VIRGINIA HANUSIK, *Sunrise over the Lake Borgne Surge Barrier #1,* 2022.

SAMANTHA MONTANO

The Roots That Ward Off Disaster

Recent disasters have strained the Gulf's ability to respond. Building capacity for local emergency management agencies and disaster research could help the region cope—and thrive.

Every summer I take my undergraduate emergency management students to Louisiana to learn about disasters in the Gulf. One of our most valuable experiences is volunteering with local organizations that are replanting coastal wetlands. On these trips, we take a boat from the shore and then jump out onto unsolid ground. Standing is impossible; instead, we army crawl our way through shallow water. Every few feet, we pause to punch a hole into the mud with our fists while our free hands push in plugs of California bulrush so that they run in rows parallel to the shore. This plant is well suited to prevent erosion in places where land and water meet. Eventually, they will grow to be 5–10 feet tall. When we run out of plants and energy, we return home soaked, sunburnt, and muddy, hoping that the little reeds will have sufficient time to grow strong enough to hold up against some of the world's fiercest winds and storm surges.

Restoring the wetlands is one tactic that can help millions of people miles inland cope with continuous cycles of flooding. Approximately 25% of the Louisiana wetlands, an area equivalent to the state of Delaware, have been destroyed by past storms, a century of Mississippi River manipulation, climate change, and the activities of the oil and gas industries. The loss of the wetlands has made flooding worse as the natural barrier protecting land from sea shrinks. The general rule of thumb when it comes to storm-surge mitigation is that every 2.7 miles of wetlands can reduce storm surge by a foot.

The disappearing coast is an existential risk, and the state has approved a $50 billion, 50-year comprehensive master plan that includes many strategies to restore the wetlands, including massive dredging projects and diversions. In the two decades that it took to develop the plan and search for funding, the wetlands continued to erode. In the interim, small volunteer groups have tried to move ahead by restoring the wetlands plant by plant.

This approach to wetland restoration in Louisiana mirrors the relationship between formal government efforts and communities in the face of vast hazards in the region. Problems that should be the responsibility of government, or are of such a scale that federal funding is required, are often kicked down the road by elected officials. Disasters, though, do not run on political timelines. People who live in these communities increasingly find government help is absent or insufficient, and so it is volunteers who step in to help locals undo a century of ecological damage.

For my students, there is plenty to be learned while planting bulrushes—about the conditions that contribute to disasters, about the strengths and weaknesses of the system we use to manage them, and about what it takes, tangibly, to hold Louisiana's soil together.

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AN ELUSIVE & INDEFINABLE BOUNDARY

VIRGINIA HANUSIK

Seven years before the release of *Silent Spring* in 1962, marine biologist and writer Rachel Carson wrote *The Edge of the Sea*. Part field guide to the Atlantic seashore, part meditation on Carson's love for the evanescent world between land and water, it was an idea that came to her while working for the United States Fish and Wildlife Service. The book begins:

> The edge of the sea is a strange and beautiful place. All through the long history of Earth it has been an area of unrest where waves have broken heavily against the land, where the tides have pressed forward over the continents, receded, and then returned. For no two successive days is the shore line precisely the same.... Today a little more land may belong to the sea, tomorrow a little less. Always the edge of the sea remains an elusive and indefinable boundary.

As a photographer, my work explores that indefinable boundary, often by visiting sites multiple times over the course of many years. I photograph certain structures repeatedly to capture a perspective of change and time that's larger than the frame itself.

The development of the American shoreline reflects our ideas of living with the natural world—a world which, it was once believed, could be manipulated and maneuvered without consequence. The Army Corps of Engineers, the agency responsible for designing and implementing the infrastructure of many of these water-ruled landscapes, describes their mission as relating to "the desire of many people to live near the coast," which, along with economic opportunities, "led to extensive development of coastal areas and the need to protect lives and property from waves, storms, and erosion."

