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Grassroots Relief: Informal and Community-Based Response to Extreme Weather Events from Occupy Sandy to the Cajun Navy

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Abstract

This study examines the role that local grassroots efforts play in disaster response and recovery. Drawing on findings from an ongoing research project on the experience of Hurricane Sandy in New York City since 2012 as well as new data from more recent hurricanes and other events, we show how volunteers, community-based organizations, and activist groups often play an important role in both immediate response and longer-term recovery efforts. Many communities hit hard by Sandy and other disasters were significantly aided by locally organized and 'informal' responses, often from groups that initially had nothing to do with emergency preparedness (community centers, neighborhood associations, and activist affiliated with Occupy Wall Street), yet often in ways that compliment or even fill in for state actors. We consider the lessons that the successes of these grassroots interventions offer for how we think about community resiliency going forward. This is, to use the ASA's language, a draft/working paper, and will be added to and refined in the coming months. Nonetheless, findings presented here demonstrate how informal efforts, preexisting social infrastructure, and everyday innovation made a difference in some places. The working paper argues not only that local and informal responses are an important aspect of the sociology of disasters themselves, but that they provide guides to building more physically and socially resilient communities for what is likely to be the increasingly common collision between extreme weather and large coastal cities.

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Introduction: The Cajun Navy

With Hurricane Harvey bearing down on metropolitan Houston in August of 2017, one of the largest disaster response and recovery operations in American history was underway before the storm even made landfall. By September 1st, more than 31,000 federal personnel – not to mention 82 aircraft and 75 boats – had been deployed in the state, including employees of the Federal Emergency Management Agency and more than a dozen other federal departments, agencies, and service branches (FEMA 2017a). They joined countless Texas state and local civil servants (certainly in the tens of thousands; see TDPS 2017a). Non-governmental organizations were also a big part of the response. The Salvation Army deployed more than 4,000 volunteers to the disaster area, and the American Red Cross deployed some 3,000 staff and volunteers (FEMA 2017a). More than 300 other smaller organizations also took part, from providing emergency aid to clearing fallen trees and rubble.

One group that made headlines, however, barely qualifies as an organization at all. "'Cajun Navy' races from Louisiana to Texas," exclaimed the *Washington Post*. An ad hoc collection of volunteers organized via social media, members of the so-called Cajun Navy had climbed into their trucks and boats and rushed to aid their neighbors on the other side of the border (Wax-Thibodeaux 2017). The group, such as it is, had first gained some prominence the year before as they helped people in need during the devastating floods that wracked Louisiana in 2016, though the term had also been applied to volunteer efforts in the wake of Hurricane

Katrina in 2005. They exist online across a handful of different Facebook pages; one group, called the Cajun Coast Search and Rescue Team, maintains a website. Mostly, though, the Cajun Navy is a clever name for a loose bunch of individuals who felt the need to do something. With Twitter tweets, phone calls, emergency radio channels, and dedicated groups on apps like Zello (a push-to-talk walkie talkie emulator) and Waze (for directions), volunteers and victims alike were able to communicate across vast expanses of flooded terrain and back to coordinators at home, forming a sort of informal, crowd-sourced rescue armada.

"We basically had to find our way in," one volunteer from New Orleans said in an interview. "Rivers were already over-topped, we were hitting road blocks and having to turn around, find another road." When they couldn't drive any more, they would back their trucks in as far as they dared from improvised landings and launch their boats into the water. "The mailboxes were completely underwater, we were trying to avoid mailboxes as we pulled up to people's houses," he said. "It was a hodgepodge of boats and it was a hodgepodge of people."

Accounts vary, but Cajun Navy volunteers aided in hundreds of rescues in southeastern Texas during Hurricane Harvey, usually person by person in their personal fishing boats, adding needed resources to overtaxed emergency services. Volunteer dispatchers back in Louisiana would listen to emergency frequencies or hear from people online. "Emergency calls were coming in. I don't think people were able to get through on 911, or if they were they weren't getting the answer they wanted," a volunteer said. "People were getting on Facebook and saying nobody came for them. [Or] they were reaching out to their family, and then the family would get online and say, Can anyone help my aunt?" It is hard to know how to place these efforts in the bigger picture of a disaster – and disaster relief effort – on the staggering scale of Harvey

(especially considering the limited perspective afforded just a few months afterword).[1] But informal actors like these are unquestionably an essential part of urban disaster response and local resilience. And the Cajun Navy is not alone.

This working paper looks at the role of different "grassroots" relief efforts like these during extreme weather events. In particular, we turn to findings from New York's experience of Hurricane (or "Superstorm") Sandy in 2012, another massive disaster response in which we can see how community-based organizations, a network of political activists, and everyday people on bicycles and social media platforms provided essential services. We explore how these grassroots efforts supplemented the actions of official relief agencies, sometimes in more effective ways. Their successes demonstrate their significance for how we think about the uneven geography of disaster impacts, social infrastructure, and local resilience.

