5 white paper series: local support

COMMUNITY NETWORK ANALYSIS FOR DISASTER RECOVERY

EXECUTIVE SUMMARY

Community networks are the relationships among community members that result in the provision and sharing of support, information, and resources. When identified and analyzed, these networks can be integrated into local disaster recovery and preparedness frameworks to better assess community needs and recovery capacities, especially when the presence of federal aid is no longer available or difficult to access. In addition, geographically and socially vulnerable communities still do not receive the adequate support or aid needed for equitable and resilient recovery.

This white paper aims to provide an understanding of how networks between community organizations and households influence disaster recovery. In addition, this paper identifies gaps in current disaster management frameworks, and encourages the implementation of participatory asset mapping and social vulnerability assessment processes. Finally, this paper provides a roadmap for how these strategies can be incorporated into disaster preparedness, immediate recovery, and long-term recovery frameworks.

5.1 Introduction

As global climate change worsens, the frequency and intensity of natural disasters, such as hurricanes and wildfires will continue to increase. This increase in the number of disasters will have widespread financial, health, and societal impacts on residents and communities across the United States. In the first nine months of 2020 alone, 16 separate one-billion-dollar natural disasters impacted residents across the US, resulting in significant displacement of households. [1] To address these challenges, disaster management frameworks must acknowledge and respond to the social dimensions of disaster recovery. This is essential to creating equitable, efficient, and resilient disaster recovery models that can help uplift communities following major disasters. Currently, inequities in disaster recovery can be attributed to recovery assistance largely being based on the amount of damage sustained to structures rather than a household's or community's ability to recover. This is often reflected in recovery frameworks that tend to favor "white disaster victims more than people of color, even when the amount of damage is the same."[2] Moreover, there is often an inattention to the lived experiences of individuals impacted by structural inequality within historically marginalized and rural communites that directly and indirectly impact pre-disaster conditions and vulnerability.[3] This, coupled with a general inattention to community networks and social capital as a significant variable in disaster vulnerability, justifies the need for a new approach to disaster recovery decision making.

This white paper aims to provide an understanding of how networks between community organizations and households influence disaster recovery. In addition, we offer ways beyond current disaster response frameworks to leverage existing social connections within communities to more effectively target communities for disaster preparedness training and distribution of recovery resources. Together, this white paper will introduce a method for incorporating social networks, community assets, and social capital into disaster recovery efforts.

DEFINITIONS

SOCIAL NETWORKS

Structures of connected individuals and organizations that interact and share information and resources that can support a holistic approach to disaster response. These networks often have overlapping commonalities, for example location, mission, industry, or cultural and social ties.

SOCIAL CAPITAL

A form of social support that bridges resources and knowledge shared between local residents and across networks outside of their immediate community.

CAPACITY

A measure of organizational strength, reach, and ability to mobilize resources to prepare for and respond to disaster events.

RESILIENCY

The ability of communities to adapt to, respond to, and recover from disaster events.

Together, these concepts form the basis of a Community Network Analysis Framework for equitable disaster management.

CURRENT AND EMERGING APPROACHES TO DISASTER RESPONSE

The Federal Emergency Management Agency (FEMA) published its second edition of the National Disaster Recovery Framework (NDRF) in 2016 with the goal of establishing "a common platform and forum for how the whole community builds, sustains, and coordinates delivery of recovery capabilities."[4] The framework documents values of resiliency and sustainability and challenges past recovery models that have focused primarily on rebuilding a community's physical infrastructure to its pre-disaster state. It also placed the ability of communities to coordinate local partners and resources as a guiding metric of future recovery success. In 2019, the FEMA National Response Framework introduced the concept of Community Lifelines as a focal point of immediate response. According to the framework, community lifelines are "those services that enable the continuous operation of critical government and business functions and are essential to human health and safety or economic security."[5] By prioritizing lifeline services, such as water and electric power, and approaching disaster preparedness by building capacities to "stabilize and restore community lifeline services", communities can more effectively recover from the infrastructural, economic, and social service loss.

