app in the App Store.
Hover your phone or mobile device over the page to access additional augmented reality content about LSU research.

Research Works for

THE COAST

Credit: LSU.

Students grow and plant dune grass to learn about coastal land loss through the Coastal Roots program.

The Coastal Crusader: Pam Blanchard

By Tiffany Davis

Born and raised in Port Arthur, Texas, Pam Blanchard was never a stranger to complex coastal issues. That knowledge has followed her throughout her career.

"I've always had that coastal thread in what I'm doing," Blanchard said.

After graduating with an undergraduate degree in liberal arts, Blanchard taught middle school science and math. She taught for more than eight years before pursuing another undergraduate degree and then her Ph.D. in geology.

"I liked being outside. And, I was fascinated with the stories rocks can tell us," Blanchard said.

She studied micropaleontology at LSU and conducted her dissertation research on the Caribbean coast of Costa Rica in conjunction with the Smithsonian Tropical Research Institute.

In 1998, she joined the Louisiana Sea Grant College Program to pursue her passion in science education. While there, she connected with partners to help create Ocean Commotion, an annual hands-on ocean science education event for elementary and middle school students, and the LSU Coastal Roots Program in 2000.

"Louisiana has this huge coastal crisis, but people who aren't scientists don't understand what's going on and why it is happening," she said. "I decided that there must be something I could do to help people—kids, in particular—understand what is going on."

The Coastal Roots Program is a hands-on environmental stewardship project, which is literally a ground-altering way to incite positive changes on a coast that is eroding faster than any other U.S. coastline due to the complex challenges of sea level rise and engineered environments. Blanchard and co-director Ed Bush, a professor in the LSU School of Plant, Environmental, & Soil Sciences, facilitate elementary, middle, and high school students and teachers in 59 schools in Louisiana and Chile.

Local students grow dune grass, such as bitter panicum, and native trees like cypress and nuttall oak. The students in Chile grow native soap bark and quillay trees.

Blanchard is hoping to expand to Puerto Rico, the U.S. Virgin Islands, and Belize in the near future. Similar to Louisiana, these areas also face a coastal crisis due to sea level rise and habitat degradation. Blanchard believes in empowering students in response to what may seem like overwhelming and amorphous issues such as sea level rise and coastal erosion.

"What I really want the kids to do is to have a good experience doing something positive for a portion of our coastal plain and to remember that experience so that when they become voting adults, they will be advocates for all of our natural resources," Blanchard said.

90% of Louisianians believe that **LSU's COASTAL RESEARCH** and involvement is **VITAL TO THE STATE.**

"We need to all be environmental advocates. We need to pay attention to what's going on around us, whether it's on the beach or in our coastal forests. There are a lot of pressures on these areas. If we want to preserve what we have—natural resources and cultural resources—we need to pay attention and teach our children," Blanchard said. ■

COASTAL ROOTS BY THE NUMBERS

(since 2018)

23,003 students

168,567 plants

430 trips

1,508 teachers

3,284 chaperones

Research Works for

NATURAL DISASTER RESILIENCE

Housing's Humanitarian: Carol Friedland

By Tiffany Davis

Before pursuing a career to improve housing standards, Carol Friedland grew up in Wyoming.

"I knew I loved math, science, and being outside," said Friedland, who is the Cajun Constructors associate professor in the Bert S. Turner Department of Construction Management at LSU.

This drove her to earn a bachelor's degree in civil engineering at the University of Wyoming. After earning her degree, she worked as an engineering consultant, but soon realized she wanted more variety and challenge in her work. So, she ventured into the field of construction. She took on several industrial construction projects around the country including Nebraska, Missouri, Alabama, and Louisiana, where she worked on building power stations.

In Louisiana, Friedland realized she wanted to further her education—earning her master's degree in 2006 and her Ph.D. in 2009 from LSU, both in civil engineering. As a graduate student, she taught classes in construction management. She taught structural technology and materials and methods for industrial and heavy civil construction, like highways and levees.

"Even though my degrees are in civil engineering and I focused more on structural engineering in my Ph.D., my work and research areas and job experience have always been in construction," Friedland said.

Credit: LSU.

LSU Cajun Constructors Associate Professor Carol Friedland in the Bert S. Turner Department of Construction Management provides her expertise to national media including Discovery's Science Channel.