This study also takes advantage of the opportunity that the case of Superstorm Sandy provides for understanding extreme weather events in big coastal cities outside of regions most heavily studied in hazards research, from the implications of damage to vital mass transportation systems to the experiences of high-rise residents. In doing so, we hope to contribute to a more refined conceptual framework for studying so-called natural disasters in major urban areas and suggest some implications for understanding what is likely to be the increasingly common collision between extreme weather and large coastal cities. From economics to neighborhood resilience, grassroots responses are a big part of this story. The paper moves first to a brief review of the existing social science literature on extreme weather in cities and some additional background on the research and Hurricane Sandy as a case.

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[1] Some 13 million people were affected by Hurricane Harvey, including 82 who lost their lives. Striking America's fourth largest city, it caused around $180 billion in damage, making it a contender, alongside Hurricane Katrina, for the title of costliest storm on record. Official after-action reports from FEMA and other agencies are still being prepared.

The Sociology of Extreme Weather and Community Resilience

The study of hazards, disasters, and extreme weather events forms a rich field of research at the intersection of the natural and social sciences. We are beginning to be able to say the same thing of the study of climate change impacts as well. Sociologists in particular have produced notable work on subjects ranging from the social production of environmental knowledge (Buttel & Taylor 1992) to the political economy of urban disaster recovery (e.g. Gotham & Greenberg 2014). This is not to mention an emerging sociology of climate change itself (see e.g. Urry 2009 and Dunlap and Brulle 2015 for helpful reviews).

Sociology also has a long history of looking especially at the ways that disasters tend to be experienced unevenly, and unequally, with class, race, age, location, and other socioeconomic factors shaping vulnerability to storms and the ability to recover after them. Indeed hazards research has established an important discourse on inequality in vulnerability (Blaikie et al. 1994; Peacock et al. 1997; Hunt & Watkiss 2011).[2] After some disasters, the effects of underlying social inequality are relatively clear. By comparing morbidity and mortality rates after the 1995 Chicago heat wave, Eric Klinenberg (2002) was able to assess damage across neighborhoods and demonstrate how the disaster was anything but "natural." Research after Hurricane Katrina clearly showed the storm's disproportionate impact on poor New Orleanians (see e.g. Pais & Elliot 2006, Trainer, Donner & Torres 2006, Rhodes et al. 2010). Low-income African Americans, in particular, were less able to evacuate, more likely to die, and suffered more from the effects of long-term displacement, job loss, and uneven access to aid. These inequities are largely consistent with the broader consensus of hazards research: those least able

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[2] Studies have also demonstrated variation in vulnerability to hazards across cities (e.g. Borden et al. 2007) and in vulnerability to climate change across regions and nations (e.g. Beck 2010).

and least fortunate before a disaster tend to fare worse during and after a disaster as well (Blaikie et al. 1994; Peacock et al. 1997; Fothergill & Peek 2004).

Central to how we understand how communities experience disasters are the related concepts of social resilience and social infrastructure. Resilience, a wildly bandied about and hazily applied term of the moment, to be sure, refers simply to how prepared something is to weather a storm (so to speak) and recover. Keck and Sakdapolrak (2013) frame social resilience in terms of coping capacities (the ability to handle and overcome adversity), adaptive capactities (the ability to learn from and adjust based on adversity to better face future challenges), and transformative capacities (the ability to build and shape institutions that foster social welfare and societal robustness toward future crises). Social resilience is tied to social cohesion, social capital, and social infrastructure. Locally-held knowledge, for instance, can be a powerful form of expertise and invaluable resource for strong communities, if one that is often overlooked by outsideres. Social infrastructure itself, a more recently described component of this, has the potential to transform how we think about building resilience communities. Social infrastructure comprises the community and public spaces, churches, organizations and libraries, safe streets and parks that provide the underlying framework for building social relationships and local organizing capacity, for supporting people during crises, and upon which social capital and resilience can be built (see e.g. Klinenberg 2018). It comes in many forms, and may not look like we expect; building it is a technical project, and an economic and political one.

Sandy, New York, and the Superstorm Research Lab

Hurricane Sandy is an analytically useful case for examining many important aspects of what appears to be the increasingly likely collision of extreme weather events and large, dense

urban areas. In some ways, Sandy was much like other disastrous hurricanes, and it wrought its damage in ways that were broadly typical. When the storm arrived in New York on the evening of October 29th, 2012, it brought heavy rain, surging sea levels, and gale-force winds. Although the whole region was heavily impacted, the hardest hit communities in terms of direct impact were low-lying coastal areas running from southern New Jersey up into New York Harbor and east along the south shore of Long Island. In New York City, the southeastern shore of Staten Island, Lower Manhattan, and waterfront communities in Brooklyn and southern Queens saw the worst flooding, with powerful waves, 13-foot storm surges, and a majority of the drowning deaths caused by the storm. People on higher ground experienced little flooding (though destructive winds still brought down trees and power lines).[3]

Sandy's path itself was thus indiscriminate of demographics or economics. The hardest-hit neighborhoods included the poor, the wealthy, and a great many "middle class" New Yorkers with a variety of racial and ethnic backgrounds.[4] But this does not mean that all New Yorkers experienced the storm equally.[5] Within the hardest-hit neighborhoods, some structures fared better than others, and some families and businesses were better prepared to weather the storm. Sandy-related deaths were unevenly distributed across the population: half of the people who died in New York City were older than 65, and over 60 percent were male. Many of these

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[3] The path and timing of the storm, along with other geographic and climatological circumstances, meant that some other waterfront areas, like Hunt's Point in the South Bronx, were also comparatively unscathed.