Both frameworks place great emphasis on the FEMA Whole Community Approach to Disaster Management, which offers a strategy to engage the full capacity of private and nonprofit partnerships within the disaster preparedness context. FEMA defines the Whole Community as a "means by which residents, emergency management practitioners, organizational and community leaders, and government officials can collectively understand and assess the needs of their respective communities and determine the best ways to organize and strengthen their assets, capacities, and interests.[6] Together the collaboration of institutional and local community leaders can shape equitable and resilient disaster recovery by combining technical capacity, local knowledge, and trust to inform disaster planning.

Although these new frameworks for disaster response have been presented by FEMA, there is still a lack of action towards equitable and robust implementation and ensuring that all communities have the resources and support needed to pursue disaster planning through a Whole Community Approach. In addition, there is insufficient literature on how successful locally-scaled coordination of leaders and disaster management policy structures can occur.

A COMMUNITY NETWORKS APPROACH: LESSONS FROM NEW ORLEANS

A field visit to New Orleans showed our research team that disaster response, specifically within the context of Hurricane Ida recovery period, is driven by a network of local leaders who are taking the initiative to protect and restore their communities when external support is not always guaranteed. This was evident in many of our conversations with local parish organizations, university scholars, and community members who spoke about the unmet needs of their communities, disconnections across the region, and the roles they were finding themselves filling during immediate and later recovery periods. We learned that through these roles, leaders from faith-based organizations, cultural organizations, and nonprofits have become hubs for communication, long term resource collection, and emotional support for residents following a disaster. However, during our field visit we also learned from organizations such as Second Harvest Food Bank, United Houma Nation, and Lower Nine that while communication between organizations and residents is strong, communication with other local and federal organizations is lacking. This leads to the duplication of work by multiple organizations and low levels of trust especially in federal organizations and agencies. In addition, other local organizations such as The Descendants Project expressed that existing communication structures resulted in the over distribution of resources such as ice rather than resources that were identified as high-priority aid.

Therefore, identifying where community assets and robust organization-resident communication channels already exist can help to identify where linkages in a network can be made. Furthermore, identifying and leveraging key leaders and organizations can help to understand a community's capacity to coordinate its networks to more equitably and efficiently prepare and respond for future disasters. With this in mind, our team guided our research questions to address these social network complexities.

5.2 Network Analysis as Disaster Preparedness Framework

A community's ability to prepare for any type of disaster can be strengthened by acknowledging and supporting the resources, knowledge, and relationships that already exist from within. Together, these factors form the foundation of community-based networks that evolve and expand as individuals establish roots within a community, maintain cultural traditions, form relationships, and learn to adapt to unique, context-specific challenges.[7] Once identified, community networks and community challenges can present a roadmap for disaster preparedness reflecting the unique experiences, vulnerabilities, and local capacities of a community. This community network-based approach to disaster management can shift the reliance on distant, higher levels of government to networks of established community partners. Ultimately, this can place communities in a position to establish resilient systems that can efficiently mobilize resources and communicate the needs of their most vulnerable populations.[8]

Network identification and network building are strategies that can be incorporated into municipal disaster preparedness plans and training. These strategies can range from traditional needs assessments that are completed for external state and federal recovery funding to less traditional participatory network mapping and vulnerability assessments that aim to build community-based recovery from within.[9] Establishing a disaster management plan that incorporates both strategies can lead to a holistic understanding of the needs, vulnerabilities, and local capacities present within a community. Yet, the latter strategy is often left out or not intentionally pursued within the disaster preparedness process, leading to equity gaps, miscommunication of needs, and preparedness and recovery plans that do not consider unique cultural and historic contexts of a whole community. Therefore, techniques to approach vulnerability assessments and participatory community network mapping are explored within the following sections.