Her research initially focused on the vulnerability of industrial facilities to hurricanes, but after Hurricane Katrina, her focus shifted. Her research began to focus on the resilience of housing structures to natural hazards, specifically to wind and flood. Working with the State Hazard Mitigation Plan, she and other researchers look at all of the hazards that affect the state. She and representatives from agencies across the state specifically work on risk assessment and prioritize mitigation opportunities based on capability, cost, effectiveness, and a number of other criteria.

"The ultimate goal of my research in hazard resistant construction and mitigation is to improve the quality of life for people who live in Louisiana, the nation, and the world."

Carol Friedland
LSU Cajun Constructors Associate Professor in the Bert S. Turner Department of Construction Management

After the massive floods surrounding Baton Rouge, Louisiana, in 2016, Friedland took an even more tenacious approach to not only solving the consequences of flooding, but preventing them. She has addressed issues with current building codes and what can be done, such as increasing elevation of homes during construction.

"Rather than spending thousands of dollars to mitigate damage within existing homes, it would be much better to spend the time and money on constructing homes to a more stringent and resilient standard," Friedland said.

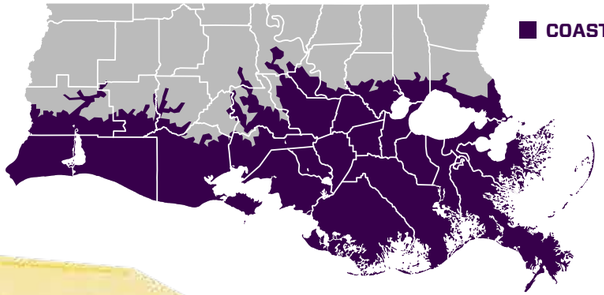
If houses are built to standards beyond what is required by the current code, it could dramatically decrease the risk of losing everything to a flood or other natural disaster.

Residents can also educate themselves about their flood risk by visiting LSU AgCenter's Louisiana Flood Map portal. By visiting the flood map portal, people gain access to a detailed map highlighting where the flood zones are in Louisiana, down to their approximate ground elevations.

"The hazard will occur," she said. "To me, it's a question of if we're able to resist it, then it won't become a disaster."

In the future, Friedland is working to provide concrete, quantitative data to the appropriate audiences and ensuring that change occurs for all who live in flood-prone areas, which includes many places in Louisiana. If disaster can be prevented on the front end, the state and homeowners can be spared from its toll. ■

OVER 20% OF THE MOST INTENSE U.S. MAINLAND HURRICANES ON RECORD **MADE LANDFALL IN LOUISIANA**.



COASTAL ZONE AND EXTREME STORM SURGE POTENTIAL ZONE

OVER 2 MILLION PEOPLE LIVE IN LOUISIANA'S COASTAL ZONE.

THE EXTREME STORM SURGE POTENTIAL ZONE **FACES STORM SURGES OF OVER 9 FEET FROM EVEN A CATEGORY 3** HURRICANE.

Research Works for

OUR HEALTH

Environmental Health Scientist: Stephania Cormier

By Alison Lee Satake

Pollutants and hazardous substances released into the air we breathe are detrimental to our health. LSU Superfund Research Center Director Stephania Cormier studies how airborne pollutants such as particulate matter and environmentally persistent free radicals, or EPFRs, affect our health. Her research has shown that exposure to environmental pollutants with free radicals can lead to a whole host of health problems including heart and lung disease, more prolonged and severe cases of pneumonia resulting from respiratory infections, and an increased risk for obesity.

Exposure to these pollutants can also lead to severe asthma, especially among infants and children whose lungs and immune systems are still developing. Challenges faced during the critical developmental stage of infancy can lead to long-term health problems.

"I study all of this in infants because I want to know what we can change in the environment to prevent children from developing long-term lung diseases like asthma."

Stephania Cormier
LSU Superfund Research Center director, LSU Department of Biological Sciences Wiener chair and professor, and LSU School of Veterinary Medicine Comparative Biomedical Sciences professor

Asthma affects about 235 million people worldwide, according to the World Health Organization. It is the most common chronic disease among children. Cormier's research has found that infants and young children exposed to particle pollutants with free radicals have a higher risk of developing asthma including severe asthma that is resistant to steroid therapy. Her research has also shown that exposure to these pollutants can increase mortality from infections like the flu.