In South Louisiana, where much of my work has been based over the past 10 years, the control of water permeates all aspects of life. In geological terms, floods formed Louisiana as snowmelt from as far west as the Rocky Mountains drained into the Mississippi River. When the development of the Mississippi Valley accelerated in the early 1900s, people sought ways to lock the river in place. The Flood Control Acts of 1928 and 1936 authorized the Army Corps to construct thousands of miles of levees—structures that were monumental in shaping the Louisiana landscape and would have massive environmental impacts in the decades to come.

Since the 1930s, approximately 2,000 square miles of the state's coast have sunk into the Gulf of Mexico. A plethora of maps and aerial surveys document this figure in attempts to convey the magnitude of what has already been lost to the sea.

A particular visual lexicon has emerged out of the desire to understand a "disaster" at this scale, one that seeks to make the complexity of changing landscapes legible in a compact form. The violence of climate change is often represented and communicated through images of flooding, destroyed buildings, and wildfires. But these events are seen through a narrow temporal lens that omits the many social, political, economic, and scientific reasons for the way disasters unfold.

In my work, I engage with the ongoing environmental crisis by looking at the ways architecture and infrastructure symbolize our beliefs about inhabiting space. I'm drawn to projects like the Lake Borgne Surge Barrier, which is nicknamed the "Great Wall of Louisiana" and is the largest design-build project in the history of the Army Corps of Engineers. It is a physical monument of our relationship with the natural world.

I'm also drawn to invisible infrastructures—like flood insurance—that continue to alter the landscape and built environment. Beginning in the 1960s, the National Flood Insurance Program further encouraged and incentivized the development of floodplains, and the downstream effects of these policies are now clear—for example, the flooding in Houston after Hurricane Harvey. Flood insurance also dictates the elevation of structures throughout South Louisiana, which is why so many houses are raised 12–20 feet in the air.

These subtle changes in the built environment speak to how we view our relationship to the earth and with each other. The boundaries always seem to be shifting, and yet they also stay the same. Although our tools and strategies for building have become more complex, we still all need shelter, security, water, and community.

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VIRGINIA HANUSIK, *Grand Isle, Jefferson Parish,* 2021.

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Blue tarps layered over each other

The Gulf Coast has faced an exhausting run of hurricanes: Ivan, Katrina, Rita, Wilma, Gustav, Ike, Isaac, Harvey, Irma, Michael, Barry, Sally, Laura, Delta, Zeta, Ida, Ian, and Idalia. Floods have been named for the holidays they disrupted—the Tax Day and Memorial Day floods in Texas, for example—but many more have gone unnamed. Some, like the 2016 Louisiana flood, cause massive damage all at once; others, like street flooding in New Orleans, cause chronic damage over time.

And the Gulf has battled many other disasters. Katrina caused, at the time, the second-largest oil spill in US history, a record far surpassed just five years later by the BP oil disaster. Chemical plant explosions regularly rock communities across Texas and Louisiana. In Mississippi, Jackson has gone without reliable drinking water, while the threat of saltwater intrusion up the Mississippi River in Louisiana looms. Parts of the region have experienced weeks without power, from the Texas-Louisiana freeze to Hurricane Ida. Tornadoes have become even more frequent across the land as Tornado Alley makes a shift east. Wildfires in Louisiana and Florida have filled the air with smoke. COVID-19 preyed on areas with high poverty rates and poor access to health care. And all the while, the Gulf slowly rises.

VIRGINIA HANUSIK, *Near Delacroix, St. Bernard Parish,* 2015.