COMMUNITY NETWORK ANALYSIS

Identifying formal and informal networks within a community is by no means an easy task. Community ties and relationships are often very complex and are built over time, therefore requiring just as much, if not more time to fully understand every role and relationship.[10] Within the context of disaster preparedness, identifying community organizations and local businesses and the services they provide can present a holistic picture of the skills and resources available within a community. Moreover, these local institutions are often sources of trust and local knowledge, offering direct linkages to individual

households and resident voices and needs. Identifying these linkages can be leveraged for faster and equitable communication and collaborative resource mobilization strategies even beyond the scope of the disaster context.

Asset mapping can be a first approach to visualizing these community networks. In addition, it can become the basis for community engagement and participation strategies that may establish relationships among community organizations, municipalities, and local businesses. Assets can be mapped through two approaches, first as an assessment of physical infrastructure assets, or specific equipment or facilities that can be utilized during disasters, and second as an assessment of social infrastructure, or specific organizations and individuals that provide communities with essential service.[11] These services range from food, utilities, shelter, and healthcare services to emotional support services that are often provided by local church groups and cultural organizations. The data collection process itself can take place either through survey distribution, interviews, or through mapping workshops that invite local leaders to participate in the creation of a community database of essential services and community contacts. Data collected during these workshops can be mapped using GIS or other mapping technologies to show geographic proximity and density of resources. This participatory approach to network mapping can ensure that individual communities guide the identification of community assets that are the most meaningful to them. These assets are often overlooked when asset mapping is approached using traditional asset definitions and categories.

A community network analysis goes a step further by defining how these sources of community assets communicate and to what extent organizations interact or collaborate with other local and regional organizations. The process establishes local organizations and leadership as nodes, or central hubs of communication that are essential to providing services and communication across local and regional scales. Local leaders are often city managers, first responders, administrators of public and private social organizations, coordinators of volunteers, and skilled workers.[11] By identifying these individuals and by analyzing the geographic reach for which their organizations serve, disaster management can tailor disaster preparedness plans to include formal and informal community leadership that can efficiently communicate and distribute resources that meet the needs of community residents. In addition, recovery from disasters rarely occurs immediately, as the physical and emotional impacts on communities can extend years after a disaster occurs. Therefore, identifying and strengthening these networks can create systems of support that can offer community members encouragement and tangible resources that may protect residents from future displacement during the rebuilding phase of recovery. Image 1 below illustrates just one example of how these asset maps can be visualized to be impactful tools for planners and emergency managers.

VULNERABILITY ASSESSMENTS

Assessing community vulnerabilities is yet another layer of preparedness that can be combined with network mapping to understand which areas of a community may be experiencing a gap in essential services. Specifically, it is important to identify at-risk populations first. The CDC defines at-risk populations as "individuals or groups whose needs are not fully addressed by traditional service providers or who feel they cannot comfortably or safely use the standard resources offered during preparedness, response, and recovery efforts."[12] These groups are often identified as those with limited English language skills, individuals with unique medical needs, geographically or culturally isolated individuals, homeless individuals, historically and economically disadvantaged individuals, elderly, and children. Identifying these sub-populations, knowing where they are located, and considering who their strongest community ties are can be invaluable to the identification of unique community needs and already-established leadership and resource communications structures.

