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After Centuries of 'Controlling' Land, Gulf Learns Who's the Boss

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The Gulf Coast has always been vulnerable to coastal storms, but over the years people have made things worse, particularly in [Louisiana](#), where Hurricane Katrina struck yesterday. Since the 18th century, when French colonial administrators required land claimants to establish ownership by building levees along bayous, streams and rivers, people have been trying to dominate the region's landscape and the forces of its nature.

As long as people could control floods, they could do business. But, as people learned too late, the landscape of South Louisiana depends on floods: it is made of loose [Mississippi](#) River silt, and the ground subsides as this silt consolidates. Only regular floods of muddy water can replenish the sediment and keep the landscape above water. But flood control projects channel the river's nourishing sediment to the end of the birdfoot delta and out into the deep water of the Gulf of Mexico.

Although early travelers realized the irrationality of building a port on shifting mud in an area regularly ravaged by storms and disease, the opportunities to make money overrode all objections.

When most transport was by water, people would of course settle along the Mississippi River, and of course they would build a port city near its mouth. In the 20th century, when oil and gas fields were developed in the gulf, of course people added petrochemical refineries and factories to the river mix, convenient to both drillers and shippers. To protect it all, they built an elaborate system of levees, dams, spillways and other installations.

As one 19th-century traveler put it, according to Ari Kelman, an environmental historian at the University of California, Davis, "New Orleans is surprising evidence of what men will endure, when cheered by the hopes of an ever-flowing tide of dollars and cents."

In the last few decades, more and more people have realized what a terrible bargain the region made when it embraced - unwittingly, perhaps - environmental degradation in exchange for economic gains.

Abby Sallenger, a scientist with the United States Geological Survey who has studied the Louisiana landscape for years, sees the results of this bargain when he makes his regular flights over the Gulf Coast or goes by boat to one of the string of sandy barrier islands that line the state's coast.

The islands are the region's first line of defense against hurricane waves and storm surges. Marshes, which can normally absorb storm water, are its second.

But, starved of sediment, the islands have shrunk significantly in recent decades. And though the rate of the marshes' loss has slowed somewhat, they are still disappearing, "almost changing before your eyes," as Dr. Sallenger put it in a telephone interview from his office in St. Petersburg, Fla. "Grassland turns into open water, ponds turn into lakes."

Without the fine sediment that nourishes marshes and the coarser sediment that feeds eroding barrier islands, "the entire delta region is sinking," he said. In effect, he said, it is suffering a rise in sea level of about a centimeter - about a third of an inch - a year, 10 times the average rate globally.

"Some of the future projections of sea level rise elsewhere in the country due to global warming would approach what we presently see in Louisiana," Dr. Sallenger said.

Hurricane Katrina was a strong storm, Category 4, when it came ashore east of New Orleans, near a string of barriers called the Chandeleur Islands. "They were already vulnerable, extremely so," Dr. Sallenger said.

He said he and his colleagues were reviewing photos, radar images and other measurements made of the islands after Hurricane Lili, a Category 2 hurricane that passed over them in 2002.

"The degree of change in that storm was extreme," he said. "So we had a discussion this morning: O.K., if Lili can do this, who knows what Katrina is going to do?" The scientists expect to fly over the coast on Wednesday and find out.

Of course, New Orleans is vulnerable to flooding from the Mississippi River as well as from coastal storms. North of the city, the Army Corps of Engineers has marked out several places where the levees would be deliberately breached in the event of a potentially disastrous river flood threat, sending water instead into uninhabited "spillways."

But there is no way to stop a hurricane storm surge from thundering over a degraded landscape - except, perhaps, by restoring the landscape to let the Mississippi flow over it more often.

Some small efforts are being made. For example, at the Old River Control Structure, an installation of dams, turbines and other facilities just north of Baton Rouge that keeps the Mississippi on its established path, workers collect sediment that piles along the dams and cart it by truck into the marshes.

But truly letting the river run would exact unacceptably heavy costs - costs that would be paid immediately by people in the region and in particular by any politician rash enough to endorse such a plan.

Instead, there continue to be efforts to build more capacity into New Orleans flood control efforts, said Craig E. Colten, a geographer at Louisiana State University and the author of a new book, "An Unnatural Metropolis: Wrestling New Orleans From Nature" (Louisiana State University Press, 2005). That will mean ever more costs, Mr. Colten said, given that the city, which is below sea level, must run pumps simply to keep from being flooded in an ordinary rainstorm.

Roy K. Dokka, a geologist at Louisiana State, said flooding would be even worse for decades to come, not just in New Orleans but in the entire Gulf Coast region.

The consequences were clear yesterday, Dr. Dokka said, around Port Fourchon, La., where the single road that is the commuting route for oil workers heading to offshore rigs lay under water. "That road that all the roughnecks and oil workers drive down every day has sunk a foot in 20 years," he said. "It's now under water every time there's a significant south wind blowing."

But as Dr. Kelman said: "Once you've invested enough in urban infrastructure, you have to keep on buying in. And that doesn't even count the cultural dimension." The reference was to the region's cuisine, culture and mystique.

"With billions of dollars sunk into the soil in southern Louisiana and the Gulf Coast," Dr. Kelman said, "it's kind of too late. We're there, and we're staying there."