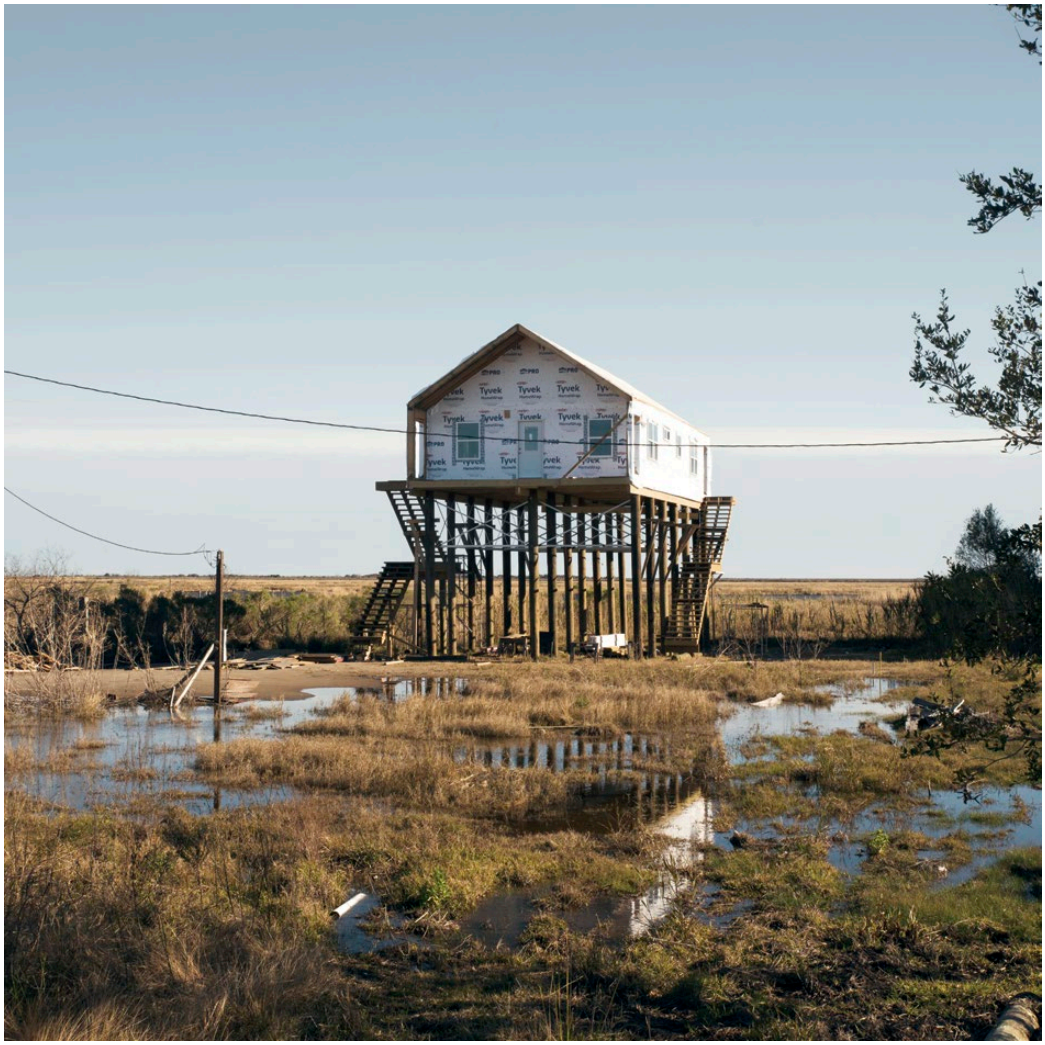
On paper, these 150 presidential disaster declarations, plus others that did not meet the federal threshold, are treated as individual disasters—but in reality, their impacts compound. In southeast Texas, homeowners became trapped in a disaster cycle when they could not rebuild before the next flood came. In Lake Charles, Louisiana, the blue tarps are layered over each other. In Florida, hurricane debris became fuel for wildfires.

Writers have long described the trials and calamities of the Gulf—from Europe's brutal colonization of Native tribes to the area's central role in slavery—as the origins of an assemblage of discrimination that residents today continue to navigate and endure. These legacies have paved the way for the future to arrive faster in the Gulf than in other parts of the country. The Gulf is an epicenter where both the causes and consequences of climate change collide with a history of policies that have entrenched social vulnerability.