[4] Eastern Staten Island and southern Brooklyn and Queens are famous bastions of multi-generational and predominantly white middle-income families as well as a number of newer immigrant communities. Areas such as Coney Island and Red Hook in Brooklyn, and the Rockaway Peninsula in southeastern Queens, are also home to large concentrations of subsidized low-income housing. Other affected areas, including Manhattan's Lower East Side and other parts of Red Hook, while once poor, are notable for growing economic and racial diversity (if not necessarily integration) as a result of gentrification. And some wealthy neighborhoods, including Brooklyn's DUMBO and Manhattan's Tribeca, also saw considerable flooding, as did that global center of banking, trading, and corporate wealth, the Financial District.

[5] A study by Faber (2015) found that the most flooded areas tended to be those with higher percentages of white and black residents than the city as a whole; areas with higher Asian and Latino populations were by and large dryer.

individuals were more isolated, less willing to ask for help, and did not comply with mandatory evacuation orders – either because they feared losing possessions to looters, lacked the means to leave, or felt they had nowhere else to go (Casey-Lockyer et al. 2013: 395). Such patterns are strikingly similar to those in other disasters, from Hurricane Katrina and the Chicago heat wave to the hurricanes and fires of 2017 (Klinenberg 2002, Donner and Rodriguez 2008, Tierney 2011, Misra 2017, Nedelman 2017, Villafranca 2017).

On the other one hand, Sandy was clearly an historic event. Media coverage variously dubbed Sandy a Frankenstorm, Superstorm, or the perfect storm; New York City Mayor Michael Bloomberg called it simply "a storm of unprecedented proportions" (Duke 2012). The largest Atlantic hurricane on record, Sandy which spanned some 800 miles and 20 American states as well Caribbean nations, set new records for lowest measured barometric pressure upon landfall, highest storm surge in New York Harbor, and the greatest number of power outages in multiple states. The storm also struck a highly populous, diverse, and infrastructurally complex urban region. It was an extreme example of the dangerous weather that climatologists have suggested will become the "new norm" on the Atlantic seaboard and in other coastal metropolitan areas around the world by the middle of this century (see Mason 2012). To that end, it was also, more so than Hurricane Katrina or even many more recent storms, immediately perceived by many public officials, media outlets, environmentalists, and affected community members as tied to climate change.[6]

The case of Sandy offers us an opportunity to dig deeper into the social and spatial factors at play while focusing especially on those exceptional aspects of the event that can contribute to our understanding of future extreme weather events in big cities. And the fact that

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[6] See for instance the November 1st, 2012, issue of *Bloomberg Businessweek*, with the cover story "It's Global Warming, Stupid."

the storm struck where it did, when it did introduced factors that have received little attention in prior research, including the experiences of high-rise residents and the role that grassroots activists played in disaster relief, as well as the sheer scale of vital services and advanced infrastructure that were affected. In other words, Sandy is an analytically useful event because examining it can inform how we think about the impacts of extreme weather and climate change on large, densely settled metropolitan areas with vulnerable hard infrastructure and highly complex social conditions – the types of places that are likely to experience more extreme weather events in the future, yet have received relatively little attention in prior studies of extreme weather events.

This study is based largely on data from a multi-year team research project based out of New York University's Institute for Public Knowledge focused on Hurricane Sandy, the response and longer-term recovery that followed, and the implications of all of these for how we think about cities and climate change. It began, in effect, the night of the storm and continues, in many ways, to this day. This broader research endeavor included the extensive work – including interviews and policy analysis – of members of the Superstorm Research Lab (SRL), a student-driven and community-engaged mutual-aid research collaborative supported by the Institute,[7] as well as individual and collaborative research by the three authors. As part of this larger endeavor, this working paper draws on many dozens of interviews and countless hours of conversations, meeting notes, and participant observation conducted by SRL team members in communities hardest hit by Sandy and among the grassroots relief providers working in them during the

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[7] Founded in December, 2012, a month after Sandy struck, the Superstorm Research Lab functioned as a mutual aid and writing collective, working to understand social, economic, and environmental issues in the aftermath of the storm, and how New York City policymakers, non-governmental organizations, activists, and residents responded. Please see www.superstormresearchlab.org for more information, and see for instance Bergren et al. (2013) for an example of the collective research produced.

summer and fall of 2013 (all of which are publicly available online). The authors individually undertook targeted fieldwork and interviews with community group leaders in parts of Brooklyn, Staten Island, and more recently with Cajun Navy volunteers from Louisiana. We also analyzed official data and reports on the storm from a variety of sources, including numerous "after action reports" from city, state, and federal agencies, the published assessments of a variety of non-governmental actors, and data and meeting minutes made available by Occupy Sandy and local community groups. Examining the reports enabled us to compare official accounts from across the affected areas, while our interviews and observations offered the opportunity to incorporate the stories of those who experienced the storm and the relief effort firsthand (as did the authors themselves).

