Saving Louisiana's coast

August 27 2015, by Mary Ann Travis

A NASA Earth Observatory image from 2014 shows the Mississippi River wending toward the Louisiana coastline. Credit: earthobservatory.nasa.gov

It was Day Nine after Katrina struck in 2005 when Sarah Mack's bosses at the Sewerage and Water Board of New Orleans called her back to work.

Mack had been working as an environmental scientist pre-Katrina. Her supervisors brought her back as emergency manager, she says, because she could communicate what is "a real and what is a perceived risk."

Seeing the massive destruction from the storm opened Mack's eyes. In a city defined by water, with a river winding through it and a lake to the north, pumping stations are important. Levees are essential. And drainage is a necessity.

But—and this was the lightbulb moment—"we could do whatever we want within our system but it isn't going to do a lot of good unless we address the coastal land loss."

That realization led Mack, who has a master's degree (2004) and PhD (2009) in public health from Tulane, to found her own company, Tierra Resources, in 2007. The company is now involved in several projects with Louisiana businesses such as Entergy and Conoco-Phillips to transact carbon credits in the wetlands.

The oil companies and power plants invest in wetland restoration to offset the carbon dioxide emissions—or greenhouse gases—that result from their operations.

Tierra Resources uses a relatively straightforward but data-heavy measurement of the photosynthesis process: The wetlands take the carbon dioxide out of the air. The carbon in the carbon dioxide gets incorporated into the plants and roots and soil. So, carbon dioxide, a major factor in warming up the atmosphere, is naturally stored as long as the wetland is in place.

"We are the ones that actually introduced wetlands to emission trading," says Mack. "It took us five years but we developed the very first methodology to transact carbon credits in wetlands."

She's working with private companies "because these projects get bogged down in bureaucracy when you're working with the government."

Mack wants more private enterprises to incorporate coastal restoration into their business models.

The coast is in "dire straits," she says. All her calculations show that land is rapidly disappearing and the Gulf of Mexico is fast encroaching. In the Leeville-Port Fourchon area, on the southernmost coast of Louisiana, Mack predicts that large blocks of land will be gone in 14 years.

"That's the window of opportunity," she says. "And it's not long."

Learning from last Ice Age

Sarah Mack's work offers "a bit of hope," says Torbjörn Törnqvist, Vokes Geology Professor and chair of the Department of Earth and Environmental Sciences. Otherwise, if nothing is done to reduce greenhouse gases, "it's going to get ugly."

The goal should be to strive for carbon neutrality, says Törnqvist. That is, like in Mack's enterprise, "whatever carbon is released into the atmosphere is balanced by what is taken out—anything from plants to the ocean to perhaps geoengineering projects, where we take CO2 and store it in the subsurface."

Sea levels are rising worldwide. And this acceleration is directly related to rising temperatures in the atmosphere, which comes from increased emission of carbon dioxide.

In the 20th century, the globally averaged rate of sea-level rise was 1 to 2 millimeters per year, but in the last 20 years it has ramped up to just over 3 millimeters per year. And in coastal Louisiana, it is rising even faster,

more like 10 millimeters per year, due to rapid land subsidence.

"The rate of sea-level rise in the last century is the highest we've seen in the last 7,000 years," says Törnqvist. "That's when the North American ice sheet was totally gone."

Törnqvist is looking even further back, to the last gasp of the last Ice Age—8,000 to 10,000 years ago. In his research, for which he recently received a $400,000 grant from the National Science Foundation, he takes core samples from the Mississippi Delta to study the interactions between the melt water of the ice sheets and the rising seas. At that time, the seas around the globe rose a whopping centimeter per year.

Climate conditions then were somewhat comparable with today, says Törnqvist. And, although the warming of the climate then had to do with the way the Earth orbited the sun and not greenhouse gas emissions as it does today, we can learn a lesson about accelerated sea-level rise: It's hard to stop once it gets started.

As a geologist, Törnqvist usually thinks in terms of hundreds or thousands of years. He is willing, though, to peer a mere 50 years ahead to imagine a future for New Orleans. He says, "If we don't take any action, if we don't do anything about greenhouse gas emissions and let climate changes continue to accelerate—and we don't do anything about restoring the coast by means of big river diversions—yes, New Orleans is still going to exist but it's increasingly going to look like a precarious peninsula sticking out into the Gulf of Mexico."

Crucible for understanding

In 2007, Louisiana created the Coastal Protection and Restoration Authority and developed a Coastal Master Plan, recognizing the threats to the way of life and the land of the state. Five years later, the plan was

revised into "Louisiana's Comprehensive Master Plan for a Sustainable Coast." A new plan will be coming out in 2017.

The plan is based on "strong science and a good vision for coastal restoration of Louisiana," says Michael Blum, associate professor of ecology and evolutionary biology, Eugenie Schwartz Professor of River and Coastal Studies and director of the Tulane Center for Bioenvironmental Research.

The plan addresses key issues of flood protection, natural processes, coastal habitats, cultural heritage and the working coast.

"I wouldn't say it's a blueprint but it's a well-thought-out vision for 50 years of restoration," says Blum.

The current projected cost of implementing the plan is $50 billion over 50 years.

"It's not going to happen overnight," says Blum, "but it is going to happen."

With the infusion of cash from penalties to be paid by the BP oil company for damages stemming from the 2010 Deepwater Horizon disaster, the state can now get busy making the plan a reality.