"In infants, the immune system is still being 'educated' and the lungs are still developing. Exposure during this critical window can alter the lungs' structure resulting in long-term dysfunction that can affect the developing immune system altering response to infections. It's like a double whammy to be hit at that critical point in time—infancy," said Cormier, who has been conducting research on how exposure at critical points in development leads to long-term biological changes since her post-doctoral fellowship at the Mayo Clinic after receiving her doctorate at the LSU Health Sciences Center in New Orleans.

Credit: LSU.

4-H students catch bottom-dwelling aquatic insects to measure water quality at Camp Grant Walker with LSU Superfund Research Center Coordinator Jen Irving.

She joined the faculty at LSU in 2003.

Her research has also shown that mothers who are exposed to these particle pollutants are more likely to have children with childhood asthma. Those offspring are also more predisposed to obesity, especially when consuming a high fat diet, than offspring from mothers who are not exposed.

The LSU Superfund Research Center has found EPFRs in a variety of places including contaminated soil at Superfund sites, in the air after electronic waste is combusted, in the wetlands after the burning of oil from the Deepwater Horizon oil spill, as well as in e-cigarette vapor. EPFRs have also been found in soot, coal, ash, and cigarette smoke. EPFRs do not easily decompose and can linger in the air up to a few months, which increases our exposure to them.

Because we have little control over the free radicals found in our environment, Cormier suggests boosting our immune systems with foods rich in antioxidants such as green tea, blueberries, blackberries, vitamin C, and red wine. Antioxidants are molecules that can protect the body from damage from free radicals.

"When you do get sick, antioxidant supplementation can lessen the amount of infection and help your body clear it from your system. We've seen this for both viral and bacterial infections in the lungs in the setting of EPFR exposure," Cormier said.

To help protect yourself, she recommends antioxidants and eating a low fat diet. ■

Research Works for

SMART CITIES

Credit: LSU.

LSU Division of Computer Science & Engineering Dr. Fred H. Fenn Endowed Professor Jay Park and LSU Center for Computation & Technology Director J. "Ram" Ramanujam.

Big Data Connector: Jay Park

By Alison Lee Satake

Seung-Jong "Jay" Park was a computer scientist working in Seoul, Korea, for many years before coming to the U.S. He was 30 years old when he immigrated here to pursue his Ph.D. at the Georgia Institute of Technology, where he developed software. At the time, Georgia Tech did not have a supercomputer. However, the LSU Center for Computation & Technology's supercomputing power impressed Park so much so that he joined the faculty in 2004. Now, as a jointly appointed professor in the computer science department and the Center for Computation & Technology, or CCT, Park develops numerous types of software that span the disciplines and tackle some of the biggest problems we face today—from improving cancer detection to flood resilience. Currently, he is working with the city of Baton Rouge to develop software to address traffic, crime, and blight.

"Data is the key," Park said. "And, I enjoy collaboration."

This collaboration is part of an international trend of "smart cities." From London to Chicago, cities around the world are leveraging technology to improve infrastructure, environmental health, safety, and security.

"The pattern of crime and traffic are similar among cities," Park said.

Thousands of traffic cameras capture video footage and data along all of the highways and major roads throughout Louisiana. This real-time data currently helps emergency responders and law enforcement. Park is developing software that can expand the use of this video footage and help planners identify traffic patterns, such as the number and frequency of 18-wheel trucks that cross the bridge over the Mississippi River. With higher resolution information, the city will be able to plan roads and transportation based on more accurate traffic patterns. He also sees a need for being able to identify every vehicle's make, model, and year in order to assist with Amber Alerts.

Similarly, he and colleagues are exploring ways to use satellite imagery and data to identify areas that are on the verge of becoming blighted. The advantage of a mid-sized city such as Baton Rouge is that systems and technology can be deployed more quickly than in a large metropolis.

However, Park is sensitive towards privacy concerns.

"We need to delete personal information and only extract the metadata," he said.

It is a fine line. This is especially true when it comes to addressing communities and violence prevention. He believes community engagement is a critical factor. The smart city committee plans to meet with community stakeholders.

> "We want people to understand how this technology works to reduce crime and protect privacy."
>
> Jay Park
> LSU Division of Computer Science & Engineering Dr. Fred H. Fenn Endowed professor

He has grown into the role of facilitator.

"When I was a new assistant professor, I could not work with faculty outside the computer science department, because I could not understand their disciplines. I needed to learn their research language first," he said.

Now, he serves as the conduit between social scientists and computer scientists.