It is worth noting here that part of the warrant for this research is the inadequacy of the existing official reports. While often rich in numerical information and impressive factoids, these documents tend to be highly selective. And, functioning as they frequently do as a combined self-appraisal and public relations tool for the agencies responsible, they tend to feel insufficiently self-critical (the Federal Emergency Management Agency's after action report is a notable exception). The dozens of other reports from different agencies and non-governmental organizations that we reviewed vary in quality and tend to be single-mindedly focused on particular social or policy issues. Few make any mention of local grassroots contributions to the relief and recovery process. With voluminous data in hand, in what follows we examine how local organizing, underlying social infrastructure, and grassroots innovation shaped community-based recovery efforts in the days and weeks that followed.

Grassroots Relief

In the moments, days, and weeks after Sandy's initial impact, people in hard-hit neighborhoods across New York City had a wide range of needs and faced highly uneven levels of official response. Fortunately, disaster response efforts came not only from public servants and well-known relief agencies, but also from citizen volunteers and community-based organizations. In some places, pre-existing organizations with unrelated missions effectively repurposed themselves to respond to the storm. New organizations and coalitions also formed in the storm's aftermath, and in other places everyday people with no organizational affiliation at all found innovative ways make do and help others. Each of these elements are overlapping. We begin with one of the most powerful examples of a grassroots relief effort that achieved a scale of response comparable to that of some official relief agencies, but which also introduces the importance of preexisting community organizations, without which it would not have achieved its success. We then describe some other such local organizations, which had nothing to do with disaster relief before the storm but pivoted to become invaluable resources for their communities and others. A final section describes some more individual-level innovations uncovered in the research, but all of which had applications in the organized efforts as well.

Occupy Sandy

One of the most unique success stories to emerge from Hurricane Sandy was the phenomenon known as Occupy Sandy. A grassroots network of volunteer responders with its roots in the 2009 Occupy Wall Street movement, the citywide effort captured substantial attention for their rapid and vast response to the storm, not to mention their ad hoc, do-it-yourself attitude. Exactly how they organized and how their efforts played out on the ground in different neighborhoods reveals just how important grassroots innovation supported by underlying social

infrastructure can be, even and perhaps especially in complex urban disaster scenarios where official efforts may be stretched to their limits.

Occupy Sandy volunteers focused their efforts on areas and populations that were viewed as especially vulnerable or underserved by formal emergency relief efforts. They provided food, blankets, temporary shelter, help with reconstruction, assistance with relocation and aid claims, and other services. The People's Medical Relief, a grassroots coalition of volunteers led by Occupy Sandy, provided much-needed medical services after the storm, conducting home visits, refilling prescriptions for homebound residents, and staffing makeshift clinics that served over 800 people. Official documents describe FEMA and Red Cross personnel working with Occupy Sandy volunteers, sharing local knowledge and distributing food and medicine in places that the official agencies were unable or unwilling to access directly (see Homeland Security Studies and Analysis Institute 2013).[8]

To bring people together to work toward these goals, Occupy Sandy relied heavily on existing social infrastructure. For one thing, they sought out pre-existing community spaces to use as "hubs" for local relief activities in hard-hit and outlying neighborhoods.[9] In the immediate aftermath of the storm, the organizers of a nascent Occupy Sandy had quickly sought out local groups that had spaces to which they could direct volunteers and supplies. In many cases they also looked to groups that were already known and trusted by community members. The dozens of Occupy Sandy relief sites that resulted were run out of neighborhood churches, mosques,

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[8] Occupy Sandy volunteers interviewed by Superstorm Research Lab members expressed ambivalence about being lauded for filling this gap in government service provision. Some expressed concern about whether their work could even enable or perpetuate government failures and emphasized the need for public resources in addition to volunteer/private responses.

[9] Occupy Wall Street itself likewise relied upon exploiting existing spaces as organizational resources. The movement began with the physical occupation of Zuccotti Park in Lower Manhattan, selected explicitly for its unique legal status as a privately owned public space, and used similar spaces, from parks and plazas to covered arcades to building lobbies, to hold meetings. Many subsequent Occupy efforts in other cities were similarly initiated by the occupation of public or semi-public space.

community centers, restaurants and other small businesses, as well as street corners, parks, tents, and trailers.