The BP settlement that was announced in July will provide at least $500 million per year over 15 years for coastal restoration and protection. In addition, Louisiana will get a share of the $5.5 billion that BP is paying in penalties under the Clean Water Act for the company's responsibility for the disaster—the largest accidental marine oil spill in the history of the petroleum industry.

Blum, who also directs the Tulane Riverfront Initiative, says that it's

important to keep in mind that the energy infrastructure is "so deeply embedded within our coastal environment that you can't talk about the coast without talking about the energy infrastructure. You have to talk about pipelines. You have to talk about canals. You have to talk about all of the platforms that have been built up over the years that are effectively part of the physical environment of the coast. One has to talk as much about infrastructure as you have to talk about ecosystems."

A pragmatic, scientific and practical perspective is what Blum expects the Tulane Riverfront Initiative to bring to the coastal restoration effort. The inaugural 8,000-square-foot Tulane River and Coastal Center, slated to open in early 2016, will include labs, offices and conference space on the Mississippi River waterfront close to the Ernest N. Morial Convention Center and the Central Business District. The Riverfront Initiative has received funding from the U.S. Department of Commerce and the federal Delta Regional Authority to spur economic development through research, training and business incubation.

"Our role is to sustain and improve the dialogue" among competing interests in coastal restoration and protection, says Blum. The priorities include fishing sustainability, wildlife protection, oil and gas production and, of course, building land.

The biggest priority for coastal restoration gets back to earth building—or moving mud, jokes Blum. "Our greatest assets are sediment and sand and water. Without those building blocks, doing coastal restoration is very difficult."

An efficient, cost-effective and sustainable way to build land is through river diversion projects, most coastal scientists agree.

Through the eons, the Mississippi River meandered, flooding its banks and creating land in the process. In the 20th century, however, the river

became increasingly confined in a straitjacket of levees.

Levees, without a doubt, are essential for protecting property and people. But a controlled dismantling of some levees in Southeast Louisiana would help build land through sediment dispersal and slow the Gulf of Mexico's inexorable inundation.

River diversion, though, is only a part of the complex coastal restoration plan.

Blum's own research is on marsh grass, which can be another tool for shoreline remediation and erosion reduction. Grasses have an "anchoring capacity, holding soil in place," says Blum.

After the BP oil spill when 4.9 million barrels of oil spewed for 87 days, there was a "bathtub ring effect" along the contaminated shoreline. As a consequence, an acute loss of grasses occurred. Where grasses typically grew right up to the water's edge, they struggled to survive, further exacerbating land loss.

Grasses have been replanted in some areas of the oil spill—and some grasses have rejuvenated on their own. Blum and a team of collaborators are exploring which kind of grass thrives best where—and what is the most sustainable grass for erosion control.

"It's an interesting time," says Blum. "There's lots of activity. And Tulane has positioned itself well to engage on a lot of issues. From a scholarship perspective, this is an extraordinary place to be."

Louisiana is a "crucible for understanding issues related to coastal and community resiliency," says Blum. "I would challenge anybody to come up with a better example, a better laboratory for understanding and for studying issues related to sea-level rise, global environmental change and

disaster response at a fundamental level."

Safer and smarter

Mark Davis knows water well. As a senior research fellow and director of the Institute on Water Resources Law and Policy at Tulane Law School, Davis leads scholars who foster "the development of laws and policies that promote the sustainable management of water resources."

These scholars are not sitting on the sidelines. Like Blum, they are playing the game. "And every at bat matters," says Davis.

There is no time to lose. "The distinctions between basic and applied research are not necessarily the same [here] as they are elsewhere," says Davis. The cost of waiting to act until there is absolute certainty about the problems or the opportunities will be too great.

"If you wait too long, it may be too late to do anything," says Davis.

Simple recovery from Katrina is not the major issue for Davis. It's not a matter of patching things up and moving ahead. Yes, "we have a more robust levee system and drainage system," says Davis.

But sustainability is "going to have to become a way of life. It's going to have to be how we learn more about ourselves, how we learn about the world around us, how we adapt and what we're willing to commit ourselves to. This is not easy, cheap stuff."

The state's master plan for coastal restoration and an urban water plan for dealing with street flooding and using runoff to help with ground subsidence, which was devised with input from Davis' shop, are good beginnings. But they will require more funding than even BP can provide. Predictable funding sources must be identified and tapped."If

we don't step up and invest in the kinds of things that have to be paid for, no one else is going to do it for us," says Davis.

New Orleans is not alone in its water challenges. Florida, Texas, New York, Arizona and California are coping with other water and sustainability issues. They may be living beyond their water means or dealing with storm issues.

"You realize that at some point, you come to terms with those things. You manage for them or you get managed by them," says Davis.

That's what makes New Orleans a "universal city" at this juncture. Before Katrina, this was a "decidedly unsustainable place," says Davis. But so were Las Vegas, Phoenix and Miami. Now the eyes of the world are on New Orleans. And other places can learn from what's going on here.

"We've given ourselves a shot at sustainability," says Davis.

New Orleans is a "remarkably exciting city to live in, and it's an exciting time to be in it," he says. "This is a place that is trying to learn and do. We are safer and smarter because we've had to be."

There is a sense of urgency here. "Tulane needs to stay in the mix," adds Davis. "The kind of energy that a university like Tulane can provide is indispensable." And with a strong academic university like Tulane acting to fulfill its civic responsibility, "there's probably not a better place to be on the planet."

Provided by Tulane University