# RESEARCH COUNTS

## EQUITY AND INCLUSION IN DISASTERS

SPECIAL COLLECTION

NATURAL HAZARDS CENTER

University of Colorado **Boulder**

# RESEARCH COUNTS

Over the decades, the hazards and disaster research community has amassed an enormous amount of knowledge on everything from risk perception to the long-term ramifications of unjust recovery policies. The Natural Hazards Center is committed to making this information widely available. We launched the ***Research Counts*** series in 2017 as a platform for researchers to share key findings and actionable recommendations.

The pieces in the series are brief and intended for broad consumption. Our editorial team works closely with authors to showcase research and share the most important lessons for practitioners, policymakers, and the public. We recognize that in this era of mega-disaster, the stakes are too high for findings to be inaccessible behind journal paywalls. The decisions being made are too consequential for evidence-based insights to be sidelined.

*Research Counts* includes numerous original briefs from experts in a variety of academic disciplines. These scholars have lent their voices to help us understand hazards risk and disaster impacts. This series is a testament to their commitment to the public communication of science.

As more people and places are affected by disaster, it is crucial that our research community responds by sharing the lessons learned from previous and ongoing work. We thank the authors who have contributed to this series and the various special collections we've produced. We also owe a debt of gratitude to all those who take the time to read these pieces and move the findings into action.

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

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For the online version of this *Research Counts* Special Collection on Equity and Inclusion in Disasters, please visit:
**hazards.colorado.edu/news/research-counts/special-collection/equity-and-inclusion**

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**hazards.colorado.edu/news/research-counts/special-collection/equity-and-inclusion**

*Farmer distraught over fire that has burned his farm. Source: Vecteezy.com*

# INTRODUCTION:
## EQUITY AND INCLUSION IN DISASTERS

BY NNENIA CAMPBELL, LORI PEEK, AND ANNA CANNY

Disasters have long been characterized by the media, elected officials, and members of the public as "acts of nature" or "acts of God." Such depictions are rooted in the idea that disasters are *external* to social systems, rather than a *reflection* of society itself.

More than 50 years of scholarship on social inequality in disaster has challenged this idea. A vast body of evidence underscores that disasters almost always lead to disproportionate harm and suffering among the most disadvantaged people in society. Low-income families, people of color, children, older adults, people with disabilities, and others with less power and fewer economic resources tend to be hurt first and worst when disaster strikes.

Research led by social scientists and interdisciplinary teams has clarified *who* is most at risk, *where* the most exposed and socially vulnerable populations live, *why* these groups may struggle to prepare for and respond to disaster, and *how* they are impacted in both the immediate and longer-term aftermath of environmental extremes.

The big question that remains is *what can be done* to address the inequities at the root of uneven exposure and the unequal effects of disaster?

This special collection of *Research Counts* provides groundbreaking insights from emerging leaders in the hazards and disaster field to help answer that pressing question.

## ABOUT THIS COLLECTION

This special collection on **Equity and Inclusion in Disasters** grew out of a shared commitment of the **Natural Hazards Center** and the **Bill Anderson Fund** to reduce disproportionate disaster harm. With the unwavering support of the **Margaret A. Cargill Philanthropies**, members of our respective organizations teamed up to publish this collection.

Our focus and choice of terminology were intentional. In emphasizing **equity**, we wanted to not only identify the uneven distribution of harm, but also promote fairer practices that can produce better, more just outcomes and conditions for all people. In highlighting **inclusion**, we started with an acknowledgement that there can be no justice unless we center the experiences of those who bear the greatest burdens of disaster, while embracing approaches that encourage deeper understanding and participation in disaster planning. Equity and inclusion go hand in hand, as the *process* of involving a spectrum of people in disaster research and its applications can lead to better *outcomes* across time, space, and hazard type.

The special collection features **24 original articles** written by Bill Anderson Fund fellows, alums, and collaborators. The authors represent a diversity of perspectives and a wide range of disciplines. They bring approaches from the arts and humanities, social and physical sciences, engineering, public health, and beyond. They focus on a number of hazard types as well, including drought, floods, falling space debris, tsunamis, wildfires, extreme heat, winter storms, hurricanes, and compound hazards. What binds this body of work together is the commitment to identifying evidence-based, community-grounded, and equitable approaches to disaster risk reduction, response, and recovery.

The articles in this collection are organized around the following cross-cutting thematic areas:

- Low-Attention Disasters
- Social Marginalization and Inequality
- Equity and Inclusion Throughout the Disaster Cycle
- Best Practices for Community-Based Collaborations
- Strengths and Capacities of Socially Marginalized Communities

Across these thematic areas, the authors offer fresh insights that can help inform more inclusive and effective policy and practice. For example, articles in this collection demonstrate how exclusionary policies and regulatory gaps are worsening the impacts of disaster—a situation that demands more robust disaster legal and financial aid. Other pieces illustrate how creative methodologies can uncover hidden risks and convey collective experiences of disaster injustice that powerfully communicate the need for systemic change. Several contributions speak to the urgent need to close gaps in data availability through using new tools and building broader coalitions of community partners.

Each article sheds light on a different, complex issue of inequality. Taken together, this special collection offers hope for a more compassionate, caring, and just future.

*This special collection includes contributions from more than two dozen talented authors. This effort was made possible through a partnership between the following organizations:*

## ABOUT THE AUTHORS

**NNENIA CAMPBELL** is executive director of the Bill Anderson Fund and a research associate with the Natural Hazards Center at the University of Colorado Boulder. Campbell's research centers on the intersections between disaster vulnerability and resilience among older adults, racial and ethnic minorities, and other marginalized communities, as well as the roles that community-based organizations play in disaster preparedness, response, and recovery. Her work translates empirical research on the social aspects of disasters into tools and information products for practitioners and decision-makers, with an emphasis on inclusive engagement.

**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 the 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 is currently leading *the Third Assessment of Natural Hazards in the United States*, a community-driven effort to take stock of 30 years of hazards and disaster research.

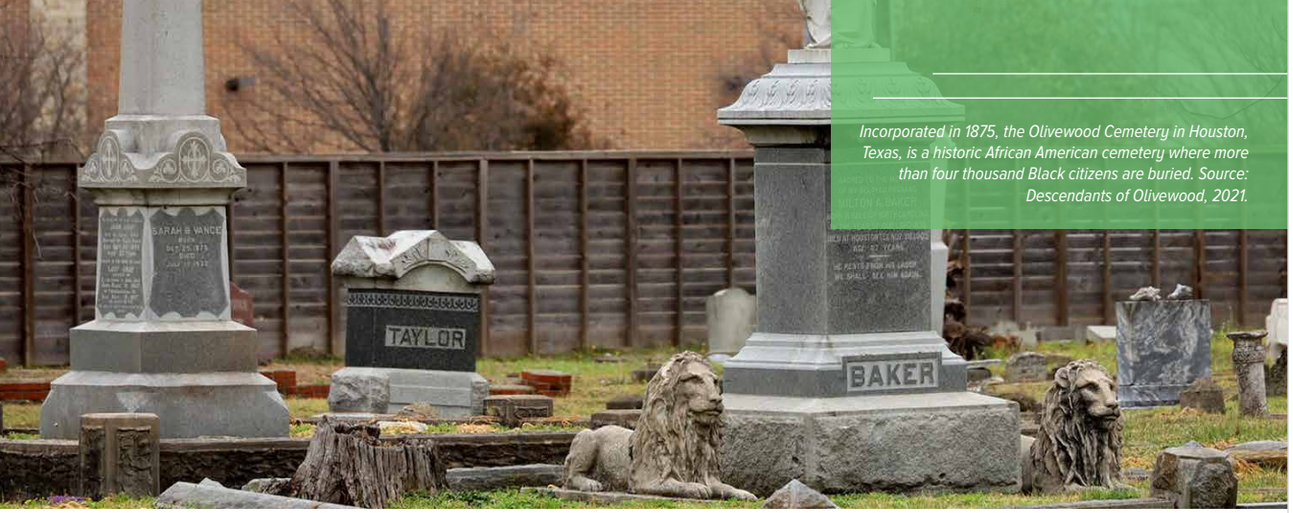
**ANNA CANNY** is a science writer, editor, and communicator with the Natural Hazards Center at the University of Colorado Boulder. Her work is driven by the belief that effective science communication empowers the most vulnerable populations and creates more resilient communities. Before joining the Natural Hazards Center, Canny was a climate and weather reporter for KTOO Public Media in Juneau, Alaska, where her reporting on avalanches, landslides, and glacial outburst floods earned awards for best public safety reporting, best science reporting, and best history reporting from the Alaska Press Club.

## CITATION

Campbell, N., Peek, L., & Canny, A. (2026). Introduction: Equity and Inclusion. *Research Counts*, Special Collection on Equity and Inclusion in Disasters, *6*(SC1). Boulder, CO: Natural Hazards Center, University of Colorado Boulder. **https://hazards.colorado.edu/news/research-counts/special-collection/introduction-equity-and-inclusion**

ARTICLES:

# LOW ATTENTION DISASTERS




*Incorporated in 1875, the Olivewood Cemetery in Houston, Texas, is a historic African American cemetery where more than four thousand Black citizens are buried. Source: Descendants of Olivewood, 2021.*

# SEEKING JUSTICE:

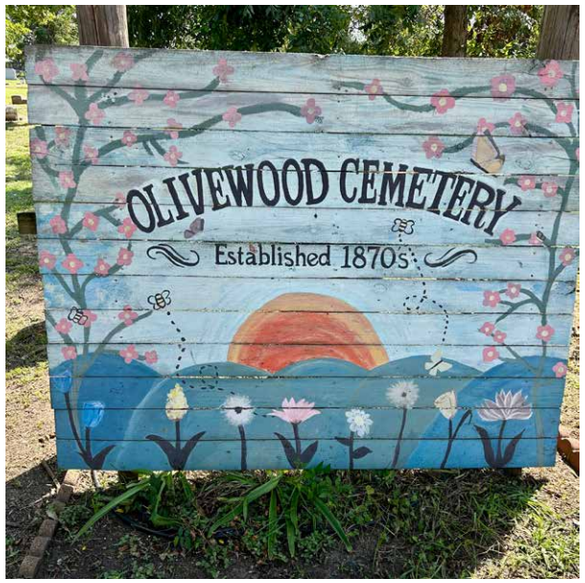
## CEMETERY PRESERVATION FOR CURRENT AND FUTURE GENERATIONS

BY JENNIFER BLANKS

For years, neglect and the creeping landscape of the nearby White Oak Bayou threatened to erase Olivewood Cemetery, the first incorporated African American cemetery in Houston, Texas. That changed only when local elders and long-term residents formed the **Descendants of Olivewood**, a nonprofit dedicated to its preservation, maintenance, and cultural interpretation. Yet, even with this stewardship, the cemetery faces an uphill battle with the threat of **routine floods**, erosion, **windstorms, repeated hurricanes**, and encroaching development.

The endangerment of this site is indicative of a broader national pattern. Disasters pose significant threats to the restoration, function, and preservation of **burial landscapes across the country**. Historic African American cemeteries are **disproportionately exposed to hazards**. Despite this heightened vulnerability, these sacred places receive limited recognition in formal recovery planning, and traditional post-disaster assessments often overlook the unique conditions of African American burial grounds.

Careful risk assessments and more robust support for preservation and disaster recovery are needed to address these compounding crises and protect this **vital cultural infrastructure**. What is at stake goes beyond damaged headstones and eroded soil; it encompasses place-based knowledge embedded within African American communities and the enduring educational, cultural, and spiritual functions of cemeteries.




*A handpainted sign, put up by the Descendants of Olivewood, near the entrance of the cemetery. Source: Jennifer Rochon Blanks.*

### THE UNIQUE VULNERABILITIES OF AFRICAN AMERICAN CEMETERIES

Historic African American cemeteries often exist in an active state of recovery long before a hurricane or flood arrives. Many have endured a centuries-long disaster of institutional neglect, exclusion from public record-keeping, and chronic underfunding. As a result, standard post-disaster assessments—designed around measurable contamination or visible structural damage—frequently overlook the specific challenges of these sites. For example, in many African American cemeteries, markers are handmade, nonpermanent, or undocumented due to legally enforced segregation-era barriers to formal burial records. When these features are missing or misread, the true extent of disaster impact goes unreported, making the path to "full" recovery nearly impossible.

Post disaster cleanup can compound the problem. Well-intentioned efforts to "clear" or "restore" land—debris removal, grading, vegetation cutting—can inadvertently obscure grave locations, disturb culturally significant memorial practices, or erase fragile evidence of burial presence. In landscapes where memory is already precarious, these interventions can cause a second, quieter form of loss.

### PROACTIVE DOCUMENTATION AND PRESERVATION

Proactive documentation and preservation must be central to hazard mitigation planning for African American cemeteries. Many of these sites are still fighting for basic recognition while simultaneously attempting to reduce the risk of natural hazards. Combining archival research with environmental and spatial data is essential to reconstruct burial records and restore knowledge lost through decades of neglect and environmental disturbance.

Partnerships with researchers and genealogists can play a transformative role in restoration and recovery efforts. At Olivewood, for example, a **collaboration with Rice University** has helped reconstruct lost burial knowledge through Ground Penetrating Radar (GPR)—a noninvasive method that transmits radar pulses into the ground and records subsurface reflections to detect and map anomalies like unmarked graves—and through the recovery of archival plot records. These efforts have restored cemetery maps and identified previously undocumented graves, strengthening both preservation and disaster-planning capacity.

Hazard-based planning frameworks that might otherwise justify relocation are neither feasible nor ethically appropriate for most African American cemeteries. In Olivewood's case, its Texas Historical Marker designation, deep descendant ties, and ongoing efforts toward National Register listing anchor the site firmly within Houston's First Ward cultural landscape. Preservation in place is not simply a preference—it is an ethical imperative.

### SUPPORTING STEWARDSHIP IN AN UNEQUAL SYSTEM

Many historic African American cemeteries depend heavily on community advocacy and volunteer labor, revealing how post-disaster recovery funding structures routinely privilege formally resourced institutions while **sidelining culturally significant yet underfunded burial grounds**. This disparity represents a persistent challenge within both environmental justice and cultural resource management: African American cemeteries remain excluded from the institutional pipelines that typically sustain preservation and recovery work.

Local regulations and state cemetery policies further constrain access to resources by determining who qualifies for funding, what types of interventions are permissible, and which administrative hurdles must be cleared. Community led organizations—often operating without formal preservation infrastructure—are left to navigate systems that were not designed with burial landscapes in mind, while simultaneously performing labor-intensive restoration.


*The author, Jennifer Rochon Blanks, leads an environmental justice tour at Olivewood Cemetery. Source: Jennifer Rochon Blanks.*

Community programming—including school and civic presentations, walking tours interpreting African American burial traditions, and events highlighting Black history—extends recovery beyond physical repair. Such activities engage diverse people in the process of understanding historical forces and the connection to the present. There is also growing interest in recognizing the cemetery as a recreational green space, consistent with its classification as parkland within environmental planning. This framing not only broadens public engagement but also strengthens the case for integrating African American cemeteries into long-term resilience and land use planning.

### SUSTAINING SACRED LANDSCAPES

The experience of Olivewood Cemetery reveals that post disaster recovery is not only a matter of physical repair, but a reflection of whose histories are recognized as worthy of protection in the face of mounting environmental risks. As sites of memory, resistance, and community continuity, historic burial grounds occupy a precarious position within recovery and preservation frameworks that privilege visibility, documentation, and institutional legitimacy. Olivewood demonstrates how environmental vulnerability intersects with structural neglect, forcing descendant communities to shoulder the labor of recovery while simultaneously fighting for recognition. Its restoration

is therefore not only an act of preservation, but a reclamation of historical presence in a cityscape that had rendered it invisible.

Recognizing African American cemeteries as critical cultural infrastructure—rather than marginal or abandoned land—requires integrating these sites into disaster planning, expanding access to preservation resources, and supporting community led stewardship across generations. Olivewood stands as both a warning and a model for cemeteries across the country: a reminder that equitable hazard mitigation planning must account for sacred landscapes where history, environment, and justice converge.

## ABOUT THE AUTHOR

**JENNIFER ROCHON BLANKS** is the tribal coordinator and cemetery specialist for the Texas Department of Transportation and the founder of The Cemetery Sista, LLC. She is an environmental scientist, planner, and cultural resource management expert, rooted in scholarship of environmental justice and critical geographies. Her work bridges natural resource protection and cultural heritage preservation, with a focus on African American burial grounds and memorialized landscapes in communities vulnerable to climate change. Blanks' research analyzes geo-ethnographic data to assess cemetery risks and vulnerabilities, recover and document cultural landscape knowledge, and identify sustainable strategies for long-term cemetery management.

## CITATION

Blanks, J. (2026). Seeking Justice: Cemetery Preservation for Current and Future Generations. *Research Counts*, Special Collection on Equity and Inclusion in Disasters, *6*(SC24). Boulder, CO: Natural Hazards Center, University of Colorado Boulder. **https://hazards.colorado.edu/news/research/seeking-justice-cemetery-preservation-for-current-and-future-generations**

*Irrigation of planted fields using pump trucks in Homestead, Florida. Source: Francisco Blanco / Shutterstock.com.*

# BALANCING SUPPLY AND DEMAND:

## FEDERAL TOOLS TO UNDERSTAND AND PREPARE FOR WATER SCARCITY

BY JENNIFER RAPP AND ORONDE DRAKES

People depend on a clean, accessible supply of water to support their well-being, operate industries, grow food, and nourish the environment. Yet, for many places in the United States, there is an imbalance between the amount of water people demand and the amount of water that nature can reliably supply.

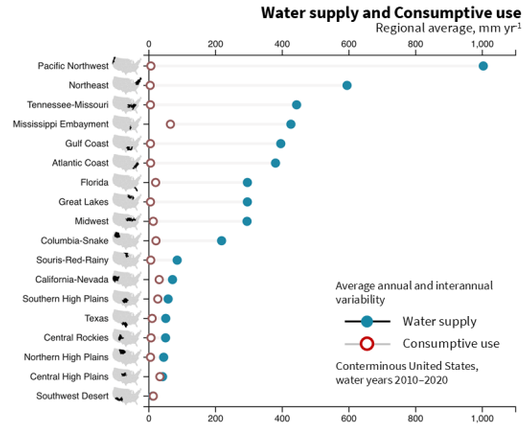
Water scarcity is an increasingly pressing issue, which can benefit from more robust scientific data on water supply, quality, and consumption across the nation. This information is critical to help communities plan for dry periods and build resilience, but it can be **difficult to obtain data** on the places and people most vulnerable to water stress.

### UNDERSTANDING WATER SCARCITY

Making water data more centralized and accessible has been a recent focus on the U.S. Geological Survey (USGS). In 2025, the agency released the **National Water Availability Assessment**, a comprehensive study quantifying the nation's water availability. The information in this assessment can be used to identify and mitigate emerging imbalances between water supply and demand and help support water management decisions in the future.

Many of the people who rely on water data are local government officials, planners, and organizations who make daily water management decisions. Some may not have the financial and technical resources they need to collect and analyze their own information. The National Water Availability Assessment **Data Companion tool**, a user-friendly web platform, provides access to a curated, consistent set of USGS model outputs detailing historic water availability conditions across the lower 48 states. This tool helps users understand the dynamics of water availability in their region.

Comparing water supply and demand can provide insights on how water scarcity originates, potential risks associated with additional use, or likely effects of water conservation. For instance, in dry regions like the central High Plains—which spans parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming—a large percentage of local rainfall goes toward water consumption.

