RESEARCH COUNTS

VOLUME II

NATURAL HAZARDS CENTER

University of Colorado Boulder

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VOLUME II

Catastrophic. Historic. Unprecedented. Unbelievable.

These are just a few of the words now regularly used by the media when attempting to characterize disasters that seem beyond description.

Every year, hurricanes, floods, tornadoes, wildfires, and other environmental extremes destroy critical infrastructure and cost taxpayers billions of dollars. They kill, injure, and displace people, especially the most vulnerable among us. But while recent disasters have shattered historical records, in many ways, they are not without precedent.

Hazards and disaster researchers have consistently and systematically studied the causes and consequences of such events for decades. This research community has amassed an enormous amount of knowledge on everything from the root causes of disaster to the long-term ramifications of unjust recovery policies.

Make no mistake, with each fresh catastrophe comes new questions and new opportunities for learning. There are, however, also important commonalities across disasters that have been documented time and again.

These lessons from past disasters matter, and we must make them widely available. In this era of the mega-disaster, the stakes are too high for findings to be inaccessible behind journal paywalls. The decisions that are being made are too consequential for evidence-based insights to be sidelined. Facts matter. Research counts.

The Natural Hazards Center is committed to uplifting the work of others and bringing it to new audiences. To that end, we launched the ***Research Counts*** initiative in 2017. Since then, this series has served as an important platform for hazards and disaster researchers to share enduring lessons as well as cutting-edge research findings. It has also provided a forum for raising new questions worthy of exploration and identifying urgent challenges in need of solutions. The pieces in the series are brief and intended for broad consumption. We want to work with our community to get this knowledge into the hands of those who need it most.

This latest volume of Research Counts includes 29 original briefs from experts in a variety of disciplines, ranging from anthropology to engineering. These scholars have lent their voices to help us understand catastrophes that disrupt lives and livelihoods and place them in a broader context. Hazards and disaster researchers have long shown a deep commitment to sharing their knowledge with practitioners, policymakers, and the public to help reduce risk and to ameliorate the suffering caused when disaster strikes. This collection is a testament to that.

As more people and places are affected by disaster with each passing year, it is crucial that our research community responds by sharing the lessons learned from previous and ongoing work with a larger public audience. Thank you to those who contributed to this volume and thank you to those who take the time to read these pieces and move them into action.

Please take care of yourself and others.

Lori Peek, Director
Natural Hazards Center

Peek, L. (2017 / 2025). Research Counts. *Research Counts 1-2*(1). Boulder, CO: Natural Hazards Center, University of Colorado Boulder. **https://hazards.colorado.edu/news/research-counts/research-counts**

RESEARCH MATTERS, AND WE WANT TO HELP MAKE IT COUNT.

ABOUT THE AUTHOR

LORI PEEK is professor in the Department of Sociology and director of the Natural Hazards Center and CONVERGE at the University of Colorado Boulder. She is author of ***Behind the Backlash: Muslim Americans after 9/11***, co-editor of ***Displaced: Life in the Katrina Diaspora*** and the ***Handbook of Environmental Sociology***, and co-author of ***Children of Katrina*** and ***The Continuing Storm: Learning from Katrina***. She also served as a contributing author to FEMA P-1000 ***Safer, Stronger, Smarter: A Guide to Improving School Natural Hazard Safety***.

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Residents evacuating Miami Beach after mandatory order ahead of Hurricane Irma in 2017. Source: Felix Mizioznikov/Shutterstock, 2017.

EVACUATION OBSTACLES

WHY SOME PEOPLE REMAIN IN HARM'S WAY DURING DISASTERS

BY CARSON MACPHERSON-KRUTSKY

FEBRUARY 18, 2025

This article was first published on October 10, 2024, by **The Conversation**.

As Hurricane Milton roared ashore near Sarasota, Florida, tens of thousands of people were **in evacuation shelters**. Hundreds of thousands more had fled coastal regions ahead of the storm, **crowding highways headed north and south** as their counties issued **evacuation orders**.

But not everyone left, despite dire warnings about a hurricane that had been **one of the strongest on record** two days earlier.

As **Milton's rain and storm surge** flooded neighborhoods late on Oct. 9, 2024, 911 calls poured in. In Tampa's Hillsborough County, more than **500 people had to be rescued**, including **residents of an assisted living community** and families trapped in a flooding home after **a tree crashed though the roof** at the height of the storm.

In Plant City, 20 miles inland from Tampa, at least **35 people had been rescued** by dawn, City Manager Bill McDaniel said. While the storm wasn't as extreme as feared, McDaniel said his city had flooded in places and to levels he had never seen. Traffic signals were out. Power lines and trees were down. The sewage plant had been inundated, affecting the public water supply.

Evacuating might seem like the obvious move when a major hurricane is bearing down on your region, **but that choice** is not always as easy as it may seem.

Evacuating from a hurricane requires money, planning, the ability to leave, and, importantly, a belief that evacuating is better than staying put.

I recently examined **years of research** on what motivates people to leave or seek shelter during hurricanes as part of a project with the Federal Emergency Management Agency and the Natural Hazards Center. I found three main reasons that people didn't leave.

EVACUATING CAN BE EXPENSIVE

Evacuating requires transportation, money, a place to stay, the ability to take off work days ahead of a storm, and other resources that many people do not have.

With **1 in 9 Americans facing poverty today**, many have limited evacuation options. **During Hurricane Katrina in 2005**, for example, many residents did not own vehicles and couldn't reach evacuation buses. That left them stranded in the face of a deadly hurricane. Nearly 1,400 people died in the storm, many of them in flooded homes.

When millions of people are **under evacuation orders**, logistical issues also arise.

Gas shortages and traffic jams can leave people stranded on highways and unable to find shelter before the storm hits. This happened **during Hurricane Floyd** in 1999 as 2 million Floridians tried to evacuate.

People who experienced past evacuations or saw **news video of congested highways** ahead of Hurricane Milton might not leave for fear of getting stuck.

HEALTH, PETS, AND BEING PHYSICALLY ABLE TO LEAVE

The logistics of evacuating are even more challenging for people who are disabled or in nursing homes. Additionally, **people who are incarcerated** may have no choice in the matter – and the justice system may have few options for moving them.

Evacuating nursing homes, people with disabilities, or prison populations is complex. Many shelters are not set up to accommodate their needs. **In one example during Hurricane Floyd**, a disabled person arrived at a shelter, but the hallways were too narrow for their wheelchair, so they were restricted to a cot for the duration of their stay. Moving people whose health is fragile, and doing so under stressful conditions, can also worsen health problems, leaving nursing home staff to make difficult decisions.

But failing to evacuate can also be deadly. During Hurricane Irma in 2017, seven nursing home residents **died in the rising heat** after their facility lost power near Fort Lauderdale, Florida. In some cases, public water systems are shut down or become contaminated. And **flooding can create several health hazards**, including the risk of infectious diseases.

In a study of 291 long-term care facilities in Florida, **81% sheltered residents in place** during the 2004 hurricane season because they had limited transportation options and faced issues finding places for residents to go.

People with pets face another difficult choice—some choose to stay at home for fear of leaving their pet behind. Studies have found that **pet owners are significantly less likely to evacuate** than others **because of difficulties** transporting pets and finding shelters that will take them. In destructive storms, it can be days to weeks before people can return home.

RISK PERCEPTION CAN ALSO GET IN THE WAY

People's perceptions of risk can also prevent them from leaving.

A series of studies show that **women and minorities** take **hurricane risks more seriously** than other groups and are **more likely to evacuate or go to shelters**. One study found that women are almost **twice as likely** than men to evacuate when given a mandatory evacuation order.

People navigate flooded streets in Houston, TX after Hurricane Harvey in 2017. Source: Irina K/Shutterstock, 2017.

A sign directs hurricane evacuees to safety. Source: Darwin Brandis/Shutterstock, 2017.

Lonestar College in North Harris, TX became a shelter after Hurricane Harvey in 2017. Source: All Stock Photos/ Shutterstock, 2017.

If people have experienced a hurricane before that didn't do significant damage, they may perceive the risks of a coming storm to be lower and not leave.

In my review of research, I found that many people who didn't evacuate **had reservations about going to shelters** and **preferred to stay home** or **with family or friends**. Shelter conditions were sometimes **poor, overcrowded, or lacked privacy**.

People had fears about safety and whether shelter environments could meet their needs. For example, **religious minorities** were not sure whether shelters would be clean, safe, have private places for religious practice, and food options consistent with faith practices. **Diabetics** and **people with young children** also had concerns about finding appropriate food in shelters.

HOW TO IMPROVE EVACUATIONS FOR THE FUTURE

There are ways leaders can reduce the barriers to evacuation and **shelter use**. For example:

- Building more shelters able to withstand hurricane force winds can create safe havens for people without transportation or who are unable to leave their jobs in time to evacuate.
- Arranging more shelters and transportation able to accommodate people with disabilities and those with special needs, such as nursing home residents, can help protect vulnerable populations.
- Opening shelters to accommodate pets with their owners can also increase the likelihood that pet owners will evacuate.
- Public education can be improved so people know their options. Clearer risk communication on how these storms are different than past ones and what people are likely to experience can also help people make informed decisions.
- Being prepared saves lives. Many areas would benefit from better advance planning that takes into account the needs of large, diverse populations and can ensure populations have ways to evacuate to safety.

An aerial view captures a car driving through a flooded street after Hurricane Milton made landfall, navigating the aftermath of heavy flooding. Source: Shutterstock, 2024.

ABOUT THE AUTHOR

CARSON MACPHERSON-KRUTSKY is a research associate at the Natural Hazards Center. She uses social science methods to investigate what motivates people to take protective actions and which risk communication styles are most effective. MacPherson-Krutsky is also interested in creating multimedia products—infographics, websites, videos, workshops—that convey technical information in user-friendly ways. She holds a bachelor's from Western Washington University, a master's from University of Montana, and a PhD from Boise State University. She is passionate about making connections across disciplines, sectors, and with community members to ensure that research can help support real world decision-making in communities of all shapes, sizes, and backgrounds.

CITATION

MacPherson-Krutsky, C. (2025). Evacuation Obstacles: Why Some People Remain in Harm's Way During Disasters. *Research Counts*, *2*(29). Boulder, CO: Natural Hazards Center, University of Colorado Boulder. **https://hazards.colorado.edu/news/research-counts/evacuating-in-disasters-like-hurricane-milton-isnt-simple-there-are-reasons-people-stay-in-harms-way**

HAZARDS BEHIND BARS

HOW COLORADO'S INCARCERATED PEOPLE ARE EXPOSED TO EXTREME WEATHER

BY SHAWHIN ROUDBARI AND SHIDEH DASHTI

FEBRUARY 18, 2025

This article was first published on January 22, 2025, by **The Conversation**.

Incarcerated people in Colorado are exposed to climate-related extreme heat and cold, plus flooding and wildfires. Because they're unable to escape these hazards, their health suffers and some die.

"I remember it being summer, and there's no way to get away from the sun. And I remember people just burning," said one formerly incarcerated person. "My [cellmate] at the time, … he was out there all day. And he was so purple, and he had edema on his head so bad, you could put your thumb in his forehead and [the print] would just stay."

Another person recounted how they would escape the heat by pouring water on the ground of their cells to form a shallow pool.

"Granted, it was only a quarter-inch, at the most, deep," they said. "But you would just strip down to your boxers and just lay on the floor in the water."

Exposure to extreme heat, and other hazards caused by climate change, are **not unique to Colorado's prisons and jails**. A study that looked at deaths of incarcerated people between 2001 and 2019 in Texas found that of more than 3,000 deaths in that time period, or 13%, could be attributable to extreme heat.

The **intensity and frequency of climate disasters** are increasing at the same time as **1.2 million people are incarcerated in the U.S.**.

Incarcerated people **lack the ability to evacuate** or otherwise protect themselves from heat, cold, wildfire or the effects of these disasters. This simple fact led us to investigate the **vulnerability of incarcerated people** to climate hazards in Colorado.

We are a collective of scholars in **architecture**, **environmental communication**, **geotechnical hazards engineering**, **geography**, **sociology**, and **structural engineering**. We have spent the past four years scrutinizing the vulnerability of carceral facilities—buildings like prisons, jails, and detention facilities—to climate hazards. During that time, we also looked at the experiences of formerly incarcerated individuals. Our research has resulted in three papers, **an exhibit at the University of Colorado Boulder**, and two symposiums.

We analyzed the **exposure of 110 carceral facilities** in Colorado to wildfire, flood, extreme temperatures, and landslides. We did so by mapping facility location and hazard exposure for single and multiple climate events, such as floods or the combination of fire and heat.

We found that 75% of the facilities we studied had a moderate or high relative exposure to one or more of the hazards. These

facilities house **roughly 33,300 people**, or 83% of people incarcerated in Colorado.

STORIES OF INCARCERATED PEOPLE

In our most recent study from 2022 to 2023, we held a series of interviews and focus groups **with formerly incarcerated people in Colorado** to understand how climate hazards had affected their daily lives in detention.

We found that climate-related extreme temperatures, wildfires, and flood events affected the majority, about 65% of the 35 study participants. To check the validity of what we learned from this small sample, we compared the information we collected with other investigations and projects, and found they were aligned.

The people we interviewed experienced prolonged exposure to temperatures upward of 90 degrees Fahrenheit (32 Celsius) and below freezing, poor air quality, and water contamination. We found that Black and Latino **people were disproportionately exposed** to these hazards, based on the location of the facilities where they were incarcerated.

Their stories are harrowing.

"It was so cold at times in the winter that I would have every piece of clothing I had on," one participant said. "I was also afraid to go to sleep at night because it felt like it was so cold that I would not wake up. In the morning, there's steel toilets, and so you would have ice in your toilet."

Another participant described the smoke of a nearby wildfire.

"The smoke actually woke me up, and it was choking. I just couldn't breathe, and I was just coughing, coughing," the participant said. "I asked if I could go, like, to medical, and they were just like, 'No, you can't go to medical at this time. There's nothing we can do for you.'"

As **extreme temperatures become more common**, we believe such stories are important to collect. They offer insights into experiences that may otherwise remain unheard and provide data for a more accurate quantification of the risks incarcerated people face. Our hope is that documentation of actual conditions will provide evidence that can be used for advocacy and reform.

COMPOUNDING EFFECTS

We discovered three common ways incarcerated people cope with their climate vulnerability: by trying to modify their environment, making commissary purchases, and lodging formal complaints.

"[W]hen it's that hot, you're filling out that grievance, you're dehydrated because you can't go to the water fountain, everybody's mad, angry, pissed off," said one study participant. "You have symptoms of heat exhaustion, your brain is not firing on all cylinders, and you're sitting there trying to do the right thing, trying to follow their procedures."

This participant, and others, told us that if they made a mistake in their formal complaints—either by misspelling a word or using the wrong technical terminology for the problem at hand—their grievance could be dismissed.

The study participants also talked about retaliation for grievances. If they were to file a lawsuit, according to an interviewee, prison staff members are "going to make it the worst that it could possibly be." They feared **inmate privileges could be taken away** or, as one participant explained, people could be suddenly moved to another facility. That move could disrupt important connections with family, visitors, and their communities on the inside.

Experiences such as these were **corroborated by multiple participants**. Prison officials did not respond to our requests for more information about their facilities or the exposure of incarcerated people to extreme weather.

Denver County Jail. Source: Photo Denver/Shutterstock, 2019.

Colorado Territorial Correctional Facility. Source: Rosemarie Mosteller/ Shutterstock, 2023

LACK OF INSIGHT INTO PRISONS

Talking to formerly incarcerated people about their experiences made us eager to see the facilities we were studying ourselves to reliably assess risk, but it was almost impossible to get permission to **get inside prisons or talk to the people inside**.

Our requests to see building floor plans or engineering drawings, which would have allowed us to analyze the exposure of facility staff and incarcerated people to hazards such as extreme temperatures or flooding, were denied. Corrections officials said our requests raised **security concerns**.

Regardless of their function, jails and prisons must keep their occupants safe. We believe Colorado's current carceral infrastructure does not provide humane spaces that protect against increasingly intense and frequent climate hazards. This produces unjust human suffering and hampers the ability of people who are incarcerated to stay healthy.

ABOUT THE AUTHORS

SHAWHIN ROUDBARI is a faculty member at the Program in Environmental Design (ENVD) at the University of Colorado Boulder. He studies and teaches about ways designers organize to address social problems. Roudbari's work bridges studies of social movements and race with architectural theory. His research contributes to theories and practices of contentious politics and employs ethnographic and speculative design methods. Roudbari is a founding member of the DissentXDesign research collective, which publishes work in architectural, sociological, and interdisciplinary journals. He also organizes with Dark Matter University.

SHIDEH DASHTI is an associate professor in geotechnical engineering and geomechanics at the University of Colorado Boulder (CU) and the associate chair for administration in the Department of Civil, Environmental and Architectural Engineering. She also directs a college-funded interdisciplinary research theme titled RISE: Resilient Infrastructure with Sustainability and Equity. Dashti's research team studies the interactions and interdependencies among infrastructure systems during earthquakes and climatic extremes and the intersection of resilience, environmental sustainability, and justice.

CITATION

Roudbari, S., and Dashti, S. (2025). Hazards Behind Bars: How Colorado's Incarcerated People Are Exposed to Extreme Weather. *Research Counts*, *2*(28). Boulder, CO: Natural Hazards Center, University of Colorado Boulder. **https://hazards.colorado.edu/news/research-counts/extreme-heat-flooding-wildfires-colorados-formerly-incarcerated-people-on-the-hazards-they-faced-behind-bars**

FRAMING MATTERS

COMMUNICATING COASTAL REBUILDING TO THE PUBLIC

BY RISA PALM, TOBY BOLSEN, AND JUSTIN KINGSLAND

MAY 2, 2024

As climate-driven flooding becomes more common, policymakers and the public are more frequently confronted with two questions: whether to rebuild in flood-prone areas and who should be responsible for the cost repairing or replacing damaged homes and infrastructure. We wanted to know more about how the American public responds to arguments that support or oppose using federal assistance to rebuild in coastal flood zones, as well as how they receive arguments attributed to either Democrats and Republicans.

Our **research found** that public viewpoints about rebuilding and who should foot the bill were powerfully influenced by messages arguing for or against providing federal assistance. Furthermore, the responses of Democrats and Republicans were also impacted by whether messages were attributed to sources inside or outside of their identified affiliation.

MESSAGES FRAMES AND PARTISAN SOURCE CUES

Since the issue of federally subsidized rebuilding is a complex one, the way various arguments are presented can affect the way people think about the issue. This is supported by the **theory of message framing**. Different frames can increase or decrease support for federal contributions to rebuilding in coastal flood zones.

A message emphasizing that one basic purpose of government is to protect citizens—and that withholding federal assistance would leave many people homeless after a disaster—could increase support for rebuilding and solidify the belief that it is government's responsibility to provide aid. People might also respond favorably to arguments that rebuilding will benefit the local economy and that innovative and environmentally sensitive rebuilding can protect coastal habitats. Finally, highlighting the collective responsibility to help each other in times of crisis can also increase the perception that rebuilding in these areas is the right thing to do.

On the other hand, there are frames that could reduce support for federally funded rebuilding. A message positing that federal investments encourage development in high-risk areas, creating future risk for people and property, could increase opposition. Arguments that rebuilding is an inefficient and inequitable use of taxpayer money that can destroy natural ecosystems could also generate opposition. Another argument that could reduce support is that individuals can choose to live where they want, so it is their responsibility to assume the risks through private insurance or other means.

Furthermore, people take "cues" from others about whether they should pay attention to a message. People may trust some sources of information more than others. In a politically polarized society, a message from one's own political party may, for example, have more of an impact than one from the opposing party. This is an example of the effect of a partisan source cue. More generally, a message will be more impactful if the source of the message is trusted by the individual hearing the message.

WHO SHOULD PAY FOR REBUILDING?

To study the impact of these messages and cues on rebuilding, we surveyed a nationally representative sample of 2,000 people who self-identified as Republicans or Democrats. Respondents were randomly assigned to either a control group or to read a short passage that included the arguments above without any source attribution or with the respective message attributed to either Democrats or Republicans.

Respondents were then asked if they supported the federal government paying to rebuild homes and subsidize insurance in coastal flood zones; what their beliefs were about the impacts of rebuilding on public safety, the economy, and the environment; whether the government or individual residents should be primarily responsible for rebuilding costs; and if they would be willing to pay additional taxes to support such federal assistance.

In line with our expectations, the message framing had the greatest impact on opinions, as well how people felt about both the *effects* of rebuilding and *who* is financially responsible. While messages attributed to the opposing political party were often less impactful compared to one's own party, respondents did not blindly follow party cues and often found the messages persuasive regardless of the source.

This research contributes to a better understanding of how Americans respond to information advocating or opposing federal assistance to coastal flood victims or likely future flood victims. The topic may gain salience as even more damaging coastal flooding and windstorms result from continuing climate change.

Science communicators engage in framing when they emphasize specific information about a topic or issue to an audience. The careful selection of frames can play a vital role in gaining public attention, shaping public discourse, and improving the public's understanding of policy debates—including whether federal funds should be used to rebuild homes in coastal flood zones.

ABOUT THE AUTHORS

RISA PALM is a professor of urban studies at Georgia State University. She has done research on natural hazards response, including a general text on natural hazards. She has also written monographs and papers on topics including earthquake hazard response in California, Puerto Rico, and Japan and information about sea-level rise in South Florida.