The Occupy Sandy effort attracted an estimated 60,000 volunteers – four times as many as the Red Cross (Homeland Security Studies and Analysis Institute 2013: 1) – as well as nearly $1.5 million in donations and countless donated goods in the year after the storm. But in doing so the group also depended on the presence of large, accessible distribution sites, first outside of the most affected areas where power and restored transit access made centralized coordination easier, and later, as the efforts became decentralized to the communities being rebuilt, in these neighborhoods themselves.

As such, Occupy Sandy's effectiveness on the ground proved easier and more effective in some places than others, and this was influenced directly by the local organizational resources already present when the storm hit. The neighborhoods where the first Occupy Sandy sites sprang up only hours after the storm hit were the Lower East Side in Manhattan and Red Hook in Brooklyn. On the Lower East Side, organizers connected with two community groups that had been working in the neighborhood for decades. In Red Hook, they set up at the offices of the Red Hook Initiative, one of the few buildings where power stayed on and volunteers could make use of the kitchen facilities and community space to serve up hot meals to neighborhood residents, a number of whom had gathered there many times before. These existing links and spaces facilitated the work of Occupy Sandy volunteers, and helped ensure that nearby residents who needed help could get it somewhere they already knew to go.

Difficulty finding spaces like these in other neighborhoods was a real encumbrance. In conference calls and in-person meetings, Occupy Sandy organizers discussed reports from "scouting teams" working to negotiate access to sites in various areas (Occupy Sandy 2015). In

the southern Brooklyn neighborhood of Sheepshead Bay, for instance, where volunteers were able only to establish a "pop-up location, which is basically just a table on the corner," although presence on the street leant visibility and put volunteers in close proximity to the houses that suffered the greatest damage, the location posed challenges as time went on and the cold winter arrived, making it difficult to attract volunteers. About a month after the storm, an Occupy Sandy member explained at a meeting that they were "really afraid of the sustainability of the site" (Occupy Sandy 2012a). At this time, hubs in places like Staten Island and the Rockaways were continuing to grow and expand, but in Sheepshead Bay organizers had begun trying to find a "remote location we can work out of" (Occupy Sandy 2012b). The group was still on the street in January, but had at least moved into a donated trailer – a warmer site, certainly, if not a more permanent one.

Existing social infrastructure was also crucial to Occupy Sandy's abilities to work in Coney Island, where many residents were stuck in high-rise public housing buildings that had lost power and elevator service. As in Sheepshead Bay, organizers described how they had again started with a "pop-up stand on the corner" before a local tenants' association president helped them gain access to community centers inside several public housing developments. By late November, three weeks after Sandy, an Occupy Sandy volunteer reported that they were now "working out of 6 NYCHA public housing developments where we have distribution centers – storage centers where we keep things down here; sort of like mini-hubs so that we can do canvassing and outreach to homebound populations" – which numbered approximately 700 according to a list compiled by another grassroots relief organization, the People's Relief (Occupy Sandy 2012b).

The experiences of Occupy Sandy volunteers make it readily apparent that finding space for, setting up, and staffing relief hubs was essential to an effective response effort. They also highlight the invaluable role of existing community organizations, and the importance of unexpected innovations that allowed goods and services to reach those who were less able to seek them out. The next two sections explore these other components of grassroots relief.

Community-Based Organizations

Throughout New York City on that night in October, 2012, with rising seawater rushing under people's front doors, local neighborhood organizations found themselves taking on the role of relief providers. Some have not stopped, and have since even changed their very cultures and missions in order to focus on continuing to help members of their rebuild communities. Others have turned to increasing preparedness and resilience in their neighborhoods or have incorporated planning for climate change and its effects into their previous missions. In Red Hook, for instance, staff and volunteers at the Red Hook Initiative, a local service organization devoted primarily to health, employment, and educational programming for the neighborhood's low-income youth, were able to quickly repurpose their resources for disaster relief and provide a physical space for residents to gather, share information, and help each other. Employees at the Red Hook Initiative are required to be neighborhood natives who live or grew up in the neighborhood, which meant that they had strong local ties and deep knowledge about who would be vulnerable or in need of support.

Farther southeast in Brooklyn, in the quiet seaside community of Gerritsen Beach, a longstanding neighborhood nonprofit known mainly for its annual Halloween festival transformed virtually overnight into a disaster relief operation and was soon joined by other

community organizations, such as the local Ancient Order of Hibernians. Gerritsen Beach Cares has continued to provide assistance (everything from manual labor to help with insurance and aid requests) throughout that neighborhood and even beyond. And in the Rockaways, the Rockaway Beach Surf Club – a bar, restaurant, and cultural center – likewise stepped up to become a hub for relief supplies, donations, medical assistance, and companionship in one of the more distant and underserved communities in the city.

