KATIE PICCHIONE AND LAUREN FINEGAN

# The Case for a National Disaster Research Strategy

An integrated, interdisciplinary national research strategy is urgently needed to strengthen the country's efforts to prepare for, respond to, and recover from disasters.

The study of disasters is impressively multisectoral and interdisciplinary. Academics, government practitioners, private sector researchers, and even volunteers have developed knowledge in disciplines that include meteorology, geology, climate science, sociology, emergency management, risk analysis, engineering, economics, epidemiology, psychology, and public health. This interdisciplinarity could be a strength, yielding new insights that could be applied across many contexts. But it is not yet coordinated in ways that could magnify impact and contribute to improving disaster management on the ground. Studies of disasters and emergency management are generally too limited and siloed, focusing on describing individual disasters that have already occurred, documenting successes and failures, and treating each as a stand-alone incident. Having observed these shortcomings many times over the past decade in our various roles as practitioners, university researchers, and federal researchers, we propose that an integrated, interdisciplinary national research strategy is urgently needed to strengthen the country's efforts to prepare for, respond to, and recover from disasters.

## Disasters are changing

Record-breaking disasters have become the norm in recent years, and their effects stretch ever further afield. In 2024 alone, a trio of extraordinary hurricanes—Beryl, Helene, and Milton—caused extreme flooding and hundreds of deaths. Then, widespread drought in the northeastern United States led to hundreds of fires in October and November of 2024. Massachusetts, which typically sees fewer than 20 wildfires during the month of October, had 200 in October 2024. Spread across thousands of communities, these disasters not only destroy homes and infrastructure, they also impair people's mental and physical health.

Disasters now seep into other domains as well, creating broader challenges to the economy and national security. In 2022, for example, droughts caused record-low water levels on the Mississippi River and in the Panama Canal, limiting cargo operations on both of those critical waterways and impacting global trade. Thousands of barges were backed up on the Mississippi, which typically moves more than 90% of US agricultural exports. As the drought dragged on, backups continued and exports from Louisiana ports fell by an estimated half a billion dollars. Meanwhile, low rainfall decreased water levels in the Panama Canal, reducing its flow of traffic by 10%. Not only did these disruptions affect American farmers, they disrupted food supplies in other countries.

Further, in today's global information environment, local disasters do not stay local. The 2020 Homeland Threat Assessment released by the US Department of Homeland Security cites natural disasters as one of the most direct and pressing national security threats to the country. "Disasters pose a significant threat to human health and safety, property, critical infrastructure, and homeland security while subjecting the nation to frequent periods of insecurity, disruption, and economic loss," says the report. The 2025 assessment claims that China has intentionally targeted US disaster response

with disinformation that "could impact recovery activities and place emergency management personnel, facilities, and survivors at risk." In 2023, for example, disinformation campaigns falsely blamed the Lāhainā Hawaii wildfires on US military activity, potentially reducing trust in US institutions and officials and dissuading survivors from pursuing federal recovery response and support.

## Disaster research needs to change too

Even though disasters are evolving rapidly across domains, research has stayed relatively siloed. This is not for lack of research on the subject. A 2018 review of 30 years of disaster literature found almost 10,000 relevant publications in more than 900 multidisciplinary journals. The problem is that the research is so interdisciplinary that it lacks a unifying theoretical basis, and although interdisciplinary research is essential to developing applications, much disaster research exists *only* in the interdisciplinary space. A 2021 systematic literature review found that disaster research primarily comprises "single case studies and exploratory research," and another review found the literature to be largely descriptive and "lacking in objective, postdisaster evaluations." Or, as emergency management researcher Samantha Montano points out in her recent *Issues* article, we are "selectively learning from recent failures," referring to the practice of after-action reporting focused on what went well and what did not go well after a disaster, rather than a systematized approach to generalizing and applying findings. Even the examples we present in this article demonstrate the severity and impact of disasters on the ground, rather than theoretical or cross-disciplinary frameworks for understanding disaster management. This gap needs to be filled.

Among the federal agencies that fund disaster research, such as the National Oceanic and Atmospheric Administration (NOAA), US Geological Survey, and Environmental Protection Agency, there is no overarching strategy relating the disparate fields, and jumps are rarely made across siloes. Each agency studies natural hazards and applies that knowledge to carry out operational response activities mandated by Congress. Thus research on hazards themselves is often entirely divorced from supply chain management research, studies on economic shocks, building science, the development of technological capabilities to assist disaster management, the social sciences, or pockets of disaster research in any other discipline.

Even within agencies, there is rarely a design or strategy driving the research. Rather, in the bubble of each agency, research direction often comes in the form of grants awarded through programs that grew organically where the need for scientific rigor was perceived. For example, the now-sunsetted National Science Foundation (NSF) Disaster Resilience Research Grant and Humans, Disasters, and the Built Environment programs offered a small number of grants each year; this research is now being incorporated into the Infrastructure Systems and People grant program. In addition to that grant program, NSF, along with a combination of other federal agencies, provides funding to the Natural Hazards Center to serve as the designated clearinghouse for the social dimensions of hazards and disasters, among other research. The Department of Homeland Security's Science and Technology Directorate funds university and private sector organizations to develop and commercialize niche technology solutions that often are not tied to emergency management priorities nor effectively integrated into practice. In this way, each agency independently sets priorities, makes research funding decisions, and disseminates findings.