TOBY BOLSEN is the Zoukis professor of politics and justice at Georgia State University. His research focuses on political and science communication, public opinion, political behavior, experimental methods, and U.S. energy and climate policy.

JUSTIN KINGSLAND completed his PhD in political science at Georgia State University. His research interests focus on public opinion, political behavior, experimental methods, and political, science, and environmental communication.

CITATION

Palm, R., Bolsen, T, and Kingsland, J. (2024). Framing Matters: Communicating Coastal Rebuilding to the Public. *Research Counts*, *2*(27). Boulder, CO: Natural Hazards Center, University of Colorado Boulder. **https://hazards.colorado.edu/news/research-counts/framing-matters-communicating-coastal-rebuilding-to-the-public**

HOW TO AVOID THE NEXT PANDEMIC

BY ILAN KELMAN, STEPHEN ROBERTS, AND GARETH BYATT

MAY 1, 2024

The COVID-19 pandemic claimed millions of lives and disrupted countless others. Based on our case studies, we believe what began as a disease outbreak didn't need to escalate into a global crisis. Our work indicates that better management of three key aspects—international cooperation, isolation, and available technology—could have curtailed it in its initial stages. Understanding these elements fully can help ensure that future disease outbreaks do not become pandemics.

STRONGER INTERNATIONAL COOPERATION

Our **research on disaster diplomacy for disease outbreaks** before and during COVID-19 demonstrates how international cooperation can prevent disease-related disasters. Health diplomacy, medical diplomacy, and vaccine diplomacy **were used to help countries cooperate** on improved health outcomes before COVID-19. Successes include eradicating smallpox in 1980 and rinderpest in 2011, each of which required vaccination campaigns in conflict zones. Meanwhile, the World Health Organization **International Health Regulations**, which are legally binding in most countries, require collaboration and information sharing in disease outbreak response.

Although not all such efforts prevail, the lessons learned from them could have been applied to COVID-19. Before the COVID-19 pandemic, **we adopted a disaster diplomacy perspective** to examine three examples. These instances showed how medical diplomacy has the potential to solidify alliances, although barriers in conflict zones can obstruct achievement. They also indicated that—for both COVID-19 and the previous coronavirus pandemic, Severe Acute Respiratory Syndrome—if control measures are not immediately implemented, spread cannot be adequately contained.

For COVID-19, a disaster diplomacy perspective **helps explain** how existing knowledge could have facilitated better integrated international cooperation as the virus emerged. Political posturing inhibited some countries from giving or accepting aid. Valuable information about the virus and vaccine sharing was impeded. Knowledge at the onset of the virus's emergence could have been used to plan and implement cooperation, which would have helped everyone. Decisions made by countries ultimately contributed to the disease outbreak morphing into a pandemic disaster.

BETTER MANAGEMENT OF ISOLATION

Isolation, both individual (quarantine, self-isolation, and physical distancing) and national (lockdowns, border closures) was a widespread response to COVID-19. Such measures have **known drawbacks**—including exacerbated mental health issues, worsened diets, and increased domestic violence and substance use—that could have been anticipated and minimized. Isolation measures did successfully ease pressure on health systems, but they could have been even more effective if best practices had been used consistently worldwide while still addressing adverse impacts.

Claims that some locations, notably islands and smaller jurisdictions, had an isolation advantage over continental or larger territories were not backed up by **our investigations**. For example, Nunavut—a vast, autonomous territory of Canada—did not confirm its first COVID-19 case until November 6, 2020 whereas neighboring **Greenland confirmed a case** on March 16, 2020, three days after lockdown was initiated.

What seemed to be the case instead, is that **consequences were related to the balance** of the isolation-related measures adopted, how well they were followed, and how well they were enforced. New Zealand and Thailand both used national lockdowns and border restrictions to keep cases at a minimum throughout 2020. The United Kingdom and the United States each used a patchwork of isolation measures, which were not always consistently enforced.

TECHNOLOGICAL AND HUMAN APPROACHES

Many countries adopted technology-related measures, generally apps and digital health data, in an effort to increase disease surveillance, create transparency, and limit the amount of time that isolation would be necessary. As with isolation, the effectiveness of this technology ended up being more a function of how it was applied, rather than of the technology itself.

Our **analysis of several examples** determined these technological solutions weren't always beneficial in reducing isolation measures or controlling the spread of COVID-19. For instance, the United Kingdom spent more than **$90 million on a contact-tracing app** that had no discernible impact on reducing required isolation measures. Iceland's contact-tracing app was also deemed to have had limited useful results. In many cases, governments partnered with private companies to digitize COVID-19 strategies without clearly communicating or consulting with local residents about data collection and security. While these technologies did help the public to perhaps better visualize and understand issues like escalating case rates, they did not always deliver promised results.

In contrast, Taiwan and Thailand each combined digital health approaches with community engagement, local volunteers, and informality. Examples include civic-led mapping of mask availability, local development of chatbots and apps, and door-to-door monitoring to check on people, to disseminate hygiene information, and to collect health data. While no single measure could be identified as "successful," the combination of high tech and engaging directly with people appeared to be most effective in countering the pandemic's impacts and supporting people during a time of great uncertainty.

The numerous lessons and extensive experience that emerged from COVID-19 and other pandemics can be applied to future pandemics, even after new pathogens have surfaced. Treating the social and political afflictions that allow outbreaks to escalate is harder. As our various investigations have shown, we have the knowledge of how to work better together. We just need to use it.

ABOUT THE AUTHORS

ILAN KELMAN is professor of Disasters and Health at University College London, England and a professor II at the University of Agder, Kristiansand, Norway. His overall research interest is linking disasters and health, integrating climate change into both. Three main areas are: (i) **disaster diplomacy and health diplomacy** (ii) **island sustainability** involving safe and healthy communities in isolated locations, including **Many Strong Voices**; and (iii) **risk education for health and disasters**.

STEPHEN ROBERTS is a critical global health security scholar and lecturer in global health at the Institute for Global Health, University College London. His research focuses on the digitisation of global health security practices during public health emergencies, and considers the impacts of these digital shifts across government, politics, society, law and ethics.

GARETH BYATT is an independent consultant in urban resilience, risk and resilience for various industries and business sectors, and disaster risk. He is an ambassador for the Institute of Risk Management, and he regularly undertakes research work independently and with academic institutes around the world.

CITATION

Kelman, I., Roberts, S., and Byatt, G. (2024). How to Avoid the Next Pandemic. *Research Counts, 2*(26). Boulder, CO: Natural Hazards Center, University of Colorado Boulder. **https://hazards.colorado.edu/news/research-counts/how-to-avoid-the-next-pandemic**

Author Jennifer Blanks conducts an assessment of headstones in the Pyland African American Cemetery in Marion County, Texas. Source: Jennifer Blanks, 2023.

GONE BUT NOT FORGOTTEN

SAVING OUR CEMETERIES FROM DISASTER

BY JENNIFER BLANKS

OCTOBER 20, 2023

Coffins, grave ornaments, and floating corpses were among the first images to appear in news coverage of Hurricane Katrina's devastation. Photos captured cemeteries submersed in haunting flood waters and caskets balanced in the thick branches of oak trees. For many, these scenes might have been the first thought they gave to graveyards in the context of disaster.

This was nothing new for cemetery caregivers and local Louisianans; however—cemeteries in southeast Louisiana flood frequently. The level of damage, though, was different and profoundly concerning as multiple crises descended on the Gulf Coast region in the aftermath of the hurricane. When limited resources are focused on rebuilding the lives of the living, do the cities of the dead even matter?

The answer is yes—cemeteries are non-renewable resources that, once destroyed, cannot be replaced. Their cultural importance and the role they play in preserving our history and heritage is immense. Therefore, **managing and protecting cemeteries is a vital activity** the intersection of disaster and preservation planning. The number of cemeteries impacted by disasters is increasing, so reducing threats through cultural resource risk management is more essential now than ever.

CULTURAL RESOURCE RISK MANAGEMENT

Cultural resource risk management allows disaster planners to explore, plan, and deploy risk management practices for cultural heritage sites such as cemeteries. Without it, burial grounds can suffer from catastrophic damage caused by floods, tornadoes, wildfires, and other hazards. Original headstones can be displaced or damaged beyond repair. It is typical for crypts and caskets to open, exposing human remains. Mausoleums, headstones, and other landscape features can cost thousands of dollars to replace.

While applying cultural risk resource management to cemeteries was in practice before Hurricane Katrina, the storm's impact on gravesites was significant enough to move discussion from policy into action. For example, in response to the frequency of coffin displacement, the State of Louisiana and the Federal Emergency Management Agency (FEMA) created the **Louisiana Cemetery Response Task Force** in 2018. This group assesses cemetery responses and recovery needs when an emergency is declared by the state. Following the assessment, FEMA representatives are deployed to the disaster site to assist the **Louisiana Cemetery Board**, cemetery managers, and family members with resources to address issues. Today, this program has led reburial processes after Hurricane Laura in 2020, Hurricane Ida in 2021, and other storm events.

Unfortunately, the task force program is only active in Louisiana. Other states, however, can still access **FEMA Disaster Assistance Recovery Grants** to restore cemeteries and other cultural resources after a disaster—but doing so isn't always straightforward. Protecting cemeteries is a shared responsibility between multiple disciplines and stakeholders who must work together to achieve their goals.

WHO IS RESPONSIBLE FOR MANAGING CEMETERY RISK AND RECOVERY?

Government agencies like FEMA can enforce regulations related to financial assistance, provide technical assistance to restore damaged plots, offer resource coordination and allocation, and facilitate coordination among various groups involved in cemetery recovery. This includes working with stakeholders from state historic preservation offices, local governments, and volunteer groups to centralize resources and expertise. That's where things can get complicated.

Cemetery owners—which can be a single person, a private company, or a nonprofit group, among other options—are responsible for cemetery management, including daily maintenance, security, and disaster preparedness. Although larger entities might have disaster plans in place, smaller cemetery groups such as churches, grassroots organizations, and formal and informal volunteers are often left to resolve recovery issues with limited information from local and state municipalities.

Community members, too, are essential stakeholders who report issues, provide feedback, and support initiatives to preserve their cemeteries. Including the voices of community members, cemetery volunteers, and other caregivers can enrich cemetery risk management—especially when sharing the cultural heritage and practices within the landscape. This aspect, however, is often largely overlooked, even though local community knowledge provides critical information to disaster planners who lead cemetery recovery efforts.

Although cultural site recovery grants often provide the primary funding cemeteries receive to make repairs, the complexity of cemetery management, ownership, and stakeholder engagement means that these funds aren't always distributed equally, which is a situation that needs to be addressed.

STRATEGIES FOR SUCCESSFUL PRESERVATION

Ensuring equitable and effective risk management of cultural resources provides fair treatment of different cultural sites, mainly historical sites within marginalized communities. There are several strategies that disaster, preservation, and planning professionals can adopt to foster positive engagement with cultural resource managers. Conducting risk assessments routinely can ensure conditions are not exacerbated post-disaster. Local and state agencies can also create culturally sound policies and procedures that increase the cultural competency of disaster volunteers and responders. Finally, disaster planners must identify the caregivers of key cultural sites—those with local knowledge of the site—to ensure that cultural heritage is not lost.

State and federal agencies are responsible for creating a policy that improves disaster management. Clear guidance and funding for cemeteries and other memorialized landscapes is needed. Without both, cemeteries across the United States will continue to suffer devastating impacts from hazard events—and we all risk losing the physical landscape and cultural heritage that makes cemeteries relevant beyond their primary function of housing the deceased.

ABOUT THE AUTHOR

JENNIFER BLANKS is a PhD candidate in Urban and Regional Science at Texas A&M University. Blanks identifies as an environmental planner; her other research interests include preservation planning, digital humanities, and Black geographies. Blanks' dissertation project relates to best practices for African American participatory preservation methods, theories, and approaches to provide perpetual care for ancestral burial grounds and other memorialized landscapes.

CITATION

Blanks, J. (2023). Gone But Not Forgotten: Saving our Cemeteries From Disaster. *Research Counts, 2*(25). Boulder, CO: Natural Hazards Center, University of Colorado Boulder. **https://hazards.colorado.edu/news/research-counts/gone-but-not-forgotten-saving-our-cemeteries-from-disaster**

The Camp Fire Pet and Wildlife Memorial. Source: Ronald Schumann, 2022.

MORE THAN WORDS IN STONE

COMMEMORATING PLACES RESHAPED BY DISASTER

BY RONALD SCHUMANN AND ELYSE ZAVAR

OCTOBER 18, 2023

The term disaster memorial might conjure images of stone walls inscribed with epitaphs, but **commemorations**—a term we prefer to better illustrate the creativity and healing potential of post-disaster memory work—are so much more than that. Commemorations **take diverse forms** that can range from tangible artifacts to ephemeral performances to digitally mediated remembrances.

Regardless of form, though, commemorations serve three primary purposes—they shepherd survivors through grief, thereby **promoting psychological recovery**; they communicate the hazards of a particular setting to unaffected populations, including future generations; and they help create community among those connected to an event or place of tragedy.

Given these noble-minded aims, commemorations are often seen as a universal good, however, a just and holistic remembrance is not guaranteed. Thoughtfully designed commemorations have the potential to heal, inform, and connect community members. Poorly conceived commemorations can—inadvertently or purposefully—harm, misinform, or fracture communities. Commemorations that successfully integrate a range of perspectives are the ones that have the greatest healing potential—not only to help recover from the current disaster but to reunite historically fractured communities in the face of future extremes.

As geographers, we've studied commemorations after environmental and technological disasters across the United States and explored the politics of memory at heritage sites irrespective of disaster type. The following are two examples we find useful to illustrate both the scope of commemorative activities and their potential benefits for communities.

THE CAMP FIRE PET AND WILDLIFE MEMORIAL

The Camp Fire Pet and Wildlife Memorial (pictured above) is a massive granite tablet eulogizing the thousands of animals that died or went missing in the blaze. Perched on the rim of a canyon, its placement intentionally communicates how the fire transformed an entire living landscape. At the monument's base—**more typical of ephemeral memorials** than permanent ones—is a collection of photographs, tokens, and stones painted with the names and likenesses of animals lost.

Components of the commemoration beyond the actual monument are less visible. They include the breadth of performative caregiving, communication, and community building that went into its making. It was conceived by Gina Schaffer, an animal rescue volunteer who didn't have ties to the area before the fire. Schaffer was a magnetic agent who spearheaded online fundraising. Her Facebook page became a place for digital commemoration and collaboration on the memorial design. The monument's unveiling ultimately drew nearly 100 animal lovers to form a community of care and perform commemoration by decorating the rocks that adorn the monument's base. This coalescence shows how a static stone memorial can sometimes be more than the sum of its parts.

It's interesting to note that, despite the memorial's placement—an allusion to the place-role ties that are the bedrock of Indigenous worldviews—the monument and its artifacts communicate a distinctly Western view of interactions between humans and animals. This divergence is an example of how even the most thoughtful commemorations can reach a bit further to understand that not all people experience the same loss or experience loss in the same way.

COMMEMORATION IN MINOT, NORTH DAKOTA

Commemorations don't only remember tragedy, but can also look forward, envisioning more resilient and inclusive communities. Such is the case of the commemorations of the catastrophic 2011 Mouse River Flood in Minot, North Dakota. After the flooding, the City of Minot **implemented a buyout program** relocating people and structures out of the floodplain. Relocation can dismantle ties to place and often become a second trauma for participants after the initial disaster. Although commemoration after buyouts are rare, preserving the history of a transformed place and those who called it home can serve as a powerful tool for individual and community recovery.

For the 10-year flood anniversary, **Minot held a public gathering** that included a memory walk organized along a path featuring photos and descriptions of the people and places impacted by the flooding. The walk allowed former residents a chance to revisit altered homeplaces while introducing other visitors to the legacy of a relocated community and the portent of future flood risk. Additionally, more than 3,000 community members submitted photos, both online and in-person, that documented the homes, businesses, and neighborhoods affected by the floods. Images from this digital and physical memory bank were then stitched into a memorial mural entitled, Resilient Together. These commemorations—the memory walk and mural—were intentionally designed for residents with varied histories of disaster impact and relocation, threading their experiences into the tapestry of collective remembrance.

Even though the Minot commemorations are vibrant and inclusive, they mark the remembrance of modern communities whose forebears resettled lands forcibly taken from Indigenous people. The commemorations remain silent about that past and the present it shaped. Imagine how much more impactful and educational they might be if they acknowledged the original inhabitants and how they lived with Mouse River flooding.

Other innovative remembrances such as the **Hackensack River Flood Theater** and the **Biloxi Civil Rights Wade-In pop-up** go beyond our examples to illustrate the breadth of perspective required for commemorations to be both restorative and adaptive. These remembrances create forward-looking commemorative communities that transcend generations, cultures, and degrees of impact.

Commemorations that enable communities to acknowledge shared tragedies through a multitude of lived experiences provide the best support for recovery and ultimately promote communal healing and justice. Community engagement in the design process can help avoid the unilateral narratives that are too often chiseled into stone monoliths. Such commemorations not only support inclusion but further stretch our concept of post-disaster memorials as more than words written in stone.

ABOUT THE AUTHORS

RONALD SCHUMANN is an associate professor in the Department of Emergency Management and Disaster Science at the University of North Texas. A human geographer by training, Schumann's research focuses on long-term community recovery and post-disaster mitigation. His research utilizes participatory, geospatial, and mixed methods to explore issues of social vulnerability, cultural memory, equity, and risk perception. Schumann has previously conducted fieldwork documenting recovery efforts after Hurricanes Katrina, Sandy, and Harvey. He is currently collaborating on a study funded by the National Science Foundation that uses photovoice to understand how place attachment affected housing recovery after the recent California wildfires.

ELYSE ZAVAR is an associate professor in the Department of Emergency Management and Disaster Science at the University of North Texas. Zavar uses mixed-methods approaches to study how communities reconstruct post-disaster landscapes to mitigate hazard risk. The design, management, use, and commemoration of post-buyout open space are of particular interest. Zavar was a 2020 Gulf Research Program Early-Career Research Fellow. Her current projects examine commemoration activities following flood-induced relocation programs and the impacts of the COVID-19 pandemic on conservation areas, heritage sites, and museums.

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Conducting a prescribed burn in Santa Barbara County, California. Source: Jeff Rumans, BurnBot Inc.

CARE, EQUITY, AND JUSTICE

REIMAGINING THE FORESTRY AND FIRE WORKFORCE

BY SHEFALI JUNEJA LAKHINA, LENYA QUINN-DAVIDSON, BRANDON SMITH, AND DANIEL GODWIN

DECEMBER 12, 2022

Communities across the United States are contending with deteriorating forest health and a fuel management crisis. Although a range of strategies are being employed to address escalating wildfire risk, implementation will be **challenging** without a sustained, diverse, and future-ready forestry and fire workforce.

Federal, state, and local agencies are currently **experiencing a severe capacity gap** and retention challenges are making it worse. Policy actions that **develop a robust infrastructure of care**—including health insurance, secure housing, and inclusive career development pathways—are critical.

THE NEED FOR CARE, EQUITY, AND JUSTICE IN THE INFORMAL WORKFORCE

Much-needed work is underway to ensure the federal firefighting workforce has **family-sustaining, career-track jobs, with equitable pay and benefits**. A number of **state** and **local** efforts to train more people in forestry and fire jobs are also in progress. Recent wildfire risk management strategies, such as the U.S. Forest Service ***Confronting the Wildfire Crisis***, California's ***Wildfire and Forest Resilience Action Plan***, and Colorado's ***Strategic Wildfire Action Program*** also detail ambitious goals.

In addition to these ongoing efforts, there is also a need to address the lived experiences of the informal workforce, which is **marginalized, largely uncounted**, and often composed of volunteers, students, and seasonal and temporary workers—including **migrant** and **incarcerated** workers. These workers are already contributing to essential agriculture, forestry, and fire management work; however, their labor is not counted, nor is it equitably compensated.

Fair recognition of the contributions of informal workers to the restoration of local forests and economies can help meet fuel reduction and climate mitigation goals. It can also ensure that equitable working standards—including pay, health care, housing, safety, and well-being—are guaranteed for all workers in our fiery future. We know this because we've seen it in action.

CASE STUDIES IN IMPROVING WORKFORCE CAPACITY

At the 47th Annual Natural Hazards Workshop, we held a plenary discussion—***Reimagining Caring, Equitable, and Just Futures in a Fiery World***—which highlighted how community-centered coalitions, volunteer associations, and small businesses that train and hire informal workers are leading with narratives and practices to reimagine care, equity, and justice for all workers in the future.

Drawing on Wonder Labs' ***Reimagining 2025: Living with Fire Design Challenge*** methodology, we discussed three case studies that show how place-based efforts are reimagining forestry and fire capacities for inclusive, equitable, and socially just outcomes. They included:

- California's **prescribed burn associations**, which affect systems change using workforce-led and community-centered organizing and policy. These grassroots efforts **reimagine a future with fire** and contribute to an empowering shift from the previous era of fire suppression by professionals to a more democratic era of **fire stewardship by all people**.
- **The Forestry and Fire Recruitment Program**, which addresses structural inequities by providing employment and integration pathways in California's Conservation Camps for incarcerated people. It also enables whole-person care and well-being for formerly incarcerated firefighters.
- **The Ember Alliance**, which works to create a kind, diverse, and robust fire management workforce that supports the development of fire-adapted and resilient communities in Colorado by partnering with underserved and underrepresented people.