Preexisting local organizational infrastructure like this, along with subtler elements of community social capital, provided real benefits for people in the neighborhoods that had them. As New York City Councilmember Mark Treyger, Chair of the city's Committee on Recovery and Resilience, noted two years after the storm: "As we continue the recovery from Sandy, it is imperative that we do not forget about the charitable organizations and houses of worship that opened their doors to storm victims and played a vital role in the hours, days and weeks after the storm hit our city" (qtd. in NYC Mayor's Office 2015). A survey conducted six months after Sandy found quite succinctly that "Neighborhoods lacking in social cohesion and trust more generally are having a difficult time recovering from Sandy" (Thompson et al. 2013: 2). Indeed, 73% of "unofficial" volunteer emergency responders – those everyday New Yorkers not affiliated with governmental agencies who went out to help – lived in affected communities themselves (Resilient Communities report 2014: 15).

Some neighborhoods that received little assistance from outside aid groups and volunteers (whether official or informal) and had not had their own community-based organizations to turn to during Sandy, new local organizations have been formed to work on recovery and longer-term resilience. In the Staten Island neighborhood of New Dorp, for instance, there was a civic association prior to Sandy, but not in the part of the neighborhood that

was most affected, called New Dorp Beach. Seeing how crucial civic associations were for getting out information and identifying local needs in other hard-hit neighborhoods along Staten Island's shore, residents started one of their own (see also Koslov 2016). Their founding president explained the benefits of this new social infrastructure in an interview about six months after Sandy:

> "And now having like the civic association, you have a structure for communicating with people that you didn't have before which presumably will be really good. I mean like Oakwood Beach and certain other areas, even though they were devastated, they had that communication. They had that trust in each other. They had been fighting this together for so long that right after it happened they all got together and said this is not happening, they're going to fix this. They're going to take of it, it needs to happen."

Interestingly, as time goes on these new organizations have also had to repurpose and expand what *they* do as they move from being responsive to Sandy-specific needs to finding a more permanent mission in their communities.

Everyday Innovations

Outside of the deaths and destruction caused by the floodwaters themselves, perhaps Sandy's biggest effect on New York was its dramatic damage to the region's vital infrastructure. The vital systems, including electricity, transit networks, communications, and fuel supply, that keep a modern city "running," were eviscerated by the storm. Even at their best, such systems are complex and unwieldy, their limitations tested by comparatively minor complications or surges in demand, and stronger and more frequent storms only place new stresses on them. With the subway partially submerged and power and phone lines down across the region, the conveniences of an advanced 21st century city were suddenly unavailable to New Yorkers who

faced instead a sprawling and impossibly complex urban area to coordinate emergency services and recovery efforts in.

New York City's Deputy Mayor for Operations estimated in Senate testimony that Sandy downed 95% of the telecommunications network in lower Manhattan, where most centralized city services are based (see Holloway 2013:4), and the Federal Communications Commission found that Sandy took down approximately 25% of cellular and cable service across the 10-state affected region, and significantly more than that in the most heavily affected areas (Genachowski 2013). While emergency communications from city government were impressive, including via the internet and social media[10], successes were largely limited to outgoing communications. Systems designed to enable residents to communicate back to city officials did not work as well during the storm, with dropped calls and lengthy wait times for callers to 311 and 911 lines. And despite the substantial presence on social media platforms that afford interaction, the city used them primarily as one-way broadcasting tools. It took days for city officials to gain a complete understanding of the storm's impacts across the five boroughs.[11] As the city's After Action Report makes clear:

> [The] city did not immediately have access to accurate, timely data from power utilities, telecommunications companies, fuel providers, gas stations, and other sectors that provide critical services. As a result, it took a few days – and in the case of telecommunications, longer – to get an accurate, comprehensive understanding of the magnitude of power and service outages at the household level (Gibbs & Holloway 2013:18).

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[10] According to a city-commissioned survey, officials "pushed out information through as many channels as possible" (Gibbs and Holloway 2013:6) and suggests this was successful on at least one measure, finding the vast majority of residents in the flood evacuation zones knew that they were subject to the evacuation order and reported hearing instructions to leave. Then again, the same survey found that those residents who reported hearing instructions to evacuate were no more likely to actually do so than were residents who did not report hearing the instructions (Gibbs & Holloway 2013).

[11] Rahul Merchant, the city's CIO, testified to the FCC: "Hurricane Sandy's impact on the public's ability to communicate, and the City's ability to communicate with it, was significant" (Merchant 2013: 2).

Everyday citizens, on the other hand, used social media as real-time news sources to find out evolving conditions on the ground. Many motorists, for instance, depended on Twitter to gather up-to-the-minute information about which gas stations were open, the lengths of lines to fill up, and where police were present or fights were breaking out – crowd-sourced data that traditional news sources then began to collect, report, and repost. Some local officials also turned to social media to gather information from constituents. Staten Island Assemblywoman Nicole Malliotakis monitored her Facebook page during the storm to find out how people in her community were faring:

> The night of the storm was crazy 'cause 911 was busy, so they only – we got busy signals, you know, people calling, people were on roofs, people were in attics. And I had people contacting me – their mother was in the car and the water was going up, rising and all these crazy scenarios… we were on Facebook fielding these crazy situations, and we were calling the Office of Emergency Management and reporting it that way, and then they were going out, because the phone lines were [busy]. […] Facebook that night saved lives.