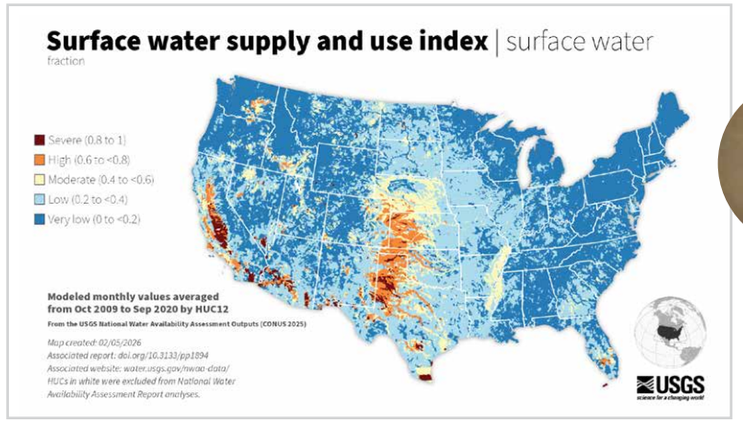



*Average and interannual variability of water supply and consumptive use by hydrologic region, water years 2010–20. For most regions, error bars in consumptive use estimates are smaller than the symbol. (Source: Stets et al., 2025 USGS Professional Paper 1894F)*

As shown in the 10-year regional averages in the figure, there are many such places across the United States where there is a narrow margin between water demand and the amount of surface water available. As a result, communities may rely on water that is transported over long distances or drawn from deep groundwater reserves, which can be slow to replenish and, when depleted, may have **reduced storage capacity** or become salty. In times when natural rainfall is below normal, these places are especially vulnerable to disruptions in their water supply. These aren't abstract trends—they are realities that affect agriculture, health care systems, and ecosystems.

### BUILDING RESILIENCE BY MANAGING WATER SUPPLY

The USGS Supply and Use Index (SUI), a tool available in the **Data Companion**, is designed to help users understand the balance between their local water supply and demand. The SUI compares long-term natural water supply approximated by streamflow over a 10 year period, **with consumptive use**—the amount of water that is incorporated in products or crops, consumed by humans or livestock, or otherwise lost to evaporation or transpiration—to identify where and when water stress is most severe. The burgundy and orange areas on the map represent places where water limitations are severe or chronically high.




*Average decadal surface water-supply and use index represents the imbalance between natural supply and consumptive water use for each watershed across the lower 48 states, water years 2010–2020 (Source: Stets et al., 2025 USGS Professional Paper 1894F)*

About **26.7 million people live in these high-stress watersheds**, and many are among the most socially vulnerable. In fact, more than half of the 9 million people living in severe SUI areas are also considered highly socially vulnerable based on their socioeconomic status, household characteristics, racial and ethnic minority status, and/or housing type and transportation, according to the **U.S. Centers for Disease Control and Prevention's Social Vulnerability Index for 2020**. These communities are at greater risk of running out of water and of the **cascading impacts** on **health, livelihoods**, **housing**, and environment.

By examining extensive historic drought periods, the SUI helps to pinpoint where the greatest impacts of water stress could occur in the future. This work doesn't just identify problem areas; it also gives decision makers information that can be used for water management decisions, like developing more **robust drought preparedness plans** or issuing water supply permits for new housing or industry. With the **National Water Availability Assessment Data Companion**, users can access monthly data, explore seasonal patterns, and understand regional nuances that might not fit the national trend. This level of detail matters because water stress may not be uniform. California's Central Valley, for example, **can shift substantially between wet and dry seasons**, creating unique challenges for water managers.

### PLANNING FOR PEOPLE

Planning for water hazards isn't just about hydrology—it's about people. The SUI and related water supply and demand datasets give users the ability to anticipate where water stress may hit the hardest, and which population centers and groups may be most affected. It can help communities build resilience, prioritize resources, and make informed decisions before the next potential drought. Tools such as these are particularly valuable in areas where local officials lack the capacity to independently collect and analyze the data they need to protect the most at-risk communities. As water scarcity is experienced by more communities, these data can make all the difference.

## ABOUT THE AUTHORS

**JENNIFER RAPP** leads the Decision Support Branch of the Integrated Information Dissemination Division for the U.S. Geological Survey's (USGS) Water Resources Mission Area. Current project work in the branch involves development of the National Water Availability Assessment Data Companion (NWDC) to deliver routinely updated water availability information in the United States.

**ORONDE DRAKES** is a research physical scientist in the Water Resources Mission Area of the U.S. Geological Survey (USGS). Drakes' research interrogates the intersections among natural hazards and society, focusing on multiple hazard risks and their implications for compounding and cascading hazard exposure, impacts, and recovery. His current work assesses risk factors for drought and water insecurity. He co-chairs the USGS Human Dimensions Community of Practice.

## CITATION

Rapp, J. L. & Drakes, O. (2026). Balancing Supply and Demand: Federal Tools to Understand and Prepare for Water Scarcity. *Research Counts*, Special Collection on Equity and Inclusion in Disasters, *6*(SC20). Boulder, CO: Natural Hazards Center, University of Colorado Boulder. **https://hazards.colorado.edu/news/research-counts/special-collection/balancing-supply-and-demand-federal-tools-to-understand-and-prepare-for-water-scarcity**

*The Soyuz TMA-19 spacecraft departs the International Space Station on November 25, 2010. Source: Rawpixel.com / Shutterstock.com*

# FALLING SPACE DEBRIS:

## AN UNDERESTIMATED THREAT TO UNDER RESOURCED EMERGENCY MANAGEMENT AGENCIES

BY AMIDU KALOKOH, HANS LOUIS-CHARLES, JOSE TORRES, AND THOMAS JAMIESON

Recent growth in space activities and an increasing reliance on satellite technologies have made rocket launches much **more commonplace**. This, along with the widespread expansion of air transportation, rocket launch anomalies, and natural space hazards, further heightens the risk of falling space debris, with estimates suggesting **a 26 percent chance of uncontrolled reentry** affecting airspace near major airports each year.

Emergency management agencies must prioritize their time and carefully allocate scarce resources, making it difficult to justify preparation for a space hazard. Yet, falling space debris is a growing public safety, strategic, and financial concern. **Our research** suggests that preparedness efforts need to be ramped up to meet the growing threats posed by this emerging risk. Such enhanced preparedness efforts are important in all communities, and especially those with limited capacity and constrained resources to address falling space debris.

### UNDERSTANDING SPACE DEBRIS

Space hazards can be classified as either human-made or natural. The former includes rocket launches and satellite deployments that leave traces of human activity in space, such as fragments, discarded rocket stages, and defunct satellites. Over time, these have accumulated into a cloud of space debris. The latter includes meteorites, comets, asteroids, bolides, space weather, fireballs, solar flares, and other natural space hazards. Space debris can range from the size of a fleck of paint to a school-bus-sized rocket body. Some of this debris can travel at roughly **18,000 miles per hour**, almost seven times the speed of a bullet, making this hazard especially destructive upon impact. Further, unlike many hazards, space debris is not confined to the geography of its origin; once in orbit, it can reenter and impact any community on Earth, regardless of proximity to a launch site.

### THE THREAT AND IMPACT OF SPACE HAZARDS

Concerns have been raised about the threat of falling space debris since the **launch of the first artificial satellite nearly 70 years ago**, as falling space debris can affect individuals, critical infrastructure, and entire ecosystems. For example, a falling space object can damage aircraft or commercial buildings and create substantial liability for states and space companies, which, **under international law**, are responsible for damage caused by their space objects. Although rare, a single aircraft incident could be disastrous, endangering lives, disrupting air traffic, causing significant flight delays, and requiring flight diversions. Such incidents can also lead to airspace closures as more debris falls.

While there has not been a catastrophic event yet, there are concerns about the risk of future collisions due to orbital congestion caused by the high density of active and inactive satellites. Recent examples highlight the dangers of these hazards. For instance, **a Chinese spacecraft was recently struck by space debris**, leading to a delay in its return.

Additionally, **a pilot was injured** when an unknown object from space collided with a commercial aircraft on its way from Denver to Los Angeles.

In response to these risks, in 2023, the **Federal Aviation Administration** (FAA) developed a proposal that would have required commercial launch providers to deorbit rocket bodies within 25 years of launch and submit a plan for debris removal prior to launch. The proposal aimed to align commercial standards with standards set by the National Aeronautics and Space Administration (NASA) and help mitigate the growing threat of space debris. The FAA **withdrew this proposal in January 2026**.

### SPACE HAZARDS IN EMERGENCY MANAGEMENT

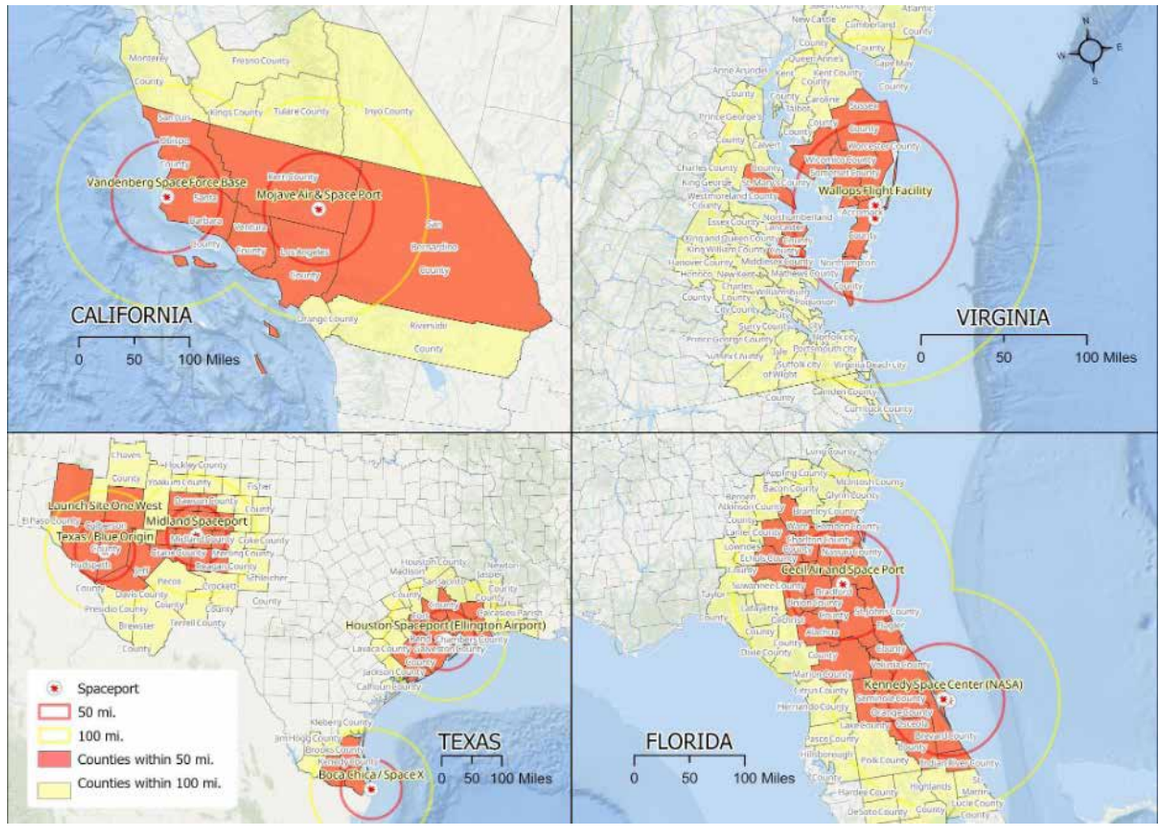
Emergency management agencies face a chronic shortage of public funding, which reduces emergency managers' ability to address human-made space hazards. When funds for preparedness and mitigation are already limited, emergency managers tend to allocate their scarce resources to preparing for and mitigating damage from more familiar hazards.

To better understand local preparedness for space hazards, **our study** analyzed 391 publicly available emergency management documents, such as emergency operation plans and local mitigation plans, from 512 local jurisdictions across California, Florida, Texas, and Virginia. A spatial analysis identified 66 high-risk counties within 50 miles of rocket launch sites. We estimated the relationship between the presence of a rocket launch site within a county or its proximity to one and the likelihood that its emergency management policies consider falling space hazards.

Our research found no planning for space hazards in many counties' emergency management plans, even in some counties closest to active launch sites. Only 31.25% of the 512 local jurisdictions studied mentioned human-made space hazards at all in any publicly available emergency management document, and a mere 8.01% mentioned natural space hazards. Counties that contained launch sites were more likely to mention natural space hazards in their emergency management documents relative to counties that did not contain them, but were not more likely to mention human-made space hazards.

### PREPARING FOR THIS EMERGING RISK

Our findings have significant implications for local emergency management, as preparing for the threats of space debris is important yet remains challenging. A well-prepared county requires more than document references; it also includes consistent training and standard practices for falling space debris. Such practical preparedness would require enhanced emergency management capabilities to alert their community in a timely manner, conduct tabletop exercises that focus on




*This map shows rocket launch sites and at-risk counties in California, Florida, Texas, and Virginia.*

space debris, and plan for removal of debris that could potentially contain hazardous materials or human remains from catastrophic launches or reentries. Because preparedness is linked to resource availability and human capacity, under-resourced emergency management agencies and communities prioritize higher-probability, high-consequence events like flooding or hurricanes over falling space debris. **This preparedness gap** will be more pronounced in under-resourced communities, whose emergency management systems are often inadequately funded and chronically understaffed.

Mitigation efforts for falling space debris are limited and include the introduction of **sustainable materials in satellite designs** and **robotic engineering** to gather debris in low earth orbit. However, with the exception of the **1972 Liability Convention**—which holds launching states responsible for any damage caused to other states—there is no binding international treaty governing these risks of rocket body/debris reentry. The risk posed by falling space debris calls for global efforts to remove existing space debris in Earth's orbit and to establish universal rocket-launch standards to prevent uncontrolled reentries of rocket bodies. Without additional global mitigation efforts, communities worldwide may eventually confront this hazard and should evaluate whether their warning systems are sufficient.

Although still considered a low-probability event, understanding existing local emergency management planning for space hazards is vital. This work marks the beginning of increased scholarly, practitioner, and policy attention to this emerging risk.



## ABOUT THE AUTHORS

**AMIDU KALOKOH** is a PhD candidate in Public Policy and Administration at Virginia Commonwealth University (VCU). His research intersects emergency management and homeland security, criminal justice, and public management, with current projects on correctional emergency management, institutional and community preparedness and recovery, environmental justice, and AI in public administration. He uses quantitative, qualitative, and geospatial methods. He is a graduate research associate with the Research Institute for Social Equity at VCU, a William A. Anderson Fund for Hazard & Disaster Mitigation Education and Research fellow, and an alumnus of the Coastal Hazard, Equity, Economic Prosperity, and Resilience program.

**HANS LOUIS-CHARLES** is an associate professor at The Wilder School of Government and Public Affairs at Virginia Commonwealth University. He teaches risk assessment, hazard mitigation, and disaster recovery courses within their Homeland Security and Emergency Preparedness program. His research focuses on emergency management, collective behavior in disaster, risk communication, social vulnerability, and disaster research ethics. Louis-Charles earned his PhD from the University of Delaware and is a former research assistant at the Disaster Research Center. He is a founding fellow and the current vice president of the William A. Anderson Fund for Hazard & Disaster Mitigation Education and Research.

**JOSE TORRES** is an American Institute of Certified Planners certified geographer and planner with a decade of experience in California community development. Torres' work spans municipal consulting, advocacy, and GIS analysis, with a focus on housing policy and hazard mitigation. He holds an MSc in Geography and an MA in Community Planning from Auburn University, where he taught global geography and managed GIS labs. Fluent in Spanish and Mandarin Chinese, he serves Spanish speaking communities across California's central coast. Torres is an alumnus of the William A. Anderson Fund, which mentors underrepresented doctoral scholars in hazard mitigation and disaster risk reduction.

**THOMAS JAMIESON** is a senior lecturer in the School of History, Philosophy, Political Science and International Relations at Te Herenga Waka - Victoria University of Wellington. He previously taught in the School of Public Administration at the University of Nebraska at Omaha. His research focuses on the relationship between information, public opinion, and policymaking, especially during periods of crisis. Jamieson received a PhD in political science and international relations from the University of Southern California. He completed a BA (Hons) and an MA at Te Herenga Waka - Victoria University of Wellington.

## CITATION

Kalokoh, A., Louis-Charles, H. M., Torres, J., & Jamieson, T. (2026). Falling Space Debris: An Underestimated Threat to Under Resourced Emergency Management Agencies. *Research Counts*, Special Collection on Equity and Inclusion in Disasters, *6*(SC19). Boulder, CO: Natural Hazards Center, University of Colorado Boulder. **https://hazards.colorado.edu/news/research-counts/falling-space-debris-an-underestimated-threat-to-under-resourced-emergency-management-agencies**

*A farmer stands in a dry and barren field. Source: Antònia Cos / Shutterstock.*

# DISAPPEARING GROUNDWATER:

## UNEQUAL CONSEQUENCES IN THE COLORADO RIVER BASIN

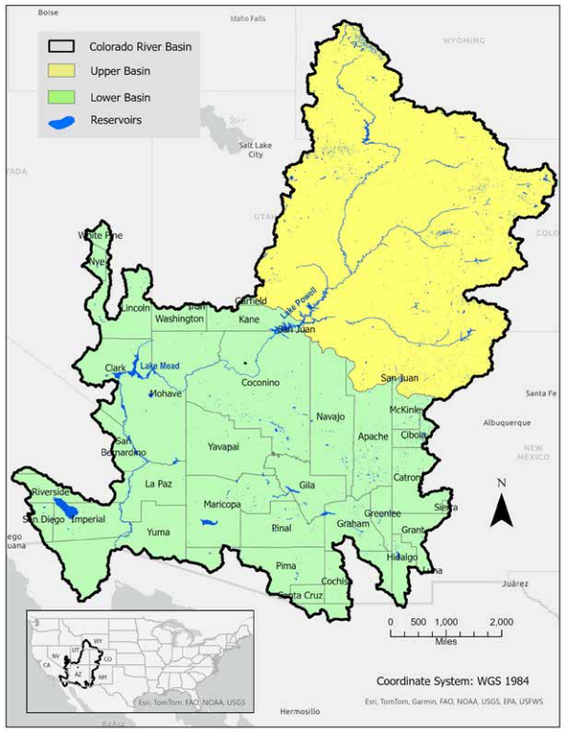
BY ESTHER OYEDELE

Groundwater in the Colorado River Basin is disappearing rapidly, unevenly, and unfairly. As climate extremes intensify and water supplies from rivers, reservoirs, and snowpack dwindle, communities across the American Southwest are relying on groundwater at unsustainable rates.

When these **invisible reserves run dry**, communities do not have equal capacity to respond. Smaller, rural, and economically and racially marginalized communities are often impacted most severely because they lack the money or political capital to drill deeper wells, import water, or influence regional water policy. These disparities are compounded by gaps in groundwater information, leaving many of the same communities underrepresented or undercounted in the data used to guide water management decisions.

## UNCOVERING A HIDDEN CRISIS

**My research** investigates the human-driven depletion of groundwater in the Colorado River Basin using satellite observations and high-resolution climate models. This 250,000 square-mile region supplies water to more than 40 million people across seven southwestern U.S. states and Mexico. It is also home to areas that are among the most water-stressed and agriculturally productive in North America—overlapping factors that intensify risk. By mapping where groundwater losses are occurring most rapidly, and identifying the climate and human drivers behind them, my work aims to support more equitable and inclusive responses. This can ultimately help mitigate a mostly hidden crisis that is unfolding and already affecting lives and economic systems.




*A map of the Colorado River Basin (CRB) showing the Upper and Lower Basins and the counties within the Lower Basin. The inset shows the location of CRB covering seven U.S. states: Arizona (AZ), California (CA), Colorado (CO), Nevada (NV), New Mexico (NM), Utah (UT), Wyoming (WY), and northern Mexico. Source: Esther Oyedele, 2026.*

Unlike more sudden-onset events like floods or wildfires, groundwater depletion is a slow-motion disaster that is hard to see, easy to ignore, and profoundly unjust in how it impacts communities. In Arizona's Pinal County, for instance, small-scale farmers' water wells have run dry while larger, **well-capitalized agricultural producers drill deeper with expensive new infrastructure**. On tribal lands, legal and infrastructure barriers prevent many Indigenous communities from **accessing the groundwater beneath their sovereign territories**. Migrant farmworkers **face compounded risks**—as laborers they depend on irrigation for their livelihoods, but they are also residents living in informal housing with limited infrastructure and other basic services. As such, their water supplies are among the most precarious in the region.