To the extent that the US government has attempted to address climate change, it has focused largely on the reduction of CO_2 emissions rather than the increasingly critical problem of adaptation. This choice has strained the emergency management system—which is already falling short. To better understand the current and future ability of the emergency management system to meet the needs of the Gulf Coast, it is instructive to start with an understanding of the history of how this system was created.

Inventing emergency management

In 1965, across the wetlands we are now replanting, Hurricane Betsy arrived as a Category 4 storm. In 1969, Hurricane Camille made landfall as a Category 5 just to the east. Although hurricanes had always affected the area, these storms were different, not only in terms of scale of destruction but also because the United States now had a



VIRGINIA HANUSIK, *Construction near Lake St. Catherine, Orleans Parish*, 2020.

civil defense system. Created in the wake of World War II to prepare Americans for nuclear attack, this system was beginning to be repurposed for other disasters. Betsy and Camille (along with the 1964 Alaska earthquake) were the first big tests of whether activating a pre-existing system to respond to a disaster would work.

At the time, the public's attitudes about the role of government in times of crisis were shifting toward an expectation that the government could and should respond immediately when disaster struck. Although much of the new field's attention was focused on how to respond to a nuclear attack, these other disasters helped spur conversations about the need for a national all-hazards emergency management system. And some envisioned a well-tuned system that could help communities before, during, and after disasters.

Despite consensus across presidential administrations that having a way for the federal government to help in moments of crisis was important and necessary, the mechanism remained elusive; funding and organization frequently shifted between civilian and military. There was even a point during the Kennedy administration when the location and authority of civil defense changed monthly. In 1979, at the behest of the National Governors Association, President Carter signed an executive order establishing the Federal Emergency Management Agency (FEMA), and the transformation of civil defense into emergency management as we know it today began.

From the beginning, the emergency management system was based on two fundamental pillars. The first was that emergency management should take an all-hazards approach. This meant that agencies would plan for any hazard that could happen, from hurricanes to terrorist attacks. The second was that emergency management must be comprehensive. This meant emergency management

VIRGINIA HANUSIK, *Construction near Lake St. Catherine, Orleans Parish*, 2020.

agencies should address all four phases of the disaster cycle: mitigation, preparedness, response, and recovery—each one in concert with the others. Neglecting just one phase would undermine the overall effort.

Throughout the 1980s and 1990s, the federal government increased its investments in disaster mitigation and developed national disaster recovery policies. Across the country, state and local emergency management agencies followed FEMA's lead as they chased mitigation grants from the new federal agency. Simultaneously, researchers in other disciplines expanded the work of disaster sociologists on human behavior. They began to untangle the complexities of managing disasters and started emergency management degree programs at universities.

Across the Gulf Coast, the transition to relying on a formal emergency management system led to the creation of local agencies that hired new staff (mostly white male veterans, building on the field's origins). In many counties and parishes, however, the responsibility of interfacing with FEMA often fell to the fire or police chief who, on paper, took responsibility for emergency management.

Through tornadoes, floods, and hurricanes, the emergency management system learned on the job. Following Hurricane Andrew in 1992, FEMA faced extensive criticism for a response that brought too little aid too slowly. The Clinton administration took note and appointed former Arkansas state emergency manager James Lee Witt as FEMA director—the first with actual emergency management experience, as opposed to a military background. The decision ushered in a period at FEMA referred to now as the "golden years." During this time, the agency was able to build relationships with local governments and administered a popular mitigation grant program, Project Impact, which enabled local communities to fund mitigation projects. By the end of the decade, emergency management agencies in Florida earned the reputation of being some of the most effective at emergency management in the country.

Even during FEMA's golden years, emergency management was a work in progress. But by 2000, just 20 years after

FEMA had been created, the US emergency management system in the Gulf and the rest of the country looked to be on a trajectory toward a future that evaluated risk more realistically, prioritized mitigating those risks, and had an emerging academic discipline to support that work. Then a disaster far from the Gulf threw the emergency management system off course.