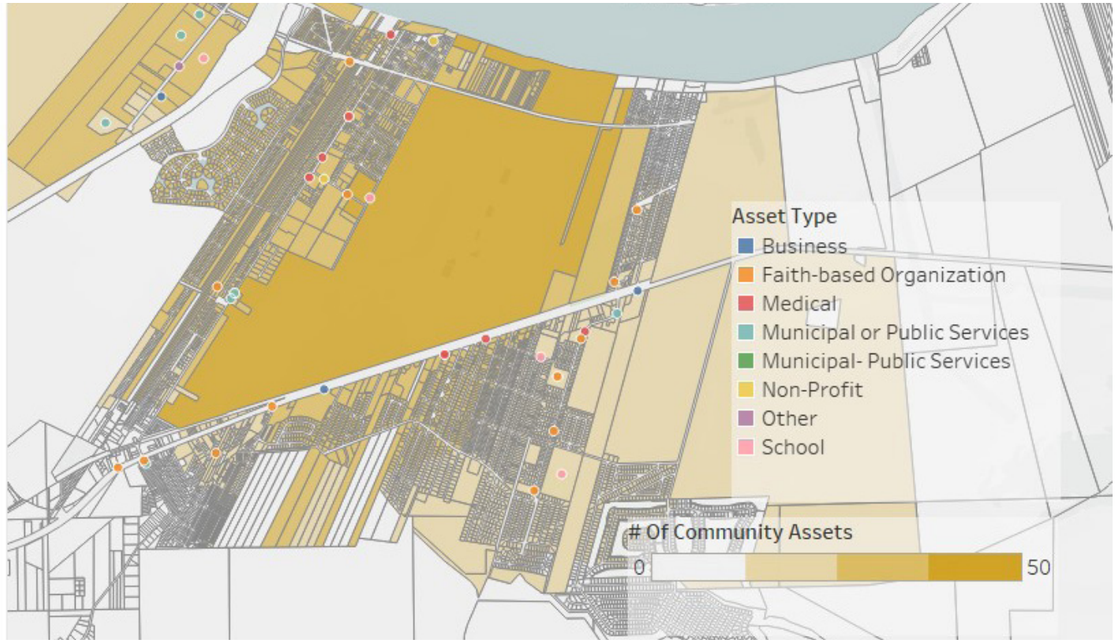

Image 5.1: Map illustrating density of community assets in St. Charles Parish. Households with greater access to assets and resources are shown in dark yellow.

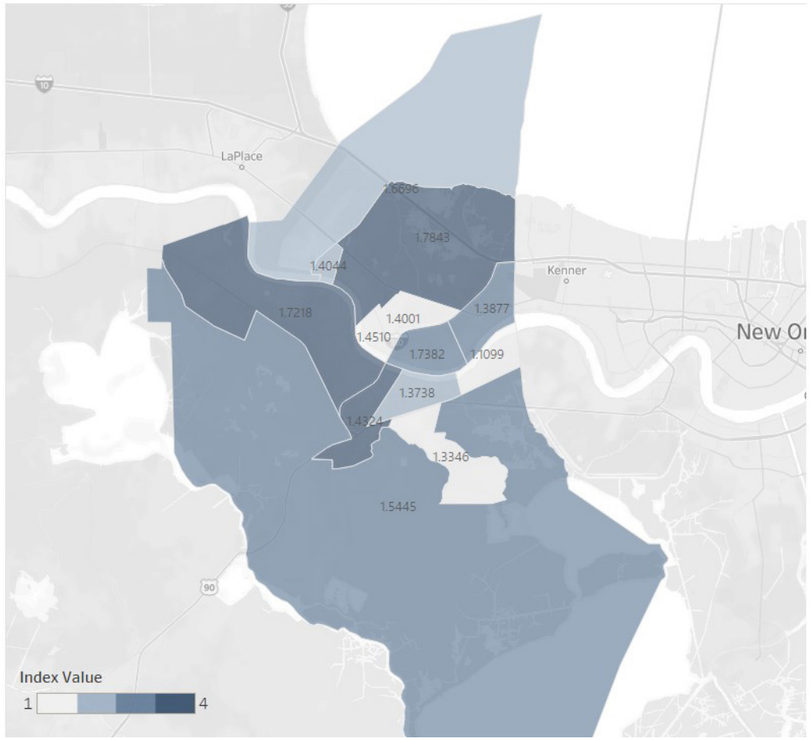

Image 5.2: Map illustrating vulnerability in St. Charles Parish. More vulnerable census tracts are indicated by dark blue.