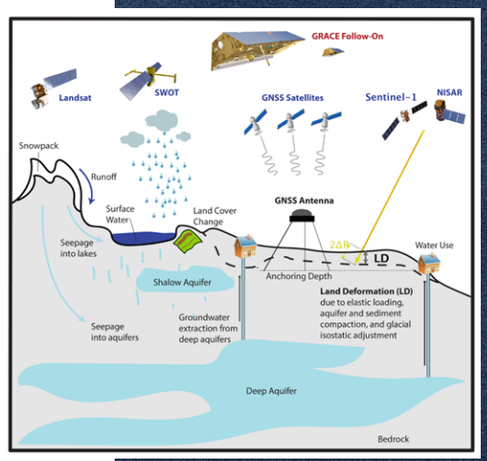
These are obviously not just environmental problems—they are systemic, social, and deeply tied to histories of exclusion. Many vulnerable communities lie in data blind spots that further inequity by erasing people and the specific problems they face. For example, because ground-based monitoring wells are generally clustered around urban centers and major agricultural districts, they leave water supplies in rural, tribal, and marginalized communities under-measured. In many parts of the Southwest, households depend on shallow domestic wells that are rarely monitored and can fail quickly as groundwater levels decline—**a vulnerability that researchers have documented** across thousands of wells in the United States. Without clear information about where and how groundwater is being lost in these unmonitored areas, those who live there are often left out of policy decisions that directly affect their survival. Improving visibility of groundwater conditions is therefore not only a scientific challenge but also a question of fairness in how water risks are recognized and addressed.

## ADDRESSING THE DATA DROUGHT

That's where satellites come in. In my work, I use data from the **National Aeronautics and Space Administration's Gravity Recovery and Climate Experiment (GRACE) Follow-On satellites**, which detect changes in Earth's gravity field to track variations in total water storage above and below ground. I also use GPS data and radar images from satellites such as NASA's newly launched NISAR and ESA's Sentinel-1 to see how the land surface rises or sinks as groundwater is lost or refilled. Various satellite missions provide information on surface water, snowpack, and soil moisture, helping us see how these parts of the water cycle are connected to groundwater. By combining these observations, I can estimate the extent of groundwater loss across the Colorado River Basin. These tools help reveal changes that would otherwise remain hidden and show how groundwater decline is linked to both prolonged droughts and human influences, such as heavy pumping for irrigation.

More importantly, they can help bring overlooked communities into the conversation. Satellite observations have already helped researchers **identify rapid groundwater depletion** in agricultural regions of central Arizona, including Pinal County, where reductions in Colorado River allocations have **pushed farmers to rely heavily on groundwater**. By revealing these trends at the basin scale, satellite data can provide communities and local officials with evidence that the problem is not hypothetical but already unfolding. Similar approaches could help rural or tribal communities that lack dense monitoring networks by providing independent data on where groundwater losses occur and how quickly conditions are changing. In this way, satellite observations can strengthen the information communities bring to regional water negotiations and planning discussions.

In the face of a slow-moving groundwater crisis, we must consider not only how much water remains, but also who has more access when it declines, and whose voices are included in understanding the problem and shaping responses to it. Satellite data can make hidden groundwater changes more visible, but they are only one part of the picture. When combined with local knowledge and the perspectives of communities most affected, they can contribute to a more equitable understanding of water scarcity and to decisions that do not place the greatest burden on those with the fewest resources to adapt.




*Conceptual illustration of various satellites used to study groundwater. Source: Hydrologic Innovation and Remote Sensing (HIRS) Lab at Virginia Tech.*

## ABOUT THE AUTHOR



**ESTHER OYEDELE** is a doctoral candidate in geosciences at Virginia Tech, where she specializes in groundwater hydrology and remote sensing. She conducts research in the **Hydrologic Innovation and Remote Sensing (HIRS) Lab**, using satellite observations and data-driven methods to study groundwater depletion and water security. Oyedele is particularly interested in how these approaches can be used to better understand hydroclimate variability and support more equitable and inclusive water management. She is committed to making science more accessible, inclusive, and actionable through outreach and engagement.

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*A young man stands amidst damage caused by Hurricane Maria. Source: Jean-Francois Manuel / Shutterstock.com, 2017.*

# DATA MATTERS:

## THE IMPORTANCE OF PUBLIC INFORMATION AND YOUTH DISASTER MENTAL HEALTH RESEARCH

BY ALEXA RIOBUENO-NAYLOR

A child born today will **experience several times more climate-related disasters** than someone born in 1960. Yet, most research **on children, youth, and disasters** still focuses on single events. Young people today are also living through rapid social change and upheaval.

Researchers often rely on public data to understand how extreme events and other forms of stress affect youth mental health, but access to this information is increasingly under threat. This missing data not only limits scientific insight, but also deepens age-, race-, and gender-based inequities by obscuring who is most at risk and where intervention is most needed.

### PUBLIC DATA: A CRITICAL RESOURCE

Government-funded public datasets play an important role in understanding youth mental health. Resources like the **Youth Risk Behavior Surveillance System (YRBS)** and the **National Health Interview Survey** allow researchers to track population-level trends and link them to broader conditions, including disaster exposure. Studying the intersection of climate change, disasters, mental health, and equity requires sustained access to publicly available data.

But this access is increasingly uncertain as public datasets **become subject to political interference**. In the past year, the scientific community has lost access to **over 3,000 government datasets**. As the datasets disappear, so does the ability to track where risks are rising, which people and communities are most vulnerable, and where support systems are falling short.

### DISASTERS AND YOUTH MENTAL HEALTH

**Our research team at Boston College** recently used public data to evaluate how multiple disaster exposures shape youth mental health across the United States. We combined five public datasets, **creating a novel dataset** that includes over 415,000 adolescents across 37 districts in 18 states. The sample was highly diverse. Nearly 80% of youth identified with a racial or ethnic group other than non-Hispanic White. Using **the Federal Emergency Management Agency's disaster records**, we calculated how many weather-related disasters occurred in each district during the two years before students participated in the U.S. Centers for Disease Control and Prevention's **Youth Risk Behavior Surveillance System**.

Bringing these datasets together allowed us to examine disaster impacts from a broader perspective than most single-event studies. Several patterns emerged. Young people living in districts with moderate disaster exposure—characterized as three recent disasters—reported higher rates of mental health distress compared to those in districts with fewer or more disasters. Importantly, this does not mean three disasters represent a universal threshold for risk. Several explanations may account for this pattern. One possibility is that communities with more frequent exposure to disasters have stronger systems of preparedness and response, while moderately exposed regions may not. But to understand whether this pattern holds, we need to see it replicated across different disaster types, regions, and timescales.

Identity and geography also shaped the findings. Black and Latino youth were more likely to live in districts with higher disaster exposure and greater underlying adversity, including poverty and community violence. Native Hawaiian and Pacific Islander youth faced similar vulnerabilities. The specific patterns varied, but the broader message was clear—the mental health consequences of disasters are not evenly distributed. This aligns with what educators and clinicians observe every day: young people with the greatest needs often live in places with the fewest resources.

### THE IMPORTANCE AND THE IMPACTS OF MISSING DATA

Understanding how mental health varies across populations is necessary for identifying effective interventions. The need for solutions is becoming even more urgent in the midst of the **youth mental health crisis**. Rates of depression, anxiety, and suicide are climbing. Exposure to disasters can intensify mental health challenges, especially for youth who are already struggling.

In January 2025, two of the datasets we relied on in our study—the **Youth Risk Behavior Surveillance System** and the Center for Homeland Defense and Security's **School Shooting Safety Compendium**—were removed from public access. The decision was political, tied to pressure surrounding gender-identity questions and transparency in reporting firearm-related violence. Although the Youth Risk Behavior Surveillance System was restored, **the school-shooting dataset remains offline**.

The consequences of losing public datasets are profound. Without them, we cannot reliably track youth mental health or understand which groups are most harmed by disasters. We cannot document inequities if they remain hidden. And we cannot give communities, schools, and policymakers the evidence they need to act with moral and scientific authority.

Protecting public data is fundamentally an equity issue. Young people cannot be supported if their experiences are invisible. Disaster-related disparities cannot be addressed if they are not being measured. As climate-related disasters accelerate, the future of youth mental health depends on safeguarding the information that allows us to understand, prepare for, and respond with the urgency that this moment demands.

## ABOUT THE AUTHOR

**ALEXA RIOBUENO-NAYLOR** is a psychologist-in-training whose research has focused on supporting individuals, families, and communities affected by trauma, including disasters. Her dissertation in Counseling Psychology at Boston College examined how cumulative disaster exposures shape youth mental health. As a clinician, she currently provides evidence-based care to diverse children, adolescents, adults, and families in New York City.

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*A female prisoner looks exhausted behind bars. Source: Shutterstock.com*

# EXPOSED AND NEGLECTED:

## GENDER INEQUITY AND EXTREME HEAT IN CARCERAL FACILITIES

BY BENIKA DIXON

Extreme heat is increasing and most carceral facilities aren't equipped to keep people cool. Across the nation, incarcerated people are suffering in these inadequate facilities, but incarcerated women are especially at risk of severe mental and physical health challenges caused by heat. Their lack of autonomy makes this already dire situation even worse. Without meaningful mitigation strategies in place to reduce exposure to extreme temperatures or to minimize its impacts, heat becomes a predictable and preventable threat to human health and dignity.

### THE HARSH REALITY OF INCARCERATION DURING EXTREME HEAT

Many carceral facilities lack the basic resources needed to manage extreme heat, including fans, air conditioning, adequate ventilation, access to cold drinking water, and designated respite areas where individuals can cool off. Incarcerated people are often **made to work outdoors during extreme heat** and engage in other physical activities that put them at risk. Attempts to **avoid the heat using the means available** to them can be denied on the basis of security concerns or with no justification at all.

Currently, more than a dozen states do not have air conditioning in all of their correctional facilities, leading to life-threatening conditions. Texas, which is one of the hottest states in the nation, has **reported cells with temperatures that regularly reach 110 °F** (and on at least one occasion a unit reached 149 °F). Legal advocacy organizations have argued that lack of air conditioning is a violation of basic constitutional rights, and even though **a federal judge agreed**, no action was taken to mandate it.

### PHYSICAL VULNERABILITIES OF WOMEN IN CARCERAL SETTINGS

For women and girls, these injustices compound other inequities related to their more complex health needs. Menstrual conditions, pregnancy and postpartum care, and higher rates of psychotropic drug prescriptions—which increase heat sensitivity—are just a few examples that demonstrate how women's needs differ from men's. Because the carceral system is designed primarily by and for men, women's access to resources is **limited, and they face increased vulnerability to trauma, sexual victimization, and systemic neglect**.

Reproductive health is also impacted by exposure to extreme heat. Studies **have linked heat exposure** to an increased risk of pre-term birth, stillbirth, and low birthweight. Experiencing extreme heat during pregnancy can lead to heat stress, hypertensive disorders, and other serious complications. These risks increase with the duration and extremity of the exposure.

### MENTAL HEALTH IMPACTS OF EXTREME HEAT

Extreme heat can also take a significant toll on the mental health of incarcerated women, who often have **higher rates of mental health disorders compared to incarcerated men**.

Research that my colleagues and I conducted along with our community partner, **Lioness**, found that women were not only impacted by the extreme temperatures and hazardous conditions they experienced while incarcerated, but that those **experiences had detrimental and long-lasting mental health impacts**.

We conducted focus groups with individuals formerly held in a women's carceral facility to better understand their lived experiences during disasters. Many who were primary caregivers reported that the psychological toll of being separated from children or family members during such events weighed heavily on them, compounding their trauma and emotional distress. Lack of privacy, inadequate access to mental health care, and gender-insensitive responses to the needs of incarcerated women during heat emergencies further increased feelings of helplessness, isolation, and fear. Our findings also highlighted that the stresses regularly associated with climate hazards—information uncertainty, community disruption, and safety concerns, for example—are also exacerbated by the restricted autonomy, dehumanization, and punishment that is common in carceral facilities.

### A CRISIS WITHIN A CRISIS

Incarcerated individuals endure crises such as poor sanitation, inadequate medical care, violence and abuse, and institutional neglect daily. These conditions become more dangerous when combined with extreme weather. For incarcerated women, these conditions are further heightened by other factors such as existing trauma, caregiver stressors, isolation, and continuous surveillance—and these compounding issues often persist after women are released.

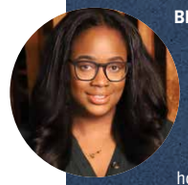
Making matters worse, there is a lack of transparency and accountability related to extreme heat in carceral settings. Few states collect or **report data on heat-related illnesses or deaths in such settings**, making it difficult to truly assess the scale of the crisis. Moreover, there are no federal standards requiring prisons or jails to prepare for extreme weather events. Many facilities are not climate resilient and have not adopted structural or nonstructural mitigation measures. This regulatory and action gap leaves incarcerated populations at the mercy of worsening climate conditions.

### TAKING ACTION

Addressing these issues requires immediate policy attention. Climate adaptation standards that mandate cooling systems, adequate medical and mental health care, and disaster and hazards planning should be implemented. Incarcerated and formerly incarcerated women should be included in planning and response efforts, and both should be done with an intersectional approach that acknowledges the identities of those impacted.

Most importantly, we must ensure that the health and safety of incarcerated women are prioritized—not overlooked or treated with a one size fits all approach. Ultimately, protecting incarcerated women during extreme heat and hazardous conditions is not only a matter of public health, but a one of dignity, justice, and equity.

## ABOUT THE AUTHOR



**BENIKA DIXON** is an assistant professor in the School of Public Health, Department of Epidemiology and Biostatistics at Texas Agricultural and Mechanical University. Her work focuses on understanding the physical and mental health impacts of environmental exposures and hazards, particularly among vulnerable populations including environmental justice communities and system impacted individuals. Her work integrates scholarship in epidemiology, environmental health, hazard and disaster research, and ethical community engagement practices. She is a 2025 National Academy of Sciences Kavli Fellow. Dixon is also a founding fellow of the William Averette Anderson Fund.

## CITATION

Dixon, B. (2026). Exposed and Neglected: Gender Inequity and Extreme Heat in Carceral Facilities. *Research Counts*, Special Collection on Equity and Inclusion in Disasters, *6*(SC9). Boulder, CO: Natural Hazards Center, University of Colorado Boulder. **https://hazards.colorado.edu/news/research-counts/special-collection/exposed-and-neglected-gender-inequity-and-extreme-heat-in-carceral-facilities**


ARTICLES:

# SOCIAL MARGINALIZATION AND INEQUALITY

*Residents walk across the flooded street in Houston, Texas during Hurricane Harvey in 2017. Source: Michel Mond / Shutterstock.com*

# "CALL ME, SHOW ME YOU CARE":

## PUBLIC HOUSING RESIDENTS ON DISASTER RESPONSE AND RECOVERY

BY CHANDLER IAN WILKINS

"Call me, show me you care." That was the plea from one public housing resident in Houston, Texas when asked what kind of support she wished she had received during 2023's deadly Winter Storm Uri.

Her words convey a pattern that emerged from interviews I conducted with 24 residents across five of Houston's public housing developments. During Winter Storm Uri and other recent disasters like Hurricane Harvey and the COVID-19 pandemic, many residents expressed a desire not only for resources, but for respect, connection, and dignity in these moments of crisis.

These appeals for recognition are not isolated. The Houston Housing Authority (HHA), which oversees 15 federally subsidized housing developments in the city, has faced criticism for **mismanagement**, lack of transparency, and a shift toward privatization. Residents' concerns and the broader critiques of the HHA are indicative of a growing body of research that has found that people who live in public housing **face unique challenges** in the context of disasters, yet are often **overlooked or excluded from decision-making**. These systemic issues help explain why residents may feel forgotten and they underscore the urgent need for stronger institutional plans and resources to help residents.

### UNMET NEEDS OF PUBLIC HOUSING RESIDENTS

My research in Houston found that residents were not entirely unprepared for disasters. In fact, many proved knowledgeable and resourceful. Some spoke about relying on intuition and memories of Houston's past storms to get through Hurricane Harvey, for instance. However, that experience did not translate to other, less familiar disasters like Winter Storm Uri, which brought rare freezing temperatures and snow to the city. Lacking both preparedness information and financial resources to purchase necessary supplies, some were caught off guard and left in harm's way.

**Public housing authorities have a formal responsibility** to protect their residents before, during, and after disasters, which includes communicating preparedness information. In 2022, the Department of Housing and Urban Development issued **comprehensive planning guidance** to public housing authorities that emphasizing exactly that—guidance that, unlike the related fact sheets that remain on the HUD website, has been removed and is now only accessible via the Internet Archive.

Residents I spoke with described a standard process for receiving information from the HHA: flyers on doors, notices on bulletin boards, and announcements from property management. In an ideal scenario, this should ensure that everyone receives the same disaster preparedness information. In practice, residents noted that communication was inconsistent and often inequitable in terms of its uneven reach.

During the disasters, some residents received check-ins from HHA or property management staff. Others heard nothing at all—even within the same development. Additionally, several residents described favoritism in how information and supplies were distributed, explaining that emergency notices or supplies like water or meals were withheld, handed out unevenly, or even, in the case of food, taken home by property management staff. Together, these failures left residents without the resources and reassurance they needed to navigate disasters.

### RESOURCEFULNESS AND AGENCY IN DISASTER PREPAREDNESS, RESPONSE, AND RECOVERY

In the absence of consistent support from authorities, residents relied on each other. "Management was not around, but the neighbors were," one resident said.

This informal **mutual aid** was crucial. Residents became first responders in their own communities—delivering food, sharing information, and offering comfort. These networks filled urgent needs, but residents were clear: these temporary fixes were not a substitute for institutional support.

Many expressed an interest in contributing to systematic disaster planning activities, but ultimately felt left out of the process. Numerous residents said they were unaware of public meetings held around the city to address disaster recovery. Even when meetings were well advertised, they weren't always accessible. For example, transportation was a major barrier for some. The timing of meetings was a barrier for others, particularly meetings that start at or around 5:00 p.m.

While some residents remained eager to stay informed, others spoke to the exhaustion of having tried—often for decades—to make their voices heard. One resident reflected on the toll of repeated efforts to engage with decision makers who rarely responded: "I don't have the personal gas for that [attending meetings] anymore… I don't know if I would've had an impact. They don't listen to us."

Still, many voiced a desire to be involved not just in recovery, but in planning. They wanted transparency around allocation of funds, available resources, and how to access them, as well as real opportunities to contribute to disaster decision making.

### LISTENING AND TRUST: TOWARD A MORE EQUITABLE DISASTER RESPONSE

Public housing residents I spoke with were not passive recipients of aid. They were proactive, resourceful, and deeply invested in their communities. They were also clear-eyed about how systemic failures directly affect people's lives. In the absence of institutional support, they led anyway: checking on neighbors, sharing resources, and holding their communities together when the systems meant to protect them fell short.

Improving disaster response for public housing communities is not just about logistical refinements and investments in infrastructure, though those are critical measures to reduce physical and social vulnerability. It is also about listening deeply, building trust, and designing systems that ensure the leadership residents have already shown out of necessity becomes a genuine partnership—recognizing residents as full participants in their own safety.

Public housing authorities have a responsibility to understand the experiences and priorities of their residents. The development of **comprehensive needs assessment frameworks** which engage residents, especially those historically excluded from decision-making, should be an essential component of disaster planning and communication strategies.

Important emergency information should be gathered and shared in ways that meet residents where they are to ensure broad participation. This might mean a flyer slipped under every door, with multilingual versions of the text; a meeting announced in advance, in an accessible location, with transportation and childcare support. A phone call that says, "We are here, and we are listening." And crucially, a commitment to follow through on resident feedback—not only during recovery phases but as part of ongoing planning and preparedness activities.