Lack of coordination and strategy is particularly evident at the Federal Emergency Management Agency (FEMA), which maintains several decentralized research-oriented components, including the Building Science Division, the recently formed National Disaster & Emergency Management University (NDEMU), and ad hoc research partnerships with companies, universities, and Federally Funded Research and Development Centers. One of the NDEMU's three schools, the School of Disaster Leadership, emphasizes research. FEMA is also one of four federal agencies that have contributed to the National Earthquake Hazards Reduction Program, and the National Windstorm Impact Reduction Program, whose aims include research on these specific hazards. Each of these research efforts has a well-defined, limited scope and operates largely on its own. Research priorities are not coordinated even within FEMA, let alone with other agencies.

One effect of this dearth of coordination is that emergency management lacks institutional infrastructure that might aid in translating research to real situations. This shortcoming is most noticeable in the way emergency managers and first responders must use technology that is 10–15 years behind what is widely available to the public. For example, even though overhead imagery has been a valuable resource for disaster response since the 1906 San Francisco earthquake (when kite photography provided the first aerial view of disaster damage), emergency managers today often don't have access to remotely sensed data. Of course, commercial satellite and aerial imagery is widely used by the insurance industry to assess damage, but cost, coordination failures, lack of technical knowledge, and unclear requirements for requesting access leave overhead imagery out of reach for all but the most catastrophic incidents. These challenges could be relatively easy to overcome with solutions designed specifically for the emergency management community, rather than improvised on the fly from other applications.

## Developing a National Disaster Research Strategy

To bridge the gap between research and practice across multiple disciplines, we recommend the federal government

develop a National Disaster Research Strategy to provide priorities and goals for research, development of advanced technologies, and flagship programs that benefit the whole community. The strategy could be developed through collaboration between the federal agencies involved in disaster management and federal science agencies; state, local, tribal, and territorial emergency managers; volunteer agencies; private sector partners; professional associations; and academic researchers.

Following the precedent of similar research agendas such as the NASA Decadal Surveys, the strategy could be revised every 6–10 years, with short-term goals and priorities set annually. Long revision cycles allow time for implementation and technological advancement while spanning federal administration changes. The strategy should promote research activities across Technology Readiness Levels, from basic research to commercialization. A congressional mandate and appropriation for a decadal survey (perhaps with coordination from the National Academies of Sciences, Engineering, and Medicine) would reduce waste and duplication in disaster research, while magnifying its impact and improving disaster response, recovery, and resilience in the United States.

## Bringing research to the schoolyard

The creation of a strategy for disaster research alone is not enough. The research must get to the people who need it most: disaster survivors and emergency managers in the field. However relevant the research, if studies remain sequestered in journals or if their recommendations and conclusions are uninterpretable by responders in the field, their influence will be limited. Insights from individual studies, and cross-analysis of those studies, must be clearly communicated to emergency managers and other responders, as well as to citizens living in harm's way. Thus, whatever agency is overseeing the coordination of the research must be poised to communicate new information and insights in a way that responders, managers, and the public can proactively use.

We have seen what it looks like when insights from scientific research are applied to real lives. One example comes from the spring 2011 tornado outbreak, which saw more than 360 tornadoes hit several Southern states, killing hundreds of people. Schools that were in the path of the tornadoes, including Alberta and University Place elementary schools in Tuscaloosa, Alabama, were significantly damaged. Fortunately, school had let out before the storms hit so no one was hurt, but this near-miss inspired action.

Immediately following the 2011 storms in Tuscaloosa in April and Joplin, Missouri, in May, FEMA deployed a team of researchers that included academics, agency and outside experts, and representatives from the National Institute of Standards and Technology and NOAA as well as other organizations. Findings from their field research and recommendations for building performance improvements were summarized in FEMA's *Mitigation Assessment Team Report*. The study's conclusion was that the damage patterns of these storms indicated that schools in tornado-prone areas should have dedicated tornado shelters. In part based on those findings, the 2015 update of the International Building Code incorporated a requirement that tornado shelters be included in school facilities with 50 or more occupants. The study also produced recommendations for homes and businesses to build back stronger for the next tornado, including guidance for wind resistance and debris impact protection. In a full-circle moment, the University Place Elementary School in Tuscaloosa reopened its doors in August 2013, just over two years after the tornadoes destroyed it. Even ahead of the 2015 code requirements, the school incorporated a safe-room facility in the new building.

To ensure that research that translates to on-the-ground safety becomes the rule rather than the exception, it must be coordinated at the highest level. Ideally, a federal entity—such as FEMA, DHS, the White House Office of Science and Technology Policy, NASA, NOAA, or a federal advisory council—would bring together stakeholders from every corner of the emergency management and academic community to develop a cohesive strategy. At the same time, that entity, or another one, needs to oversee the execution of the strategy, coordinate research funding, set short-term priorities, link related projects, avoid redundancies, and transition findings and advancements to practice. It is essential to ensure that the results of the coordinated research make their way to those who can apply them to save lives and property, accelerate recovery, and fortify national security.

Given today's rapidly changing policy landscape and the shifting discourse on the role of the federal government in emergency management, the prospects for a federally coordinated strategy for disaster research and communication seem unlikely in the short term. But this same uncertainty creates incentives for emergency management practitioners and disaster researchers at every level to identify areas where priorities align with areas of active research. Entities such as the Natural Hazards Center are already embarking on such efforts. This is a time to build relationships across government agencies at every level, universities, nongovernmental organizations, and the private sector, with an eye toward increasing collaboration. Emergency management requires the whole community—including the research community—to achieve resilience in the face of intensifying disaster risk.

***Katie Picchione*** *currently serves as the response coordination lead for the NASA Disasters Response Coordination System. She previously held roles at the MIT Lincoln Laboratory and the FEMA Response Geospatial Office.* ***Lauren Finegan*** *is a researcher in the Humanitarian Supply Chain Lab at the MIT Center for Transportation and Logistics.*