RESEARCH FOR A REIMAGINED FUTURE

As we prepare to live and work in a fiery future, we call for a **convergence research and practice agenda** to pursue the following kinds of questions. Our hope is these research questions will inform the development and implementation of more caring and just policies for all workers.

Who is doing the work? To understand the diversity of the forestry and fire workforce, we need a better count and characterization of who is doing this essential work. Research can identify who comprises the informal workforce across sectors—in firefighting, logging, forestry services, power, manufacturing, and agriculture—as well as how the work is being counted and compensated.

How is the forestry and fire workforce experiencing care, safety, and well-being? To understand how forestry and fire practitioners find a sense of belonging, care, and empowerment in the "fire world," it is important to engage with the life experiences of diverse workers. This includes understanding who is receiving what kind of education, training, skills development, and mentoring and from what avenues.

Research can also contribute to a deeper understanding of **collective bargaining**, including how unionized and labor mechanisms protect and care for different categories of workers in the forestry, fire, and agricultural sectors. Finally, research can encourage accountability by critically examining how state and local institutions are fulfilling a duty of care towards an increasingly marginalized, informal, temporary, and seasonal workforce.

What is needed to enable a workforce-led and community-centered just and equitable transition? By engaging with diverse workforce perspectives and lived experiences, research can provide insights into what needs to be reimagined for a community-centered transition led by the workforce. Research can also identify entry points for federal and state policy to be more responsive to workers in diverse contexts, including rural and tribal lands. It can reveal concrete pathways to democratizing fire governance so all people can be stewards of land and fire. Finally, building on current policy momentum, research can identify how federal and state authorities can prioritize investments in building an infrastructure of care that ensures parity of benefits for all workers.

As we prepare to reimagine life and work in our fiery future, research and policy will have to pay closer attention to how care, equity, and justice can be achieved in inclusive ways for all workers.

ABOUT THE AUTHORS

SHEFALI JUNEJA LAKHINA is the founder of **FireUp**, a career platform exclusively dedicated to the fire and forestry workforce. Over the past 20 years, she has developed disaster resilience policy, programs, and research across Asia, the Middle East and North Africa, Europe, Australia, and the United States. In 2020, she cofounded **Wonder Labs**, a climate justice think-and-do-tank based in California. She is the author of the *State of FireTech Report* and host of *Innovating on the Frontlines: The FireTech Podcast*.

LENYA QUINN-DAVIDSON is the Fire Network director for the University of California Agriculture and Natural Resources, where she leads a statewide team working on various facets of fire resiliency. Her work has focused in large part on breaking down social, political, and cultural barriers to beneficial fire. Quinn-Davidson has worked locally with private landowners and community members, at the state level on policy, research, and training, and nationally/internationally, through her leadership on the Women-in-Fire Training Exchange (WTREX) Program. Quinn-Davidson is passionate about using fire to empower people, from ranchers and scientists to agency leaders and young women, and everyone in between.

BRANDON SMITH is the co-founder and CEO of the Forestry and Fire Recruitment Program, a nonprofit that helps justice system-impacted people transition into family-willing careers within the wildfire sector. Formerly a firefighter with the United States Forest Service, Smith's purpose is to rethink and create unique solutions to California's wildfire challenges.

DANIEL GODWIN co-founded The Ember Alliance, a national nonprofit that supports fire-adapted communities. He now works with the Arapaho-Roosevelt National Forests and Medicine Bow/Routt National Forests as a forest fire planner.

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Hurricane Laura made landfall as a Category 4 storm in downtown Lake Charles, Louisiana. Source: Jeff Gammons/Shutterstock, 2020.

COVID-19 VS. HURRICANES

EVACUATION RISK PERCEPTION DURING A PANDEMIC

BY JENNIFER COLLINS AND AMY POLEN

FEBRUARY 24, 2022

Traditionally, evacuations and public sheltering protect those who are most at risk during a hurricane; however, such measures can be in direct conflict with the need to socially distance during the COVID-19 pandemic. Emergency management offices nationwide have revisited emergency procedures to limit the risk of disease transmission, but our research shows that the public is still wary of contracting COVID-19 during evacuation and sheltering.

Research on evacuation behavior during a global pandemic is vital to ensuring emergency management planning and risk communication is effective, especially since individuals who encounter unfamiliar risks might have to make unanticipated decisions. Individual risk perception is highly subjective and often includes personal assessments of health status, hurricane risk, and public shelter safety. Understanding individual risk perception during the COVID-19 pandemic can shed light on why people might choose to shelter in place rather than evacuate, even when such a choice poses danger.

Our **multi-year research** examines individual health and risk perceptions and how hurricane threats, compounded by the risks of the COVID-19 pandemic, influences potential and actual protective action decisions such as evacuation or sheltering at home.

A **pilot study** conducted in June 2020 looked at how individuals expected they would react to a hurricane threat during the COVID-19 pandemic. The study, which surveyed more than 7,000 people living in Florida, showed that nearly half of the respondents viewed themselves as vulnerable to COVID-19 because of pre-existing health conditions and that 74.3% of that sample considered the risk of staying in a shelter during the pandemic to be more hazardous than sheltering in place during a hurricane. A significant number of respondents who would have likely accessed a shelter previously indicated they would now not because of the additional COVID-19 risks—a 7.8% drop in anticipated shelter usage compared to respondent's likelihood to shelter before the pandemic.

These results highlight what people thought they would do, but we also wanted to learn what people actually did. This led us to conduct a survey of people who experienced Hurricanes Laura and Sally, which made landfall in Louisiana in August 2020 and Alabama during September 2020, respectively. The design of this survey was inspired by the pilot study, but looked at actual evacuation decisions and perceptions of risk immediately following the events. A combined convenience and snowball sampling method was used, supported by our professional network of emergency managers, researchers, and meteorologists who distributed the survey in local communities impacted by the hurricanes.

Our analysis showed that less than one percent of individuals surveyed accessed a public shelter. The overwhelming majority of individuals (76.7%) stayed in their homes during Hurricanes Laura and Sally. Respondents expressed many of the same reasons for staying home as those cited in the pilot survey, including a high rate of perceived health vulnerability (34.9%) and generally negative perceptions of shelters.

Interestingly, perceptions of shelters among those who had experienced Hurricanes Laura and Sally was more favorable than those in the pilot survey, although the majority (58%) still indicated that they felt the risk of staying in a shelter during the pandemic was more dangerous than risks posed by the hurricane.

Even so, 87% of respondents noted that their pre-hurricane perceptions of shelter safety still felt accurate to them after they experienced a hurricane. These results indicate that concern about hurricane impacts matter more in an actual event than when compared to hypothetical planning. As one respondent said, "I guess everyone is in survival mode. We are more concerned with food and shelter than the virus. To be honest, the virus seems very far away right now to people who have lost quite literally everything they have."

These results highlight differences in the decisions people think they would make compared to those they actually make to protect themselves in light of the COVID-19 pandemic. Public shelters are traditionally used by vulnerable populations, such as the elderly and those with lower socioeconomic opportunities. If such individuals are hesitant to use shelters during the pandemic, emergency managers and shelter organizers might have to take extra steps to ensure individuals are confident about sheltering and evacuation options so that they don't put themselves at undue risk by sheltering in their homes.

In such situations, communication campaigns should emphasize that necessary precautions have been taken to help protect evacuees and shelter residents from COVID-19 infection. This could build trust and potentially encourage people to move out of harm's way in future disasters that occur during the pandemic. Other measures can also be taken to persuade evacuation, as well. For instance, during Hurricane Laura, government officials made arrangements for people to shelter in hotels rather than in congregate shelters.

Disaster planners and communicators can use the results presented here to better understand how pandemic measures, such as social distancing, can impact emergency planning for evacuations and sheltering. Disasters are growing in frequency and severity and taking these considerations into account can help anticipate future challenges that will likely arise in the reality of an ongoing pandemic.

ABOUT THE AUTHORS

JENNIFER COLLINS is a professor in the School of Geosciences at the University of South Florida. Her research focuses on weather and climate. As a hurricane researcher, Collins is interested in the interaction between large scale climatic patterns and seasonal patterns of tropical cyclone activity in multiple oceanic basins. As well as her work in the physical sciences she also works in the social sciences as she examines human behavior relating to hurricane evacuation. In addition to her hurricane work, Collins works in other areas related to weather, climate and hazards.

AMY POLEN earned both her Bachelor of Science in environmental science and policy and her Master of Science in public health specializing in emergency management at the University of South Florida (USF). During her time at USF, Polen primarily worked with the USF Hurricane Research Team and the Florida Center for Community Design and Research on projects regarding risk perception, hurricane evacuations, coastal vulnerability, and coastal resiliency.

CITATION

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REMOVING BARRIERS

INCLUDING PEOPLE WITH DISABILITIES IN DISASTER RISK MANAGMENT PLANNING

BY BARBARA CARBY AND THERESE FERGUSON

JANUARY 20, 2022

The importance of capturing community knowledge in disaster risk management (DRM) planning has been recognized for some time. This understanding, however, does not regularly extend to people with physical impairments, which is problematic for communities as a whole. Leaving people with disabilities out of the planning process robs them of a voice and everyone else of their expertise.

INCLUSION IS NOT ALWAYS A REALITY

The right to equitable treatment for people with disabilities has been recognized in global frameworks and agreements and is the law in some countries. Understanding and planning for the needs of people with impairments has improved with the development of these frameworks, agreements, policies, and legislation. In many places, however, people with impairments are still not fully integrated into DRM planning. Our research in Jamaica, for instance, found that, at the national level, none of the government ministries included people with disabilities on planning committees. At the local level, only 33% of parish councils included such people—even when DRM plans included sections for people with disabilities.

SOCIETY BUILDS THE BARRIERS

Often, people with disabilities are seen as victims in need of help rather than as people who can contribute to DRM planning and operations. It's true that environmental barriers—such as documents and signs that cater to the sighted or the lack of ramps for those with mobility issues—are daily obstacles faced by people with disabilities. Even so, according to the social model of disability, these constraints are what lead to impairments becoming disabilities—the barriers erected by society make it difficult for people with impairments to function to their full capacity.

These limitations can be exacerbated during periods of crisis and disasters, when accessing warning information needed for safety and being able to evacuate are vital. Crucial alerts and warning messages, precautionary information, and information on evacuation and shelters must address the needs of people with disability such as being provided communication in sign language or ensuring that color choices aren't misinterpreted by those with impaired color vision.

MAKING DRM PLANNING MORE INCLUSIVE

All too often, people with disabilities are planned for rather than with. This means that their valuable knowledge and skills aren't captured in Disaster Risk Management (DRM) planning, where they could serve as an integral resource for successful disaster response and recovery operations. A more inclusive approach to DRM can be established using a variety of mechanisms, such as:

- Developing specific DRM policies for people with disabilities
- Including people with disabilities on DRM planning committees at every level to ensure their voices are heard
- Building or retrofitting shelters to accommodate the needs of people with disabilities and their caregivers
- Producing DRM literature, including warnings and precautionary information, in formats friendly to people with disabilities
- Identifying roles and responsibilities for people with disabilities in DRM plans and operations that uses their knowledge and skills to the benefit of the community

Enhancing people with disabilities' resilience and ability to cope with disasters is critical. Rather than seeing these individuals as victims, they should be viewed as knowledgeable partners in the DRM planning process. This would not only support their overall participation in society, but also ensure society benefits from their vast experience and skills.

ABOUT THE AUTHORS

BARBARA CARBY is a disaster risk management expert with experience in the public sector and academia. She was director-general of the Office of Disaster Preparedness, Jamaica, founding director of Hazard Management Cayman Islands, and former director of Disaster Risk Reduction Centre, University of the West Indies. Carby's research interests include integrating knowledge bases for disaster risk management and planning for people with disabilities. She has served in a voluntary capacity on several United Nations and other committees and has received national honors from Jamaica and France. When not advocating for risk reduction, Carby enjoys training dogs and gardening.

THERESE FERGUSON is a senior lecturer in Education for Sustainable Development (ESD) in the School of Education (SOE) at The University of the West Indies in Mona, Jamaica. Ferguson serves as the program leader for Change from Within, a school-based initiative that addresses violence and indiscipline. She is also the coordinator of the ESD Working Group within the SOE. Her research interests lie in ESD, peace education, and climate change education. Ferguson has published a co-authored book, book chapters, journal articles, book reviews, and encyclopedia entries.

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BEYOND DAMAGES

SOCIAL EQUITY IN ALLOCATING DISASTER ASSISTANCE

BY ORONDE DRAKES, ERIC TATE, JAYTON RAINEY, AND SAMUEL D. BRODY

SEPTEMBER 16, 2021

The structure of federal disaster recovery programs can marginalize households that have limited resources and create disproportionate recoveries in the areas that can least afford them. Locations with more **marginalized people are likely to become economically worse off after disaster**, while areas with more privileged populations are poised to receive greater benefits from disaster assistance.

Households rely on insurance, personal savings, and social capital to overcome the damage, job loss and impacts that accompany disaster. Those with fewer resources, however, are less able to meet such challenges. Short-term assistance can improve household coping capacity, but this assistance is not distributed equitably—places with minority and lower income populations **receive disproportionately low disbursements** compared to White communities.

To better understand how equitable disaster assistance programs are, we explored the population characteristics of places that received short-term assistance from the Federal Emergency Management Agency (FEMA) Individuals and Households Program (IHP). The **program is the largest component** of FEMA Individual Assistance, the agency's primary short-term, household-level assistance program. IHP focuses on meeting immediate, basic needs that aren't covered by insurance or other resources, but **our research**, which examined data from the contiguous 48 states from 2006 to 2018, found that IHP may not be reaching the places that most need federal aid to manage the impacts of disasters.

FAIR DISBURSEMENT OF DISASTER ASSISTANCE

Federal disaster aid programs use the appraised value of physical losses to determine need without accounting for **social factors**—such as minority status, housing type, or poverty levels—that can make households more vulnerable to disaster. Overreliance on monetary losses can **perpetuate inequalities** and **widen societal disparities**. Wealthier households, for instance, might suffer greater monetary losses from disasters than poorer households, but that's because they tend to own more high-value possessions and property. Accordingly, they will get more assistance to recover from a disaster, even though they have more coping capacity overall. Overcoming this disparity requires the consideration of social inequalities. Past research, however, has been inconclusive about the relationship between household coping capacity and the receipt of IHP assistance. Although, socially vulnerable households may be more likely to receive IHP, they may receive less assistance. This means that, although they suffer proportionately greater relative losses than their wealthier neighbors, they are left with fewer resources to overcome those losses.

THE CASE FOR SOCIAL EQUITY

Our findings revealed distinct patterns in the social characteristics of places that receive IHP disbursements. There were low levels of IHP disbursement in places where households have high levels of social vulnerability, suggesting locations where the program is underperforming. This means IHP may not adequately reach people in the areas with the most need. Such places were mostly rural and clustered in Appalachia, the Mississippi Valley region, and the Southeastern United States. Conversely, places where socially vulnerable households received high levels of IHP disbursements—indicating overperformance—were usually urban and clustered in the Midwest and Northeast.

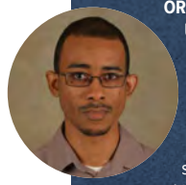
Aid disbursements in all of these places were affected by factors that point to a lack of social equity. As mentioned, the cost of damages suffered (losses) was the major predictor of how much aid was disbursed to a location. Vulnerable households with fewer resources, however, need more assistance than the dollar amount of their losses alone because their coping capacity is already less.

Data for IHP disbursements to homeowners indicated that population characteristics in surrounding areas influenced the payments. This could point to existing societal disparities affecting the total amount of assistance, as well as limited access to the knowledge and technology needed to apply for assistance. For instance, in places where IHP seemed to overperform, the amount of aid disbursed fell as the proportion of minority households (Asian and Black) rose. Therefore racial and ethnic minority status limited aid even where IHP disbursements were otherwise high.

For renters, social disparities across surrounding locations were less influential than the value of IHP at those locations. Renters are a population with limited or no input on the hazard mitigation investments of their residences, and have more limited access to disaster assistance than homeowners. It's likely that our findings reflect the IHP's reliance on losses and the fact that IHP only covers losses to personal property for renters. However social inequity was still evident. Where IHP underperformed, locations with higher populations of unmarried couples and families with low income received less IHP funds than their neighbors. The takeaway here is that where IHP aid is already limited, places with larger socially vulnerable populations (and more limited resources) receive less disaster assistance.

When the dollar amount of damages are the major factor in allocation decisions, the populations that are least able to manage after disasters—and therefore most in need of aid—may not receive adequate assistance. To achieve social equity in allocating recovery aid, programs must explicitly consider the social vulnerability and, particularly, the coping capacity of households.

ABOUT THE AUTHORS



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The "Renaissance Mural" in the Bronzeville, Chicago. Source: ComEd.

AN EXERCISE IN RESILIENCE

TESTING THE BRONZEVILLE COMMUNITY MICROGRID

BY JEFFREY SCHLEGELMILCH, JACKIE RATNER, DANIEL KUSHNER, AND SUSANNA AGUILAR

August 23, 2021

As climate change brings extremes in temperatures and weather, outdated electrical infrastructure across the United States has been strained. In recent instances, places such as California, Texas, Michigan, and the Pacific Northwest have served as stark warnings of the growing stressors our existing grid is facing.

Residents in these areas have endured rolling blackouts, and lengthy loss of service. These impacts are inconvenient at best, but for many people who are already vulnerable, or inaccessible electric service is life threatening.

While the situation is dire, there are solutions on the horizon. One option that has **shown potential** is microgrids—small power grids that can either be connected to the main grid or, during emergencies, be disconnected from it to keep locally generated power flowing.

Microgrids can contribute to social and infrastructure resilience, but they require investments that can be a hard sell without information to support the benefits and value of funding such projects. To begin to provide such information, the National Center for Disaster Preparedness (NCDP) worked with Commonwealth Edison (ComEd) to run a tabletop exercise testing the **Bronzeville Community Microgrid**, which ComEd built on the South Side of Chicago with the help of U.S. Department of Energy grants.

THE BRONZEVILLE TABLETOP EXERCISE

As we wrote in a **March 2020 Research Counts article**, ComEd and the NCDP at Columbia University's Earth Institute created a partnership to incorporate insights in social vulnerability with advances in electrical grid design and implementation. With that in mind, the exercise looked at continuity of operations, societal impacts, social vulnerability factors, advantages to nearby communities, and ways to quantify the benefits of the microgrid across these areas.

The simulation was designed as a tabletop exercise using the U.S. Department of **Homeland Security Homeland Security Exercise and Evaluation Program doctrine**. It brought together 12 organizations from in and around the footprint of the Bronzeville microgrid to test the scenario, which was based loosely on the **August 2020 derecho** that caused widespread damage in the Midwest. In our scenario, conditions were amplified to depict widespread power outages across Chicago, followed by a major heat and humidity event.

Exercise participants—which included representatives from the Chicago Fire, Police, and Public Health departments; Chicago Public Schools; the Chicago Office of Emergency Management; the Illinois Institute of Technology, a local business association, and local faith-based communities—worked through three modules based on the premise that the microgrid would perform as expected in such a scenario. This allowed us to test the value of the design at multiple stages, including in the first hour after an event, in the next 24 hours after an event, and within 72 hours and beyond.

We were especially interested in learning how grid continuity affected healthcare, the elderly, economically disadvantaged populations, housing stability, transportation access, and the ability of community-based organizations to support their clients.

EXERCISE FINDINGS

The general conclusions of the exercise indicated that the Bronzeville Microgrid provided enhanced benefits to the communities in its footprint and areas surrounding it. This was particularly true for populations with underlying vulnerabilities, businesses, and community organizations.

The scenario results pointed to the ability of emergency responders within the grid to respond to an event without downtime caused by electrical failures. This could not only free up responder capacity to quickly assist residents in their own and surrounding neighborhoods, but would also reduce the need to respond to subsequent issues, such as vulnerable individuals who would be at greater risk of injury or death during a prolonged power outage.

Similarly, faith-based and other community organizations indicated that the microgrid would allow them to continue their regular operations and potentially offer resources, such as cooling centers or emergency shelters, for surrounding communities. Businesses, too, saw a great benefit to continued electrical service, including a reduction in negative economic impacts for themselves and employees and the ability to provide critical resources such as fresh food and water.

We learned that more community outreach will be necessary to maximize these benefits, however. Several community participants indicated that they needed more familiarity with the microgrid footprint and its capabilities if they were to include it in their internal contingency planning. Government-level participants noted that they would likely require advance planning or formalization through memorandum of understanding or similar mechanisms.

More work will also be needed before the value of the resilience provided by the microgrid can be quantified. What, for instance, is the economic benefit of the number of response calls averted or business losses avoided? While still in early development, the exercise helped identify factors that can offer a roadmap for potential quantification strategies.

FUTURE DIRECTIONS

Simulating extreme weather events is increasingly important for understanding disruptions to the power grid as climate change, cyberthreats, and other factors introduce new vulnerabilities—and past experience is **not necessarily a dependable predictor of future threats**. Furthermore, understanding precisely how grid resilience correlates to social resilience is crucial to ensure that the right technologies are put in the right places.