When public housing residents are excluded from the systems meant to protect them, disaster response becomes a site of inequity. Their experiences make clear that structural change is urgently needed and that a more equitable, compassionate, community-led response is not only necessary, but possible.


## ABOUT THE AUTHOR

**CHANDLER IAN WILKINS** is a research associate in the Housing and Communities Division at the Urban Institute, where his work examines the impacts of hazards on low-income communities, particularly in federally assisted housing, while pursuing solutions and interventions to better support these populations. His research also addresses climate change adaptation and mitigation, resiliency planning, and community development. Wilkins earned a PhD in Urban and Regional Science from Texas A&M University.



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*Portrait of an expectant mother. Source: DC Studio / Shutterstock.com, 2022.*

# THE MOTHERS WE'RE MISSING:

## ACCESS TO MATERNAL MENTAL HEALTHCARE DURING SUCCESSIVE DISASTERS

BY NATASHA MALMIN

Faced with successive hurricanes, including Matthew, Florence, Michael, and Dorian, more expectant mothers on Medicaid showed up at North Carolina emergency departments seeking treatment for mental health crises. Yet one vulnerable group was missing: pregnant women from predominantly Black communities.

Climate change is contributing to the increased prevalence of extreme weather, straining the already fragile last-resort systems meant to catch and support mothers. At the same time, pre-disaster laws and policies may prevent already marginalized groups from accessing the resources they need during disaster recovery. A new approach is needed to understand the layered barriers that influence Black women's experiences at the intersection of gender, motherhood, mental health, structural racism, and disasters.

### WHICH WOMEN ARE MISSING OUT ON MENTAL HEALTHCARE?

Hurricanes can inflict significant mental health consequences on affected people and communities, with severe storm damage linked to major depressive disorders, post-traumatic stress disorders, and anxiety. Pregnant women are particularly vulnerable, facing unique challenges related to reproductive health, such as unplanned cesarean births and heightened stress for both the child and the mother. While there is evidence on the **various mental health impacts** of individual hurricanes, there is **limited research** on how back-to-back storms affect pregnant populations.

My colleagues and I sought to **analyze the impact of single and consecutive hurricanes on emergency department visits** for mental health crises among Medicaid-eligible pregnant women in North Carolina. Our work focused on the impacts of four major storms that affected the region—Matthew in 2016, Florence and Michael in 2018, and Dorian in 2019—and accounted for factors such as rurality, maternal age, race and ethnicity, economic segregation, and access to maternal care. Findings revealed that overall, pregnant women from areas affected by repeated storms sought emergency mental health care more than those in areas hit by just one storm. Specifically, multiple storm exposures were associated with increased risks for maternal mental disorders during pregnancy, including perinatal mood or anxiety disorders, as indicated by visits to emergency departments.

However, this trend did not hold for expectant mothers from majority Black communities. Even in places hit by back-to-back storms, we found that Black expectant women visited emergency departments for psychiatric illnesses less frequently, as compared to communities with no storm exposure.

Recurrent disaster exposures may increase trauma for Black mothers, yet low engagement with behavioral health treatment among this population may mean missed opportunities for screening of maternal mental disorders.

While Black mothers may very well be feeling the mental health effects of these storms, social and economic barriers to care can also prevent them from seeking adequate treatment.

### THE UNIQUE CHALLENGES BLACK EXPECTANT WOMEN FACE

Black communities are more likely to be located in the **path of storms** and have **less access to recovery resources** compared to White communities. Yet even before disasters occur, Black women must navigate a complex risk landscape. Pregnant Black women in low-income areas **experience higher trauma exposure** and greater risk for trauma-related mental health disorders compared to their White counterparts. Nevertheless, they are **less likely to use behavioral health services** due to financial constraints, time constraints, institutional biases, and other factors.

Moreover, interactions with state and local safety-net agencies often prove challenging and may deter families from seeking help due to the **risk of family separation**. For instance, Black children **are overrepresented within the foster care system**, with **documented bias** among medical professionals in reporting to child welfare systems. As a result, seeking assistance through safety net systems like healthcare has the potential to trigger the enduring trauma of family separation. Calling attention to the demographic vulnerabilities and inequitable institutional policies and responses at play *before* disasters is key. It helps us understand the unique response and recovery challenges that mothers in these communities may face.

### A LEGAL FRAMEWORK FOR UNCOVERING HIDDEN RISKS

There's an urgent need to examine the structural inequalities that perpetuate these disparities in access to mental health care in the context of repeated disasters. Legal epidemiology, the study of how policies and laws **shape health outcomes**, can be a powerful framework in this context. Leveraging this approach may allow researchers and practitioners to reveal and, crucially, interrogate the social roots of disaster risk.

Recent policy studies demonstrate the growing application of legal epidemiology in disaster work. For instance, my previous research **examined laws** that could enable or limit healthcare volunteers' ability to respond during disasters. In other instances, researchers have examined the policies that shaped state and local authority to **respond to public health emergencies** like the COVID-19 pandemic. Such studies highlight barriers and opportunities for improving disaster response. Legal epidemiology also has the potential to reimagine our disaster risk frameworks by deepening our understanding of how **upstream** determinants influence mental health and healthcare infrastructure.

With the promise of more powerful storms ahead, there's an urgent need for more reparative and restorative pre-disaster policies. Resilience through this lens centers the holistic well-being of expectant women. Critically evaluating how our pre-existing policies shape disaster impacts and recovery is imperative, not only for women, but for the future of families and communities in places at risk to disasters.

## ABOUT THE AUTHOR

**NATASHA MALMIN** is a tenure-track assistant professor of environmental health at Georgia State University. A scholar at the intersection of public policy, health equity, and disaster resilience, Malmin holds a joint PhD in public policy from the Georgia Institute of Technology and Georgia State University, complemented by a Master of public health in Global Environmental Health from Emory University. Malmin's research examines how bureaucratic processes in federal disaster recovery programs create administrative burdens that disproportionately affect marginalized communities, with particular attention to their cascading effects on social and health equity.

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*A suburban mobile home in Florida was heavily damaged by Hurricane Ian. Across the eastern coast of the United States, renters and mobile homeowners face housing recovery challenges. Source: Shutterstock.com*

# RETURNING HOME:

## HOW HOUSING TENURE SHAPES LONG-TERM DISASTER RECOVERY

BY KAYODE NELSON ADENIJI

From Hurricane Floyd in 1999 to Hurricane Florence nearly two decades later, disaster recovery has been a long and challenging process for many residents of **storm-prone eastern North Carolina**. But renters and mobile homeowners, who are **more likely to be economically marginalized before disasters**, tend to face greater difficulties returning home after storms. That's because they're often excluded from the policy and financing programs that help single-family homeowners get back on their feet.

To better understand these recovery dynamics, I partnered with researchers from the **Coastal Hazards, Economic Prosperity, and Resilience Hub**. We interviewed 21 local officials, representatives from non-governmental agencies, and other stakeholders working on housing recovery in the region.

Our work revealed that single-family households took between six months and six years to return to stable housing. In contrast, renters and mobile homeowners were sometimes displaced as long as seven and eight years, respectively. The latter group of residents spent that time often moving between hotels and motels, homeless shelters, and friends' homes. Sometimes, they were forced to remain in storm-damaged dwellings, unable to secure repairs. These experiences reflect persistent inequity in the long-term housing recovery trajectory.

### WHEN HOUSING RECOVERY AID DEPENDS ON OWNERSHIP

Rebuilding, repairing, or relocating in the wake of a disaster is time-consuming and expensive for all people. Single-family homeowners, however, often have access to more sources of recovery aid than their renter or mobile homeowner counterparts. For example, homeowners may be more likely to have personal funds in the form of savings or other assets. They're also more likely to be deemed eligible for homeowners' and flood insurance payouts, aid from non-governmental organizations, and grants and loans through the Federal Emergency Management Agency or the U.S. Small Business Administration. For many government-funded programs, homeownership is a prerequisite to access more robust recovery funds.

While renters and mobile homeowners can sometimes get assistance to replace personal property or pay for temporary housing, they are often excluded from the programs that provide support to repair a storm-damaged dwelling and make it livable. Local officials in our study were aware of these problems but struggled to articulate systematic recovery pathways, especially for renter households.

### BARRIERS TO REBUILDING, CHALLENGES WITH RELOCATING

Beyond financial constraints, renters and mobile homeowners face other challenges in the process of rebuilding or finding a different, safe place to live.

Contractors tend to prioritize repairs for homeowners with higher purchasing power. For mobile homeowners specifically, many agencies are unwilling or unable to rebuild or repair, in part because their homes are viewed as too structurally fragile.

"[The] next storm, which could be two months from now, could tear it all apart again," said one representative of an eastern North Carolina nonprofit.

In some cases, restrictive land-use planning and zoning policies prohibit the reconstruction of mobile homes. In others, access to recovery assistance is contingent on property ownership, as mobile homeowners are only eligible for programs such as the Hazard Mitigation Grant Program if they own both the home and the land it sits on. Often, they don't.

This leaves mobile home residents vulnerable. In the case of the 2013 Colorado Floods, for instance, the owners of mobile home parks sold land for redevelopment, **leaving residents with nowhere to place their homes**.

Renters' repair options are effectively controlled by their landlords or property owners, severely limiting external agencies' ability to intervene.

As one eastern North Carolina official told us, "The owner [landlord] doesn't care or doesn't see that as economically viable for them to do it [repair a damaged structure]. So, they'll let people live in the conditions the storm left them."

More broadly, when landlords delay repairs or choose not to reinvest after disasters, renters may be left in unsafe housing, displaced, or **forced to relocate without adequate support**. Even when renters are eligible for relocation assistance under the **Uniform Relocation Act**, sharp rent increases or a shortage of rental properties following storm damage makes it difficult to find permanent housing.

### TOWARD INCLUSIVE HOUSING RECOVERY

In a country where renters comprise more than **34% of households and mobile and manufactured housing accounts for more than 5%**, the challenges identified here demand urgent policy attention. Unless recovery policies are designed to systematically include renters and mobile homeowners, post-disaster housing programs will continue to reproduce inequitable recovery outcomes and prolong housing instability for those least able to absorb it.

Recovery funding mechanisms should move away from their disproportionate focus on home ownership, which explicitly favors wealthier residents. Instead, program eligibility should be based on vulnerability, proportional loss, and displacement.

Housing recovery programs should also ensure that mobile homeowners are afforded the same benefits as wood-frame structure owners. This might require agencies to reform eligibility criteria and policies like land ownership requirements that systematically exclude mobile homeowners.

At the local level, decision makers should work to regulate the landlord-tenant relationship, to ensure that landlords **acknowledge renters rights and accelerate the repairs**. To build resilience in the long-term, local governments should also incentivize the development of affordable housing outside the floodplain.

Economically marginalized households have a right to return to safe and stable housing. With the promise of more intense and repetitive storms to come, ensuring inclusive and equitable housing recovery is critical.

## ABOUT THE AUTHOR

**KAYODE NELSON ADENIJI** is a PhD candidate in the Integrated Coastal Science program at East Carolina University. His research focuses on long-term housing recovery and disaster mitigation, particularly non-structural strategies such as property acquisition, community-driven initiatives, and policy interventions. He employs mixed methods, combining qualitative and quantitative approaches, and leverages geospatial analytics to identify risk patterns and inform evidence-based decisions. His work aims to advance sustainable mitigation strategies that enhance community resilience.

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*A group of volunteers use a boat to deliver food and relief items to flood victims in Tanah Merah, Kelantan Malaysia. Source: Muhd Fuad Abd Rahim / Shutterstock.com*

# THE HAIKU EYE:

## USING POETRY TO BEAR WITNESS TO MARGINALIZED VOICES IN DISASTER

BY IBRAHIM NURENI

***flooded village...***

***a girl in the washtub***

***paddles with her hands***

**-- Ibrahim Nureni**

When disaster strikes, official reports offer statistics about deaths, injuries, and the extent of the damage done. But poetry and other art forms can capture quieter truths about the emotional toll, cultural losses, moments of resilience, and uneven way people are impacted.

In this poetic tradition, haiku is a uniquely powerful tool to bear witness to the often-invisible dimensions of loss and healing that mainstream narratives too often ignore, especially within marginalized communities. Beyond its traditional three-line, 17-syllable structure[1], this Japanese poetic form offers what I call a *haiku-eye*: a research perspective and observational method that prioritizes small, specific moments to reveal larger systemic realities.

Drawing on nine years of practice as a poet, I propose the haiku-eye as a shift from the process of data extraction toward a more relational approach rooted in human connection. Indeed, the haiku-eye can allow for the documentation of survival with an expansive humanity that escapes most traditional data sets.

### DISASTER AND THE HAIKU-EYE

Adopting a haiku-eye means shifting focus to the more granular, sensory details of disaster experiences and survival. It is both a perspective and a practical research method. One way to put it into practice is by treating a site visit as a *ginko*, or a traditional haiku walk. In a disrupted environment, a ginko fosters an ethical presence by having the researcher walk without instantly documenting observations or relying on a formal checklist. The researcher is encouraged to remain open to the present moment. This approach is about slowing down before any questions are asked. Instead of looking for specific things, the researcher tries to notice the small details in the space, like the scent of wet concrete or how a shadow falls across the floor. The aim is to pick up on subtle qualities that a typical survey or research guide might miss.

Researchers can also try haiku-style note-taking during fieldwork, to better document fleeting but significant moments of motion, atmosphere, and lived reality. This method asks the researcher or practitioner to start with their senses. Make short notes about what you see, hear, or smell, focusing on small details. Through this focus on the minute, the haiku-eye moves beyond traditional means of disaster reconnaissance to witness the soul of the survivor, as seen in this moment of profound, isolated grief documented by the Californian poet, Darrell Byrd:

***smell of death—***

***a mother wades the school yard***

***alone***

Byrd's poem, centered on Hurricane Katrina, moves beyond casualty counts by honing in on the sickening smell of death and the stagnant image of floodwater; striking details that pull the reader directly into the survivor's immediate reality. The mother is "alone," a word carrying the weight of a community that may have been marginalized long before the storm hit. The haiku-eye forces us to stand in that schoolyard, recognizing that disaster is not a headline or a research question, but a profoundly personal experience affecting mother and child along with entire communities. This witnessing highlights the emotional truths that statistics, printed in black and white, often obscure. Sitting with these moments of deep, specific pain serves as a necessary exercise in methodological humility; it reminds the researcher that the 'subject' is not a data point to be solved, but a life to be honored. It can also spur practitioners to remember that "one-size-fits-all" recovery plans often do not fit into landscapes of trauma and suffering.

Disaster demands incredible ingenuity, often from those with the fewest resources. Anthony Itopa Obaro, an award-winning Nigerian poet, captures this in the haiku below:

***July rain—***

***ferrymen paddle canoes***

***on the highway***

In Obaro's work, the haiku-eye calls attention to adaptation rather than just suffering. The highway, a symbol of state-funded infrastructure, has failed. In response, the ferrymen repurpose their skills. This image captures the resourcefulness of the marginalized. Observing and documenting such adaptations allows for a deeper understanding of local knowledge, resourcefulness, and survival strategies—the essential, everyday tactics of endurance that are too often overlooked by traditional disaster frameworks. By looking through this lens, we see how communities often excluded from official planning are already solving their own problems, turning a failed road into a lifeline before the first aid truck arrives. This highlights how people actively respond to crisis rather than passively enduring it.

### APPLYING THE HAIKU-EYE

In a disaster context, haiku is far more than a literary exercise or a form of art; it is a vital, practical lens for the researchers, policymakers, and humanitarian workers who navigate the complexities of disaster. Embracing the haiku-eye asks researchers and practitioners to maintain a presence that honors the beauty and pain of the disaster context through sensory attention. Using this lens can encourage members of our field to resist the urge to reduce human experience to mere data points, ensuring that our work remains innovative, just, and humane.

[1] People may remember the 5-7-5 syllable structure, which adds up to seventeen syllables and is taught in primary school. However, modern haiku, along with the "haiku-eye" method described here, has moved beyond these strict rules to focus on vivid imagery, juxtapositions, and sharp observation.

## ABOUT THE AUTHOR

**IBRAHIM NURENI** is a creative writer, researcher, and literary critic, pursuing a research degree program in English at Louisiana State University. He received his Bachelor of Arts in english literature from Ahmadu Bello University. His current research interests include disaster, eco-criticism, postcolonialism, and haiku poetry. His literary achievements include: the Mukai & Farm Haiku Festival Award (Social Justice Category), the People's Choice Grand Award at the Atlanta Haiku Festival, and second place in the 2025 Maya Lyubenova International Haiku Contest. Nureni is a Fellow of the Bill Anderson Fund.

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*Signage for title loans and other predatory lending options are a common sight along South Texas Highways. Source: Lucas Belury, 2024.*

# SURVIVAL, NOT RECOVERY:

## PREDATORY LOANS AND FLOODING ALONG THE TEXAS-MEXICO BORDER

BY LUCAS BELURY

Along a South Texas highway near San Antonio, large advertisements for mobile homes dot the landscape. The signs, often in Spanish, promote financing using an individual taxpayer identification number (ITIN), a common form of tax identification for immigrants. I see similar signs in the Rio Grande Valley for payday and auto title loans.

Such products are often predatory, targeting immigrants and others with limited financial resources. These types of loans can involve **interest rates between 200% to 500%**. They're **especially prevalent** in colonias in the Rio Grande Valley, where I research how flooding, social vulnerability, and finance are interwoven.

Worsening floods and other climate-related threats there have driven many people to turn to title and payday loans to assist in their disaster recovery. These lending practices can trap borrowers in perpetual debt and compound disaster impacts. Yet, with limited access to federal aid or traditional lending, these borrowers often have no choice. This is especially true for colonia residents.

### FLOOD RECOVERY IN COLONIAS

Colonias were first defined by the **Cranston-Gonzalez National Affordable Housing Act of 1990** and include unincorporated communities within 150 miles of the United States-Mexico border. Often these neighborhoods lack critical infrastructure, such as drainage, and are generally characterized by substandard housing and high poverty rates. Those who live in colonias are largely Hispanic.

Roughly one-third of colonia residents were born outside the United States, including those with dual citizenship and various immigration statuses.


*An advertisement outside of a pawn shop in Texas targets Spanish speakers. Source: Lucas Belury, 2024.*

Since 2019, I've researched flooding as a racialized disaster in the Rio Grande Valley. This includes an **ongoing participatory research** project I've worked on with a coalition of five community-based organizations since 2023. After speaking with more than 100 flood-exposed, socially vulnerable residents, I've heard repeatedly how they often lack checking or savings accounts, have limited incomes, and have either been denied traditional loans, or simply don't trust banking institutions.

Additionally, there is a lack of disaster aid for colonias. When flooding or other disasters strike, residents are often excluded from Federal Emergency Management Agency assistance due to their flood risk, property values, and other factors, which puts them at further disadvantage. While these racialized disparities have long been **recognized** and **documented**, it doesn't change the fact that residents must find some other way to pay to fix their homes.

### FORCED TO TURN TO FINANCIERAS

Many disaster victims turn to predatory lenders, known locally known as *financieras*. These lenders provide residents access to needed liquidity, but at high interest rates.

"I have taken out a loan from a financiera and the interest rates are very high, but you have to pay because there aren't other options," stated a colonia resident I spoke to. "Sometimes I need to repair my house or my car, so for that I needed to ask for a loan because we don't have savings."

Institutional exclusion can also drive residents to a predatory lender following a disaster. Although I do not collect or request documentation status in my research, it's an important factor in securing a traditional loan. As one participant told me, "Because we don't have Social Security numbers, we don't have other options to get a loan with a lower interest rate. So, we had to get our loan with a financiera."