A catastrophe bigger and more complex than any before

After 9/11, the Bush administration and Congress created the Department of Homeland Security (DHS). The FBI, National Security Agency, and other politically powerful agencies protected themselves from being swallowed into the behemoth, but FEMA was unsuccessful in lobbying to maintain its status as an independent cabinet-level agency. It became one of 22 agencies moved under DHS and, in the process, lost authority, status, funding, key personnel with expertise, and vision.

State and local governments scrambled as the federal government issued new training requirements that forced every emergency management and first-responder agency in the country to be retrained on a new system. The mandate was unfunded and difficult to implement. Furthermore, Congress shifted federal grants away from all-hazards preparedness and toward terrorism preparedness. The Gulf Coast, more than anywhere else in the country, bore the brunt of the consequences of these post-9/11 changes.

Amid this chaos and confusion came a catastrophe bigger and more complex than any before: Hurricane Katrina and the federal levee failures. Even before Hurricane Katrina made landfall, the impacts of these federal changes were felt. In Louisiana, the final phases of the now infamous Hurricane Pam exercise that effectively predicted the impacts of a storm like Katrina were cut from the budget, which meant that the problems identified were never addressed in the region's response plans. Although much of the criticism of Katrina and the levee failures was rightly placed on the incompetence of FEMA administrator Michael Brown, the Department of Homeland Security, and the Bush administration in general, the failures within the overall emergency management system were even bigger than the public understood at the time.

On top of the failed response, it quickly became clear that the government did not have a plan for recovery. In its absence, local residents, alongside volunteers from around the world, moved ahead, rebuilding homes nail by nail. An entire ecosystem of nonprofit organizations dedicated to rebuilding was created. Two million people are estimated to have volunteered their time for the Katrina response and recovery. While some of those organizations remain in the Gulf today, most have either disbanded or moved on to the next disaster.

Modern-day emergency management

Today the region has a web of emergency management agencies that quietly orchestrate the programs, projects, and plans that keep life on the Gulf possible, knitting together all levels of government, the private sector, nonprofit organizations, and the public. But this system is barely keeping up with the relentless disasters.

In many ways, the bones of the emergency management system are good. Government agencies at the local level (e.g., public works, planning offices, first responder agencies) and their state and federal counterparts (e.g., the Environmental Protection Agency, Department of Housing and Urban Development, Centers for Disease Control and Prevention) make up the core of the system. They create mechanisms to coordinate the many stakeholders and a shared language to ease communication. The private sector fills in through its role in restoring utilities and fulfilling contracts for everything from bringing in food and water to removing debris to rebuilding structures. Because the Gulf's oil, gas, and chemical operations themselves present risks to the public, close collaboration between industry and emergency managers is particularly important. The needs that go unmet by the public and private sectors are left to nonprofits and volunteers. In theory, it is easy to see how the many parts fit together to take a comprehensive, all-hazards approach that involves the whole community.

Emergency management agencies are at the center of getting this complex system to function, but as the country faces more disasters, more quickly, the ability of these agencies to do so is in trouble. The problems across the emergency management system range widely—from bungled responses to the deprioritization of mitigation, protection, and recovery—but what underlies them all is a lack of capacity.

Building local capacity

Most funding for emergency management comes when agencies' communities receive a presidential disaster declaration. This is extremely important funding that helps survivors and communities recover (a long and difficult process). The steady stream of declared disasters in the Gulf has meant that emergency management budgets look big on paper, but recovery is only one part of the disaster life cycle; there is much less being spent on preparedness efforts, including building the capacity of the emergency management system.

This underfunding of preparedness creates a context where local emergency management agencies not only struggle to respond to disasters in a community but also lack funds and personnel to reduce its vulnerability. Research has found that for every $1 the federal government spends on mitigation projects, around $6 is saved in response and recovery.