Soon after the storm, members of the group New York Tech Meetup volunteered to create websites for small businesses that lacked them prior to Sandy, enabling shops to let their customers know they were open, even if their phone lines were down. These volunteers also created an app for drivers to report price gouging at gas stations directly to the Attorney General's office. Seeing how people spontaneously gathered together to use functioning power strips, talking and sharing information as they recharged their phones, students at NYU came up with the PowerClip, an attachment that clips easily to a car battery and enables multiple electronic devices to charge via built-in USB ports. The students noted that there were hundreds of cars stranded in the Rockaways, and one car battery could power more than thirty phones (DrivenxDesign 2014).

A more old-fashioned response to the communications breakdown came in the form of "bicycle brigades" established by volunteers with Occupy Sandy and other groups to collect and spread information. An Occupy Sandy participant explained:

"We didn't have a lot of cell service, […] those huge brick buildings just didn't allow us to use our radios. So we created a bike brigade and people would bike over and be like, What can I do? You're on a bike, great, go to five of these locations and ask this person what they need. […] And we had bike messengers take information to all the different hubs. That worked out really well."

Bicycles came in handy in other ways as well. A cycling and environmental advocacy group, TimesUp, also began organizing relief rides multiple times per week, with cyclists carrying supplies some 18 miles by bike from an Occupy Sandy distribution center in a Brooklyn church to a local community center in the Rockaways to distribute to those in need. A participant explained:

"We would drop off supplies and then split into groups as we wanted, to do other things. […] Some people would do deliveries because easily up to four weeks after the storm there was still a whole number of places that you could only get to easily by bicycle. And you'd, a car would take you an hour and a half from Beach 96th Street to somewhere that, you know, you could get there in 10 minutes on a bike."

TimesUp also provided bicycle-powered generators for electricity in areas without power, allowing affected residents to charge their cell phones and get back on the grid.

Of course, with subway service dramatically reduced and commute times doubled or even tripled for many people (Kaufman et al. 2012), bicycles were also invaluable simply for basic mobility. Many volunteers coming from outside the most affected neighborhoods turned to

bikes to get in and out every day, and so did people living in areas with no transit access pull out their bikes to get to work. Bicycle use in general increased dramatically in New York after the storm. The number of cyclists crossing the East River bridges into Manhattan during commute times was up 130 percent.[12] The city, advocacy groups, and community members worked together to provide assistance and advice for cyclists. The group Transportation Alternatives set up bike commuter stations with coffee and donuts, bike pumps, and quick repair services. As a report from NYU's Rudin Center for Transportation (Ibid.: 25) notes, despite the considerable damage to a network built to accommodate more than 10 million daily commuters, "New Yorkers managed to reach their places of work in impressively large numbers following Hurricane Sandy, not only as a result of transportation providers' major efforts, but also through residents' own adaptability and ingenuity."

Discussion and Conclusions

The Great Blizzard of 1888, which inundated New York City with as much as 40 inches of snow, led to a wholesale rethinking of the city's infrastructure so sweeping that it became a large part of the justification for the subway system itself. Storms like Sandy and Katrina and Harvey, likely only to become more common and more severe due to climate change, demand of us a similar willingness to rethink what works and how are cities function. If some nearly comparable signs of boldness have been visible in fits and starts with certain initiatives since Sandy – some elements of the federal Rebuild by Design regional resiliency competition, for instance – it is unclear what meaningful changes have been made, especially at the highest

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[12] What's more, an NYU study showed that walking and biking commuters were less frustrated than those trying to drive or take the subway, and while non-cyclists experienced double or triple their standard commute times, walkers and bikers added only 9 minutes to their commute times on average.

levels. Adapting to future extreme weather and climate change will take more than updates to physical infrastructure. It will take shifts in thinking.

We are broadly familiar with just how large and complex disaster response and recovery operations are from an organizational and infrastructural perspective. So too with the inspiring dynamic in which enormous public resources are mobilized alongside "everyday people" stepping up to lend a hand. Such things have been documented in federal after-action reports and academic studies, not to mention the sorts of heart-rending accounts that tend define local news coverage of these dramatic events. What we see here is just how consequential grassroots relief efforts can truly be. And we continue to see it, with the Cajun Navy in Louisiana and Texas, with volunteer firefighters, with the autonomous *Centros de Apoyo Mutuos* carrying out what Molly Crabapple (2017) has described as "DIY disaster relief" on a grand scale in Puerto Rico in the absence of federal aid. When devastating mudslides closed Highway 101 near Santa Barbara in 2018, local nature tour groups began offering impromptu (if sadly not free) ferry service for commuters.