### THE CONSEQUENCES OF LIMITED DISASTER ASSISTANCE

Without adequate post-disaster aid, colonia residents must turn to predatory, small-dollar loans to make their homes livable after a disaster—and after the disasters that follow, because these floods are significant, repetitive, and ongoing. For instance, on March 27, 2025, as much as 20 inches of rain fell on parts of the Rio Grande Valley and some residents were still trapped in their homes over a week later due to standing flood waters. The local response was robust, with philanthropic, religious, and nonprofit organizations working tirelessly to support those affected by the floods. Even so, when these and other affected residents are unable to access post-disaster support, predatory lenders may be their only choice to fix their flooded cars, warped floorboards, and destroyed appliances.

There are alternatives to rampant predatory lending. For example, some residents I spoke with used micro-lending programs such as **Communities Unlimited** which support families with replacing destroyed appliances and housing materials. However, overall, the gap is simply too great for an individual nonprofit to fill. Some states such as Colorado and Arkansas, are working to **limit the exorbitant interest rates** of predatory lenders. While the federal government has undergone significant transformations in the last year, discussions about ways to make **government flood aid policies more just** are increasing in academic, policy, and local government circles.

These are important steps, but to truly serve the needs of flood exposed, economically and socially marginalized colonia residents, both robust federal disaster aid policies and improved limitations on high interest predatory loans must be implemented. Until then, these residents will likely continue to be exploited by predatory lenders.

## ABOUT THE AUTHOR

**LUCAS BELURY** (he/him/el) is a PhD candidate in geography at the University of Arizona. His research blends ethnography, satellite imagery, and machine learning for racial and environmental justice. For the last several years, Belury has collaborated with community-based organizations on the Flood Justice utilizing Satellite Observation (FLUJOS) - Rio Grande Valley project. FLUJOS (flows in Spanish) is a co-production framework that elevates the lived experiences of flood-vulnerable residents to the forefront of flood mitigation decision-making. Belury is currently a Gulf Policy fellow at the Water Institute based in New Orleans, Louisiana.

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*An attendee views a display at the I'm Literally Taking It Out of the Mud exhibition at the Delaware Historical Society. Source: Wendell Sisnett / VSSLS, 2023.*

# AMPLIFYING MARGINALIZED VOICES:

## ARTS-BASED ACTIVISM AND DISASTERS

BY FELICIA HENRY

A photograph in a gallery depicting protests in response to state-sponsored violence. An open-mic spoken word piece demanding an end to racism. A living room gathering to develop new music that resists apathy toward political polarization.

Every setting where art is found is ripe for conversations about social justice. Infusing art with a call to take action against injustice—known as arts-based activism, or **artivism**—is an effective tool to connect more deeply to disaster-affected communities and cultivate better solutions to the social and systemic issues that lie at the root of disasters.

Applying these creative methods to disaster research provides a platform that allows the stories of those impacted to be heard. Disasters are increasing in frequency and severity, leaving communities increasingly more exposed. Artivism **is a way forward** for community-led and community-driven research to capture their impacts.

### WHY ARTIVISM?

It is necessary to know how disasters affect the most marginalized people in our society if we want to design innovative approaches to prepare for and respond to them, as well as build individual and community resilience. Artivism is one strategy that addresses that. It gives us the ability to more fully recognize the humanity of those around us, thereby tapping into limitless ingenuity and creativity to achieve social justice and reduce suffering.

Creative methodologies should not be separate from the theories used to interpret disaster phenomena. Indeed, **these non-traditional techniques** help uncover what traditional approaches cannot completely account for. Genuinely representative research and engagement, as encouraged by artivism, centers how people engage in the world from their social perspective. Paying attention to personal accounts of both extraordinary and everyday experiences of injustice can drive home the true extent of disaster impacts.

### ARTIVISM AS AN ANALYTIC STRATEGY

Art is dynamic and expansive and so artivism can take many forms in disaster research. For instance, it can be used as a process within an analytic research strategy. I used artivism **in this way in my research** on Black women under community supervision (i.e., probation, parole, and electronic monitoring) during the COVID-19 pandemic to better understand their involvement in the criminal legal (**formerly termed criminal justice**) system and how they made meaning of it during the pandemic.

Using a **poetic inquiry method**, I immersed myself in the qualitative interview transcripts of Black women describing their community supervision experiences and the specific challenges of their status during COVID-19. This helped me to understand their perspectives and create poetry that interpreted and aligned with those experiences. This methodology allowed for an iterative analysis that amplified each participant's personal stories while illuminating the broader experiences shared by all participants.

Additionally, the poem itself was a text that could be analyzed. What language was used to describe an experience? To what extent did it come directly from a participant's words? What creative liberties were taken? How I interpreted Black women's experiences through poetry led to a more refined analysis that better encapsulated the myriad impacts of COVID-19.

*The author (center) converses with other panelists at the I'm Literally Taking It Out of the Mud exhibition at the Delaware Historical Society. Source: Wendell Sisnett/VSSLS, 2023*

### ARTIVISM AS A RESEARCH OUTCOME

Artivism can also be a research and engagement outcome that results in creative projects that bring together audiences who may not always be in community with one another—academics, activists, advocates, community members, decision-makers, and those who are directly and disproportionately impacted by disasters.

I—along with my research participants and colleagues—used my social justice arts organization, **Behind the Walls, Between the Lines**, to co-curate and co-host ***I'm Literally Taking It Out the Mud***. This exhibition used audio, visual, and spoken word representations to celebrate Black women's spirit of resistance as they rebuilt their lives after being involved in the criminal legal system.

It was a powerful demonstration of how creative methodologies allow for direct engagement with research participants. It also amplified the stories and tellings of Black women, showing that they had agency to shape their worlds. The women's calls to transform the criminal legal system underscored how research can be used as a political tool to bring about change based on the needs of community members. The exhibition also allowed the audience to experience their stories in a way that stripped away barriers and humanized the women.

### A WORLD OF POSSIBILITIES

In ***Sister Outsider***, Audre Lorde argued that poems serve as a vehicle for imagination. That is the essence of artivism in disaster research. Using creative methodologies expands the possibilities of how we prepare for, respond to, and recover from disasters. They offer an alternative existence—one that marginalized communities may or may not already embrace—that is achievable. In this way, artivism serves as an intentional strategy for social justice. It fosters empathy and understanding and connects the audience more deeply to the experiences of those marginalized by society. The solutions to the most pressing disaster challenges lie with those most deeply affected by them. Artivism amplifies their voices.

## ABOUT THE AUTHOR

**FELICIA A. HENRY** is an artivist scholar whose research concentrates on the racialized and gendered aspects of the carceral state. Her scholarship also uses disasters as social occasions to study the strains of criminal legal involvement. Henry is the founder of Behind the Walls, Between the Lines, an arts-based movement to deepen the awareness of the legacy of racial inequity in America and inspire activism aimed at its dismantlement. Her work challenges systems of power that fuel anti-Blackness and advances creative solutions to promote the well-being of Black communities.

## CITATION

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*A woman uses a straw broom to sweep water from a flooded floor. Source: Flystock / Shutterstock.com*

# BEARING THE BURDEN:

## DISASTER RECOVERY AND WOMEN OF MEXICAN ORIGIN

BY MELISSA VILLARREAL

After Hurricane Harvey struck Houston in 2017, the women of Mexican origin living there were forced to embark on an arduous journey toward recovery. For many, it took months and even years to regain some sense of normalcy—in large part because they had to overcome systemic barriers and obstructive policies that others didn't.

To better understand the obstacles they faced, I interviewed 46 women of Mexican origin—both those who had migrated from Mexico and those who had been born in the United States to an immigrant parent—about their experiences following Hurricane Harvey.

The **results of my research** showed that these women faced distinct hardships in accessing disaster housing assistance and recovering in general. It was also clear that recognizing the inequities they regularly encounter can provide opportunities to address them.

### DISCRIMINATION IN DISASTER RECOVERY

Immigrants have often faced discrimination from local relief officials. Latine immigrants during Hurricane Katrina, for example, were labeled Mexican by disaster relief officials—regardless of their country of origin—and assumed to be "illegal." They **routinely faced housing discrimination** because their skin was brown or their English skills were poor. This has particularly negative consequences for those with racialized gender identities. For instance, shortly after Hurricane Harvey, then-President Donald Trump **revived the welfare queen trope** once used to discredit Black women, insinuating that Mexican immigrant mothers were depleting government resources.

These racialized and gendered stereotypes are at the root of numerous **anti-immigrant policies** that actively or passively discriminate against individuals of Mexican origin—especially women—by restricting access to resources.

The women I interviewed faced policy barriers and obstacles that emerged from power dynamics—structural, organizational, and interpersonal—that limited their access to resources, information, and opportunities. Their immigration status, financial circumstances, housing tenure, and household responsibilities all impacted their ability to access disaster housing recovery assistance.

### DISASTER ASSISTANCE BARRIERS AND IMPACTS

Applying for disaster assistance can be confusing under the most favorable circumstances, but adding immigration status, financial issues, and renter status to the mix can make the process particularly daunting.

For instance, immigrants without documentation can apply for Federal Emergency Management Agency (FEMA) disaster assistance as long as someone in their household—**including underage children**—has a social security number. This, however, is not widely understood.

The women in my study were unsure if they were eligible for assistance from FEMA and other programs, including nongovernmental sources, because they or an immediate family member lacked documentation. Some women said that they were afraid that seeking assistance would affect their ability to obtain documentation in the future.

Even when the women did apply, their immigration status played a role in their ability to advocate for themselves. They often became stuck in what I call application purgatory, where they don't receive updates or information on their application status. Women who became stuck in application purgatory or were denied assistance attributed it to their legal status, reflecting misinformation about programs. Similarly, those who rented their homes had the misconception that renters are not eligible for any assistance. This meant renters had less access to financial resources to recover.

Compounding this lack of disaster assistance is a lack of other assistance types. Although more than half the women in the study lost income due to Harvey, they couldn't access either regular or disaster unemployment benefits because they lacked a social security number. This compounded their low socioeconomic status and ultimately hindered their ability to recover swiftly.

### POINTS OF INTERVENTION

In recognizing these barriers, we have the opportunity to identify specific interventions that could improve the outcomes for women of Mexican origin during and after disasters.

An important first step would be to evaluate program eligibility for ways to reduce barriers for socially vulnerable applicants, including excessive documentation requirements. Doing so would ensure more equitable distribution of disaster recovery assistance.

Disaster recovery programs should also work to eliminate misinformation so that groups such as immigrants and renters are aware that they are eligible for assistance. Federal agency and nonprofit representatives, as well as case managers, should emphasize that seeking resources during an emergency will not affect an undocumented individual's ability to achieve legal immigration status or lead to deportation.

Additionally, it would be helpful to place more disaster recovery centers in communities outside of major cities and conduct targeted outreach to provide services to these communities. Disaster agencies should seek partnerships with trusted and knowledgeable community liaisons, **such as *promotores***.

Shifting policies and practices is crucial so that agencies are more capable of equitably distributing recovery assistance. Just as disaster recovery agencies can perpetuate inequities, so too do they have the power to reduce—even eliminate—them.

## ABOUT THE AUTHOR

**MELISSA VILLARREAL** is currently an Oak Ridge Institute for Science and Education (ORISE) Fellow at the U.S. Forest Service. Her work centers primarily around the post-disaster recovery of vulnerable populations. She has led and contributed to projects focused on women's experiences during and after disaster, structural vulnerability and reproductive health access for Mexican-origin women, and parental notification and access to abortion among minors. Villarreal is a Natural Hazards Center and Bill Anderson Fund alum and holds a PhD in sociology from the University of Colorado.

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ARTICLES:

# EQUITY AND INCLUSION THROUGHOUT THE DISASTER CYCLE


*Volunteers & members of the National Guard assembled at New Dorp High School to pass our aid to people recovering from Hurricane Sandy in 2012. Source: A. Katz / Shutterstock.com*

# ESCAPING THE SECURITY TRAP:

## SHIFTING EMERGENCY MANAGEMENT TOWARD HUMANITARIANISM

BY NNENIA CAMPBELL AND HANS LOUIS-CHARLES

For nearly 75 years, emergency management in the United States has been tethered to a state security framework. Rooted in Cold War civil defense and strongly reinforced by the post-9/11 integration of the **Federal Emergency Management Agency (FEMA) into the Department of Homeland Security (DHS)**, this approach prioritizes government continuity and the protection of critical infrastructure. However, as disaster losses rise and social vulnerabilities deepen, the security-first paradigm is increasingly ill-equipped to handle the complexities of modern disasters. To evolve, the profession must pivot toward a humanitarian ethos that prioritizes human welfare and disaster risk reduction.

## STUCK ON SECURITY

The state security framework views the nation-state—and its physical assets—as the **primary object of protection**. In practice, this often means that territorial sovereignty and law enforcement take precedence over disaster risk reduction and alleviation of human suffering. A striking example of this occurred in 2025 when vital FEMA resources meant for hurricane season preparation **were rerouted** to immigration enforcement and border security.

This conflation of emergency management with law enforcement and national security does more than just divert funds and resources; it fundamentally damages trust. When emergency management is perceived as an arm of homeland security, at-risk communities with a history of being targeted by state agencies—minoritized people, people with limited English proficiency, or people with undocumented or mixed residency status—may become understandably reluctant to seek public shelter or otherwise engage with the government. This undermines the ability of emergency managers to relay lifesaving information and provide aid to the very people who may need it most.

## AN IMBALANCE OF PRIORITIES

Current federal policies such as the **National Preparedness Goal** further illustrate this hyper-focus on state security. This policy emphasizes five mission areas: prevention, preparedness, mitigation, response, and recovery. However, significant resources flow toward *prevention*, which is defined as stopping acts and threats of terrorism, and *response*, such as immediate first-responder capabilities.

Meanwhile, mitigation and recovery—the phases that actually reduce long-term risk and restore community stability—deserve far more attention and investment than they currently receive. Studies show that every dollar spent on mitigation can save a community between $4 and $13 in future losses. Yet programs focused on household and community-level resilience, like **school tornado shelters** or enforcement of **disaster resistant building codes**, remain consistently underutilized. Instead, narratives of personal responsibility set the expectation that individuals should manage their own risk, which is often impossible for those living in poverty or residing in high-risk areas.

## THREE STEPS TOWARD A HUMANITARIAN FUTURE

To evolve beyond the security roadblock and toward a more humane and humanitarian future, we recommend three critical shifts in policy and practice:

***Decouple Emergency Management From Homeland Security***

First, FEMA must be decoupled from the security apparatus of DHS and restored as an **independent agency**. An independent FEMA could draw lessons from international counterparts like the United Nations Refugee Agency, adopting the core humanitarian principles of humanity, impartiality, neutrality, and independence. Changes at the federal level could serve as a model for state and local level too, encouraging the repositioning of emergency management as a field that is distinct from law enforcement and other services. This is a necessary step to restore public trust and ensure that disaster funds are not diverted to non-disaster security missions.

***Reimagine the All-Hazards Approach***

Second, the all-hazards approach needs to be re-envisioned to encompass the compound, cascading, and complex hazards that communities now regularly confront. The guiding principle of the field has long been the **all-hazards approach**, which assumes that the preparedness activities used for a terrorist attack can apply to a hurricane or that a train derailment response is similar to that for a tornado. While well-intentioned and operationally efficient for acute impacts, this model is too rigid for slow-onset disasters like **extreme heat**, drought, or sea-level rise. Because the Stafford Act—the legal trigger for federal aid—requires a discrete incident period, it is ill-suited for crises that lack a single, acute moment of impact. FEMA and the federal disaster relief and assistance laws outlined in the Stafford Act are **limited in their authority** to address such issues. Beyond environmental shifts, emergency managers have increasingly been tapped to address complex social crises, ranging from mass shootings and the opioid epidemic to water contamination events and chronic homelessness. Yet they are often forced to intervene without the leadership, training, statutory authority, or dedicated resources required for such disparate challenges.

Furthermore, the all-hazards approach **treats disasters as isolated events** rather than as **manifestations of systemic risk** factors like poverty, forced migration, racial inequality, and health disparities. A humanitarian approach could redefine mitigation as **capacity-building** and community development. Investing mitigation dollars in workforce development, affordable housing, and other measures to support holistic community well-being and economic stability could improve baseline conditions to help communities fare better during disasters.

***Invest in Domestic Humanitarianism***

Third, federal resources should be systematically invested in community-based groups and other non-governmental organizations that embody the kind of human-centered approach that is essential for the evolution of emergency management. Many of these groups are embedded in the communities they serve and confront systemic issues on a day-to-day basis. They **complement the work of emergency managers** and play an outsized role in **disaster recovery**, which is often the longest and most complex part of the disaster lifecycle. Following a disaster event, the most vulnerable community members often rely on the coordination of dozens of volunteer groups operating at various scales, including those that are part of coordinated networks of **Voluntary Organizations Active in Disaster** (VOADs). These groups don't just fill gaps; they navigate the systemic barriers that traditional agencies often overlook.

The 2023 floods on Chicago's West Side illustrate this point. Grassroots group **Light Up Lawndale** utilized its deep neighborhood roots to provide **disaster case management** for nearly 900 flood survivors after the devastation left residents dwelling in mold-infested homes for months. Light Up Lawndale focused on interconnected crises of housing, health, and affordability rather than approaching recovery as a narrow technical issue. This expansive understanding of people and place enabled the group to keep seniors and other vulnerable community members from slipping into spiraling losses.

To truly advance toward a domestic humanitarian model, the emergency management sector must move beyond viewing these kinds of entities as mere auxiliaries. Instead, government agencies must prioritize investing in, coordinating with, and learning from the voluntary sector. Coordination with the voluntary sector also deserves to be a robust component of emergency management curriculum, rather than relegated to a single module or week of instruction, as is current practice in typical homeland security -emergency management programs.

## THE PATH FORWARD

Developing emergency management into a mature, distinct profession requires moving beyond the security framework. The profession can, and must, build a more compassionate and effective approach that treats the alleviation of human suffering, rather than the maintenance of state order, as its primary objective. Without this change, the field risks being seen as just another branch of law enforcement, focused on control rather than care.

## ABOUT THE AUTHORS

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**HANS LOUIS-CHARLES** is an associate professor at The Wilder School of Government and Public Affairs at Virginia Commonwealth University. He teaches risk assessment, hazard mitigation, and disaster recovery courses within their Homeland Security and Emergency Preparedness program. His research focuses on emergency management, collective behavior in disaster, risk communication, social vulnerability, and disaster research ethics. Louis-Charles earned his PhD from the University of Delaware and is a former research assistant at the Disaster Research Center. He is a founding fellow and the current vice president of the William A. Anderson Fund for Hazard & Disaster Mitigation Education and Research.

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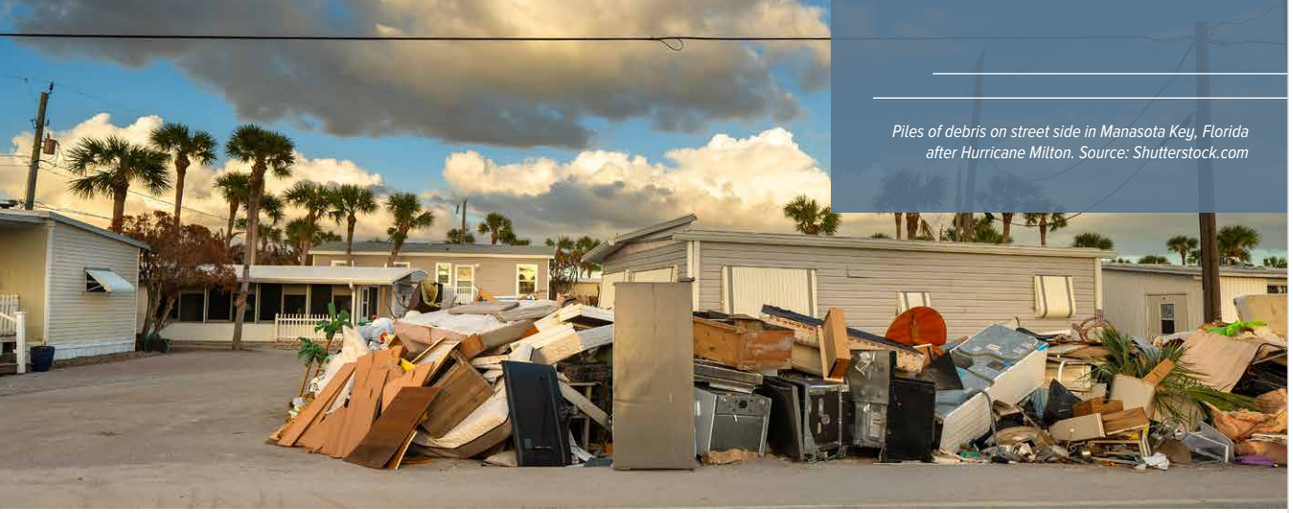

*Piles of debris on street side in Manasota Key, Florida after Hurricane Milton. Source: Shutterstock.com*

# LA VOZ DE LA EXPERIENCIA:

## HOW LIVED EXPERIENCES SHAPE SPANISH SPEAKERS' RESPONSE TO WEATHER WARNINGS

BY AMÉRICA GAVIRIA PABÓN

As a growing storm rolled towards Florida in October 2024, many Spanish-speaking residents were asked to prepare for something completely unfamiliar to them.