Microgrids can offer valuable insights because they allow us to assess how a community that maintains a continuous supply of electricity during adverse events might fare differently from surrounding areas and even extend their benefits to those communities.

While the findings in this analysis are only preliminary, they do highlight the linkages between investments in grid resilience and societal resilience. While most people agree that resilience is a goal to strive for, ultimately, decisions related to investing in these projects must rely on sound economic criteria to support it.

Without the hard data to bolster infrastructure decision-making, we might unknowingly undervalue resilience and inadvertently move in the direction of risk. There is work ahead, but exercises such as this simulation indicate that investments in grid resilience can be a lifeline for communities during the extreme weather events to come.

ABOUT THE AUTHORS

JEFFREY SCHLEGELMILCH is the deputy director for the National Center for Disaster Preparedness at Columbia University's Earth Institute. In this role, he oversees the operations and strategic planning for the center. Schlegelmilch also oversees projects related to the practice and policy of disaster preparedness. His areas of expertise includes disaster policy, public health preparedness, community resilience, and the integration of private and public sector capabilities.

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ENGAGING WITH CARE

INCORPORATING ETHICS AND COMPASSION INTO DISASTER RESEARCH

BY SHEFALI JUNEJA LAKHINA

February 2, 2021

In the past year, disaster researchers around the world have undertaken important, caring, and difficult work. They have put aside shock, terror, and grief **to come together** and attempt to make sense of the cascading disasters and compounding impacts that we now face—public health, social, economic, political, and ecological. Many, like myself, have been **personally affected**. Researchers do not just collect perishable data about other people's experiences, they are also affected by them. The emerging climate reality, COVID-19 pandemic, and other increasingly damaging events mean that **researchers from adjacent disciplines**, many who might not be trained in disaster research, will need to conduct **emotionally challenging research** in emerging disaster contexts. Yet, **how can they keep at it** as disasters intensify and systems break down around them? What does and should an ethical strategy for conducting disaster research look like? I'd like to reflect on two.

As this difficult and caring work persists into 2021, I want to explore how strategies of researching with care and research as care can enable researchers to nurture themselves, and others, even as they live with daily experiences of uncertainty. I developed these strategies based on grounding truths I learned while working with **people from diverse backgrounds in Australia**.

*Reaching Hands by artist **Janaia Donaldson**. Source: Janaia Donaldson, 2002.*

RESEARCHING *WITH* CARE

Researching *with* care has been a long-standing **aspiration for disaster researchers**. This is something institutional protocols are set up to do. Yet, there are many unknowns that can never be fully anticipated. Even after scholars receive an **Institutional Review Board** or Ethics Review Committee approval, they are still likely to grapple with a range of **subjective and relational dilemmas** once their work is underway. They often must navigate contested relationships in the field, with institutions and funding bodies, and within the academy. They also have to negotiate how to make meaning from people's experiences—and their own—of compounding disasters.

I developed **the ethical framework of researching with CARE**—an acronym for collaboration, accountability, responsiveness, and empowerment—because it can hold us, as researchers, accountable to research participants and collaborators. The CARE framework emphasizes the need for collaboration by encouraging researchers to engage in ongoing engagement and partnerships, with the objective of holding themselves accountable to the people and institutions they work with. It positions them to listen deeply and be responsive to people's lived experiences while empowering them to speak truths and engage in transformative and healing work, wherever they stand. Partaking in a culture of sharing such guiding frameworks and including them in research protocols is important, especially when collaborating with other researchers. Because when research is done with care, it is important to state the ethics that are foregrounded, both personally and collectively.

RESEARCH *AS* CARE

Caring doesn't stop with our research methods, tools, and modes of data collection. Research can also be approached *as* care—as a relational way of being in the world. Research as care calls on researchers to be reflexive about their positionality and biases; their power and privilege; and their personal beliefs about other people's claims on identities, places, and disciplines. In committing to research as care, researchers must ask themselves, how they extend care in their everyday lives, conversations, and research practices. It is important to look at not just at what they publish in journals and books, but also what they say, unedited, in Zoom meetings, on social media, in email correspondence, and in daily conversation.

And it isn't always about what is said or written in these situations. We must also pay attention to the silences—what is not being said? Who is not in the room, and why? Because when research is approached as care, then we can commit to care as ongoing work that reaches beyond research projects, methods, and data collection. Our experiences in the world are too visceral, too much of consequence, to not push ourselves to speak important and grounding truths about power, inequity, and injustice. But we have to know, this work will never be done. We have to keep at it. I am hopeful that, for researchers, the strategies of researching with care and as care can contribute to the emergent code of ethics in disaster research. Perhaps these strategies can enable all researchers to imbibe more caring relationships with beings, places, and institutions, especially as they continue to live with daily experiences of precarity.

*The author initially shared this material in the form of comments at the **2020 Researcher's Meeting** Plenary session, on July 15, 2020.*

ABOUT THE AUTHOR

SHEFALI JUNEJA LAKHINA is the founder of **FireUp**, a career platform exclusively dedicated to the fire and forestry workforce. Over the past 20 years, she has developed disaster resilience policy, programs, and research across Asia, the Middle East and North Africa, Europe, Australia, and the United States. In 2020, she cofounded **Wonder Labs**, a climate justice think-and-do-tank based in California. She is the author of the *State of FireTech Report* and host of *Innovating on the Frontlines: The FireTech Podcast*.

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A tractor sits stranded in a flooded field in Winfield, Missouri. Source: Jon Rehg/Shutterstock, 2019.

RURAL RESILIENCE

DISASTER PREPAREDNESS FOR COMMUNITIES OFF THE BEATEN PATH

BY NAIM KAPUCU AND FERNANDO I. RIVERA

December 15, 2020

Depictions of rural life tend to romanticize certain qualities—the remoteness, the rustic charm, the freedom from the bustle and crowds of cities. These qualities might be appealing, but they are also what make rural communities especially vulnerable to the impacts of hazards and disasters. Because of they lack the financial and material resources that are available in urban areas, rural areas must think ahead and work collaboratively to build their disaster resilience.

Resilience, especially community resilience, has become a critical focus for emergency managers and policy makers concerned about hazard risk and vulnerability in rural areas. Resilience is usually defined as the capacity to recover quickly from adverse external impacts, such as disasters. This capacity can be built or strengthened by using hazard mitigation to reduce or prevent losses, as well as implementing preparedness activities that improve the effectiveness of response.

For rural communities, however, building resilience is difficult for a number of reasons. Smaller tax bases can cause financial constraints, limited population can affect the way state and local mitigation and recovery funds are distributed, and training opportunities and equipment for disaster response might also be lacking. Reduced access to technology can prevent communication before, during, and after disasters. These obstacles can create significant difficulties in designing and implementing hazard mitigation plans and practices.

Vulnerabilities specific to rural areas might also play into a lack of resilience. Rural communities often consist of low-cost homes (such as mobile homes), individuals with lower incomes and lower education levels, relatively older populations, and people whose livelihoods are dependent on resource-focused occupations, such as farming.

Because of these limitations, it's important for rural emergency organizations to reduce the reliance on federal resources and encourage community responsibility in addressing hazards. Typical funding and response avenues—such as formal disaster declarations or other types of mutual assistance agreements—can be almost impossible to access for rural communities and neighborhoods. As such, assistance to these areas might not arrive in timely manner, as we saw after Hurricane Katrina in Louisiana and Texas in 2005 and Hurricane Irma in Florida in 2017.

To become more resilient, it's critical that rural communities invest in building their capacity and partnering with urban areas. Because many rural locations can be considered part of urban-rural interface, opportunities exist to leverage the resources of their more populous neighbors. Our book, ***Disaster Vulnerability, Hazards, and Resilience: Perspectives from Florida***, highlights lessons we learned in that state about building resilience. These included how the rural-urban interface is important for disaster resilience in vital economic sectors, such as agriculture and tourism, as well as how important farm worker activities and response actions are to community resilience.

Our **earlier research on rural disaster resilience** focused on how communities can increase resiliency using asset-based planning, policy interventions, and collaborative governance mechanisms—including resource sharing with urban area agencies. Memorandum of agreements and collaborative engagement with nearby urban areas can be impactful in developing rural resilience, as well. Communities we examined either exhibited strong social capital and shared resources informally or they developed local mutual assistance arrangements to share resources. Taking the initiative to draft memorandum of understandings and mutual assistance compacts can help in build local capacities. Working closely with county-level government, which often act as the administrative arm of the state governments in disasters, can also help rural communities reduce costs and more effectively address impacts.

These findings point to critical implications for the specific issues that impede disaster resilience in rural communities. Collaborative culture and leadership perspectives are crucial for building rural community capacity and effectively managing emergencies. If such collaboration is not attentively implemented, there is a potential to create new vulnerabilities, lack the resources to address impacts, and ultimately be less resilient to disaster.

ABOUT THE AUTHORS

NAIM KAPUCU is Pegasus Professor of Public Administration and policy and former director of the School of Public Administration at the University of Central Florida. His research focuses on emergency and crisis management, decision making in complex environments, network governance, and leadership. He is co-editor of *Disaster Resiliency: Interdisciplinary Perspectives*, co-author of *Disaster Vulnerability, Hazards, and Resilience: Perspectives from Florida, and Network Governance: Concepts, Theories, and Applications*.

FERNANDO I. RIVERA is a professor of sociology and director of the Puerto Rico Research Hub at the University of Central Florida. He has co-edited *Disaster Resiliency: Interdisciplinary Perspectives*, co-authored *Disaster Vulnerability, Hazards, and Resilience: Perspectives from Florida*, and edited *Emerging Voices in Natural Hazards Research*. Rivera was guest editor for *Puerto Rico's Population Before and After Hurricane Maria* special Issue of *Population and Environment* and is guest editor for *Analysis of Pre and Post Disaster Management and Recovery in Puerto Rico from Hurricane Maria* special issue of Journal of Emergency Management.

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Residents and volunteers worked to clear debris and help restore services in the community after Hurricanes Maria and Irma struck Puerto Rico. Source: Joe Piette, 2017.

UNITY IS STRENGTH

COMMUNITY RESILIENCE IN PUERTO RICO AFTER HURRICANE MARIA

BY ANAÍS DELILAH ROQUE, DAVID PIJAWKA, AND AMBER WUTICH

December 4, 2020

Puerto Rico's long history of **socio-economic and political challenges** meant that when Hurricane Maria battered the archipelago in 2017, communities had to rely heavily on neighbors and civil society organizations to deliver effective disaster response and recovery. During this process, elements of social capital—shared values, collaboration capacity, and community organization—became points of reference that community members could use to gather and organize themselves.

In the wake of this humanitarian crisis, communities with established community organizations—**such as the two we studied**—can provide a perspective on community resilience that others can learn from. These communities, Corcovada and Mariana, had faced stressors (such as water insecurity) before Hurricane Maria and worked to organize community members to improve their well-being. After the hurricane, with their physical infrastructure severely affected, these organizations were invaluable in extending pre-existing networks and forging new networks to allow them to respond and recover, as well as build resilience to future disasters. Based on what we learned from community leaders' experiences, our work suggests putting a stronger emphasis on social capital could enhance disaster response.

USING SOCIAL CAPITAL TO SUPPORT DISASTER RESILIENCY

Our research focused on three domains of social capital—bonding, bridging, and linking social capital—to evaluate the two communities' organizational capacity, frontline leadership, emergency management performance, and collaborations. Bonding social capital is characterized by strong ties and assistance between group members who share similar characteristics, such as culture, ethnicity, or identity. Bridging social capital refers to accessing resources and connecting different groups with a common goal. Linking social capital allows communities to access resources from institutions of power, such as the government or non-local donations.

Our findings showed that all three dimensions of social capital were important for response and recovery efforts, although their usefulness might vary based on the stage of recovery. For example, in the early stages bonding social capital was key to gathering household resources (such as chainsaws and trucks) that allowed community members to act as first responders before formal emergency assistance arrived. Bridging social capital allowed nearby communities to bring in non-perishable items and water to affected families. After the initial response, though, linking social capital—connections with powerful institutions—was the most valuable in supporting resiliency, especially for future events. It helped facilitate donations (such as water tanks and solar panels) and brought outside volunteers in both communities.

In Corcovada, linking social capital enabled community leaders to implement a battery system for their community aqueduct, so they didn't have to rely on gasoline and support water security. In Mariana, linking social capital helped leaders modify an abandoned school into a center that the community uses for multiple purposes, including as a place to shelter in extreme weather events. In this sense, the three dimensions of social capital addressed specific needs that enhanced overall disaster resiliency at multiple stages.

KEY LESSONS FROM COMMUNITY LEADER PERSPECTIVES

As part of our study, semi-structured interviews were conducted with 13 community leaders from Corcovada and Mariana about their experiences during and after Hurricane Maria. Both communities had strong, well-established organizations that had supported residents for as many as 30 years, so their viewpoints provided a range of knowledge. From these interviews and participant observation, we learned that:

- Community-based organizations can serve as institutions where social capital is fostered, used, and strengthened in times of stress;
- Pre-disaster social organization, community planning, and interactions add significant resiliency after a disaster, especially in the ability to organize community members to take action;
- Faith-based organizations and the university can play significant roles in connecting communities with larger organizations to provide assistance and collaborative capacity; and
- Social capital can provide disaster resilience if used purposefully for such outcomes.

Cities or municipalities can foster the dimensions of social capital to become more resilient. Bonding social capital can be developed by incentivizing gatherings where community members can meet each other and connect. These can be virtual or in-person events and might feature activities that motivate individuals to interact with fellow community members. Such events could become spaces where participants and experts on resilience can evaluate their community's strengths, weaknesses, and collaborative capacities to develop a plan of action. Bridging social capital will grow as recognized community representatives and city officials work to identify key people, organizations, or resources (physical and social) nearby that support the collective goal of achieving resiliency. Linking social capital will be useful as the communities get more organized and develop specific funding targets to support their collective objectives.

Puerto Rico's compounded challenges throughout its history have taught communities to organize and learn from multiple shocks. This prevailing resilience can perhaps offer a glimpse of how other communities can face complex challenges by giving us the opportunity to reflect on the role social capital can play in disaster resilience. As they may put it, ¡En la unidad esta la fuerza! Unity is strength!

ABOUT THE AUTHORS

ANAÍS DELILAH ROQUE is an environmental social scientist and anthropologist that studies resource insecurity and health in the Anthropocene. Currently, her research agenda is interested at how households and communities experience, prepare for and respond to food, energy, and water insecurity in the wake of a hazard (e.g., geophysical, climatological) or disaster. Roque is part of several interdisciplinary and transdisciplinary teams that advance research at the intersections of environmental behaviors, community resilience, social vulnerability, climate equity and justice, and community-based collaboration. She conducts research in Puerto Rico, Phoenix (Arizona), and the U.S. Mexico Borderlands.

DAVID PIJAWKA is professor emeritus in the School of Geographical Sciences and Urban Planning at Arizona State University. He received his PhD in geography in 1983 and headed the Center for Environmental Studies, the PhD Program in architecture, design and planning, and associate director for Urban Planning among other leadership positions. Pijawka has over 100 research grants and numerous publications in the areas of Hazards and Resiliency, Sustainability Planning, Environmental Management and Policy, and Socio-Economic Impact Assessment. Among his many awards and honors, he received the 2020 Lifetime Achievement Award for Environmental Education (AAEE).

AMBER WUTICH is the president's professor of anthropology and director of the Center for Global Health at Arizona State University. Her research focuses on basic human challenges like water insecurity, food insecurity, and global mental health. As an ethnographer and methodologist with over 130 publications, Wutich edits the journal Field Methods with H. Russell Bernard. Her latest book, co-authored with Alexandra Brewis, is *Lazy, Crazy, and Disgusting: Stigma and the Undoing of Global Health* (2019, Johns Hopkins University Press). Wutich was selected as Carnegie CASE Arizona Professor of the Year, recognizing an outstanding university educator career.

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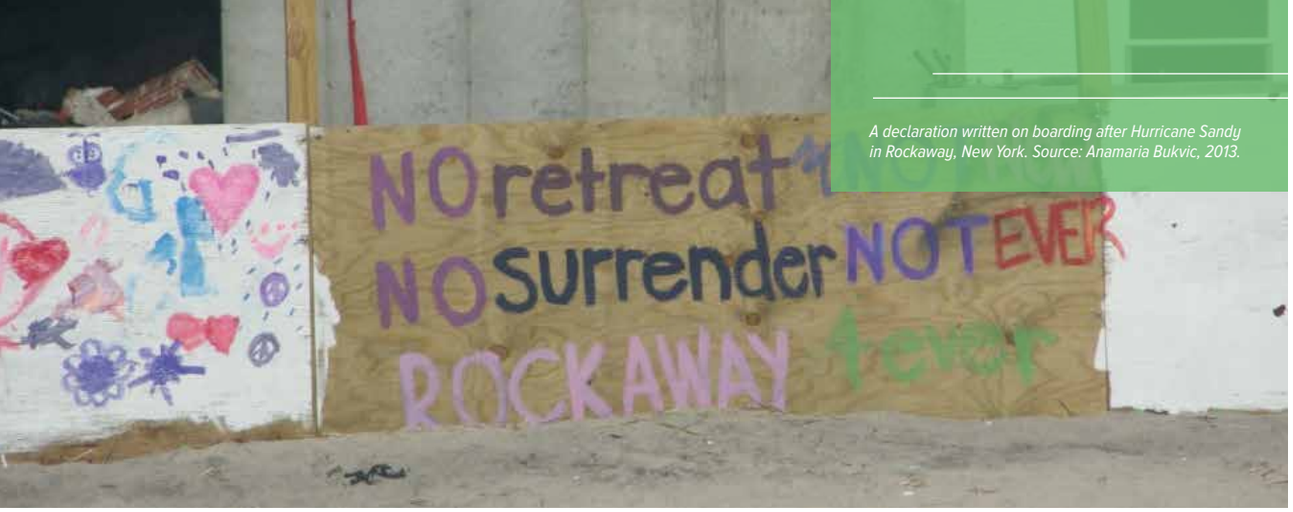

A declaration written on boarding after Hurricane Sandy in Rockaway, New York. Source: Anamaria Bukvic, 2013.

LEAVING THE SHORE

WHAT DRIVES DECISION-MAKING AFTER COASTAL DISASTERS

BY ANAMARIA BUKVIC

November 11, 2020

The devastation of Hurricane Sandy caught many East Coast residents by surprise. The gravity of the disaster, however, truly came into focus months later when the reality of slow recovery—hampered by weather, the many impacts of the storm, and bureaucratic red tape—started to sink in. The compound challenges faced by residents, including psychological trauma, property loss, and the inability to resume day-to-day life, caused several community members to wonder if relocating away from high-risk areas might be a better option.

Relocation has been increasingly discussed as a possible **adaptation** and **hazard mitigation** strategy for households and communities with high physical vulnerability to repetitive coastal hazards. The discourse about whether to move away from risk or to coexist with it has been extensively explored in the context of natural hazards and disasters. One of the key takeaways from these conversations is that the decision to relocate is highly contextual, complex, and shaped by many personal and place-based considerations.

Understanding the priorities that influence the willingness to consider relocation is crucial for developing proactive policies and programs that would ensure that the relocation process is efficient and equitable. Currently, one of the main financial mechanisms that provide support for permanent relocation, the **Federal Emergency Management Agency's Hazard Mitigation Grant Program**, only does so after a major disaster is declared and only if properties meet strict eligibility criteria based on the frequency and extent of damage.

A declaration written on boarding after Hurricane Sandy in Rockaway, New York. Source: Anamaria Bukvic, 2013.

Support for voluntary relocation varies among residents based on their financial concerns, risk perceptions, experience with chronic flooding and disasters, attachment to home and place, and social embeddedness in their neighborhood and community. These considerations and how they are prioritized often change after residents experience a major disaster.

It's important to identify personal and situational factors that influence the decision to permanently relocate if we're to develop more productive relocation programs. To better understand this issue, a total of 125 surveys were collected five months after Hurricane Sandy in the eight New Jersey communities with the highest levels of structural damage. My research suggests that the primary reasons influencing the willingness to consider relocation among Hurricane Sandy-affected homeowners were:

- **Level of stress** associated with rebuilding, recovery, experiencing recurrent hazards, filing insurance claims, and the loss of personal belongings. Relocation was not perceived as stressful, either because residents considered it less discomforting or because they did not consider it at all.
- **Financial aspects** such as increases in insurance rates, filing assistance claims, and tax increases.
- **Repetitive exposure** to coastal hazards and disasters that increase anxiety, incur damage expenses, and disrupt livelihoods—eventually pushing residents past their tolerance level and prompting them to permanently relocate.
- **Change in community** profile after disasters, possibly attributable to slow or inadequate recovery. Such changes might include a decrease in available services and amenities, deteriorated school systems, increased crime, or the closure of businesses.

Considerations that were the least important when considering relocation in Hurricane Sandy-affected communities included moving together with neighbors, friends, and family and relocation incentives, such as providing similar housing in a new location, free legal services, and assistance with finding a new job elsewhere. Survey respondents preferred an individualistic approach to the relocation reflecting their personal preferences and values. Those who had shorter residence in the household were also more likely to support relocation because of concerns about tidal inundation and frequent flooding, perhaps because they were not used to dealing with this problem.