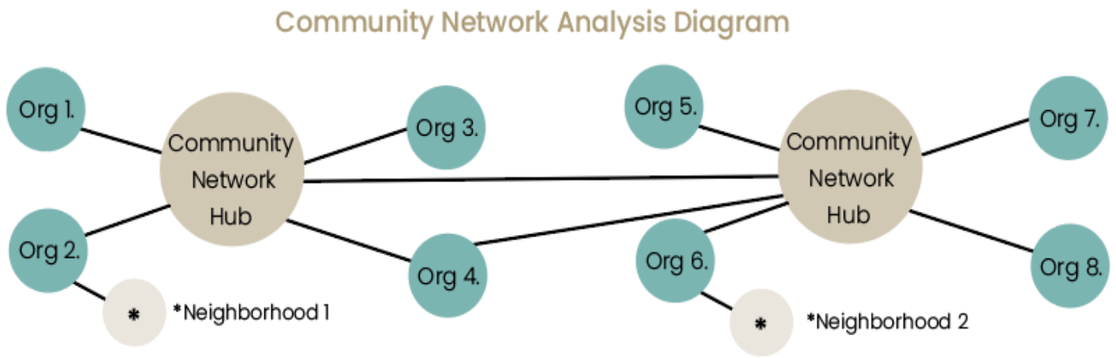

Figure 5.3: Diagram illustrating a network of community organizations. Representations such as these can aid in community network analyses.

There are many tools available to city planners, managers, and first responders that can be used to assess and visualize community vulnerabilities. One of the most well known is the use of a Social Vulnerability Index (SVI). SVI's can be used to understand geographically where certain vulnerabilities are densely located within census-defined boundaries. However, traditional social vulnerability measures focus primarily on demographic characteristics of households such as race, income, and age. In addition, these measures of social vulnerability are often executed by professionals in state and local emergency management roles, with very little input from local organizational leaders.[13] While these measures help to provide a baseline understanding of vulnerability, they are unable to assess the more nuanced characteristics of a community, such as social networks and personal ties, which are just as impactful for disaster recovery. Therefore, social vulnerability indices should be paired with other social analyses such as network analyses and asset mapping. Pairing them together allows disaster managers and planners to identify where socially vulnerable populations live and what kind of social resources they have at their disposal to help them to prepare, respond, and recover from disasters. For more information on how to create SVIs useful for disaster contexts, see our working paper on the rSVI.

5.3 Role of Strong Social Networks During Recovery

IMMEDIATE POST-DISASTER RECOVERY

Social networks act as a powerful, localized tool for communities to more effectively mobilize and respond to a disaster event in the immediate post-disaster phase. Pre-planning within social networks can enable rapid mobilization, allowing for deployment of resources not limited to response times of larger regional or national agencies. Organizations within strong social networks are geographically well positioned to respond to the immediate aftermath of a disaster event due to their proximity to the communities impacted. This proximity can inform real-time decision making processes as organizations/agencies within the network recognize immediate needs of the community within the context of the disaster event. Short-term needs post-disaster include food, water, shelter, emergency services, and transportation needs that necessitate the ability to deploy resources rapidly. Strong social networks, particularly those who have engaged in thorough pre-planning activities, serve as a mechanism of delivery of resources to their communities in the absence of larger agencies who generally arrive later in the disaster cycle.

The embedded nature of social networks is useful in linking organizations to community members more effectively. First, local organizations and agencies enjoy higher levels of community trust and buy-in due which is crucial in the immediate aftermath of a disaster event. These trust relationships can be leveraged as both a form of information sharing, and for resource allocation/distribution; expanding the reach of organizations while simultaneously linking people to services. Disaster preparedness and response professionals should recognize the advantages of strong social networks, and more importantly how resources are attained in their absence. Communities with less social capital and network strength experience worse outcomes in the immediate aftermath of a disaster event, which thus impacts both overall community resilience as well as long-term recovery prospects.

LONG-TERM DISASTER RECOVERY

Beyond the immediate post-disaster phase, social networks are impactful for long term recovery. The presence of strong community assets such as schools, businesses, and non-profit organizations has been linked to the ability for communities to recover after a disaster.[13] This is in part due to social systems "influeinc[ing] human interactions such as how information is shared,... decisions are made, resources are mobilized, and local activities are organized."[14] This highlights the importance of understanding social networks in disaster contexts, especially within socioeconomically disadvantaged areas which tend to rely on personal networks for disaster assistance.[15] Communities that are supported by strong networks of organizations experience better, more streamlined communication which allows them to recover faster than if they were disconnected from community members and organizations.