"It was the most terrible experience. I had never experienced a hurricane before. I didn't understand the magnitude of what was coming," said one Spanish speaking resident in Tampa Bay.

When Hurricane Milton made landfall, it brought powerful winds, widespread flooding, and a tornado outbreak that caused significant damage to homes, businesses, and infrastructure across the region. Millions of people were affected, including many in **communities with higher proportions of Hispanic residents**.

To better understand the local complexities of weather risk communication, I interviewed 25 Spanish speakers in the Tampa Bay area a year after the storm. Despite recent state- and national-level efforts to make weather information more accessible for Spanish speakers, many said they felt unprepared for Milton. My research suggests translation alone often fails to address the cultural context, prior experiences, and real-life barriers that shape how people understand weather warnings and decide to protect themselves.

### EFFORTS TO IMPROVE BILINGUAL WEATHER RISK COMMUNICATION

Because Spanish is the second most spoken language in the United States, providing Spanish alerts is a critical component of an effective and inclusive public emergency warning system. In recent years, there have been **improvements in Spanish-language weather communication** in both media and public safety agencies. **Latino meteorologists and scholars** from many different disciplinary backgrounds have played an important role in advocating for clearer Spanish terminology and more inclusive risk communication. In addition, **recent research and outreach initiatives** have demonstrated that effective translation can improve how Spanish speakers interpret warnings and make protective action decisions during hazardous weather events.

Before Hurricane Milton made landfall, many of the Spanish speaking residents I interviewed described receiving hurricane alerts and warnings from multiple sources, including television forecasts, social media, text alerts, and messages shared through family, friends, and community groups. Receiving weather information in Spanish made a meaningful difference. They indicated that Spanish-language alerts helped them better understand the situation, increased their trust in the information, and made them feel more confident about how to prepare and appropriately respond.

However, translation alone is not enough. In my previous work on tornado forecasts and warnings, I found that Spanish speakers **still remain less likely to understand, receive, and respond to severe weather risk information in comparison to English speakers**. Even when translated alerts are available, research suggests that translations may **be unclear or inconsistent**.

Critically, people's ability to act on warnings is shaped by more than language. Truly effective and inclusive weather risk communication goes beyond simply changing words from English to Spanish. It also entails a deep understanding of people, place, and systemic barriers to taking action.

### HOW EXPERIENCE, FEAR, AND SUPPORT GUIDED DECISIONS

Many residents I spoke in Tampa Bay immigrated to the U.S. from countries with different natural hazards contexts. Several said they were more familiar with earthquakes, flooding, or heavy rain in their home countries. Without prior experience or clear guidance on hurricanes, some expressed uncertainty about evacuation zones, transportation options, and potential impacts.

Emotions also played an important role in how people prepared and responded. Fear of the storm, concern for children and older relatives, and a sense of responsibility toward family influenced many decisions. Some participants described stocking up on food and water, monitoring updates closely, or temporarily staying with relatives or friends in safer locations. Even when they understood the warnings, some chose to stay home because they were uncertain about evacuation shelters or worried about **transportation, costs, or leaving belongings behind**. In many cases, faith, prayer, and support from friends helped people cope with uncertainty as the storm approached.

Personal networks and **community-based organizations** played an important role in helping people navigate these challenges by explaining unfamiliar concepts and providing resources to facilitate response and recovery. Some participants relied on friends, neighbors, or coworkers who had more experience with hurricanes, particularly people from Caribbean islands like Puerto Rico or Cuba. In some cases, these individuals helped translate weather information into practical guidance for preparedness.

### DESIGNING MORE INCLUSIVE ALERTS

Understanding how Spanish speakers respond to weather hazards requires looking beyond language and recognizing the role of lived experiences, culture, emotions, and everyday realities. People interpret warnings through personal histories, family responsibilities, community networks, and past encounters with risk.

Strengthening collaborations with partners in Latin America, incorporating Spanish-language Wireless Emergency Alerts (WEA), expanding multilingual coverage in broadcast markets, and developing educational materials that explain fundamental weather hazards in the United States are foundational measures to advance risk communication for Spanish speakers. Weather agencies and public safety authorities can improve their reach in Hispanic and Latinx communities by building relationships through partnerships with trusted local organizations, community-informed message development, and outreach to identify knowledge gaps and barriers to protective action. Beyond that, it is important to avoid homogenizing Spanish speakers. Truly effective weather risk communication will **demand personalized and localized approaches** for communities with different populations and hazards.

A more **holistic approach to weather communication** must account for the cultural context and the emotional and material barriers that shape understanding and decision making during extreme weather. Ensuring that people are properly informed and protected, regardless of language, is critical to saving lives when the next hurricane hits.

## ABOUT THE AUTHOR

**AMÉRICA GAVIRIA PABÓN, PHD,** is a researcher in geography and environmental sustainability whose work focuses on how people understand and respond to weather warnings. She studies how language, culture, and personal experiences shape decision-making during storms, especially in Spanish-speaking communities. Her research aims to make weather information clearer, more accessible, and more useful so that people can make safer decisions during severe weather events.

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*A sign on a beach in Japan warns of tsunamis in case of an earthquake. Source: 365 Focus Photography / Shutterstock.com*

# INFORMATION AS A HUMAN RIGHT:

## INCLUSIVE MULTILINGUAL TSUNAMI WARNINGS IN JAPAN

BY AMY TAKEBE

No matter where we live, access to information in a language that we can understand during disasters is **a human right**. In Japan, a highly hazard-prone country with over 4 million residents and tens of millions of international visitors annually, the challenge of reaching culturally and linguistically diverse audiences is ever evolving. While Japanese is the dominant language in Japan, there are also distinct regional dialects spoken throughout the country. Further, Japanese Sign Language is used, as are Indigenous languages, immigrant languages like Korean and Chinese, and many other languages spoken by foreign visitors.

Adding complexity to this picture, information about impending threats across Japan is communicated with more than just words. Sounds, colors, novel content layouts, and images like maps and **pictograms** are used to convey emergency messages more effectively. My **recent research** examines how the moment-by-moment interplay of language and other meaning-making resources shapes the effectiveness of public broadcast tsunami warnings. This work demonstrates the importance of urgently conveying complex information in inclusive ways.

### THE EVOLUTION OF TSUNAMI WARNINGS IN JAPAN

Nippon Hōsō Kyōkai (NHK), Japan's only public service broadcasting agency, plays an important role in providing timely and accurate hazards information to viewers, including multilingual communities. I examined NHK tsunami warnings between 2010 and 2024 to track changes in language use and the inclusion of meaning-making resources that shape the presentation of emergency broadcasts.

Over the years, NHK's approach has changed significantly, in part due to the devastation of the **2011 Great East Japan Earthquake and Tsunami**, widely referred to as the 3.11 disaster in Japan. Warnings before the 3.11 disaster mostly focused on providing basic information about things like tsunami arrival time and wave height, with little instruction on how people should act in response to the looming threat.


*Left: A 2016 tsunami warning broadcast by Japanese public broadcasting agency NHK. Right: The same information translated into English by the author. Source: Amy Takebe, 2024.*

In contrast, warnings broadcast after the 3.11 disaster use **a more imperative** and directive tone to urge the audience to protect themselves. My analysis of the first five minutes of a 2016 broadcast **demonstrates that shift**, with the message *sugu nigete* ("evacuate now" in Japanese) written in large font and displayed prominently in a red rectangle at the top center of the screen. The design elements are simple and eye-catching, and the language, which is written in a form of Japanese known as *hiragana*, is clear and urgent. Still, there are no instructions in languages other than Japanese.

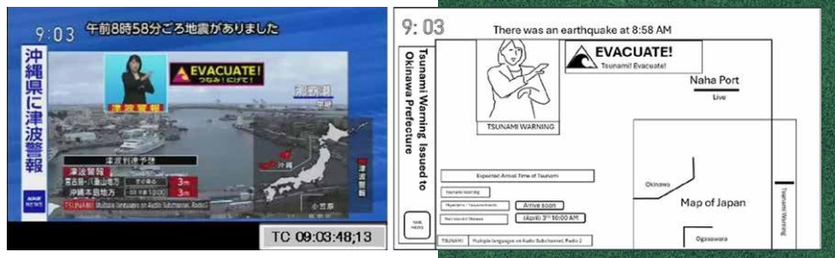
### ATTEMPTS TO REACH MULTILINGUAL COMMUNITIES

A more recent tsunami warning broadcast from 2024 demonstrates efforts to better reach multilingual communities. For instance, a Japanese Sign Language interpreter appears on top of the screen, along with the English and hiragana captions. The screen not only shows the caption "EVACUATE!" in English but also displays an adjacent red and yellow pictogram, illustrating a tsunami threat.

An instruction, "TSUNAMI Multiple Languages on Audio Subchannel, Radio 2," is placed at the bottom of the screen to direct multilingual audiences to automated audio messages in English, Chinese, Vietnamese, Korean, and Portuguese. Additionally, reports from an English-speaking announcer are available in the main broadcast by switching the audio setting.

Despite these efforts, the busy broadcast design may also contribute to a convoluted, confusing, or incomplete message for those receiving the warning. Even a cursory glance illustrates how the screen is overwhelmed with information in Japanese. Further complicating matters, the instruction to switch the audio setting only appears at the bottom of the screen, leaving non-Japanese speaking viewers searching for the extra step they may need to take to get detailed tsunami information in another language.

While the announcer directs the viewers in Japanese to evacuate to a higher ground or stay away from the river mouth, the English warning ("EVACUATE") at the top of the screen is incomplete without information about where to retreat. Overall, even though the amount of information for multilingual audience has increased in the 2024 warning, the display layout and the directive do not actually accommodate the needs of multilingual audience. Despite the increase in the amount of information for a multilingual audience, the display layout and the directive have the potential to hinder non-Japanese viewers from receiving the message.




*Left: A tsunami warning broadcast by the Japanese public broadcasting agency NHK on April 3, 2024. Source: NHK Archives for Academic Research Program. Right: The same information translated into English by the author. Source: Amy Takebe, 2026.*

### DESIGNING MORE INCLUSIVE DISASTER WARNINGS

Designing a warning that is actionable and inclusive for people of different linguistic backgrounds is a challenge that has vexed researchers and practitioners.

For multilingual disaster warnings, warning senders working in the dominant language should not only focus on accurately translating information but also pay close attention to the elements they take for granted, such as the quality of the message and the visual design. For instance, in the case of NHK's tsunami warning, instead of simply displaying the caption "EVACUATE" on screen in English, part of the screen could be dedicated to displaying areas that are generally considered dangerous or safe with illustrations and symbols to reach a wider multilingual audience that may not be familiar with tsunami hazards.

Conceptualizing disaster warnings as a social process can also be a key to making them effective. For a mass media broadcasting agency in a multicultural and multilingual country, customization can be a dynamic challenge. That's why it is crucial to include multilingual speakers' perspectives in the disaster warning design process. By embracing a participatory approach and seeking feedback from diverse audiences along the way, public agencies like NHK can design warnings that cut through the noise and inspire life-saving actions during disasters.

## ABOUT THE AUTHOR

**AMY TAKEBE** is an associate professor in applied linguistics at Otaru University of Commerce, Center for Language Studies (Japan). She holds a PhD in English from Oklahoma State University. Her areas of research center around breaking language barriers in disaster contexts from applied linguistic angles. Her recent research projects include examining the intricate relationship between linguistic production and social identities in risk communication contexts, as well as designing language learning curricula for multilingual disaster volunteers. She is a Bill Anderson Fund alum.

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*Hurricane Helene damage from Elk River flooding at closed portion of US HWY 321 Elk Mills. Source: James M. Davidson via Shutterstock, 2025.*

# RESILIENT INFRASTRUCTURE FOR PEOPLE:

## FOUR DIMENSIONS OF EQUITY

BY NATALIE COLEMAN

Cracked roads, fallen powerlines, contaminated water—after a disaster a community can become unsafe and even unrecognizable to its own residents. Infrastructure systems are so entrenched in our daily routines that they are often undervalued until they become unavailable.

Improving infrastructure resilience using various methods—enhanced construction materials, smart technologies, flexible modular designs—can prevent physical system failures when disaster strikes. But infrastructure resilience is not only related to physical systems.

Resilient infrastructure can also minimize the social impacts of disaster. For instance, a collapsed bridge or impassable transit line can keep children out of school or adults from work, negatively affecting education and the economy. Conversely, when infrastructure remains intact, roads remain passable, the power stays on, and drinking water remains safe.

### WHAT IS INFRASTRUCTURE RESILIENCE?

Infrastructure resilience in engineering refers to the ability of infrastructure systems to adapt, absorb, or recover from disruptive events such as disasters through principles of rapidity, resourcefulness, redundancy, and robustness. In 2023, the United Nations Office for Disaster Risk Reduction **recommended the use of transdisciplinary collaboration** approaches to protect the public from future hazards. Such efforts involve engaging with the public and coordinating information and expertise.

Protecting people is the ultimate goal of civil engineering, but in practice, people and their experiences can be left out of the design, creation, and maintenance of infrastructure. Standard management practices often rely on quantitative measures, such as life cycle and cost-benefit analyses, while focusing less on how people interact with infrastructure systems and how well they support us.

Holistic infrastructure resilience, which couples engineering measures with transdisciplinary collaborative approaches, is especially important during disasters. Scholars have **consistently found** that certain communities disproportionately experience the loss of critical infrastructure services during disasters. When such systems fail—often in marginalized areas—they can cause physical as well as lasting social damage to neighborhoods, homes, and people.

### FOUR TYPES OF INFRASTRUCTURE EQUITY

There has been a failure to recognize the important role that equity plays in infrastructure resilience. As a result, the needs of those most affected by disasters can be overlooked, perpetuating and worsening already existing inequities in safety, access to resources, and individual and collective well-being. Embedding equity into resilience planning strengthens physical infrastructure systems and supports more inclusive and effective community recovery to ensure no one is left behind.

Guided by environmental justice and disaster research, the following four dimensions can be used to understand how equity and infrastructure fit together.

***Distributional-Demographic Equity.*** This dimension examines the equitable allocation of infrastructure benefits and risks and how underlying social and economic circumstances influence people's ability to withstand disruptions. For instance, **my research on hurricane impacts** showed that lower-income and racial minority households faced greater difficulties, lived in areas with less-maintained infrastructure, and experienced longer service restoration times. Similarly, families with children experience greater hardship during infrastructure outages because of the stress of caregiving when basic services, such as water and communication, are disrupted. Applying distributional-demographic equity would require that the human dimensions of infrastructure are considered more fully in the planning and design phases.

***Distributional-Spatial Equity.*** This dimension explores how geographic location and systemic race and class isolation can influence exposure to infrastructure loss. For instance, rural areas can face heightened risk caused by limited access to their communities and fewer redundant systems. This was **the case** in Appalachia during Hurricane Helene when landslides and flooding rendered key roadways impassable and delayed the delivery of critical supplies and the restoration of infrastructure. Restoration and retrofit strategies that consider network performance and social impacts are **ways that have been proposed** to address distributional-spatial inequities in situations like these.

***Capacity Equity.*** This dimension considers the ability of communities to prepare, cope, and recover. For example, lower-income households are typically less able to afford alternatives to infrastructure, such as power generators or water storage tanks. Instead, at-risk populations must be adaptable. **In Winter Storm Uri**, many people used candles, flashlights, and battery-operated lanterns for lighting. While some had bottled water or stored tap water, other residents collected water from nearby lakes and creeks or melted snow for their water needs. Planning to meet the needs of those with limited capacity—such as providing supplies, warming stations, or portable health clinics—can help communities establish more equitable outcomes.

***Procedural Equity.*** This dimension relates to inclusivity and fairness in decision-making processes. Allowing stakeholders to actively participate in how infrastructure systems are designed and maintained can improve policy planning and weave equity into actionable plans. For instance, **a recent study** found that high school students assessed the state of their drainage infrastructure within 74% data accuracy of expert stakeholders. Understanding the strengths and weakness of their infrastructure systems can help community members participate in reviews, potentially speeding up the process. Interactive workshops and knowledge-sharing initiatives can further foster procedural equity.

### LOOKING AHEAD

Future research and practices of equity in infrastructure resilience must consider how the actions of today will impact future generations. Currently, our aging infrastructure systems, which are further strained by increasing natural hazard threats, are not equipped to meet the needs or ensure the rights of future generations. To do so will require ingenuity and a transdisciplinary approach that actively addresses inequities through resource allocation, better restoration and policy implementation, and meaningful opportunities for community involvement.

## ABOUT THE AUTHOR

**NATALIE COLEMAN** publishes work that uses data science and disaster research to understand how communities recover from natural hazards. She holds a PhD in civil engineering from Texas A&M University, where she worked at the Urban Resilience.AI Lab. Her doctoral thesis focused on infrastructure resilience and social inequities during disasters. Coleman has been awarded the National Science Foundation Graduate Research Fellowship and the Philanthropic Educational Organization Scholar Award. She is a Bill Anderson Fund alumna and a former member of the National Hazards Engineering Research Institute Graduate Student Council.

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ARTICLES:

# BEST PRACTICES FOR COMMUNITY-BASED COLLABORATIONS

*First responders walk through high floodwaters in Missouri City, Texas. Source: Michel Mond / Shutterstock.com, 2017.*

# BRIDGING THE RESILIENCE GAP:

## DATA AND FLOOD RISK MANAGEMENT IN RURAL AND UNDER-RESOURCED COMMUNITIES

BY KAYODE ATOBA

In Fort Hancock, Texas, flood waters cause significant damage each year. Yet residents have little reliable information about where these events might happen, because the town's **flood maps are more than 40 years out of date**. This reflects a pattern across under-resourced communities in Texas, a state where most counties are considered rural. As these small, sometimes isolated communities are increasingly threatened by complex flood hazards, many lack comprehensive data and modern tools that could help them to prepare and build resilience.

The development of infrastructure and coordinated planning to address flood hazards has **received bipartisan support in Texas**. To make meaningful progress on flood risk mitigation, however, the state must strengthen flood risk data collection, infrastructure, and accessibility. In response to these pressing needs, the **Disaster Resilience Information and Partnership** (DRIP) program at Texas A&M University—funded by the Texas Legislature—is building collaborations between researchers, residents, and decision makers to close flood data gaps in under-resourced communities. As demonstrated by DRIP, tackling data gaps in rural communities requires multi-stakeholder collaborations that make hazard risk data more accurate, accessible, and useful for local decision-making.

### HOW FLOOD RISK DATA MAKES A DIFFERENCE

Data about where floods can happen, and the people, property, and critical infrastructure at risk, are fundamental to developing flood resilience. Such comprehensive data provides a foundation to inform risk reduction efforts, make development decisions, and critically, to develop hazard mitigation plans, which are typically required to secure federal disaster aid when floods are catastrophic. Yet many under-resourced communities in rural Texas exist in data deserts, where essential flood risk information is scarce, outdated, or difficult to access and understand. In some parts of the state, these data deserts are compounded by unique geographical hazards like dry creek beds or arroyos, which are traditionally not captured in hydrologic and hydrographic models. Consequently, residents are left exposed to flash floods, and many resort to quick fixes like homemade berms which do little to reduce their flood risk. Even when data are available, many local governments lack the personnel or capacity to put it to use.