Understanding concerns, priorities, and preferences related to potential voluntary relocation after major disasters—and how they differ among diverse coastal populations—is key for developing effective and equitable relocation policies and programs. This research shows that economic factors are a major concern for most homeowners challenged by coastal disasters. Transparency about the financial consequences of hazards and disasters, the full cost of living in high-risk coastal areas, and the investment needed for adaptation and hazard mitigation effectively communicate the level of risk and may influence decisions about whether to stay in place or relocate.

This suggests that financial incentives or disincentives could play a role in helping homeowners better understand their options. In addition, proactive community dialogue about evacuation options, recovery expectations, available support, and uncertainty about frequency and duration of future hazard exposure could lessen other impacts, such as disaster-related anxiety and stress. As a growing number of coastal residents become aware of slow-onset hazards such as sea level rise and more pervasive tidal flooding, it is important to emphasize the compounding of risk and discuss all scenarios to enable residents to prepare mentally, financially, and logistically for possible relocation.

ABOUT THE AUTHOR

ANAMARIA BUKVIC is an associate professor of geography at Virginia Tech. Her research focuses on coastal adaptation, resilience, vulnerability, and relocation and has been funded by the National Science Foundation and the State of Virginia. She is also a fellow of the National Center for Atmospheric Research's 2019 Early Career Faculty Innovator Program and an associate director of the Center for Coastal Studies at Virginia Tech.

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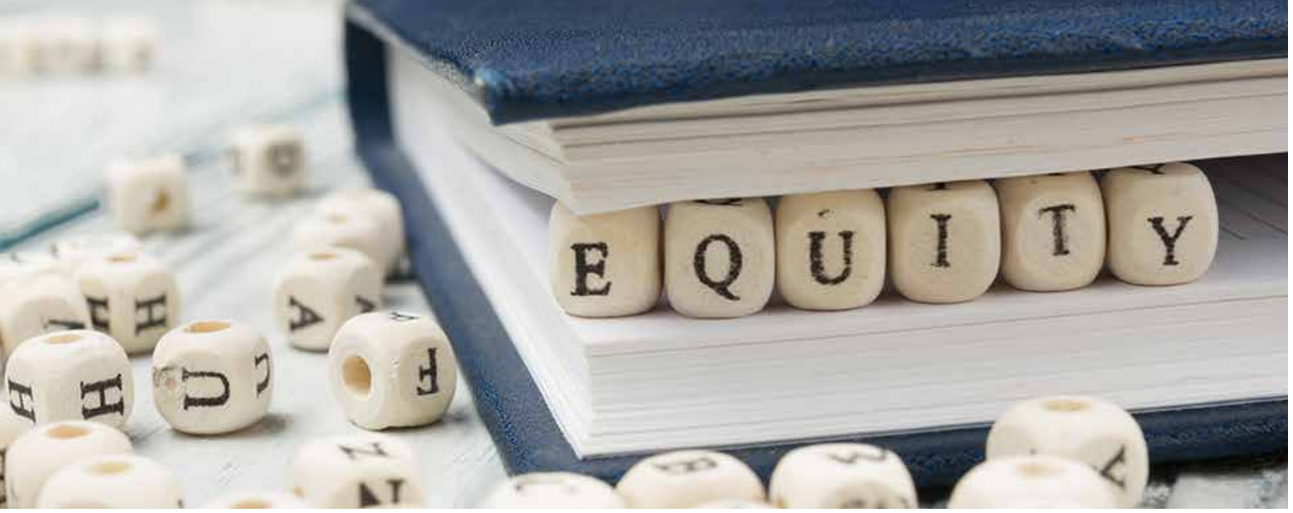

PLANNING FOR EVERYONE

CLOSING GAPS IN HAZARD MITIGATION PLANNING

BY JENNIFER A. HORNEY, COLTEN STRICKLAND, AND CAROLINE DWYER

October 13, 2020

Community members provide vital insights into the best ways to protect their cities and towns from the ravages of hazards and climate-related disasters. But planning processes that only include a portion of the community can only be partially successful. To reap the greatest benefits from hazard mitigation and climate adaptation planning, everyone must have a seat at the table.

For several decades, academic researchers and planning practitioners have worked to increase resident participation in local mitigation planning processes. The understanding of community members is a critical element in proactively assessing risk, directing safe development, raising awareness of hazards, and building consensus on equitable responses to risks. However, research shows that, regardless of efforts to include the experiences of socially vulnerable community members, some groups—including African-Americans, mobile home residents, the poor, the elderly, and short-term residents—are **consistently less likely to be represented** in local hazard mitigation planning. They are also generally less aware of the actions, policies, and investments that are prioritized in such plans. This representation gap lessens our ability to support communities and to **integrate climate adaptation into hazard mitigation planning**.

ADDRESSING THE PROBLEM

Disasters, by definition, are the result of a combination of hazard and vulnerability. With natural hazards increasing in frequency and severity worldwide—and vulnerability intensifying due to changes in land use and demographics—the **most vulnerable residents** will face increased food insecurity, be more susceptible to environmental risk, and could experience residential and occupational displacement.

These hazards will not only impact infrastructure and economies but **health systems and population health programs**, as well. If hazard mitigation planning dynamics do not shift in response to community changes such as aging, increased racial and ethnic diversity, and income inequality, they will not reflect the needs of at-risk populations or provide them with timely and adequate support.

Research indicates that several **key issues impede efforts** to engage vulnerable populations in the mitigation planning process. These include access to information (specifically the digital divide), social barriers such as racism, lack of trust, and language and cultural barriers. Mismatches between engagement opportunities and the lived experiences of vulnerable populations are also a problem. One approach communities are using to meet these challenges is an equitable engagement blueprint—a guide that identifies best practices, like holding meetings at times and in locations that are accessible to all, for all municipal planning in order to expand engagement opportunities. Cities like **Minneapolis, Minnesota** and **Durham, North Carolina** have already created these social contracts that acknowledge the many challenges of comprehensive community engagement with good results.

The City of Durham's Equitable Community Engagement Blueprint, for example, details several types of barriers that obstruct robust community engagement. These include both practical barriers (such as lack of child care or transportation), as well as less commonly acknowledged barriers such as a historic lack of transparency, inauthentic engagement, and inequitable development. To overcome physical barriers, the City identified potential solutions that included offering childcare during city-hosted events, hosting engagement opportunities in the targeted communities, and visiting residents at their homes. Efforts like these can promote active change and more inclusive hazard mitigation planning that reduce vulnerability more equitably and should be a key outcome of planning processes.

A CALL TO ACTION

While not all obstacles to participation can be removed, there are strategies that can help repair damaged relationships and make planning for the future more inclusive. Risk-based planning that engages communities and **involves partners such as public and mental health agencies and healthcare systems** can reinforce an understanding of the physical and mental health impacts of disasters on individuals and communities. Long-standing, mutually beneficial partnerships that progress on a community's timeline, rather than the academic or grant funding cycle, can engender trust and authentic engagement. Including green infrastructure and low impact development in all communities can **allay concerns about green gentrification**. Whatever the topic, authentic partnerships with trusted neighborhood organizations are key. Focusing on engagements that aren't limited to one-time projects are essential for promoting trust and making hazard mitigation planning more equitable.

Equitable engagement is gaining traction in conventional planning, but it is less certain that these practices are gaining a foothold in hazard mitigation and disaster planning. If we do not move to quickly adapt to the increasing pressures on vulnerable populations, it will be increasingly difficult to minimize the representation gap. It is now more important than ever to involve vulnerable populations in our planning efforts and to actively solicit, manage, and maintain equitable outreach and engagement opportunities in hazard mitigation planning for the communities we represent and serve.

*If you are interested in your community's Hazard Mitigation Plan or the status of the plan, you can view an **interactive map** on the Federal Emergency Management Agency website.*

ABOUT THE AUTHORS

JENNIFER A. HORNEY is a professor and founding chair of the epidemiology department and core faculty of the Disaster Research Center at the University of Delaware. Her research focuses on measuring the health impacts of disasters, as well as linkages between disaster planning and household actions related to preparedness, response, and recovery.

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DOES NATURE OR SOCIETY CREATE RISK?

PRACTICAL IMPLICATIONS OF SHIFTING THE DISASTER FRAME

BY JASON VON MEDING AND KSENIA CHMUTINA

October 2, 2020

Some scholars argue that "natural disaster" is simply a term of convenience and that the public readily understands that disasters originate from the structures of society. But public discourses—often centered around particular hazard or event-focused narratives of destruction—seem to suggest otherwise.

A lack of understanding about how risk is created isn't surprising when blame is continually attributed to nature. By naturalizing disaster in discourse, efforts to address unequal impacts are stripped of political power and the focus often shifts to taming nature.

As disaster researchers, we were concerned about the lack of data to demonstrate the tangible impacts of the disaster language that we use and, more broadly, of this "natural" framing. Our **current research** works to change this and enable dialogue with critics who argue that pushing back on the expression "natural disaster" is driven by bias and value judgements.

THE LIMITATIONS OF PREVIOUS DEBATE

Debate about the origin of disaster risk has been ongoing on for centuries (e.g. see **Rousseau and Voltaire** in the 18th Century), and while scholarship in disaster studies is now rarely devoid of a strong appreciation of the vulnerability paradigm—articulating how risk is created by society—an overarching "natural" framing still more often persists, than not.

Since 2017, we have been looking for ways to shake up this debate. As researchers involved in science communication, we have written, **recorded** and **mobilized** around the issue. In the academic space, we started investigating the contemporary usage of the expression "natural disaster" both in **academic literature** and **international organization publications**, such as the UN Global Assessment Report on Disaster Risk Reduction. Our research found that, overwhelmingly, "natural disaster" is used without critique as a convenience term.

In these various works, we have argued that this lack of critique leads to many potential problems. Those responsible for *creating risk*—such as developers building in floodplains or legislators rolling back social safety programs—are able to avoid detection when blame is placed beyond human agency. Inequality, while recognized, is also framed as a somewhat natural state that must be ameliorated, rather than a human design upheld to profit a minority. In this unjust context, aid can be offered to the vulnerable without ever addressing their systemic oppression.

But a theoretical debate has its limits. For instance, one reviewer of our work concluded that there was no problem with the natural disaster expression "unless one suffers from an excess of political correctness." The challenge we took from this criticism was to prove the tangible implications not only of the language, but of the broader framing and stories of disaster.

TAKING ON THE CHALLENGE: TESTING THE IMPACTS OF A NATURAL DISASTER FRAME

We decided to find a way to test the impact of framing disasters as natural. Collaborating with the psychology department at the University of Florida—and using the infrastructure of **Project Implicit**, which helps to educate the public about hidden biases—we designed the initial experiment.

We measured the political orientation, attitudes to social issues, beliefs about disaster causality, and risk mitigation preferences of 507 participants from 40 countries. We were initially interested in whether a person's understanding of the origin of risk as natural corresponded to purely technocratic approaches to dealing with risk. (i.e., to protect ourselves from nature's wrath.)

We found that this was indeed the case, and that implicit attitudes towards the underlying cause of disasters strongly correlated to ideological and political divides. We delved further into the data to analyze people's perceptions of who or what was to blame for disaster impact. This again differed based on understanding of the origin of risk.

The results were compelling enough to warrant further study. Our follow up experiment is currently examining the impact of simply adding the word 'natural' to narratives about disaster (comparing 'disaster' and 'natural disaster').

SHIFTING THE FRAME AWAY FROM NATURE

To begin the important process of shifting the frame of disasters, we can emphasize systemic oppression and structural violence when we discuss vulnerability. Risk is created and accumulates with human decisions. Vulnerability is underpinned by the avoidable—yet often invisible—political, economic, cultural, and legal limitations that prevent some groups from achieving equality and equity.

In this sense, the words we use matter. In a **recent article**, Natural Hazards Center Director Lori Peek highlighted that some people are the bearers of vulnerability. This is critical. At times the harm may be unintentional, but it is still a manifestation of violence and oppression. We can oppose such oppression through the careful choice of both words and actions.

The language that we use and the stories that we tell change the way that an audience engages with an issue. Too often disaster discourses fail to consider power, oppression, inequality, and injustice. Our ongoing research suggests that a more critical approach to writing and speaking is needed—because framing of disasters as natural is not only inaccurate, it upholds an oppressive status quo.

ABOUT THE AUTHORS

JASON VON MEDING is an architect turned disaster studies author and educator who centers the experiences, knowledge, and strengths of affected communities in his work. He is an associate professor at the University of Florida and has 15 years of experience leading interdisciplinary research and practice around the world. He is executive director of GatorCorps, a service program working towards a resilient Florida, and cohost of the podcast *Disasters: Deconstructed*.

KSENIA CHMUTINA is a professor of disaster studies in the School of Architecture, Building and Civil Engineering at Loughborough University, UK. Her research focuses on the processes of urban disaster risk creation in the context of neoliberalism. A core part of her activities is science communication. She is cohost of the popular podcast *Disasters: Deconstructed*.

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Cattle graze during drought conditions. Source: Michael Busby/Shutterstock, 2018.

PREPARING FOR DROUGHT ON THE RANCH

LESSONS FROM 2012

BY TONYA HAIGH, WALTER SCHACHT, CODY KNUTSON, ALEXANDER SMART, JERRY VOLESKY, MICHAEL HAYES, AND MARK BURBACH

September 28, 2020

Drought is a fact of life on the U.S. Great Plains; rangeland managers need to plan ahead to avoid devastating losses. A number of factors can make managers resistant to planning, however. There's always uncertainty about the length or severity of droughts—or if there will even be a drought—for instance.

Planning ahead can mean making decisions that raise costs or decrease revenue, so it might seem tempting to take a wait-and-see approach. Yet not preparing can be expensive, too. It seems the only real solution is to learn how to prepare more effectively. Luckily there are new evidence and resources that can help managers do just that.

Our **research on the 2012 drought in Nebraska and South Dakota** provides insight into decisions that were made by livestock and rangeland managers. The drought and results from the subsequent survey we conducted provided an opportunity to compare the management of different types of livestock operations at different severities of drought during the same time period. These findings can improve the understanding of how to plan for drought:

No single plan allows perfect drought management for every type of operation. Operations vary, even among one relatively homogenous population of cow/calf livestock producers in the U.S. Great Plains. Managers might consider their vulnerability to drought to be very different from that of their neighbors. For example, cattle production enterprises that are focused on producing calves from cows on grazing land dominate the region, but are also commonly associated with other types of cattle enterprises (e.g. grazing feeder animals during the summer). Beyond grazing land, managers may raise or purchase hay, cornstalks, and other sources of livestock feed. Operations can also vary in terms of grazing practices, access to irrigation, and economic status. These differences define how the manager is able to adapt during drought.

A farmer moves his sheep to a suitable pasture. Source: Ace Coote Photography/ Shutterstock, 2008.

Advance planning can increase drought response options. Drought plans allow managers to be more strategic in their drought response. Managers can work to improve the availability and flexibility of the operation's resources (e.g., alternative feeds or other grazing lands) before drought occurs so they can take less costly and less risky actions during drought. In 2012, almost all managers in the region took some type of action to supplement their livestock forage supplies because of the drought, but some had more options for response than others. For example, having stockpiles of hay or alternative feed sources on hand provided a buffer that could be used during drought. Others without this buffer may have had to take other more costly actions. Adapting the operation to support strategic drought response is one important aspect of the plan.

Planning ahead can make difficult decisions easier during drought. Difficult decisions come with a cost, either in extra expenses or lost revenue. In 2012, many rangeland and livestock managers were forced to make herd reductions in response to drought. In some cases, managers could lower the cost of these actions because of the flexibility that was built into their operations. For example, some operations had herds that could be moved to other forage resources so that livestock numbers and long-term animal productivity were not reduced. However, when the buffer or resilience of the operation is surpassed, selling animals might be necessary. Those who reported the greatest damages to their rangeland resources were also the ones who made herd reductions in 2012. Without a clear plan of action, managers might put off these difficult decisions until after the damage to resources is evident. But because **forage production in the region is driven by April-June precipitation**, the decision to reduce herd sizes can be reliably made by mid-summer, which can minimize the expenses of feeding, lost revenue due to lowered livestock prices, and long-term damage to rangeland health. Drought plans should address how and when to take action so that risk to the operation and stress to managers is reduced.

Insurance options shouldn't be overlooked in drought planning. The use of **Pasture, Rangeland, and Forage (PRF) Insurance** is a newer and potentially important part of a rangeland drought plan. The insurance provides payment for lack of precipitation during key (manager-determined) months. The financial benefits can provide capacity for managers to purchase supplemental hay or other feed and avoid destocking pastures. Managers who used the insurance in 2012 were also more likely than others to lease, rent, or purchase additional land for grazing.

The **National Drought Mitigation Center** has created the Managing Drought Risk on the Ranch website to support rangeland manager efforts to plan for drought mitigation, response, and recovery strategies. In a future that will include increased climate variability and extremes, rangeland managers will grapple with questions of how to plan for drought and what it means to be prepared. Planning for the easy *and* the difficult decisions is an important part of that.

CITATION

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ABOUT THE AUTHORS

TONYA HAIGH is a research assistant professor with the National Drought Mitigation Center at the University of Nebraska—Lincoln. Her research focuses on the adaptive capacity of resource managers to cope with drought. Haigh has worked with ranchers, advisors, and researchers to develop the **Managing Drought Risk on the Ranch website**, and has provided her social science expertise to developing agricultural decision support tools for Corn Belt producers and specialty crop growers.

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JERRY VOLESKY is a professor and range and forage specialist with the University of Nebraska's West Central Research and Extension Center in North Platte, Nebraska. Research and extension programs focus on plant-animal interactions in rangelands and pastures.

MICHAEL HAYES is a professor in the School of Natural Resources at the University of Nebraska-Lincoln (UNL). He arrived at UNL's National Drought Mitigation Center (NDMC) when it formed in 1995 and became the NDMC's Director in 2007. In October 2016, he transitioned into his current role where he now coordinates the Applied Climate Science major and teaches three climate-related courses. His main research interests deal with drought risk management, climate- and water-related issues.

MARK BURBACH is an environmental scientist with the University of Nebraska-Lincoln, School of Natural Resources. He has a master's degree in water resources planning and management and a doctorate in leadership studies. He is the author of nearly sixty refereed journal articles and five book chapters along with hundreds of professional papers and presentations. Burbach is an award-winning scholar and currently teaches courses in environmental leadership and human dimensions of natural resources.

COUNTING THE COSTS

IMPROVING DISASTER RECOVERY COST ESTIMATION

BY KELLY KLIMA AND ISMAEL ARCINIEGAS RUEDA

September 28, 2020

"The magnitude, frequency, location, duration, speed of onset, and other characteristics of many hazards can now be predicted and forecasted with more accuracy and further in advance than before," observed geographer Ian Burton. The knowledge of people and infrastructure has likewise improved, allowing better understanding of damages and subsequent cost estimations. These improvements may lead to higher accuracy and precision, helping to speed disbursements to pay for repairing or replacing infrastructure. Yet there are other factors to consider that influence the accuracy of cost estimates before, during, and after a disaster. For example, what happens when there is money available from Federal Emergency Management Agency? When many different groups need that money, how should those limited funds be distributed?

COST ESTIMATION UNCERTAINTIES

Estimating the cost of disasters is a complex process. Consider, for example, a school superintendent seeking to renovate a school in a non-disaster setting. The superintendent might solicit cost estimates from contractors, who would provide estimates based on their knowledge.

Let's say the school's renovation is necessary because of flood damage, though. There are now **other factors to consider**, such as how quickly the repairs are needed (e.g., is school currently in session), if contractors will be too busy to take on the project, if government assistance is available to fund repairs, or if the infrastructure needs to be upgraded to meet new codes and standards,

Next, consider how disaster recovery is complicated even further during this new era of COVID-19, when extra precautions must be taken. For example, hotels (where workers might stay) may have to clean more often. Or, some workers might not be willing to stay in a hotel, thus driving down the supply of labor and increasing costs. In the field, more personal protective equipment, sanitizing agents, and other items would be required to protect against COVID-19, and supply shortages of these items could increase cost. Furthermore, local governments are under unusual stresses due to lack of tax revenue, which may delay payments.

Uncertainties also exist within the realm of repairs related to electric utilities. A utility might be faced with the tradeoff of salvaging material and equipment from one place to reuse in another as a temporary repair. In addition, some items are rare, difficult to transport, and require special expertise to install. For example, extremely high voltage transformers can weigh 500 tons or more, requiring special cars, helicopters, or rail to transport. Given all of these and other types of uncertainty, it is inevitable that even with excellent knowledge of damages, cost estimators still lack sufficient data to estimate costs.

USING DATA TO IMPROVE COST ESTIMATE ACCURACY

How can we estimate costs quickly and reliably, thus improving the flow of dollars back into the community? The answer is data, and the basis of a reliable cost estimation is collecting and cleaning the data to develop and accurate and accessible database.

Some data are available via proprietary databases. For example, when actual costs are not available, FEMA analysts typically use a product called **RSMeans**, which includes cost estimation books for everything from nuts and bolts to wind turbines. Other databases, such as Arizona State University's **Spatial Hazards Events and Losses Database for the United States (SHELDUS)**, provide information about specific types of damages from natural hazards dating from 1960 to present.