A study following major tornado events in rural Indiana, researched the impact of social capital and personal networks in post-disaster recovery and resiliency. The researchers found that household characteristics such as time spent in their current home, density of personal networks, and trust in government institutions all impacted the speed of recovery. In some cases, households with strong personal networks were able to recover more than twice as fast as households without strong networks. Overtime, this impact of social networks on recovery is particularly important for preventing displacement of residents.[16] Once communities become fractured after displacement, collective resources and communication between organizations and residents is impeded and recovery time slows down. Therefore, identifying existing social networks and facilitating communication between them can provide an effective strategy for helping communities to recover faster and prevent displacement.

5.4 Applications for Community Resiliency

Resilience is the ability of a household or community to adapt to, respond, and recover from a disaster event. Community resilience more specifically has been defined as "a process linking a set of networked adaptive capacities to a positive trajectory of functioning and adaptation," and is a crucial characteristic for emergency managers and planners to evaluate when addressing disaster response and recovery.[17] In contrast to measuring social vulnerability, resilience focuses on a community's potential to become more adaptable through risk reduction and planning practices. Resilience also informs a community's recovery process - a more resilient community will see better outcomes in both physical and mental health, mobilization of resources, and decision making processes supported by local knowledge and community buy-in.

Study of community resilience has highlighted the opportunities and challenges presented when measuring resilience, particularly in identifying indicators that can be broadly applied in different geographic contexts. Current literature highlights the lack of cohesive metrics of analysis across agencies in defining resilience, and has led to a call for more subjective indicators to be included in evaluation of community resilience. While common factors such as income, employment, population, education, and other basic demographic characteristics are important in assessing resilience, practitioners have begun to advocate for inclusion of qualitative data in resilience measurement. Qualitative metrics, while

more difficult to measure, can provide important insights into distinct localities, and respond to the specific needs of communities. The resilience approach acknowledges that a "one size fits all" application of disaster response and recovery is not as effective without incorporation of local knowledge and capacities. Recent scholarship has called for the incorporation of contextually specific indicators including household perceptions of recovery, neighborhood and community values, and the interaction of social and organizational systems within the community.

The assets present within a community, and particularly how they engage as a network of connected resources and local leadership, can strengthen resilience in all stages of the disaster cycle. Strong social networks can serve as a critical linkage between community members, small scale organizations, and larger agencies before, during, and after a disaster event. Community assets and social networks can engender resident trust in institutions, resulting in more timely and efficient recovery processes. Additionally, networks can enhance resiliency through building out of processes and responses through each stage of the disaster cycle to provide culturally specific aid to communities.

5.5 Applications for Disaster Response Training

Building network analysis, asset identification, and vulnerability assessments within existing disaster management training modules is an important step towards equitable and efficient disaster preparedness and response. By introducing first responders and city managers to these processes, municipalities can practice identifying trusted sources of services, knowledge, and communication flows that ensure disaster management strategies are leveraging the strengths and leadership structures present within their community. Identification of these assets can be a first step towards making lasting relationships with local organizations, businesses, and, to a certain extent, individual households. This is especially important to ensure that organizations and businesses that serve isolated communities have the resources and capacities needed to support the residents they serve. As stated earlier in this document, these relationships often have the deepest reach within a local community. That is, local community organizations often provide services catered to specific populations that naturally establish trust and community-specific support. Therefore, training first responders to effectively coordinate with local leadership can establish two-way communication strategies that can lead to equitable and efficient disaster management.