For some emergency managers in the Gulf, this cycle of disaster and response has been going on for years. When Edward McCrane Jr. first arrived at Sarasota County Emergency Management during Florida's response to Hurricane Wilma in 2005, he discovered that the staff was worn out by two years of nonstop hurricane seasons. As other disasters came throughout his 18-year tenure, he tried to implement better strategies to divvy up the work, but it remained a persistent difficulty.

McCrane explained to me the challenge of understaffing in the field: an agency with just one emergency manager is expected to meet the same set of regulatory requirements as an agency of 30. One person working only 20 hours a week simply cannot navigate the Army Corps of Engineers planning process for building a levee while also building relationships across the community to encourage preparedness, leading responses to disasters, and being ready to manage the rebuilding of a town. It is not that emergency managers should not be doing all these tasks, but rather that they need the staffing and resources to do comprehensive emergency management well. McCrane noted that his agency was better off (with some half-dozen staffers) than the many others that must make do with a part-time emergency manager or even a volunteer emergency manager.

I spoke with several Gulf Coast emergency managers who, although they are working hard to meet the needs of their communities, say they lack the resources, people, expertise, and authority to do so fully. Without increasing their capacity, there is little chance that emergency management agencies will have the ability to do mitigation, preparedness, response, and recovery effectively.

Sandra Tapfumaneyi, who took over in Sarasota when McCrane retired last year, said she would like to expand the work of the agency to emerging hazards and broader pre-disaster recovery planning. Cybersecurity is a growing concern because of increasing ransomware attacks on critical infrastructure—such as hospitals and water treatment and industrial facilities—as well as misinformation campaigns during disasters. Emergency managers know these tasks are important, but they often fall to the bottom of the list because there are no legal requirements to address them. As Tapfumaneyi put it, she needs more staff to be able to "tackle some of the 'extra.'"

One consequence of this feeling of constantly falling short on staffing and to-do lists is significant amounts of burnout among emergency managers. Kesley Richardson, who works at the intersection of emergency management and public health, estimated that in the last emergency management agency he worked in, the average turnover rate was six months. Emergency management agencies cannot effectively meet the needs of communities in crisis when they themselves are in crisis.

Burnout is not only a problem for local agencies; it also affects the overall emergency management system, which counts on calling in emergency managers from across the country to pitch in when disaster strikes. If disasters are rare, this process works well, but the system has become strained. For example, during the 2017 hurricane season, the US emergency management system had to respond to Hurricanes Harvey, Irma, and Maria in the span of just two months. By the time Hurricane Maria reached Puerto Rico, many of FEMA's resources were already deployed to Texas and Florida.

In 2023, the Government Accountability Office reported that FEMA had a staffing gap in 2022 of 35%—6,200 people. These staffing issues are at once a consequence and an accelerator of the problems caused by uneven and unpredictable agency budgets. A relatively small amount of money ($355 million in 2023) is divvied up annually among the states for capacity-building and preparedness efforts through FEMA's Emergency Management Performance Grant (EMPG) program. It is left up to the states to decide how that money is spent. Some states keep the EMPG funding for the state agency while others distribute the funding at the local level, with the result that county governments generally contribute very little funding to the day-to-day work of emergency management agencies. Many—particularly those in rural areas—are just scraping by.

One way to address the growing response needs is to build the capacity of all local agencies so they are more self-sufficient as well as better equipped to send help to other parts of the country. Local emergency management agencies are the roots in each community that facilitate the rest of the emergency management system, but they have very little power to increase their own funding. FEMA and Congress could both direct additional funds into local capacity-building. Governors, state legislatures, and city and county governments also need to increase their investment in emergency management. Doing so could expand the resources directly available to residents before, during, and after a disaster. There could be state-funded household recovery programs, for example, for those who do not meet the requirements of federal assistance. Such investments would both strengthen local agencies and enable better emergency management across the region.