Other organizations are making some **disaster-related data publicly available**, from both government and private industry, which could be used to improve estimates. For example, the **U.S. Bureau of Labor Statistics** has databases that provide labor-related data to help estimate costs. Facebook has created **Disaster Maps**, which "share real-time information with response teams, helping them determine things like whether communities have access to power and cellular networks, if they have evacuated, and what services and supplies they need most." From an electricity perspective, the National Oceanic and Atmospheric Administration's **Nighttime Lights** makes it possible to determine changes in ground lighting, which can serve as a proxy for electricity usage before and after an event.

NEW TRENDS AND POSSIBILITIES

As the amount of data increases, the potential value of analytics such as linear regressions also increases. This is especially true for new data-intensive methods such as artificial intelligence or machine learning, which can help identify patterns from previous disasters to increase cost estimation accuracy

Disaster managers have enough challenges to address during a disaster without adding the estimation of costs to repair or replace infrastructure to the list. A great deal of relevant data, stemming from years of federal cost estimating for the military, air force, and domestic programs, are available. An ever-increasing quantity of data are being generated, together with the development of **technologies and cyberinfrastructure** to process, publish, and share data. Cost estimation should embrace these two trends as an opportunity for improving knowledge on disaster cost estimation in an equitable fashion.

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ABOUT THE AUTHORS

KELLY KLIMA serves as associate program director for RAND's Acquisition and Development Program for the Homeland Security Operational Analysis Center. Klima has more than ten years of experience in quantitative and qualitative decision analysis for risk reduction. Her research supports community resilience for extreme heat and flooding and has been applied in locations such as New York City and the City of Pittsburgh. She holds a certified floodplain manager designation from the Association of State Floodplain Managers and a certified cost estimator/analyst certification from the International Cost Estimating and Analysis Association.

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Spokane Valley Fire Department crews assist with a prescribed burn at a nearby wildlife refuge. Source: Spokane Valley Fire Department, 2015.

LESS FUEL FOR THE FIRE

WILDFIRE MITIGATION THROUGH HAZARDOUS FUELS REDUCTION

BY SUSAN CHARNLEY

May 14, 2020

Wildfire is a natural process, but current wildfire behavior is often influenced by human action. Although many wildfires cause unwanted social and ecological losses, some also provide social and ecological benefits for fire-adapted ecosystems and human communities. So while wildfires are often framed as disasters, it is more accurate to see megafires—wildfires greater than 100,000 acres that significantly impact social, economic, and environmental systems—as the true problem.

The frequency of megafires such as California's Tubbs and Camp Fires has increased substantially in the past two decades, and will continue to rise. What can we do to reduce their severity and impact?

One answer is to adopt mitigation practices that reduce the magnitude and severity of wildfires when they occur. An important mitigation approach is having forest landowners remove highly flammable vegetation—often referred to as hazardous fuels—near their homes and structures and on their forestland.

Ecologists studying wildfire are **conducting research** on how, where, and when forestland needs to be treated to reduce hazardous fuels. This can be accomplished by managing wildfires in remote areas; using manual or mechanical methods, such as thinning small- to medium-sized trees; or using prescribed burns to reduce surface fuels (i.e., harvest residue, leaf litter, small down wood) that cause fires to spread.

Numerous social, economic, and policy variables can influence a landowner's ability to effectively implement such treatments, however. Social science can help us understand these variables and how to promote wildfire mitigation through hazardous fuels reduction—but it's complicated!

Large wildfires burn across the landscape without regard to property boundaries. This means it's important for neighboring public, private, and tribal forest owners in high-hazard areas to reduce fuels on their own property and coordinate with their neighbors to plan the most beneficial treatments for everyone.

Different landowners, however, have different perceptions of wildfire risk and their forest management approaches, capacities, and property conditions can vary. This means that there isn't one solution that will help everyone better reduce hazardous fuels. Instead, a set of actions that can be adapted to the needs and circumstances of different landowners is needed.

Research I am conducting in Oregon **illustrates this point**. In Oregon, fire-prone forests often contain a mix of public, private, and tribal lands. The U.S. Forest Service—which manages most of the federal forestland in Oregon—conducts a variety of hazardous fuels reduction treatments to protect at-risk assets, such as homes in the wildland-urban interface, municipal watersheds, wildlife habitat, and timber. But the agency faces constraints in reducing fuels in some priority locations and at the scale needed.

One issue is that agency funding for fuels treatments is limited and something must be done with the vegetation that's removed. Markets for this material—which can sometimes be sold to make wood products or generate heat and power—are often lacking. This makes treatment less economical.

Other problems include management policies that might prevent vegetation removal in high-hazard locations, or public controversy over some treatments. Managers may also face restrictions on using prescribed fire, including labor shortages and smoke concerns. Tribal forest managers face similar financial constraints and must also balance fire management with other factors such as protecting culturally important resources.

Private owners also have concerns. Corporate forest owners can be hesitant to use prescribed fire if they fear it could escape and destroy valuable timber stands. Mechanical treatments (which are typically more costly) may also not be an option if they can't afford to remove vegetation that is not marketable. For family forest owners, they might not have the time, money, or technical expertise to remove vegetation. Or they may fear liability associated with prescribed fire or perceive their wildfire risk to be low.

A firefighter oversees a prescribed fire at the Sycan Marsh Preserve in Klamath Basin, Oregon. Source: Lisa McNee/U.S. Bureau of Land Management, 2017.

It's also important to realize that some **landowners are more vulnerable to wildfire than others**. They might have fewer resources to invest in homeowner insurance, structure protection, or cost-share programs for reducing hazardous fuels, as well as more limited access to financial and technical assistance. Therefore, investments to help mitigate wildfire risk are particularly important in places where socially vulnerable populations reside.

The good news is that progress is being made. A number of strategies that can reduce hazardous fuels across land ownerships are **in place in Oregon and California** and applicable elsewhere. These include:

- Targeted education and outreach campaigns that raise awareness of wildfire risk, mitigation strategies, and resources
- Technical and financial assistance to help landowners reduce hazardous fuels
- Policies, programs, and resources that support the use of prescribed fire
- Retention and development of local markets for vegetation removed through fuels reduction
- Partnerships that facilitate information and resource sharing, coordination, and problem solving

Communities near fire-prone forests of the western United States must learn to live with wildfire. It will be critical for all types of landowners to work together to mitigate wildfire hazard and restore fire-resilient forests by reducing hazardous fuels on their properties. Adaptation measures such as increasing preparedness and construction practices that improve the fire-resistance of homes and structures are also important. We can make it easier for people to live with wildfire in the future by giving attention to the social, economic, and policy factors that support this goal.

ABOUT THE AUTHOR

SUSAN CHARNLEY is a research social scientist with the U.S. Forest Service's Pacific Northwest Research Station in Portland, Oregon. Her research investigates how best to achieve the dual goals of environmental conservation and rural community well-being.

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A search and rescue team member explores a North Carolina home damaged by Hurricane Fran in 1996. Source: Dave Gatley/FEMA, 1996.

CLOSE ENCOUNTERS

HOW NEAR MISSES INFLUENCE DISASTER DECISION-MAKING

BY ROBIN DILLON-MERRILL

March 18, 2020

Narrowly avoiding a close call with a disaster might make people more likely to evacuate or prepare for the next one. Or it might not. Risk perception can be a fickle concept based in a number of personal factors, but research also shows the nature of that "near miss" plays an important role.

In their 1998 *Coastal Management* publication, Kirstin Dow and Susan Cutter examined **evacuation behavior** during Hurricane Bertha and, subsequently, Fran in 1996 to see if they would find a "cry wolf" effect after Bertha missed South Carolina and struck North Carolina instead. Their study ultimately did not find evidence of such an effect and determined that the "premature evacuations" for Bertha in South Carolina only played a minor role in evacuation decisions for Fran.

Building on this seminal research, we further examined the role of near-miss events in individual decision making to prepare—or not—for natural hazards. What we learned was that **decision making can be highly nuanced**. How people integrate factors including their personal experiences with previous storms and characteristics of the current storm in calculating risk is critical to determine the preparedness actions they might take.

In our work, we define a *"near miss"* as an event in which a person has a non-trivial expectation of experiencing disaster but, by chance, does not. Our natural environment produces many examples of near misses: a random tree pattern saves a house from a mudslide, for instance, or a hurricane weakens right before it hits a city. What is critical is how people interpret these events because every near-miss event has some plasticity in interpretation—it can be taken as either evidence of the seriousness of the threat or of its irrelevance.

We categorize near misses as either vulnerable (where the avoidance of a disaster results in a perceived vulnerability of the system) or resilient (where avoidance of a disaster results in a perceived resilience of the system). Near-miss events in a context where people escape harm can sometimes seem to imply resiliency because no damage was done. Our research shows that these near-miss experiences can lead to riskier behavior. On the other hand, when people understand a near-miss as a disaster that "almost happened," rather than a disaster that was avoided, then this could be associated with vulnerability. Our research shows that people who frame their disaster experience as a resilient near miss will be less likely to mitigate against impending hazards than people without this frame.

When a near-miss experience highlights the harm the event could have been caused, however, it adds information that counteracts the basic resilient near-miss effect. That is, a near miss that causes no harm can make the hazard seem less threatening, but the presence of harm creates associations with vulnerability. Thus, people with vulnerable near-miss information (that highlights how an event almost caused harm) will be more likely to take mitigating action for an impending hazard than people with resilient near-miss information.

Consistent with other research in decision making, our results suggest people are heavily influenced by previous outcomes. Past near-miss experiences shape how people explicitly judge risk and take mitigation and preparedness action. Remember, risk is a function of the likelihood of an event and its consequences. We believe the mechanism driving people's behavior is their perception of danger or the consequences, which stems directly from the influence of a near-miss influence on their memory, rather than a changed assessment of the likelihood of an event.

Finally, previous hazard research has shown that people's mitigation activity depends, in part, on what their neighbors decide to do. Research that considers how near misses influence group decision making is a logical next step. If some decisionmakers experienced resilient near-misses while others experienced vulnerable near-misses, which one would dominate when these experiences are shared? This research question should be explored further.

Understanding how near-misses impact behavior and decision making is vital to organizations responsible for informing the public about hazards. For example, those who educate the public about natural disasters may assume that people will respond uniformly to facts about the costs and probability of future events.

Our results suggest otherwise. Specifically, the same objective facts about the costs and statistically calculated risk of impending hazards will be evaluated differently by different people depending on their own near-miss experiences. Therefore, such facts may be insufficient for producing action. Instead, the narrative that accompanies these facts (including vulnerable or resilient near-miss information) can impact reactions to hazards. For those who experience resilient near misses, it might also be necessary to supplement information on possible harm to enhance their hazard decision making.

ABOUT THE AUTHOR

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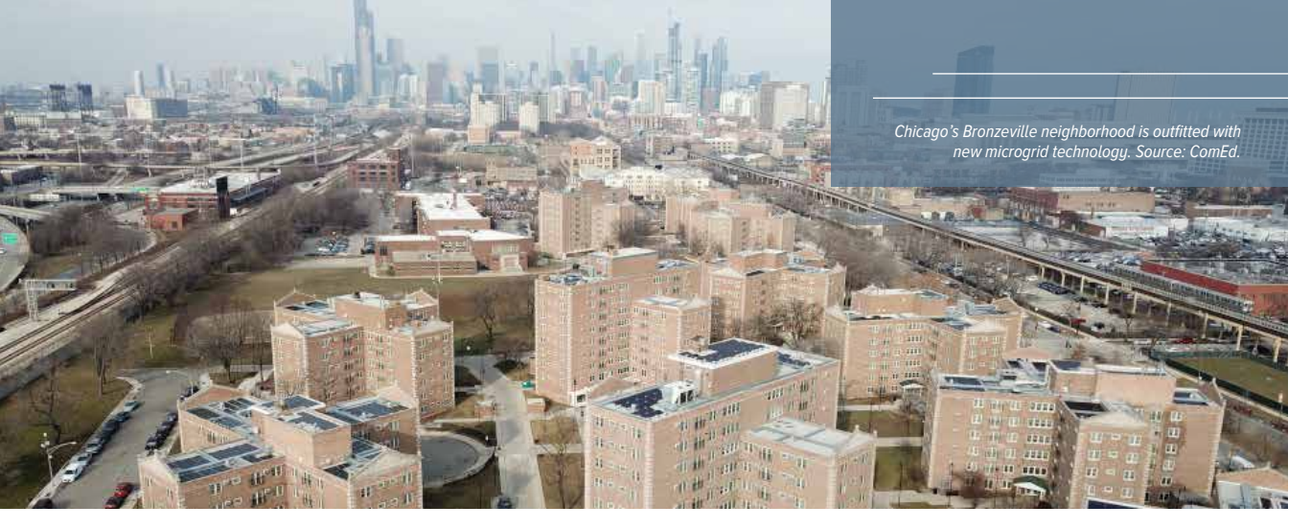


Chicago's Bronzeville neighborhood is outfitted with new microgrid technology. Source: ComEd.

LIVES ON THE LINE

THE BENEFITS OF MICROGRIDS IN DISASTER

BY JEFFREY SCHLEGELMILCH, JACKIE RATNER, SHAY BAHRAMIRAD, AND ALEKSI PAASO

March 11, 2020

So much of our modern, technological world depends on reliable access to electricity, it can be difficult to imagine what life without it would be like for a few hours, let alone days. But that's exactly what the people who prepare our infrastructure to withstand disaster must do.

Power outages can have far-reaching and cascading impacts. When the power goes out, communications systems fail, hospitals and healthcare facilities can't function at full capacity, and those on life-supporting medical equipment can be left in a lurch. Vulnerable community members, such as the elderly and the very young, are threatened by extreme temperatures when there is insufficient power to operate heating and cooling systems. As climate change contributes to increasing extremes, functioning heating and cooling systems could come to be a matter of life or death.

The importance of electric utilities in our day-to-day lives has led the Federal Emergency Management Agency (FEMA) to **designate them a community lifeline**. FEMA considers these lifelines to be so integral that they "enable all other aspects of society to function" and recommends that they are prioritized for reestablishment after a disaster and continuously improved and stabilized in non-disaster times.

This is especially important for traditional electrical infrastructure, which has **aged beyond its intended lifespan** and was not built to withstand today's climate. Experts have **projected tens of thousands of potential deaths in the United States** in the next few decades attributable to extreme heat. Add to this the burden that extreme cooling places on the grid, and we can anticipate serious public health consequences if electric distribution technology cannot keep pace.

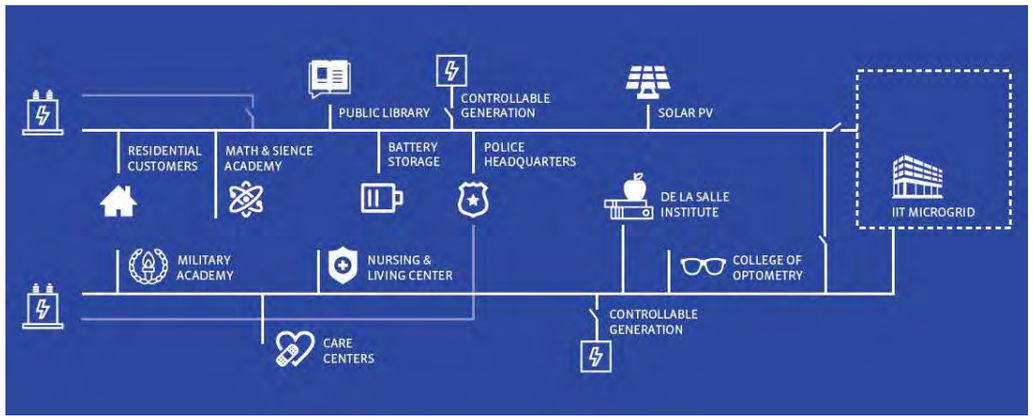
Fortunately, there are emerging strategies and technologies that can sustain electric lifelines, especially in emergencies. Experts from government, academia, and industry see **potential in the use of microgrids**, which are small power grids that can either be connected to the main grid or—during an emergency—be disconnected from it to keep locally generated power flowing. When resources such as solar panels and energy storage are also connected, a microgrid controller can route and optimize power within the grid's footprint. If the larger electrical grid goes down, the distributed energy sources within the microgrid will keep the lights on. Those in the grid's footprint are unlikely to experience extended power disruption and can serve as a resource to those outside the microgrid and help keep regional infrastructure, such as healthcare centers, shelters and responder operations, functioning.

Such **a microgrid now exists in the Bronzeville neighborhood** on the South Side of Chicago. The microgrid cluster, built by Chicago-based ComEd with the help of U.S. Department of Energy grants, is the first utility-operated microgrid cluster in the United States. The cluster includes a microgrid at the Illinois Institute of Technology and serves approximately 1,000 residences, businesses, and public institutions.

Since Chicago experiences extreme lows and heavy snowfall in the winter, high temperatures and humidity in the summer, and intense winds year-round, it's an excellent location to gauge the resilience of such a project. During a disruptive event, power in the community of Bronzeville could continue to operate, thanks to community solar and energy storage that would allow the microgrid function in isolation.

To further increase the resilience of the project—and advance overall preparedness research and science—ComEd and the National Center for Disaster Preparedness at Columbia (NCDP) University's Earth Institute have created a partnership that incorporates insights in social vulnerability with advances in electrical grid design and implementation. This will include a disaster simulation that will be held within the Bronzeville microgrid to examine and better understand the benefits of an interconnected approach. The work will eventually help inform further improvement to microgrid design and deployment strategies.

From the **rolling blackouts required to reduce wildfire risk** in California to Puerto Rico's aged and crumbling infrastructure that **contributed to the Hurricane Maria death toll**, we know that power system failures can exacerbate disasters. But new technologies, combined with the latest in disaster preparedness and science, can change these narratives from stories of failure to lessons in resilience.



The Bronzeville microgrid cluster at the Illinois Institute of Technology. Source: ComEd.

ABOUT THE AUTHORS

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JACKIE RATNER is senior project manager at the National Center for Disaster Preparedness. Her work innovates terrain maps from crowd sourced photos and digital photogrammetry called "structure-from-motion." She has received science advocacy and outreach awards, including the American Geological Union Voices for Science fellowship. She holds a bachelor's with honors in geology is from University North Carolina Chapel Hill and entered the earth science doctoral program at the University of Oxford.

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Cracked dry ground near Fremont, California. Source: N. Velichko/Shutterstock, 2014.

CANARY IN A COAL MINE

DROUGHT IN CALIFORNIA

BY LAURA OLSON AND RYAN ALANIZ

February 6, 2020

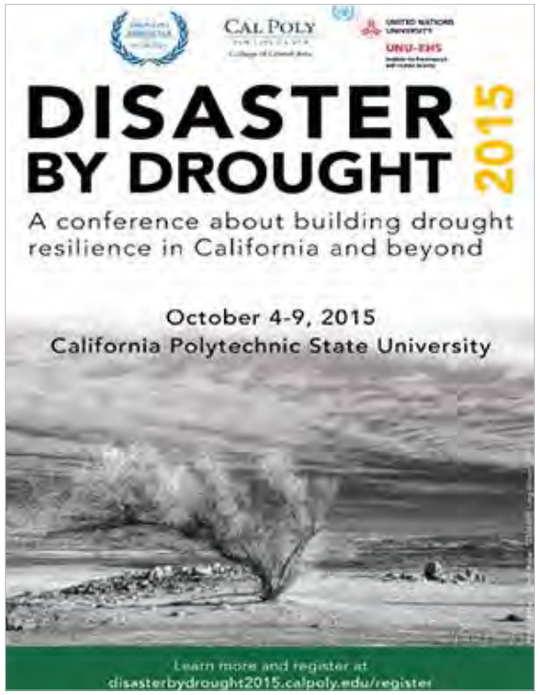
In August 2015, during one of the **longest periods of drought** in California history, I turned on my kitchen faucet to make my ritual morning coffee. Not a drop flowed from the tap and I caught my breath—our well was dry. Although I and my colleague Laura Olson explore drought academically, my immediate reaction was one of dread and panic. Like billions of people across the planet, my family was now water-stressed. And as a small farmer, our family ecosystem—including 22 goats, 40 chickens, a bee apiary, a greenhouse, a garden, and a small orchard—was without its sustaining lifeline. I had become a yet another victim of drought.

What we do now will shape our water future. Vulnerability to **water scarcity is growing** across the planet. In the United States, the impacts of drought may depend on how well local, state, and federal entities collaborate on mitigation, response, and recovery related to future water scarcity. The **Fourth National Climate Assessment predicts** future droughts will increase in length and severity as higher temperatures increase **evapotranspiration** and decrease soil moisture.

In California, the fifth largest global supplier of food and agricultural products, the 2012-2016 drought was the **worst in 1,200 years**, hitting agriculture especially hard and causing concern among state and national leaders. As uncharacteristically high record temperatures gravely stressed state water supplies, the governor declared a state of emergency and enacted mandatory water reduction measures for households statewide—but it's agriculture that **accounts for 80 percent of the state's water consumption**, and the agricultural industry was not subject to any water conservation measures. So while the state of emergency triggered some federal aid, discouraged water waste, and streamlined government processes, the larger issues related to agricultural water use and water rights in the American West were too politically contentious to overcome.