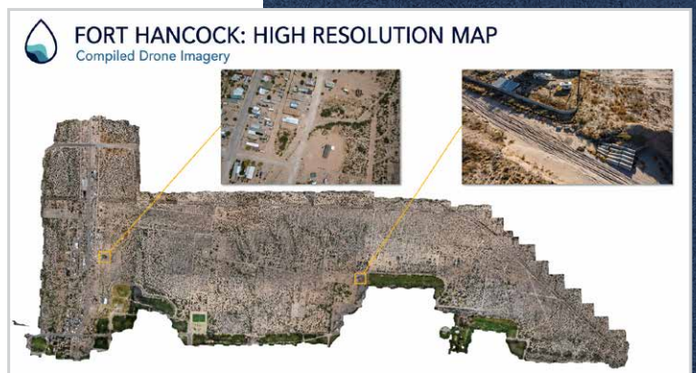
### COLLECTING AND CREATING DATA THAT REFLECTS COMMUNITY NEEDS

Existing models and data resources often fail to capture the lived experiences of people in rural, flood-prone Texas communities. To address this, DRIP's approach combines technical support with community input to make flood risks visible. When reviewing available flood risk data in Fort Hancock, for example, we found almost no documentation of flood risk for arroyos. Yet residents who've witnessed floodwaters **washing away their roads and encroaching on their homes** know this isn't accurate. To address this problem, DRIP used **high-resolution drone imagery** to provide a foundation to better understand and mitigate flood risk. Then, critically, we turned to the community to help them gather their own data. This included **door-to-door visits to document lived flood experiences and gather georeferenced photos of past floods**.

*Researchers review a paper map produced for Hudspeth County, Texas, where Fort Hancock is located. Source: Institute for a Disaster Resilient Texas.*

Community members report they felt heard and empowered by this data co-development. This approach incorporates community needs and expertise as key components of evidence-based decision making on flood infrastructure and policy outcomes. For small communities, which often face competing infrastructure demands and policy priorities with limited resources, this kind of decision support is critical.

DRIP has also worked with communities to customize data tools, as in the case of Wise County, in Northeast Texas. As development there expands, and flood hazard increases, local officials must manage a changing flood landscape while relying on outdated flood risk data and models. Again, even when models are available, they're not always useful to local planners, emergency managers, or others who might lack the technical expertise needed to interpret their outputs. To address this, DRIP adapted the most current flood models to create high resolution mapping products which visualize the potential impact of 10-, 25-, 50-, 100- and 500-year storms. These maps allow users to extract flood depth and elevation data over specific areas or points of interest within the county, which can assist in decision making, policy development, and scenario planning. A local official in Wise County underscored that this collaborative, community-engaged process helped them to "obtain information that's actionable," and that in turn helped them to reduce their hazard risk.




*A high resolution map of Fort Hancock, Texas, created using compiled drone imagery. The inset images show arroyos that have to potential to flood. Source: Institute for a Disaster Resilient Texas.*

### EMPOWERING COMMUNITIES THROUGH ENGAGEMENT

Truly inclusive and useful flood risk data and solutions cannot be simply developed and prescribed by researchers. Instead, local communities need to be empowered to define their problems and be experts of their own needs. DRIP provides data enhancement and support through supercomputing, drone technology, and technical training, but our process also prioritizes helping residents and local leaders develop flood data and tools that are contextually-grounded and aligned with community-driven visions for flood resilience.

DRIP offers a model for in-depth engagement and capacity building that can empower long-term resilience across diverse communities. Across Texas, state and university-led initiatives and community partnerships are making progress to bridge data gaps and leverage public support for infrastructure to build a future where every county, regardless of size or capacity, has the tools to protect its next generation.

## ABOUT THE AUTHOR

**KAYODE ATOBA** is a research scientist at the Institute for a Disaster Resilient Texas, at Texas A&M University. He advances sustainable, hazard-resilient built environments by developing decision support tools that translate complex data into actionable mitigation policies for local Texas communities. His research integrates quantitative and geospatial methods to analyze urban systems, assess flood risk, and improve open space and buyout program efficiency. Atoba holds a PhD in urban and regional science, a Master of Science in Geographic Information Systems, and a Bachelor of Science in urban and regional planning.

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*A clean-up crew sweeps ash and clears debris from the Palisades Fire on January 11, 2026. Source: Contributor Films / Shutterstock.com.*

# PARTNERING FOR AN INCLUSIVE RECOVERY:

## ORGANIZATIONAL COLLABORATION AND COMMUNITY ENGAGEMENT AFTER THE 2025 LOS ANGELES WILDFIRES

BY SANTINA L. CONTRERAS

In the wake of the January 2025 Los Angeles wildfires, a diverse array of nonprofits, community-based organizations, and grassroots networks mobilized across the heavily affected Pacific Palisades and Altadena communities. For wildfire survivors, these organizations have provided essential emergency supplies and longer-term recovery services.

Given the major role that these groups play in disaster-affected communities, it is essential to understand the factors that make them successful. As a co-lead investigator of an ongoing **National Science Foundation RAPID project** my team set out to document response and recovery processes following the wildfires. As part of this broader project, I led interviews with 40 representatives of nonprofit, philanthropic, and other grassroots groups to understand how organizations engaged survivors, incorporated community-defined priorities, coordinated with one another, and adapted their services over time.

Our preliminary findings highlight the importance of collaboration and community engagement as a foundation for organizations to provide effective disaster recovery support. Groups that form partnerships and work closely with disaster survivors to build trust and co-produce solutions play an essential role in shaping equitable and lasting recovery outcomes.

### LISTENING BEFORE ACTING: COMMUNITY-DEFINED NEEDS

Organizations that provided the most effective support to communities in Los Angeles prioritized listening, first, out of recognition that sustainable solutions must begin with an understanding of community-defined priorities. Rather than assuming what survivors needed, these organizations created open channels for communication and community feedback, using direct outreach, town halls, informal gatherings, and broader community-wide events to learn about the lived realities of fire survivors. They also engaged community members through survivor forums, culturally responsive information hubs, and peer-to-peer networks. This multi-faceted approach allowed organizations to be responsive to shifting conditions throughout the recovery phase.

Critically, not all engagement strategies empower communities in the same way. My previous research **on community engagement after the 2010 Haiti earthquake** showed that community participation varied widely. In some instances, communities were involved through more top-down consultation or information sharing, while in other cases they were elevated as partners in shared decision-making. Similar distinctions have played out in Los Angeles following the fires. The most adaptive organizations have relied on modes of participation where residents are not only heard, but meaningfully involved in shaping program design, resource allocation, and evolving recovery priorities.

### COALITIONS AS PLATFORMS FOR COLLECTIVE ENGAGEMENT

In many instances, organizations across Los Angeles came together to form new coalitions for disaster recovery. This aligns with past research, which has shown that interorganizational networks and emergent coalitions **enhance coordination**, **build social capital**, and **strengthen collective efficacy** in disaster response and recovery environments. After the wildfires, nonprofits, grassroots groups, and local stakeholders came together to coordinate their activities and reduce duplication of efforts, ultimately enhancing their collective ability to meet community needs. This coordination even included the creation of physical spaces for community gathering to support survivors and provide easy access to recovery resources, such as **The Collaboratory**, a community space that was established as a hub for survivors of the Eaton Canyon Fire. The building became home to a range of local partner organizations providing coordinated recovery services, resources, and community support.

Coalitions in Los Angeles came together to make information and resources more centralized and easily accessible. Shared resources and information hubs at The Collaboratory and elsewhere have reduced the burden on residents navigating fragmented recovery systems.

Coalitions such as these obviously offer great potential for streamlining disaster response and recovery processes. But coalition-based engagement requires careful attention to representation and power. While some organizations in Los Angeles embraced formal structures as effective organizing platforms, others questioned their inclusivity. Coalitions can inadvertently become the default "voice" of the community, but without clear and intentional power-sharing agreements they can reproduce hierarchies and sideline smaller or less-resourced groups. Equitable and lasting coalitions require structures that **promote reciprocal engagement and learning** across organizations of all kinds.

### HOW FUNDING CAN HELP AND HURT

In examining the successes and challenges faced by community organizations, it became clear that funding structures significantly shaped engagement practices and recovery approaches. In some cases, competitive funding environments potentially discouraged collaboration and incentivized measurable funder established outputs over relational, community-centered work. For example, to gain funding support an organization may be forced to shift their focus and develop new programing related to health, wellness, or education to align with identified funder interests. This may be counter to an organization's preference for investing funds in community engagement activities and supporting community identified needs, such as direct financial assistance. This dynamic reflects prior research demonstrating how **accountability regimes shape recovery governance** and how donor-driven performance metrics often privilege **what can be counted over participatory and community-based processes**.

In Los Angeles, organizations committed to community-centered processes and community-designed recovery strategies have called attention to the importance of having more flexible funding models. Disaster governance research suggests that adaptive, decentralized resource structures **enhance organizational responsiveness** in uncertain environments. This, in turn, promotes recovery efforts that **align more closely with community-defined priorities** and influence more inclusive and equitable outcomes. In Los Angeles wildfire recovery, creative approaches—such as direct financial assistance for renters or wage workers who lost income—emerged directly from listening to community priorities. These adaptive strategies demonstrate how meaningful engagement can shape service delivery as well as funding design and allocations.

### MOVING FORWARD

Recovery from the 2025 Los Angeles wildfires underscores a central lesson: communities are not passive recipients of aid, but active leaders in rebuilding their futures. When given the literal and figurative space, they can define their own priorities and shape the processes that bring about a just recovery. Organizations that partner with residents as co-producers—centering trust, shared decision-making, and community-defined priorities—are better positioned to foster recovery that is equitable, accountable, and sustainable.


## ABOUT THE AUTHOR

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*Dozens of organizers, community members, and friends and family of currently- and formerly-incarcerated people marched through downtown Pittsburgh during a protest in 2018. Source: Fight Toxic Prisons, 2018.*

# EXPOSING INJUSTICE:

## RESEARCH PARTNERSHIPS TO DOCUMENT AND REDUCE DISASTER RISK FOR INCARCERATED PEOPLE

BY MAGGIE LEÓN-CORWIN

In January of 2026, **Winter Storm Fern** swept across the United States, bringing subfreezing temperatures, snow, ice, and prolonged power outages. 24 governors issued emergency declarations, but even still, thousands of people were left behind in prisons and jails unprepared to protect them.

Carceral facilities often face disasters with little to no emergency management support, systematically exposing incarcerated people to heightened disaster risk that remains largely invisible within systems designed to safeguard the public. As climate change intensifies the frequency and severity of extreme weather events, incarcerated people live on the sharp edge of institutional failure—limited in their ability to **engage in protective action**.

My research examines how the carceral justice system makes people **more vulnerable to environmental hazards**. In this work, collaboration with community-based organizations is essential to rigorously document harms and, in turn, to use this evidence to challenge systems that perpetuate injustice. Partnering with these groups and supporting their work can accelerate the translation of research into action, which is especially critical in moments when our systems are most strained and those at greatest risk have the least recourse.

### FILLING THE GAPS WHEN FORMAL SYSTEMS FAIL

When Winter Storm Fern began, the advocacy group **Fight Toxic Prisons** received information about the lack of heat at Oak Park Prison in Minnesota. In response, they mobilized alongside other community-based organizations to ensure people incarcerated there had access to space heaters, extra blankets, warm beverages, and other basic protective resources. During extreme cold events, these resources are **a lifeline** for a population vulnerable to cold-related mortality.

Examples like this show how grassroots efforts fill gaps where formal systems fail. During disasters, advocacy networks activate to connect people to critical information about facility conditions, coordinate mutual aid, and pressure agencies to move incarcerated people out of harm's way.

Research can complement these critical interventions by systematically and empirically documenting harm, challenging norms that exclude those most affected, and amplifying community-based work. In my own collaborative efforts with Fight Toxic Prisons, this has involved leveraging my own skills as a researcher where and when they are most needed.

Engaging advocacy networks as a researcher requires rejecting extractive research practices in favor of accountable, relationship-based scholarship. Such an approach elevates grassroots organizers and incarcerated people themselves as co-producers of knowledge and collaborators in advancing solutions to reduce risk and prevent future harm.

### BEST PRACTICES FOR COMMUNITY-BASED COLLABORATION

Effective collaborations begin with recognizing that people closest to harm are most excluded from formal decision-making and taking action in the face of threats. In the case of carceral facilities, these spaces are often sited in **environmentally risky locations** and rely on **aging and inadequate infrastructure**. Moreover, carceral facilities operate under conditions of confinement that restrict protective behaviors, such as evacuation, self-provisioning, or access to emergency information. When disasters disrupt power, water, ventilation, and medical services, these constraints transform routine vulnerabilities into acute environmental health risks.

It is important to remember too that people who are incarcerated and their advocates hold situated knowledge about facility conditions, emergency protocol breakdowns, and everyday practices shaping disaster vulnerability. Disaster research is enriched by recognizing the value of this knowledge. It is therefore critical to start by building trusting relationships with advocacy organizations, legal groups, and family networks already mobilized around carceral conditions before disasters happen and before a research project is formally launched. This requires setting aside research-driven agendas and moving at the speed of relationships rather than the academy.

Collaboration also requires reorienting research toward accountability. By co-developing research questions, sharing preliminary findings in accessible formats, and supporting campaigns that leverage research to drive change, researchers can align their work to serve community priorities.

Researchers should aim to amplify the essential work that community organizations are already doing to make carceral risk visible and actionable by contributing data infrastructure, archiving disaster impacts in carceral settings, and translating lived experience into evidence informed policy arenas.

In practice, this can involve writing policy briefs, gathering documentation for litigation or public records requests, or co-developing public tools for organizing. The **Toxic Prisons Mapping Project**— a participatory research initiative to map the environmental hazards that prisons, jails, and detention centers face—illustrates how research can enable systematic analysis and lend legitimacy to patterns that community groups already document on the ground.

### BROADER HORIZON

Carceral disasters are products of governance arrangements that exclude incarcerated people from protection. When emergency managers and corrections agencies fail to coordinate, when evacuation plans omit prisons and jails, and when disaster assistance frameworks exclude incarcerated populations, harm is produced by design. Community-based organizations like Fight Toxic Prisons—and the researchers who support them—make these failures legible and contestable.

In doing so, we open space for preparedness models that treat carceral facilities as integral to public safety and human dignity. This also links this more immediate disaster-focused work to a broader horizon of **abolition**, **decarceration**, **prison closures**, and the **prevention of new prison construction**. While community-based collaborations do not immediately resolve these systems of oppression, they can reduce immediate harm and build the evidence base needed for slow but still transformative change.

Making incarcerated people visible in emergency management is not about adding another population to a checklist; it is necessary for just accountable disaster governance. There is an opportunity to make research count—and a responsibility to take it.


*The Toxic Prisons Mapping Project is a participatory research initiative founded by Ufuoma Ovienmhada in collaboration with Fight Toxic Prisons that maps environmental hazards near prisons and jails, weaving together facility-level data with firsthand narratives from people incarcerated in toxic prisons. Learn more through QR Below.*

## ABOUT THE AUTHOR

**MAGGIE LEÓN-CORWIN** is an environmental sociologist whose research sits at the intersection of human-environment interactions with a focus on environmental justice and disaster studies and spans three interconnected domains: carceral environmental justice, disaster risk and infrastructure resilience, and environmental risk perception. León-Corwin uses a mixed- and multi-methods approach, integrating quantitative, qualitative, geospatial, and policy analysis with community-engaged frameworks to co-produce actionable insights for technical and policy audiences.

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ARTICLES:

# STRENGTHS AND CAPACITIES OF SOCIALLY MARGINALIZED COMMUNITIES

*A rural landscape in the western U.S. Across the country, rural communities have the potential to miss out on investments in climate resilience and hazard mitigation. Source: Iampaese / Shutterstock.com*

# OVERLOOKED COMMUNITIES:

## INCORPORATING CAPACITY INTO CLIMATE VULNERABILITY MAPPING

BY JOSEPH KARANJA AND TIFFANY COUSINS

Communities across the United States will require significant investments to prepare for and adapt to floods, wildfires, extreme heat, and other climate change-driven hazards. At the federal level, decision makers have historically used climate vulnerability maps to identify the places that will benefit most from federal funds and technical assistance for climate resilience. Yet these maps overlook some of the most constrained and high-need communities.

We set out to examine two of the predominant federal tools introduced in recent years: the **Climate and Economic Justice Screening Tool** and the **Community Disaster Resilience Zones**. Our analysis reveals that these maps and metrics fail to adequately capture low-capacity communities. That means places with limited data, resources, staffing, and expertise have the potential to be left behind. **Additional cuts to these programs** only **further amplify** these existing problems.

To break cycles of underinvestment and realize climate resilience goals, there's an urgent need to strengthen available resources through integrating community capacity as a key facet of federal vulnerability designations.

### COMPETITION AND COMMUNITY CAPACITY

Federal grants and programs have long supported the planning, funding, construction, and maintenance of hazard mitigation and disaster risk reduction projects across the United States. In the face of increasingly frequent and intense extreme weather disasters, many communities rely on this support.

Yet securing funds is a **demanding process**. It often requires a time-intensive planning and application process, project reporting requirements, matching funds, or long-term project maintenance. For low-capacity communities—meaning those with limited resources to plan, fund, implement, and maintain major climate adaptation projects—this can present substantial hurdles. Indeed, with many communities vying for the same limited capital, rural, low-income, underserved, or otherwise capacity-limited local governments face a disadvantage in the competition for funds.

### FEDERAL VULNERABILITY MAPS AND CONSIDERATIONS OF CAPACITY

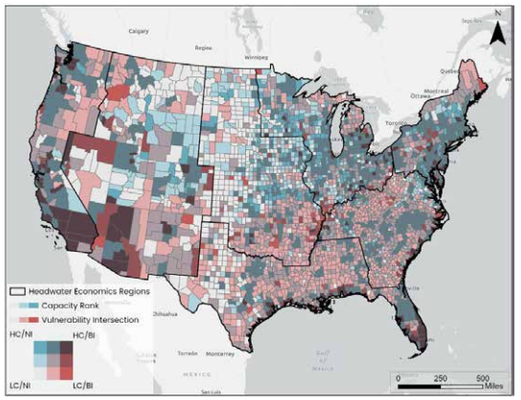
Vulnerability maps like the Council on Environmental Quality's Climate and Economic Justice Screening Tool (CEJST) and the Federal Emergency Management Agency's Community Disaster Resilience Zones (CDRZ) were created to guide the distribution of billions of federal dollars and technical assistance for housing, energy, infrastructure, and other projects that can strengthen climate resilience and mitigate disaster impacts. They assess vulnerability based on a combination of social, economic, environmental, and infrastructure conditions that shape how communities experience risk.

CEJST was the product of a 2021 **Executive Order** requiring the Council on Environmental Quality to publish maps that identify disadvantaged communities. The Federal Emergency Management Agency developed the CDRZ in response to **legislation passed by Congress** in 2022 requiring publicly available products that show the risk of natural hazards throughout the nation, with ratings for factors such as social vulnerability and community resilience. Both tools were taken offline in 2025.

Prior to their removal, we partnered with Headwaters Economics to investigate the **places or populations** that these maps may be missing. We compared the geographies captured in the federal maps against those in the **Rural Capacity Index (RCI)**. This index summarizes data on government staffing and expertise, institutional capacity, economic opportunity, and education and civic engagement in a given community. We analyzed the extent to which federal vulnerability maps incorporate these local capacity considerations in their design and implementation.

Overwhelmingly, we found a mismatch between census tracts in federal vulnerability maps and those designated as low-capacity in the Rural Capacity Index. According to our analysis, a high-capacity community is 14 times more likely to be identified for federal support by the CDRZ tool.