In addition, as damage assessment and communications technologies for disaster management continue to evolve, it will become even more important that these emerging technologies and techniques acknowledge the network complexities and community vulnerabilities that occur within the local context. First responders, city managers, or disaster response teams must be trained to perform network analyses and to use this information to tailor communication strategies to local community contexts. Network analysis can also help guide emergency leaders to leverage the strength of existing local networks, both in acknowledgement of existing capacity structures and in the identification of external or regional partners who could be called upon for resources or advice.

In terms of emerging damage assessment technologies, offering training in network analysis in addition to technical training may ensure that technologies that are moving away from on the ground, human-driven analysis and towards more computerized approaches can still accurately assess damage in a way that prioritizes vulnerable communities for resource distribution efforts. For example, machine learning, or the process of training computerized programs to identify damage from collected real-time image capture, is becoming an increasingly attractive and promising approach to faster damage assessment. Yet, if not supplemented by an assessment of both geographic and social vulnerability, this data may fail to prioritize communities that need immediate assistance or who may not have the resources to recover as quickly as others. This can create inequitable distributions of resources and slow the overall recovery process for a region. Therefore, training that coordinates both network analysis and damage assessment technology may support a holistic and equitable strategy for disaster management.

5.6 Recommendations

For planners, disaster managers, and other disaster related professionals interested in implementing social equity components to their disaster management frameworks, there are four key steps for moving towards more holistic and equitable recovery outcomes. Adopting the following recommendations can provide the first steps to approaching disasters from a social network perspective that allows for greater local participation and incorporation of local knowledge.

1. **Adopt vulnerability assessment methodologies that are specific to disaster contexts.**
   More specific measures, such as a household's time spent in their current home and access to an internet connection, can help to provide a better baseline understanding of the capacity of a community to recover. In addition, a catered social vulnerability index can integrate with social network analyses to help identify gaps between the presence of vulnerable communities and robust networks of communities with the capacity to aid in disaster recovery.

2. **Adopt a social infrastructure approach to asset mapping.**
   Social infrastructure approaches to asset mapping emphasize the role of services and organizations in a community. This identification of significant resource providers can later be further developed into a more comprehensive and robust network analysis that identifies key relationships and linkages between organizations. In addition, the process of asset mapping can help identify local leadership in an area, relationships with whom may be leveraged to access local knowledge.

3. **Use local knowledge to broaden scope of resilience indicators.**
   Communication with local leadership can help to yield identification of community specific assets and vulnerabilities. This information can be used to develop more contextual indicators of local resilience as opposed to relying exclusively on standard resilience indicators that are unable to account for the nuance of a local community.

4. **Train disaster responders to identify local social networks.**
   Training disaster responders to be more aware of existing local assets and networks can help to build trust between disaster planning and management professionals and the communities they work in. Further, training disaster responders to recognize existing communication networks can help to expedite the recovery process by utilizing trusted and verified local leadership to distribute information and resources.

5.7 Conclusion

When implemented together, these four recommendations may result in better recovery outcomes for communities. Instead of the traditional, bureaucratic approach to disaster recovery which focuses primarily on providing financial compensation for damaged structures, this whole-community approach informed by research on community capacities, vulnerabilities, and resilience narrows in on the relationships and support systems which keep communities together. Framing disaster management and recovery efforts in this way allows for local inputs and perspectives which can help to lift marginalized communities and improve disaster recovery equity.

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RISING ABOVE THE DELUGE

COMMUNITY NETWORK ANALYSIS FOR DISASTER RECOVERY

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about this project

This project is a joint effort by students and faculty within the Master of Urban and Regional Planning program at the University of Michigan and the National Disaster Preparedness Training Center (NDPTC) as a Capstone project for the Winter 2022 semester.

A key focus of the University of Michigan team is to work in a manner that promotes the values of equity, uplifting local voices, transparency and honesty. As a result, the outcomes of this capstone aim to speak to both our collaborators at the NDPTC and the local communities impacted by disasters across the United States. Our responsibilities as researchers will also include the implementation and/or recommendation of innovative solutions to issues surrounding machine learning, damage assessments, prioritization determinations, and social infrastructure networks.

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