Measures to tackle drought are consistently too little, too late. Unlike the unexpected shock of tsunamis, earthquakes, and flash floods, the slow onset of water scarcity is easily ignored or tabled until the crisis escalates. Similarly, proactive mitigation strategies to address predicted droughts are rarely implemented in a timely way. Much like Aesop's fable of the grasshopper and the ant, in which the lazy grasshopper sings the summer away while the industrious ant prepares food stores for winter, the value of early action is recognized too late, and our institutions and society are left vulnerable to water scarcity due to our lack of planning and the dismissal of swift remediation measures.

In response to these challenges, California Polytechnic State University (Cal Poly), the United Nations University Institute for the Environment and Human Security, and the Munich Re Foundation partnered on a **Disaster by Drought Summit in 2015** that brought scholars from across the globe to California to examine the implications of extreme drought and share their knowledge about drought interventions at the level of policy and practice. Products from this workshop included a **federal policy brief** submitted to the National Security Council and a **state policy brief** that went to the California State Legislature. These documents recommended changes to policy frameworks, institutional arrangements, and **drought adaptation practices**.



Disaster by Drought Conference Participants. Source: Laura Olson, 2015.

While the briefs have been recognized by the White House and adopted by the United Nations University Institute for Environment and Human Security, knowledge is often not enough to shape sound policy.

Drought management in the United States is not proactive. The nation's relief measures, mitigation strategies, and efforts to protect water resources need improvement—our toolset and level of preparedness is seriously deficient. Comprehensive reviews of federal government drought policy and programs, such as the National Drought Policy Commission **report to Congress in 2000**, have all come to the conclusion that an **overarching federal drought policy does not exist**. Instead, drought management is ad hoc and disparate drought policies and programs are implemented individually without a lead federal agency designated to ensure the coordination of relief efforts. Despite repeated calls to **reform the U.S. drought management system**, fragmented programs and funding continue to cause patchy and inconsistent relief, gaps in service, and slow and inefficient responses. Our emergency management system is equipped to handle drought the way it does other natural hazards, but treats droughts differently, despite evidence that the economic, environmental, and social consequences of drought rival quick-onset disasters.

Failure is no longer an option. Attempts to move the country towards the adoption of a coherent national drought policy go back to the **National Drought Policy Act of 1998**, and have not produced the desired results. We cannot wait 22 more years to effect these much-needed changes. Years of consecutive drought are likely to continue given predictions of extended droughts and more arid baseline conditions in the United States. The possibility of mega-droughts and dwindling water resources will challenge existing policy regimes and require us to rethink the current policy landscape. Without concerted action to prime the policy pump, it is likely our well of options will run dry.

ABOUT THE AUTHORS

LAURA OLSON is a distinguished affiliate professor of emergency management at Jacksonville State University and also teaches at Royal Roads University School of Humanitarian Studies and the Georgetown University Disaster Management program. She has 18 years of experience leading recovery, risk reduction, and climate adaptation initiatives across the globe. She has worked with governments, non-governmental organizations, United Nations agencies, and impacted communities on resilience and capacity-building after disasters.

RYAN ALANIZ is an associate professor of sociology at California Polytechnic State University, San Luis Obispo. Alaniz conducts research on disaster resettlement and community building, the social consequences of drought, and prison education. Learn more about his work at **www.ryanalaniz.com**.

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People in Detroit call for social justice on a variety of issues faced by their communities. Source: Marcus Johnstone, 2010.

DISASTER JUSTICE FOR ALL

THE NEED FOR A MORE EQUITABLE AND JUST RECOVERY LENS

BY ALESSANDRA JEROLLEMAN

December 10, 2019

As disasters become more frequent and severe, it is more important than ever to determine what can be done to promote more just and equitable disaster recovery. The outcomes of major disasters are nearly always inequitable, which increases the vulnerability of those who struggled before the disaster and often displaces large portions of communities. The tremendous burdens that disaster recovery imposes result in some individuals—such as renters, those working in low-paying jobs, and undocumented people—finding it nearly impossible to recover after disaster.

Recovery efforts will continue to replicate these patterns unless we take into consideration the systemic injustices that have shaped the landscape of risk, such as concentrating the poor and minorities into high-risk areas or refusing insurance to those considered a poor financial risk. Families who are unable to afford flood insurance or adequately maintain their homes will find it more difficult to access disaster aid, which is based on the value and condition of their home. Alternatively, the added burdens of meeting higher standards—even those for that reduce risk—can drive the gentrification of neighborhoods and displace those who cannot afford to pay such "safety premiums."

A sign at the 2014 People's Climate March emphasizes the need for community-level consideration of the impacts of climate issues. Source: Alan Greig, 2014.

Emergency managers and policymakers could address these systemic injustices through the adoption of an intentional equity and justice lens. Policy-makers, practitioners, academics, and community leaders can often clearly identify unjust outcomes resulting from disaster policies that unevenly distribute resources and do not meet basic needs. What's less clear is how to create and implement programs that result in better outcomes while still meeting legal and programmatic requirements.

In response to this challenge, advocates have created guidance to help disaster-stricken communities promote more equitable recovery. For example, the National Association for the Advancement of Colored People (NAACP) toolkit, entitled **In the Eye of the Storm: A People's Guide to Transforming Crisis and Advancing Equity in the Disaster Continuum**, provides practical guidance for community leaders and emergency managers. There are also **examples of local governments** that attempt to promote justice and equity by incorporating value statements explicitly into plans and policies.

THE FOUR PRINCIPLES FOR JUST RECOVERY

It's still difficult to clearly articulate exactly what is meant by "just recovery," though, and harder to put it into action. But if we can't clarify what is meant by justice, it will be difficult to hold ourselves accountable. I have proposed a four-principle framework that can provide a starting point for the conversation about what a more just recovery might entail. These four principles provide a lens through which policymakers and practitioners can view proposed disaster recovery practices.

The principles listed below are excerpted from my book, **"Disaster Recovery through the Lens of Justice."**

Just recovery requires the ability to exercise agency. All community members—regardless of their socio-economic status, race, gender, sexual identification, land tenure, or other factors—must have the ability to fully exercise their agency and make free and informed choices that support of their personal well-being. This is not possible if there is direct or indirect coercion, exclusion from public policies, or other barriers to participation. Furthermore, agency cannot be fully exercised if all options are not understood and made available in a timely manner and through accessible means.

Just recovery begins with equality. The principle of prima facie political equality, which establishes that only equality is inherently defensible—different or unequal treatment must be justified by the discriminator. Bureaucratic processes that force disaster-affected individuals or communities to prove their deservedness puts the onus to justify the need for equal treatment on the victims, and so fails this test.

Just recovery harnesses community capacity. Capturing the transformative and adaptive capacity of communities and honoring their definitions of resilience can reduce future risks. Holistic disaster risk reduction is not possible without acknowledging existing patterns of unequal risk distribution. It is not sufficient to mitigate against current risk when rebuilding; instead underlying social structures and patterns must be questioned. Colorblind and ahistoric recovery that does not consider context is not just.

Just recovery requires equal access. Without equal access to resources and programs—including full participation in decision-making processes that govern resource allocation, future development, and other functions—it is not possible for communities to effectively participate in their recovery.

This framework is by no means easy to implement and many of its components will require significant structural and programmatic changes to the ways that disaster recovery is managed and resourced. Incremental changes are possible, however, and awareness is the crucial first step towards those changes. Explicitly designing programs to not only consider the elements of this framework, but also be evaluated for those elements, is another critical step. It is important to remember that what cannot be immediately changed, can be brought to light—and casting such a light on injustice in clear and descriptive terms is a necessary precursor to change.

ABOUT THE AUTHOR

ALESSANDRA JEROLLEMAN is the director of research for the Center on Environment, Land, and Law at Loyola University New Orleans College of Law as well as a community resilience specialist and applied researcher at the Lowlander Center. Jerolleman is a subject matter expert in climate adaptation, justice in disaster recovery, hazard mitigation, disaster recovery, and resilience with a long history of working in the public, private, and nonprofit sectors.

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An Amazigh man draws water from a well in Morocco. Source: Mikhail Priakhin/Shutterstock.

A FLOOD OF FACTORS

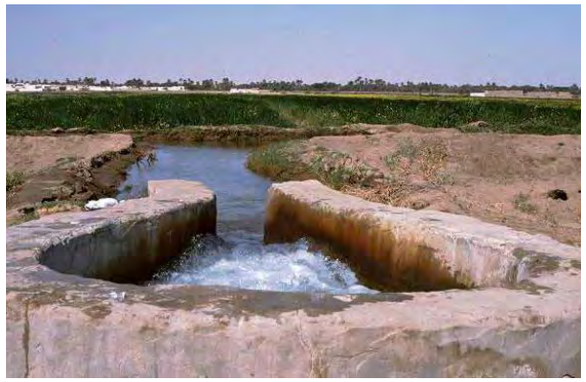
WATER SCARCITY CALLS FOR MULTI AND TRANSDISCIPLINARY APPROACHES

BY PAOLA MINOIA AND JOHANNA HOHENTHAL

September 24, 2019

Water scarcity and drought are often discussed under the lenses of natural and physical sciences. But simply understanding climatic drivers is not enough to address hazards that are intertwined with history, people, society, and geography. Neither can the role humans play in environmental degradation be limited to the study of human impacts. Our world is formed by social, economic, and political structures that are tied to physical space and ecological processes in complex ways. In places where socially transformative actions are needed to improve water availability and access to safe sources, researchers and policymakers need to engage with social sciences, human geography, political ecology and environmental histories. These scholarly lines of inquiry can reveal tensions over resources and territories that deepen critical environmental conditions and interfere with the traditional local systems that were once resilient to conditions of water scarcity and recurrent droughts. While mostly under-represented in policy making, applied research, and funding, their contributions deserve wider exposure and legitimacy.

This claim derives from our **observations from multi-sited research on the dynamics of hydro-social relations and injustice in the Mediterranean and areas of Africa**. Various studies have indicated the long-lasting impact of institutional rules introduced during colonial intervention and enforced by independent states. For example, in the Saharan and Sahelian belts of Africa, the nomadic and semi-nomadic living patterns practiced for centuries were an adaptative to recurring droughts. After the colonization—and especially with the independence of the new states—the consolidation of national borders and other political pressures, particularly in the case of ethnic minorities, have limited the mobility of populations. Among the most visible examples are the Tuareg, a nomadic pastoralist group of Berber origin interspersed along the borders of Algeria, Mali, Niger, Burkina Faso and Libya. They have been subjected to settlement plans since the early 1960s, restricting their freedom of movement and forcing them to depend on wells for water provision and to dry farm on marginal soils. While spatial mobility was at the core of their original resilience to droughts, the forced immobility made them more vulnerable to hazards, and led to severe recurring famines. These societal problems then developed into political reactions and many years of internal conflicts.



Artesian well near Dongola in Northern Sudan. Source: Paola Minoia, 1993.

Spatial and economic pressures can also exacerbate water scarcity. This is the case, for example, in **the Mediterranean area** where growing urbanization and tourism increase the water demand for irrigation, recreational purposes, drinking, and sanitation, especially in summer when use is higher. At the same time, the increasing use of agrochemicals and **overuse of aquifers** decrease quality of fresh water and groundwater. Under these circumstances, some governments have developed massive plans for mobilizing water using large dams and hydraulic infrastructures, as in the case of **the Sebou River in Morocco**, the Tagus-Segura Water Transfer in Spain, and the Southeastern Anatolia Project in Turkey. Other engineered interventions may include desalination and depuration plants that permit the use and re-use of low-quality water. Clearly, **large infrastructure destroys river ecosystems and destabilizes populations** living in impacted areas. Moreover, they affect the global climate through the great emissions of greenhouse gases.

Drought and water scarcity have been recognized among the goals of the United Nations 2030 Agenda for Sustainable Development as multidimensional problems that lead to increased poverty, decreased food security, loss of biodiversity and ecosystem services, the spread of disease, and interruptions in education. On the one hand, widescale international cooperation and agreements are needed to tackle human-induced environmental change, which is currently the main driver of water stress globally. On the other hand, UN agencies and other international institutions should be clearer about stating that external aid and technical solutions cannot solve problems if there is no understanding of how those issues are connected to political and economic structures that support authoritarianism, unsustainable exploitation of ecosystem services, and the unfair distribution of resources.

Artesian well near Dongola in Northern Sudan. Source: Paola Minoia, 1993.

Recognizing these structures and prioritizing issues related to social, ecological, and territorial justice are fundamental to addressing problems in a sustainable way. The experiences of local people—and especially traditional knowledge of local problems and adaptation measures— should be involved in research and governance practices through participatory approaches. This is what we did in **our research with the local community in the Taita Hills of Kenya**. More often than external experts think, local people have deep knowledge of their places, resources, social organization and traditions, and they have the right to have their living projects and desires prioritized.

For these reasons, the contributions of geography, social studies, and humanities need to be more closely considered to reach a deeper understanding of phenomena surrounding water scarcity and droughts—especially if we aim to support sustainable transformations that can be adapted to local circumstances. Only multidisciplinary and transdisciplinary approaches can take into account the many factors that produce such complex situations and help address them an interrelated way.

ABOUT THE AUTHORS

PAOLA MINOIA is an associate professor of geography at the University of Turin in Italy and adjunct professor at the University of Helsinki in Finland. She teaches development studies and geography. Her research has focused on water and territorial governance, political ecology, environmental justice, and epistemic rights, with extensive field work especially in Kenya, Sudan, Niger, Egypt, Tunisia, Morocco, and Ecuador.

JOHANNA HOHENTHAL is a postdoctoral researcher in development studies at the University of Helsinki, Finland. She has a PhD in Geography. Her doctoral research focused on water resource governance and local ecological knowledge in the Taita Hills, Kenya. Currently, she works on a research project that studies intercultural education in Ecuadorian Amazonia.

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Volunteers clear debris amid fallen power lines in the Florida Keys after Hurricane Irma. Source: Denny Orellana, 2017.

POWERING THROUGH

FLORIDA SHOWS THE PITFALLS OF FAST-TRACKING EMERGENCY POWER LEGISLATION

BY NICOLE S. HUTTON AND MICHAEL ALLEN

January 9, 2019

When Hurricane Michael—one of the most powerful storms in recorded history—made landfall along Florida's Panhandle on October 10, 2018, **only 184** of Florida's nursing homes met the state's new emergency power supply regulations. The regulations had been introduced a year earlier in an attempt to avoid deaths caused when air conditioning or life-sustaining equipment failed. Although compliance with **the rule** had been mandated by June 1, 2018, 523 facilities were given extensions—in part because of an increased demand for emergency power supply systems across the state.

The situation in Florida shows that using political pressure to fast-track legislation for improved safety doesn't necessarily result in timely execution or maximized benefits. **Our research** shows that the rush to meet deadlines for increased emergency power overwhelmed the elder-care industry.

MOTIVES FOR CHANGE

In September 2017, Governor Rick Scott used an **emergency action** to first initiate changes in power regulation after at least eight nursing home residents died because of Hurricane Irma-induced power outages. Although his initial order allowed only 60 days for nursing homes to comply, when Rule 59A-4.1265, Emergency Environmental Control for Nursing Homes was enacted in March 2018, the compliance deadline was set for June 1, 2018—the beginning of hurricane season. Under the new regulations, facilities are required to provide a minimum of 30 square feet of cooled space (81° F or less) for ninety-six hours in the event of an electrical power outage. Unfortunately, waits of up to four months to receive sufficient generator equipment, a lack of technicians to install it, and burdened inspectors to approve installations led to many extensions being granted. By January 1, 2019, the **Florida Agency for Health Care Administration** reported that there was still no implementation at 489 facilities. With Rick Scott now serving as state Senator, nursing home safety remains in flux as a new governor faces the legal ramifications of noncompliance.

Downed trees and power lines block the road in Norfolk, Virginia, after Hurricane Michael. Source: Jonathan Leib, 2018.

CRISIS AND COMPLIANCE

While the execution of the emergency action and subsequent regulations suffered from unforeseen consequences, the reasoning behind the rules is sound and necessary. Body temperature regulation is more difficult for older adults. During periods of elevated temperature, thermoregulatory capacity is reduced, so, lacking a moderately cooled environment, those with underlying medical conditions are at increased risk for heat-related health issues—especially when humidity is high.

For instance, Hurricanes Irma and Michael knocked out power for 6.5 million and 325,000 Floridians, respectively. Temperatures in the damaged areas of south and central Florida exceeded 90° F with dew points above 70° F before power was fully restored after Hurricane Irma. This combination of temperature and humidity heightens the risk for adverse heat-related health outcomes.

Temperatures in the days following Hurricane Michael were less extreme than those observed after Hurricane Irma because a cold front helped steer the tropical system and brought relatively cool air in the days following landfall. However, facilities that didn't have compliant emergency power systems would have still been strained trying to maintain the new standard of cooled space when the temperature reached 88° F on October 11, 2018. The expectation of prolonged power outages in heavily damaged areas **led to the evacuation** of 10 nursing homes in advance of the hurricane and four more after the storm, a total of approximately 1,600 residents.

CONDITIONS CONDUCIVE TO CHANGE

Our research into nursing homes in two counties affected by Hurricane Irma **found** that the capacity to maintain temperatures and life-sustaining equipment, such as refrigeration for diabetes medication and outlets for continuous oxygen compression, was not consistent within each county or between counties. After the emergency order was issued, we assessed 12 nursing homes from the areas with the highest concentrations of facilities in Collier and Polk counties. Only three facilities—one in Collier and two in Polk—were compliant before the emergency action deadline. The other facilities had extensions up to January 1, 2019.

The condition and capacity of existing equipment and clear procedures to initiate and approve contract work facilitated compliance. Emergency power plans at some facilities went beyond the cooling requirements to include additional systems, such as heat and lights, but in each of the counties, only one facility had planned for enough emergency power to operate the entire facility. This is a missed opportunity to maximize emergency access to life-sustaining equipment.

It's imperative to expand consistent emergency power supply legislation to other hazard-prone states if we're going to prevent deaths from post-disaster heatwaves—but the implementation must be done thoughtfully, as Florida's experience has shown. Standards for emergency power supplies at nursing homes across the country should consider the area's individual extreme temperatures and power failure risk. Furthermore, for reforms to be comprehensive and to reduce compliance delays, requirements and industry-specific resources need to be considered in advance. Only then will this vital legislation pack the power to prevent deaths.

ABOUT THE AUTHORS

NICOLE S. HUTTON is the assistant director of engagement for Old Dominion University's Institute for Coastal Adaptation and Resilience and an associate professor of geography in the Department of Political Science and Geography. Her research explores human-environment interactions across hazard types and emergency management stages. Shriners Hospital for Children had a transformational impact on her early life that resonates in her research with nonprofits and vulnerable populations in hazardous settings. She uses iterative participatory mapping processes to engage stakeholders in community resilience building and risk reduction prioritization activities.

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CITATION

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Firefighters and hotel employees participate in an earthquake drill in Mexico City on the 1985 and 2017 earthquakes anniversary on September 19, 2024. Source: Alejandra Garcia/Shutterstock.

NOT THEM

WHY MEXICO'S NEW LEADERS SHOULD ACT BEFORE THE NEXT EARTHQUAKE

BY RICHARD OLSON

October 31, 2018

Every year, residents of Mexico City conduct an earthquake mega simulacro or "big drill" to commemorate the September 19, 1985 earthquake that killed some 10,000 people and fundamentally changed the city. Sirens sound, loudspeakers blare, and emergency messages pop up on smartphones as residents prepare for the next inevitable seismic event.

Last year was no exception, and the Mexico City mega simulacro went off as normal at 1:14 p.m. But then around 3 p.m., in an almost surreal coincidence, the sirens sounded again—this time it was not a drill. A magnitude 7.1 earthquake had struck near the city of Puebla, about 75 miles (120 kilometers) south of Mexico City. With the epicenter so close to the capital, the early warning system gave residents only seconds to evacuate or otherwise prepare for the oncoming shock waves.

For 20 seconds, the ground shook violently. Forty-four buildings collapsed, **killing 369 people**. According to the **International Disaster Database of the Centre on the Epidemiology of Disasters**, the earthquake affected 256,000 people and caused $6 billion in U.S. dollars in economic damage.

Almost every in-depth journalistic treatment of the 2017 earthquake **refers back** to the 1985 quake in some way, particularly in terms of **lessons learned**—or not learned—about **public awareness and early warning** and **corruption and building codes**.

More binds the 1985 and 2017 earthquake effects in Mexico City than timing, however, and the next one could pose unprecedented political, social, and public opinion challenges for the administrations of incoming President Antonio Manuel López Obrador, known in Mexico as AMLO, and Mexico City Mayor Claudia Sheinbaum Pardo. Both are from the young National Regeneration Movement, and both ran campaigns highlighting "We are not them"—referring to the three major parties and more generally la clase política (the political class) that have dominated politics in Mexico seemingly forever. Because of this platform, the public will likely expect them to deliver a higher standard of risk mitigation, preparedness, and response.

I have been involved in team field research on the political and social implications of disasters in Latin America for more than 45 years, including in Mexico post-1985. I have seen firsthand that people in Latin America and the Caribbean immediately grasp the ways that natural events often starkly reveal socioeconomic problems and disparities. Since 1985, Mexicans in particular are acutely aware of how that happens.

MEXICAN CIVIL SOCIETY EMERGES

For Mexico City, the 1985 earthquake disaster was historic in unexpected ways. With the Mexican government shockingly slow and ineffective in response, ordinary Mexicans **organized themselves** [in Spanish] into self-help brigades and neighborhood associations.