An emerging discipline

In addition to increasing local capacities, an effort should be made to root the disaster system in empirical research. Today's practice is selectively learning from recent failures. Since the early days of emergency management, agencies have written an after-action report following disasters to outline what went well and what should be changed for the next disaster. If an approach was altered, it was usually based on these reports. But of course, no two disasters are the same. There's a danger in basing emergency management responses

on a single past event. A better way to determine future actions would be for researchers to synthesize empirical research findings across many disasters.

For example, there are important distinctions among what we colloquially call "disasters." Current emergency management practice recognizes that emergency response and disaster response are distinct from one another, but it does not recognize the distinction between a disaster and a catastrophe. The 2023 tornadoes outside New Orleans were emergencies handled using local resources. By contrast, the BP oil spill was a disaster—requiring federal resources. And Katrina along with the levee failure was a catastrophe, overwhelming even federal resources.

Researchers have demonstrated that the way people respond to an emergency is not the same as the way we should respond to a disaster, or to a catastrophe. This distinction needs to underlie the research that is done post-disaster and inform the generalizability of findings. It is not appropriate to apply the findings from one type of event to another. Adopting the hazard scale in emergency management policy would enable better use of resources to prepare for, respond to, and manage such crises.

The link between many common emergency management practices and outcomes is simply underexplored. If a community has an existing shelter plan, does that lead to better outcomes when a shelter is opened? Or has the turn toward framing disaster work around the vague language of "resilience" led to more effective outcomes?

There is reason to think that some of the traditional approaches taken in emergency management are not effective, or at least not as effective as they could be if they were done holistically. For example, the public is advised to prepare by assembling a "kit" that may include flashlights, canned goods, and other supplies. These items, although based on common sense, are not empirically grounded. It is not clear that these are the items most needed to survive a given disaster. In fact, evidence suggests that there are many other factors such as social networks, technological integration, and adaptive capacity that are equally or even more important.

Further, the current approach to individual and household preparedness falls short of incorporating the ability to prepare for both response and recovery. Researchers Trevor Johnson and Jessica Jensen point out that the "kit" approach does not include items that can be used to repair a damaged home, nor does it help people apply for government aid or otherwise navigate post-disaster logistics. By contrast, a more holistic view of preparedness engages with the many factors that influence individuals' and households' ability to survive and recover from disasters. This is the type of research that emergency management scholars can produce that, if brought into policy and practice, could lead to more effective outcomes.

It is abundantly clear to emergency management researchers and many practitioners that this work must be done—but it's difficult to accomplish. Funding aside, there are few people to do the research. Although there are many disaster researchers, there are only around 60 people in the United States who have a PhD in emergency management, and some of those programs are being cut. Support for the development of additional emergency management doctoral programs is needed for the discipline to be able to meet the challenges of practice.

The National Science Foundation is well positioned to support development of holistic emergency management research and facilitate its movement into practice. Research grants for basic emergency management research should also include funding to hire dedicated science communicators to help translate the findings into policy and inform the wider community. This support, paired with increased funding for state and local agencies, would enable emergency managers to address the full and evolving range of tasks involved in comprehensive emergency management.

Defining the future

Building community resilience to climate and other hazards requires both collective action and attention to root-building—much like planting grasses in Louisiana's coastal wetlands. In the same way that California bulrushes can withstand a storm surge when planted together, so too can well-resourced local emergency management agencies help the region weather the effects of a changing climate.

Members of the US emergency management system are among those who should be leading this endeavor. Increasing the capacity of emergency management agencies throughout the Gulf would enable emergency managers to work across mitigation, preparedness, response, and recovery and so reduce impacts on their communities. Moreover, expanded capacity would strengthen the whole region as it faces compounding disasters. And, among the bulrushes, it's also possible to see how empirical research on mitigation, combined with deliberate coordination of both government and volunteer resources, could help to build a Gulf less defined by disasters and more free to define its future.

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This is the third of three articles reporting on energy, environment, and society in the Gulf of Mexico. The series is made possible by funding from the Gulf Research Program to mark the tenth anniversary of its founding.