Did communities with grassroots responses do "better"? Measuring such a thing is highly subjective and dependent numerous additional factors that make the experiences of no two neighborhoods alike. At the community level, we can see how areas with more social infrastructure, organizational capacity, and more reliable infrastructure are going to be more resilient to extreme weather. And in fact they're going to be able to do more for themselves if there's more up-front investment in communities to begin with. To this end, in light of the clear benefits that preexisting social infrastructure and organizational capacity provided for relief efforts, we should seek to promote such resources. On the other hand, we must be cognizant of a concern, articulated by some Occupy Sandy volunteers, that groups like theirs essentially enable

less adequate responses by official relief agencies like the Red Cross or FEMA. It is also the case that groups like Occupy Sandy have been hurt by efforts to close local relief hubs in some communities and even by accusations of fiscal malfeasance (West 2013).

We must also be careful that efforts to improve physical resilience do not step all over the dynamic flexibility of local knowledge and open access technology that has allowed individuals, activists, and community groups to operate effectively as grassroots relief actors. Communications provider Verizon sought after Sandy to replace some damaged copper phone cables with an all-wireless system. This switch would potentially increase material resiliency, but would likely have decreased social resiliency by marking a shift away from universal service, as New York State Attorney General Eric Schneiderman (2013: 4) argued in his objection to the plan.[13] In contrast to traditional phone line service, the proposed system would not have permitted 911 calls if disconnected for nonpayment, nor would it have functioned during a power outage (short-term backup power would be available, but with customers responsible for the cost of replacement batteries). Affected residents would also have faced the loss of DSL internet access and services such as medical alerts and security alarms dependent on landline networks, things that could hamper local, community-based responses. Verizon abandoned this specific proposal in response to broad opposition, but other ongoing adaptation efforts, such as switching copper to more saltwater-resistant fiber optic cables, threaten to raise prices and reduce access to communications services if they are not accompanied by greater regulation (Merchant 2013: 6).

More encouragingly, Sandy led to innovation in small but replicable projects that seek to adapt to threats of increased disruption by creating new mechanisms for everyday, as well as

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[13] The move away from landlines in favor of cellular service poses broader practical and regulatory challenges. For instance, first responders such as firefighters and police are increasingly using smart phones, but service providers have thus far been successful in efforts to overturn regulations requiring backup power for cell towers, as the FCC proposed after Hurricane Katrina (see Knowledge at Wharton 2012; also Chen 2013).

emergency, communication. In Red Hook, development of a wireless mesh network that began prior to Sandy took on renewed urgency after the storm, as the network makes local digital communication possible even with the disruption of wider internet service (Cohen 2014). Access is free, and the community organization overseeing the project employs residents to construct and maintain its hardware as well as the network launch page, which features local news and neighborhood-specific apps and information.[14]

Certainly one can imagine drawbacks to relying too heavily on informal efforts. They are, almost by definition, difficult to count on or plan around. And while some groups, like the Cajun Navy, prioritize coordination with official emergency responders, there is potential for confusion among officials, volunteers, and those in need of assistance alike, and perhaps especially when informal groups, like the Cajun Navy, make use of widely used emergency channels. One such channel had to be taken offline during Hurricane Harvey after Texas Search and Rescue claimed their name and logo were being misused (Molina 2017). They introduce considerable opportunity for the sorts of bias and inequality in response that researchers have often been concerned with in studying disasters (e.g. Sobel & Leeson 2006, Malhotra & Kuo 2008), which informal efforts are especially prone to (e.g. Douglas 2018), and which broad governmental responses ought at least in principle be designed to rise above.

Still, grassroots efforts clearly contribute. We can safely say confidently that the communities examined in this study did better than they would have without any grassroots action. At their best, informal efforts like Occupy Sandy can even supplement limited or inadequate official efforts and provide assets, from local knowledge to certain inhibitions, that formal disaster relief is missing. As extremely costly disasters become more common, this sort of

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[14] See the Red Hook Initiative's website at http://rhicenter.org/redhookwifi/.

help may even be crucial financially. And in some contexts, local help is quite frankly, obviously necessary. A federal district court found in 2013 that the City of New York had violated the rights of some 900,000 residents with disabilities, who are also disproportionately poor, by not providing sufficient evacuation assistance and accessible shelters during Sandy and other recent storms (*Brooklyn Center for Independence of the Disabled v. City of New York*, 2013). And while some people had immediate and comfortable places to turn for help, whether for places to stay or resources to tap in rebuilding homes and businesses, others were forced to rely on organized relief efforts that took weeks, months, and in some cases even years to respond. Local communities, thinking of their neighbors and willing to step up and help, can be essential to making a difference in people's lives.

In this working paper, we have demonstrated the powerful role that informal and grassroots responses can have. The findings offer some lessons for thinking about how to make our cities more resilient to future extreme weather events. Sandy's impact on New York and the way that the city responded was of course in many ways specific to the unique circumstances in question. Yet they also provide an invaluable case study with great relevance for understanding future extreme weather events in major cities and, in particular, the role of informal efforts and underlying social infrastructure.

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