The result was a tremendous surge of **popular organizing** and a significant deepening of **Mexican civil society** [in Spanish]. Indeed, the 1985 earthquake triggered a "**critical juncture**" that contributed to the end of a presidentially-appointed regent for Mexico City and led to a popularly elected mayor, which truly democratized the municipal government.

The 1985 earthquake was another in a series of crises that undermined the **political legitimacy** of the Partido Revolucionario Institucional (PRI), which had ruled Mexico in various forms since 1929. The legitimacy of the PRI-dominated state system was founded on the ideals of the Mexican Revolution but over time increasingly relied on doling out jobs, contracts, and privileges on one hand, and repressing or co-opting political opposition on the other.

However, when the hard-right administration of President Gustavo Díaz Ordaz cracked down on student protestors in Mexico City—killing 300-400—just ten days before the 1968 Olympics, the system's legitimacy cracked. With more repression in the 1970s, the 1982 debt crisis, the 1985 earthquake disaster, the tainted 1988 presidential elections, high-level corruption scandals, political assassinations, and the Zapatista uprising in southern Mexico in 1994, Mexicans rejected the PRI in the 2000 presidential elections and embraced a type of national democratization. The underlying legitimacy problem of Mexican governments, however, did not go away.

Residents and authorities work together on a rescue mission following the Mexico City Earthquake in 2017. Source: Hazael R/ Shutterstock, 2017.

In a November 2017 to January 2018 public opinion survey conducted by Vanderbilt University's Latin American Public Opinion Project, people across Mexico City were asked to rate the performance of government, civil society, and other institutions in responding to the Sept. 19, 2017 earthquake on a scale of 0-10.

Thirty-two percent of respondents gave citizens and civil society a score of 10, with the average score being 7.4. The Mexican military received a decent average score—5.8 out of 10. Much less favorable was the average score for Mexico City's government (3.3) and the federal government (3.5). Fully 44% thought that President Enrique Peña Nieto did an appalling (pésimo, which is quite a strong word in Spanish) job in responding to the disaster.

The survey also asked respondents if experiencing the 1985 earthquake helped people living in Mexico City respond to the 2017 quake. Just more than 70% agreed, saying that the previous disaster experience helped residents "a lot" or "somewhat." In contrast, 64% thought the government had learned "nothing" or "very little" from the 1985 earthquake.

WHAT MEXICO'S NEW POLITICAL LEADERSHIP SHOULD, BUT MAY NOT, DO

Previous polling by other organizations before the 2017 earthquake indicated widespread disappointment with President Peña Nieto's failure to address violent crime or to tackle rampant corruption and impunity, so in all likelihood, the negative evaluation of the government's disaster response probably had only minor impacts on the 2018 elections. But for the administrations taking office in

December, the way that earthquake risk and future events are handled will be especially important.

Here's the problem: Since AMLO at the national level and Sheinbaum Pardo at the Mexico City level explicitly campaigned as "not them," code enforcement problems or a botched response to the next major disaster could cause them to be seen as "just like them." Therefore, the stakes are much higher than they were for previous administrations. They have to respond differently—and considerably better—to the next disaster than literally all previous Mexican governments.

Given that most deaths and serious injuries in earthquakes happen in partial or complete building failures, the solution is straightforward but daunting: Leaders, policymakers, government officials, and institutions must set aside venal interests and longstanding corruption patterns and openly and transparently do their jobs. This requires that the new administrations enact the appropriate earthquake safety laws, policies, and codes, and then provide for their substantive, consistent, and honest implementation. If they don't, then they will indeed prove to be "just like them."

ABOUT THE AUTHOR

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CITATION

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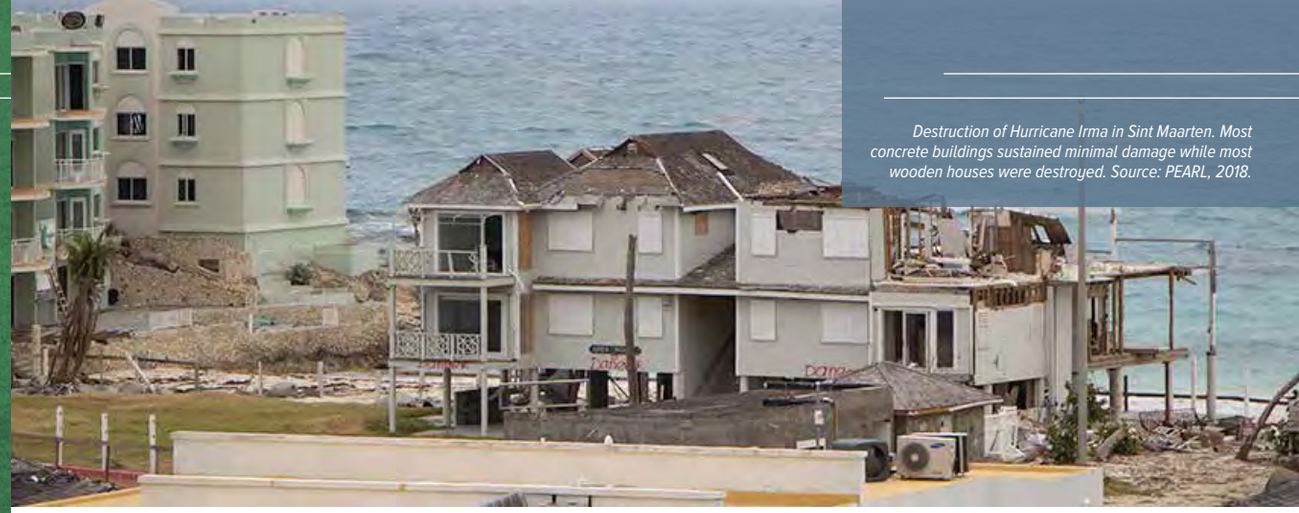

Destruction of Hurricane Irma in Sint Maarten. Most concrete buildings sustained minimal damage while most wooden houses were destroyed. Source: PEARL, 2018.

STRENGTHENING SINT MAARTEN

LESSONS LEARNED AFTER HURRICANE IRMA

BY YARED ABAYNEH ABEBE, NEILER MEDINA PEÑA, AND ZORAN VOJINOVIC

October 12, 2018

Recovering from the devastation of a Category 5 hurricane can be a challenge for any nation, but the cultural makeup of Sint Maarten—the Dutch portion of the island known as Saint Martin—poses special challenges. After Hurricane Irma struck the island in September 2017, our team went on a fact-finding mission and learned that there were improvements to be made in how warnings were issued, how evacuations were conducted, and how communities rebuilt after storms.

Hurricane Irma, the strongest hurricane on record in the Atlantic basin outside of the Caribbean Sea and Gulf of Mexico, made landfall as a Category 5 hurricane on the island of Saint Martin on September 6, 2017. Irma's strong wind was the primary cause of widespread devastation on the island, killing and injuring people and damaging properties and infrastructure. This, in turn, affected the tourism-led economy, as visits to the island declined and many lost their jobs.

Since the storm, the government of Sint Maarten has engaged in a recovery and reconstruction program based on the United Nation's premise of **building back better**, which addresses restoration of infrastructure and revitalization of livelihood and economies to make communities less vulnerable to future disasters and increase their resilience. To support the recovery and reconstruction, a team of researchers from the European Union-funded **PEARL** (Preparing for Extreme And Rare events in coastal regions) project went on a fact-finding mission to Sint Maarten.

The team carried out workshops, interviews, and household surveys five months after Irma's landfall to assess hurricane warnings, evacuations, and people's awareness and perception of hurricane impacts and responses after the hurricane. The PEARL team also applied novel methodologies and tools such as a vulnerability index method, a **risk root cause analysis method**, **agent-based modelling tools**, and a **traffic model** to assess hazard and risk; support reconstruction and recovery; and make Sint Maarten more resilient. This article focuses on the findings and recommendations of three elements of the mission: hurricane warnings, evacuation behavior, and rebuilding.

WARNINGS AND COMMUNICATION

About **70% of Sint Maarten residents** are foreign-born. We found that the diverse, multilingual nature of the island—which is a source of vibrant multiculturalism—can also be a source of vulnerability in hurricanes. English is the main language and hurricane warnings and evacuation plans are disseminated in this language. But some Spanish- and French-speaking immigrant communities, which constitute more than 20% of the total population, did not properly understand warning and evacuation information about Irma. Additionally, many find the **official public advisories** issued by the Sint Maarten Meteorological Agency difficult to understand.

To reach all residents at risk, the government should improve warning systems by conveying reliable messages in a timely manner and in multiple languages. It is crucial to communicate advisories in a plain, easy-to-understand way.

Comparing forecasted hurricanes with previous big events will give residents a better perspective and encourage preparedness. In addition, hurricane awareness programs need to be continually in place so people are prepared to take appropriate action.

EVACUATION, SHELTERS, AND SHELTERING IN PLACE

In Sint Maarten, the majority of residents do not evacuate during hurricanes. A household survey we conducted of 255 respondents found only about 30% evacuated for Hurricane Irma. Of those, most sought shelter in a friend's or relative's home and only three percent evacuated to public shelters. The low percentage of evacuation, especially to public shelters, is because people do not trust the safety of public shelters.

As shown in the photo to the right, shelters with zinc roofs were destroyed by hurricanes, creating fear about the safety of public shelters. Hence, people prefer to shelter with friends or relatives instead. This leaves some immigrants, who might have limited social networks and low levels of social capital, at a disadvantage if they can't find friends or relatives to provide better shelter during hurricanes. The other reason for the low evacuation rates to shelters was likely because it was **announced** that public shelters would be open only after Irma passed. A last-minute order was issued to open some public shelters, but it did not reach the broader population of the island.

The household survey findings also show that, after the experience of Irma, there was an increase in willingness to evacuate commensurate with the severity of the hurricane. The number of people who expressed a definite willingness to evacuate if a hurricane as strong as Irma is forecasted was greater than those that definitely would not evacuate. Though many might still seek shelter with friends or relatives, the government needs to improve the safety of public shelters, especially considering those in need. Since most people consider concrete houses to be the safest in Sint Maarten, the walls and roofs of public shelters should be reinforced with concrete.

REBUILDING

Based on the household survey, about 80% of residential buildings have concrete walls and about 70% have zinc roofs. Most residents agreed that it was the zinc roofs, debris from poorly built housing, and the other loose objects blown about during the hurricane that caused damage to the stronger houses. Poorly built housing on the island is associated with outdated and inadequate building codes, lack of inspections, and enforcement of existing regulations.

We've seen people rebuilding destroyed houses already, but there is no inspection requirement to ensure they are building resilient structures designed to withstand future hurricanes of Irma's magnitude. To reduce future damage, the government needs to improve building regulations, inspect new construction, and strictly enforce standards. Furthermore, just because a building has withstood one hurricane doesn't guarantee it will withstand the next. Hence, residents should learn to maintain their houses after every hurricane. Though Irma's destruction is associated with the strong winds, rebuilding should also consider flood hazards that can occur in future hurricanes or isolated storms.

A board walk and buildings in Philipsburg Sint Maarten completely covered in beach sand and debris after the island was hit by Hurricane Irma. Source: Shutterstock, 2018.

Considering the magnitude of destruction of Irma in Sint Maarten, the recovery and reconstruction will take years. Currently, the main focus of the government is repairing damaged public shelters and roofs of poor housings, and rebuilding critical infrastructures such as the airport and hospital. In this process, we are working closely with the Sint Maarten government and we presented a **report** describing the outcomes of the fact-finding and needs assessment mission.

ABOUT THE AUTHORS

YARED ABAYNEH ABEBE earned his PhD in urban water systems at IHE Delft Institute for Water Education. His research focuses on conceptualizing and modeling drivers of urban flood hazard, exposure, vulnerability, and risk taking into account flood disasters as outcomes of the complex interactions of natural and human systems and the urban environment. He is also interested in institutional analysis and the use of agent-based models in modeling long-term disaster risk management.

NEILER MEDINA PEÑA completed his PhD in urban water systems at IHE Delft Institute for Water Education. His research focuses on risk assessment of extreme hydro-meteorological events by incorporating the role of human behavior and crowd modelling in the vulnerability and exposure components of risk. He is currently working on an agent-based model approach for large city evacuation strategies.

ZORAN VOJINOVIC is associate professor at IHE Delft with expertise in Urban Water Systems, Risk Assessment, Climate Change Adaptation and Hydroinformatics. He is the author/co-author of book series in Urban Hydroinformatics. Vojinovic holds honorary professor position at the University of Exeter, and is a visiting professor at the Technical University of Munich, adjunct professor at the National Cheng Kung University, visiting professor at the University of Belgrade and guest faculty at the Asian Institute of Technology.

CITATION

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Home buyout programs intend to help those whose homes are repeatedly damaged by floods and other disasters, but their usefulness as mitigation and recovery tools are still being examined. Source: Sherri Brokopp Binder, 2018.

MIND THE GAP

RECONCILING MITIGATION AND RECOVERY IN HOME BUYOUT PROGRAMS

BY SHERRI BROKOPP BINDER AND ALEX GREER

September 20, 2018

Given recent hurricane and flooding impacts, the risks and realities of climate change, and the unsustainability of the National Flood Insurance Program, public officials are looking to home buyouts to reduce disaster losses.

Home buyout programs facilitate the large-scale relocation of residents out of risky areas. We have been researching these programs for several years, yet we routinely find ourselves asking a seemingly elementary question: should home buyouts be considered mitigation programs or recovery programs?

This question raises some interesting theoretical points about the overlap between the mitigation and recovery phases of the disaster cycle. Generally, mitigation refers to efforts that reduce hazard occurrences and impacts, while recovery is the physical and social process of returning to some new state of normal in a post-disaster setting. So, are buyouts mitigation or recovery? In the course of our research, we've learned that it depends on who and when you ask.

Traditionally, policy documents and government representatives have defined buyouts as mitigation programs designed to reduce the impacts of future hazards by moving people and property out of harm's way. Specifically, they **describe buyouts** as a tool for protecting against costly future losses, avoiding expensive structural mitigation measures, and correcting previous land use decisions that allowed development in unsafe areas.

Buyouts reduce future disaster losses by converting private land into open space, which also creates new land management challenges. Source: Alex Greer, 2018.

Homeowners, however, **characterize these programs** differently. They see buyouts as a way of jumpstarting their housing recovery. In **our interviews** following Superstorm Sandy, residents suggested that buyouts offered an opportunity to reestablish some sense of normalcy in a new, hopefully safer, community. At the same time, they felt the full weight of these decisions, which involve uprooting their lives and permanently abandoning their homes and communities.

This discrepancy is also evident in the timing of buyouts. As mitigation measures, buyouts are designed to be deliberative and slow, allowing government agencies to consider, research, and prioritize areas to relocate. In practice, however, buyouts are triggered by disasters and implemented during recovery. Buyout program funding primarily comes from either the Federal Emergency Management Agency Hazard Mitigation Grant Program or the U.S. Housing and Urban Development Community Development Block Grant Program for Disaster Recovery (CDBG-DR) (note that even the names of the funding sources speak to a buyout identity crisis), often available only many months after an event. For this and other reasons, buyouts are typically implemented a year or more after a disaster.

This translates into major challenges for households *and* government agencies. Homeowners interested in buyouts are effectively asked to put their recovery on hold. This is no small matter, as studies show that the time it takes to reestablish permanent housing has real impacts on survivor wellbeing. Displaced residents often lose social networks, access to healthcare, employment, and income, and suffer physical and mental health declines.

More practically, households don't want, or can't afford, to wait for a buyout, so they end up rebuilding, selling to a private developer, or simply walking away from their homes before the buyout is implemented. Government agencies suffer the effects of these challenges in the form of attrition, as homeowners eventually choose timelier options; compromising the mitigative potential of buyouts.

If we want to reconcile mitigation and recovery in home buyouts, we need to design programs that better balance the priorities of policy makers and residents. One way to do this is by planning for recovery, a recommendation made by many disaster researchers in other contexts (see the work of **Philip Berke et al**, **Raymond Burby**, **Dennis Mileti and Eve Passerini**, and **Claire Rubin et al** to name a few). In buyouts, this could mean that local government agencies proactively identify areas suitable for buyouts, begin conversations with homeowners about the benefits and costs of participation, and register homeowner interest before a disaster. Additionally, federal funds could be made available to local implementing agencies immediately after a disaster strikes, enabling buyouts to be implemented more quickly. These approaches would improve outcomes for all stakeholders and reduce the stress and trauma experienced by buyout participants.

We still have many more questions than answers when it comes to home buyouts. We don't know whether buyout participants have a better overall quality of life than disaster survivors who rebuild in place. Some buyout participants relocate to **equally risky homes**. Buyouts tend to target high-risk areas, which, in the United States, are **often occupied** by households with low incomes. While this allows the government to meet CDBG-DR requirements to prioritize low- and moderate- income persons and geographies and to maximize the number of houses purchased, there is evidence that this throws the voluntariness of the program into question.

While the ideas we discuss here don't address all of these concerns, they offer practical approaches for balancing the needs of a swift recovery with a deliberative mitigation effort.approaches can take into account the many factors that produce such complex situations and help address them an interrelated way.

ABOUT THE AUTHORS

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CITATION

Brokopp Binder, S. and Greer, A. 2018. Mind the Gap: Reconciling Mitigation and Recovery in Home Buyout Programs. *Research Counts 2*(1). Boulder, CO: Natural Hazards Center, University of Colorado Boulder. **https://hazards.colorado.edu/news/research-counts/mind-the-gap-reconciling-mitigation-and-recovery-in-home-buyout-programs**

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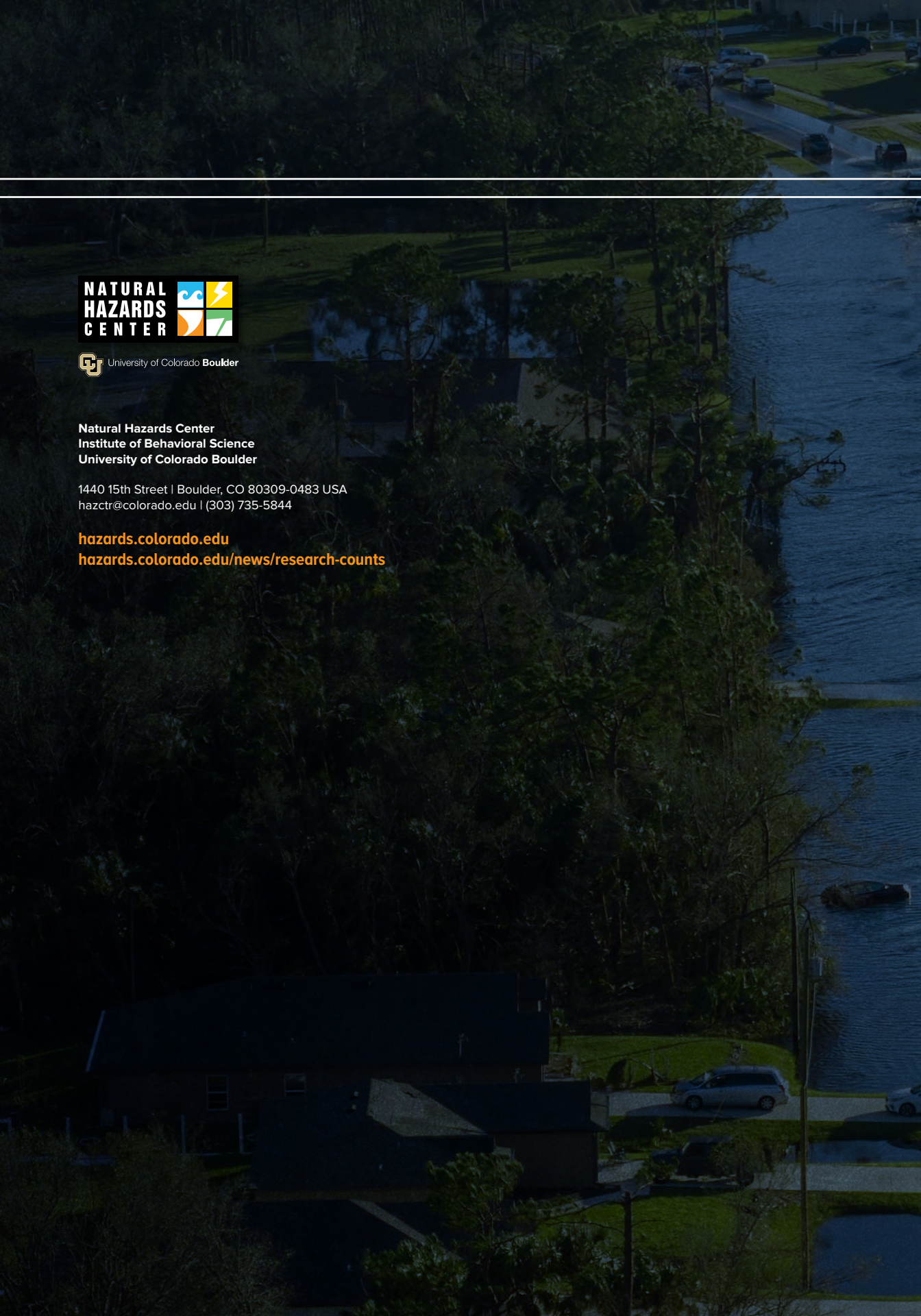

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