"My role is to integrate these two groups together," he said. "It's a rewarding challenge." ■

CITY OF BATON ROUGE

Data Source: American Community Survey and Louisiana Department of Transportation & Development

225,374 population

$39,969 household income

76 traffic cameras

30 median age

- African American **54.5%**
- White **39.4%**
- Latino **3.3%**
- Asian **3.3%**

Research Works for

LOUISIANA'S ECONOMY

By Stephen Barnes, Elly Bringaze, Dek Terrell, and Stephanie Verget
LSU Economics & Policy Research Group at the E. J. Ourso College of Business

The reputation of LSU draws many students and faculty to its ranks as it continues to receive national recognition in various areas. LSU is the largest institution of higher education in the state and the only public Carnegie-designated Research Extensive University in Louisiana. Additionally, LSU was selected for the top tier of "Best National Universities" in the 2018 edition of *U.S. News & World Report* college rankings and ranked 63rd amongst public universities, the highest ranked public university in the state. The E. J. Ourso College of Business's Flores MBA Program placed in the top 20 percent of graduate business programs in the 2018 report and LSU ranked seventh in the nation for Petroleum Engineering. More generally, LSU has taken the necessary steps to provide the future workforce of Louisiana with the only public medical schools in the state and regional campuses providing a high quality education to meet the needs of local businesses. These accomplishments make LSU and its surrounding areas an attractive destination to study, work, and live.

LSU is not only a source of new residents, but a source of marginal investment and revenue streams for the state. Professors and students work to obtain grants to conduct research in their fields with more than 2,000 sponsored research projects underway at any given time. The grant application process is extremely competitive, but LSU faculty attracted roughly $148 million in new federal grants last fiscal year alone. A professor's success in receiving a grant for research is not only a feat for that faculty member, but also for the state's economy. By receiving federal funding for research, LSU is directing monies from outside the state into Louisiana. The LSU AgCenter and the Pennington Biomedical Research Center are both responsible for bringing in numerous federal grants and projects into the region. Beyond those acute economic benefits, there is a wide array of benefits that LSU provides to each of the parishes throughout the state. LSU contributes substantially to the local workforce by educating future business and community leaders, and the skilled workforce that LSU provides also creates an incentive for businesses to relocate to the area. For example, in November 2017, Louisiana Governor John Bel Edwards announced that DXC Technology will develop a "digital transformation center" in New Orleans, bringing about 2,000 jobs to the area

between 2018 and 2024. Consequently, LSU is partnering with the state to expand STEM-related educational programs including computer science, management, science, technology, engineering, and math to meet the new workforce demands that the DXC investment will bring.

LSU also serves as a catalyst for long-term economic growth by cultivating entrepreneurship and technical expertise across the state. Even beyond economic impacts, LSU serves as a beacon for artistic and cultural activities that promote a better quality of life and also serves its community by promoting educational opportunities for children. These additional contributions to the local community represent important benefits in both economic and non-economic terms.

The pure magnitude of LSU as an institution implies that its operations are quite important to the state's economy. Although the institution's large expenditures and number of employees represent a substantial amount of economic output, they only represent the direct impact of the university. In order to determine the full economic impact of LSU operations, the indirect and induced impacts must also be considered. To use an analogy, imagine the Louisiana economy as a large pond. If a large rock (i.e., LSU) were suddenly dropped into the pond, it would make a big splash. However, the rock would also create ripples that extend to the outer edges of the pond. For example, when LSU pays its employees, they will spend their paychecks at local retail stores and restaurants, for services, on housing, etc. Their purchases generate sales, earnings, and jobs at stores and other businesses throughout the local area, which in turn ripple across the entire state.

With more than 45,000 students, 20,000 full time employees, and $3.0 billion in expenditures and student spending, it should come as no surprise that LSU's institutions and facilities have a large impact on Louisiana's economy. The results indicate that LSU's presence supports more than $5.1 billion in economic output across the state of Louisiana. In terms of jobs and earnings, over 41,000 jobs and approximately $1.9 billion in earnings are supported by LSU in Louisiana. ■

LSU'S ECONOMIC IMPACT AROUND THE STATE:

During the 2017 fiscal year

New Orleans $1 billion

Shreveport $682.9 million

Eunice $104.3 million

Alexandria $84.4 million

The full economic impact study can be viewed at: **lsu.edu/economic-impact**.