Findings were similar for our analysis of CEJST maps. According to our research, a high-capacity community is seven times more likely to be identified for federal support using this tool than a low-capacity community. This held true across different units of analysis, from census-designated communities to counties. In other words, regardless of the level of geographical aggregation, rural, low-capacity places are underrepresented in federal vulnerability designations.




*This map shows where capacity ranking (HC - high capacity; LC - low capacity) intersects with one or both of the CDRZ and CEJST maps. Source: Headwater Economics and the William Averette Anderson Fund.*

Regionally, communities in the Midwest and Intermountain West typically have the lowest capacity. However, these two regions are also least represented in federal vulnerability maps. This finding illuminates the potential for persistent inequity in the distribution of federal grants. Consider, for example, that **80% of the total funds distributed through the Building Resilient Infrastructure and Communities program** for the financial year 2021 were allocated to projects in coastal states.

### THE WAY FORWARD

These federal vulnerability maps are ultimately intended to advance climate resilience in the face of more frequent and intense disasters. Local governments play a critical role in preparing for these threats, yet their capacity is largely overlooked. While both the CEJST and CDRZs represent important progress in calling attention to at-risk and in-need communities, they are incomplete without the integration of local capacity data. Incorporating local capacity data can reduce barriers by identifying places where waiving local match requirements or providing more technical assistance can reduce barriers to secure funding.

Although these vulnerability maps have recently been deemphasized by the federal government, this work is still relevant in addressing how these or other tools can be enhanced through future federal, state, or locally-led initiatives. For example, the **state of California** has its own equivalent of the CEJST tool which could be styrengthened by what we found. Additionally, nonprofits and donor agencies keen on building climate resilience could target their investments to ensure that these data are fully integrated. By exposing data blind spots that influence how mitigation and adaptation funds are allocated, we can offer a more holistic lens for future investments.

While policies and tools change over time, the need for rigorous, data-driven, equity-focused initiatives remains constant. There is an urgent need to redesign federal programs to center not only vulnerability, but the lived realities of communities with limited capacity. Embedding capacity metrics can unlock more equitable resilience investments, ensuring that even small or under resourced local governments can plan, secure funding, build, and sustain projects that reduce disaster risks and help communities to thrive.

## ABOUT THE AUTHORS

**JOSEPH KARANJA** is a Postdoctoral Research Associate in the School of Public and International Affairs at Princeton University. He received his PhD in geographic information science at Arizona State University in the School of Geographical Sciences and Urban Planning. Karanja received his masters in geosciences (geography) from Georgia State University. Karanja investigates how different spatial analysis methods influence the determination of vulnerable populations and locations and their implications in policymaking. His research intersects key themes such as urban climate, biometeorology, scale, spatial statistics, and vulnerability science.

**TIFFANY "TIFF" COUSINS** is a research social scientist specializing in applied research, spatial data science, and disaster resilience. Her work integrates geospatial analysis, data modeling, and research methods to surface the story behind data and support evidence-based decision-making. She focuses on geospatial data collection, synthesis, and analysis, with an emphasis on tools and frameworks for post-disaster field studies, disaster resilience and risk management, and urban planning applications.

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*A hurricane ravaged street in Lake Charles, Louisiana. Source: Shutterstock.com*

# REFRAMING RECOVERY:

## POOR BLACK WOMEN AND COMPOUND DISASTERS

BY YAJAIRA I. AYALA

In the summer of 2020, Lake Charles residents experienced the negative effects of both the COVID-19 pandemic and Hurricane Laura. Hurricane Laura was the strongest hurricane to strike since 1851 and was soon followed by Hurricane Delta. The impact of these compounding disasters intersected with poverty and the **racialized violence Black women** often face.

Because of these impacts and intersections, recovery for the poor Black women of Lake Charles did not look like other recoveries, even those of other vulnerable groups. Instead, these women leveraged their existing resilience—gained from years of routinely navigating a maze of systemic barriers—and their social connections to establish a recovery consistent with their personal and cultural values.

### UNDERSTANDING BLACK WOMEN'S STRENGTHS

In 2023, I traveled to Lake Charles to **study the relationship between resilience and vulnerability** for *poor* Black women. I use the term "poor" in my work to convey the complexity of **economic status beyond income**. The term poor better highlights the impacts of limited economic resources and the cascading issues that come with them, such as living in unhealthy environments, low-quality housing, or periodic food insecurity.

In Lake Charles, I worked with a community-based resource center that provided material support following Hurricane Laura. My presence at the center allowed me to connect with and eventually interview 29 women about their experiences across the disasters and their strategies for recovery.

Despite experiencing prolonged resource deprivation, the respondents in the study displayed great resilience, which was grounded in their personal and cultural beliefs about God and religion, family and community well-being, and strong sense of self. They indicated that these beliefs allowed them to remain persistent amidst the challenges they faced.

The women also **expressed that physical and psychological spaces** strengthened their resilience. During the interviews, the women spoke about gathering with loved ones and being able to laugh, cry, and talk about what mattered to them—the storms, their experiences rebuilding, or feelings about displacement. Whether it was a porch, outside the steps of a church, during a fish fry, or at their local food bank, these spaces provided them a way to cope and support each other. Culturally, **these spaces help Black women** revise existing survival strategies and develop new ones.

### CREATING STABILITY IN DISRUPTION

Recovery for the respondents was a complex process that required them to overcome material, physical, and psychological challenges. For instance, before the women could take steps to clear debris or rebuild, they had to **find resources to do so**. They struggled to obtain financial assistance, access health care, find transportation, file insurance claims, and receive payouts. Throughout this process, their physical and mental ailments worsened. Already in a state of precarity caused by **long-standing systemic issues**, the challenges the women faced before were compounded by the pandemic and hurricanes.

Although injustices such as the legacy of slavery, police brutality, drug-related violence, and mass incarceration informed these women's lives, it also informed their ability to survive—they were able to employ the knowledge, resourcefulness, and flexibility they use regularly to navigate systems of oppression to address disaster impacts. For example, one respondent baked pastries to compensate her lawyer for an ongoing lawsuit. At least two others learned to pull and replace carpets, paint houses, and hang sheetrock. Another woman, who had pancreatic cancer and a disability, took a side job to sustain herself and her mother and pay for rebuilding materials. While this didn't evenly counteract the effects of the cumulative losses or the structural oppression they continued to experience, it did allow them to reclaim a measure of control over their situations.

### REFRAMING RECOVERY

The respondents' version of recovery allowed them to cope with their circumstances rather than being defined by them. Although the strategies they employed weren't much different than those used in their daily life, leveraging their social connections and resourcefulness helped them attain a form of recovery that restored some sense of well-being.

This persistence through compounding challenges demonstrates both the multi-dimensional and individual nature of resilience. Using the resilience acquired from lived experience, the women in the study navigated adversity while remaining true to their spiritual, family, and community values. Ultimately, their perspective on resilience positioned them to craft a form of recovery where they could negotiate their psychological and material well-being.

The women of Lake Charles exemplify the complex process of reestablishing lives from the ground up, recognizing these complexities can lead to tailored strategies for recovery. For scholars, it means reckoning with multiple forms of resilience. And for practitioners, this means recognizing and attending the unique and unmet needs of historically underinvested communities.

## ABOUT THE AUTHOR

**YAJAIRA AYALA** has a PhD in disaster science and management from the University of Delaware. Her dissertation, *Reframing Reality: Poor Black Women's Experiences with Vulnerability and Resilience During the Recovery Process*, explored the challenges of poor black women in the aftermath of Hurricanes Laura and Delta and the strategies they employed to face them. Ayala's work ultimately challenges and expands theoretical notions of resiliency, vulnerability, and recovery.

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*A family stands in front of the U.S.-Mexico border wall in Tijuana, Baja California, Mexico. Source: Matt Gush / Shutterstock.com*

# DEPORTATION AND DISASTER:

## PREPAREDNESS LESSONS FROM UNDOCUMENTED IMMIGRANTS

BY CARLO CHUNGA PIZARRO

All disasters disrupt communities, but impacts are never evenly distributed. Research has shown that socially marginalized groups bear the brunt of disaster harm—whether due to lack of resources, institutionalized discrimination, or being left out of disaster planning processes. Among these groups, **undocumented immigrants are one of the most overlooked**.

Undocumented immigrants come from diverse countries and have a variety of statuses—including those with Temporary Protected Status and those with Deferred Action for Childhood Arrivals, often referred to as DACA or Dreamers. While these groups may have differing approaches for surviving while being **racialized as "illegal,"** their undocumented status makes them less likely to access disaster relief and protect themselves from hazards.

In addition to disasters, undocumented immigrants face the added risk of deportation. Furthermore, like disasters, **deportation is a systemic threat** that upends lives and leaves devastation in its wake. The lived experiences of undocumented immigrants illuminate these layered dangers and how they prepare for them.

Recognizing deportation as a form of disaster broadens our conceptualization of vulnerability while also highlighting how undocumented communities have created their own systems of preparedness. The resilience and resourcefulness that undocumented immigrants demonstrate in their preparation for deportation provide lessons for disaster planners and could strengthen disaster planning for all.

### PREPARING FOR DISASTER EVERY DAY

For the **millions of undocumented immigrants** living in the United States, the fear of deportation isn't an occasional worry; **it's a daily reality**. Imagine living with the constant knowledge that, at any moment, a knock on the door could mean being torn away from your family, your home, and your community. This fear can become a constant hum in the background, **shaping everyday behavior**. For example, undocumented parents **might avoid attending public events**, such as festivals, where there is a risk of encountering police or immigration officials.

Unlike many disasters, there are no advance warnings or shelter-in-place orders for deportation. It strikes suddenly, often without any semblance of fairness or justice. And while disaster preparedness plans emphasize readiness for events like floods or fire, there's no official guidebook to help prepare for a deportation raid. Yet, undocumented communities do just that—**plan, prepare, and find ways to survive** despite the looming threat of expulsion.

Deportation planning may not be the type of preparedness that comes to mind when considering disaster management. But it is, in many ways, more comprehensive and resourceful than most conventional emergency plans. Families **prepare documents, arrange guardianships for children, and create networks of trusted contacts** who can provide support in case of detainment. These strategies are born out of necessity, not choice—because being caught unprepared could mean losing everything.

These are all forms of crisis management that parallel disaster response strategies, illustrating how deportation planning functions as an implicit form of disaster preparedness. The reality of deportation forces undocumented communities to live in a constant state of readiness. It also holds promise for learning how people come together to prepare for worst case scenarios.

### LIVING WITH LAYERS OF VULNERABILITY

Many undocumented immigrants live in areas at risk of natural hazards. This combination of threats—being undocumented and living in hazard-prone places—creates **a double layer of vulnerability** that limits their choices and the ability to protect themselves in disasters.

For example, during the 2017 Thomas Fire in California, many undocumented farmworkers were forced to choose between working in conditions that damaged their health or losing the only income they had to sustain their families. Without proper protective equipment, multilingual emergency alerts, or the ability to easily access disaster relief, they were left to fend for themselves.

During the 2017 Sonoma County wildfires, **stories emerged** of undocumented families that chose not to evacuate because they feared U.S. Immigration and Customs Enforcement would find them in the shelters. These families knew the risks, but the threat of deportation was even more frightening than the flames. Such decisions reflect a grim reality—the intersection of immigration status and disaster can be deadly.

Despite these barriers, undocumented communities continue to organize and advocate for themselves. They participate in **Know Your Rights workshops**, share resources within trusted networks, and develop their own disaster plans. This resilience deserves recognition—not just as a survival strategy but as a form of resistance. By taking control of their preparedness, these communities articulate that they will not be erased.

### RETHINKING DISASTER PREPAREDNESS: A CALL TO ACTION

Disaster planners can learn a lot from how undocumented families approach preparedness. Their actions show that disaster planning isn't just about physical safety—it's about maintaining dignity, agency, and the ability to protect one's family. Imagine how much stronger disaster planning could be if undocumented people were not just included, but actively engaged and carefully consulted, in the process.

Disaster preparedness is more than just a technical exercise—it's a moral obligation for governments and emergency planners to ensure the safety of all communities. When we exclude the most marginalized from planning, we actively decide whose lives matter.

Even as the number of undocumented people in the United States has risen over the decades, undocumented status has been overlooked in the planning process, treated as an afterthought, or ignored altogether. But as climate-induced disasters become more frequent and severe, it's time to rethink what it means to be prepared.

Preparedness means building trust, creating accessible resources, and ensuring that everyone has a seat at the planning table, regardless of citizenship status. When undocumented families plan for deportation and disasters, they're not just preparing for the unexpected—they're preparing for survival. It's time we acknowledge that and plan with them.

## ABOUT THE AUTHOR

**CARLO CHUNGA PIZARRO** is a PhD candidate in urban and environmental planning and policy at the University of California, Irvine. He has a background in urban planning and GIS. His research addresses the intersections of immigration policy and disaster management systems. Chunga Pizarro has published works on farm worker safety during wildfires, as well as reviews in journals focused on undocumented critical theory, adaptive governance, and nonprofit disaster preparedness. A Ford Foundation Fellow and Decarbonization Fellow, he has been involved with the Bill Anderson Fund as a student council executive member since 2021.

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*An older man broadcasting from a community radio station. Source: Audry Labor / Shutterstock.com*

# LISTEN TO YOUR ELDERS:

## ENGAGING OLDER ADULTS TO BUILD A MORE RESILIENT COMMUNITY

BY NNENIA CAMPBELL

Older people are repeatedly portrayed as more likely to experience injury, loss, and death during disasters. Because of this, emergency managers and others responsible for disaster planning and recovery often consider older populations as a problem to be solved.

This has also been the case in research—much of the **published literature on how disasters impact older adults** focuses on advanced age as a one-sided indicator of vulnerability without considering their strengths. Both groups tend to rely too often on narrow perspectives from caregivers, elder-serving institutions, and others responsible for elder care to address issues rather than on the accounts of older people themselves.

This tendency to ignore the voices of older adults and underestimate their resilience not only diminishes their ability to contribute, but also deprives the entire community of the valuable skills and knowledge they have to offer.

### EXPANDING PERSPECTIVES OF AGING

Uninformed attitudes about how older adults experience disaster often stem from **negative stereotypes of aging and the aged**. Characterizing aging as an inevitable downward spiral—and older adults as flatly vulnerable—unfairly denies their agency and obscures the breadth of their capacities. This thinking has undergirded systems that keep older people from meeting their own needs and leveraging their skills for the good of the community during crisis.

Older people's diversity, abilities, and contributions to community resilience are less frequently discussed, but there is much to be gained from engaging and listening to them when planning for disasters. Fortunately, this is beginning to change. Emerging voices in research and practice have begun expanding the discourse about aging and disasters in ways that appreciate the **agency**, **strengths**, and **resilience of older adults**. As these conversations become more common, so too will examples of elders supporting their communities in disasters.

### OLDER ADULTS TURN PERSONAL PREPAREDNESS INTO COMMUNITY RESPONSE

One example of older people enhancing community resilience can be found in a response to the **2010 Fourmile Canyon Fire** in Boulder County, Colorado. The fire spurred power outages that disrupted communication networks and kept many residents from getting evacuation information. In response, a group of formal and informal mountain community leaders—which included many older people—formed a coalition, now known as the InterMountain Alliance, to **regularly share knowledge and information** about common interests, such as emergency preparedness.

The alliance eventually worked with the Boulder County Amateur Radio Emergency Services to develop two amateur (ham) radio networks that could be activated when other communication methods failed—the **Mountain Emergency Radio Network** and the **Allenspark Neighbors Emergency Network**. Older mountain residents spearheaded many of these efforts and recruited dozens of other residents to be trained as ham radio operators with the explicit intent of **strengthening emergency communication** for both personal and community preparedness.

Several years later, **one of these networks was put to the test** when a massive flood washed away major roads, trapping a group of schoolchildren and their chaperones on an outdoor education trip. Older adults within the amateur radio network were able to make contact with the group, relay information to the Boulder County Office of Emergency Management, find an alternate evacuation route, and ultimately facilitate a successful evacuation.

In this case, collective action, driven by leadership from local seniors, provided critical system redundancy and direct support during a crisis.

### INTENTIONAL ENGAGEMENT FOR A MORE CONNECTED RECOVERY

In Boulder County, older adults stepped in and showed what an asset they were to their communities. But a project in Japan shows how intentionally including older people in disaster recovery and resilience building efforts creates more beneficial outcomes for everyone.

The **Ibasho project** was established in Ofunato, Japan, after the 2011 Great East Japan Earthquake and Tsunami. The project—recognizing older adults as valuable assets to the community—intentionally engaged them as contributors and empowered them to play a meaningful role in the recovery by operating an all-ages community gathering space. The Ibasho Cafe offered amenities such as an organic farm and farmers market, festivals and events, after school care for children, and lessons on operating equipment and meeting basic needs without electricity, all primarily coordinated by elders.

Research found that, regardless of age, those who regularly frequented the Ibasho cafe experienced an **enhanced sense of belonging in the community**. Additionally, the project connected residents of all ages, strengthened social capital, and benefitted elders at risk of social isolation. This demonstrates how inclusion can create positive outcomes for older people that ripple through entire communities.

### MOVING TOWARD INCLUSION

Understanding the experiences older adults have in disaster and how they plan can reframe our thinking about what preparedness and resilience can look like. This, however, will require moving past stereotypes of aging, acknowledging the agency of older people, and intentionally including them in disaster planning and research. Older people need to be asked for their perspectives and play a key role in decision-making. Above all, they should be valued as assets, not burdens, to their communities.

## ABOUT THE AUTHOR

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# SOCIAL MARGINALIZATION AND INEQUALITY

## "CALL ME, SHOW ME YOU CARE": PUBLIC HOUSING RESIDENTS ON DISASTER RESPONSE AND RECOVERY
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## THE MOTHERS WE'RE MISSING: ACCESS TO MATERNAL MENTAL HEALTHCARE DURING SUCCESSIVE DISASTERS
### BY NATASHA MALMIN


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# EQUITY AND INCLUSION THROUGHOUT THE DISASTER CYCLE

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# BEST PRACTICES FOR COMMUNITY-BASED COLLABORATIONS

## BRIDGING THE RESILIENCE GAP: DATA AND FLOOD RISK MANAGEMENT IN RURAL AND UNDER-RESOURCED COMMUNITIES
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## EXPOSING INJUSTICE: RESEARCH PARTNERSHIPS TO DOCUMENT AND REDUCE DISASTER RISK FOR INCARCERATED PEOPLE
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# STRENGTHS AND CAPACITIES OF SOCIALLY MARGINALIZED COMMUNITIES

## OVERLOOKED COMMUNITIES: INCORPORATING CAPACITY INTO CLIMATE VULNERABILITY MAPPING
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## DEPORTATION AND DISASTER: PREPAREDNESS LESSONS FROM UNDOCUMENTED IMMIGRANTS
### BY CARLO CHUNGA PIZARRO


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## LISTEN TO YOUR ELDERS: ENGAGING OLDER ADULTS TO BUILD A MORE RESILIENT COMMUNITY

### BY NNENIA CAMPBELL


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The ***Research Counts* series** was born out of a desire to share key hazards and disaster research findings with a broader audience and ensure that knowledge is available to those who need it most. Therefore, the pieces in the series are brief and written to be used by a wide range of practitioners, policymakers, journalists, and others concerned with understanding disasters and reducing their toll.

In 2026, the Natural Hazards Center teamed up with the **Bill Anderson Fund** to publish this special collection on **Equity and Inclusion in Disasters**. We are grateful for the Bill Anderson Fund fellows, alums, and collaborators who wrote the pieces in this collection. The authors represent a wide range of disciplines and a diversity of perspectives, but they all share a common commitment to advancing equitable approaches to disaster risk reduction, response, and recovery.

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We deeply appreciate you reading and sharing this special collection on Equity and Inclusion in Disasters.

## THANK YOU FOR TAKING THIS RESEARCH AND MAKING IT COUNT.

# FURTHER INFORMATION

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