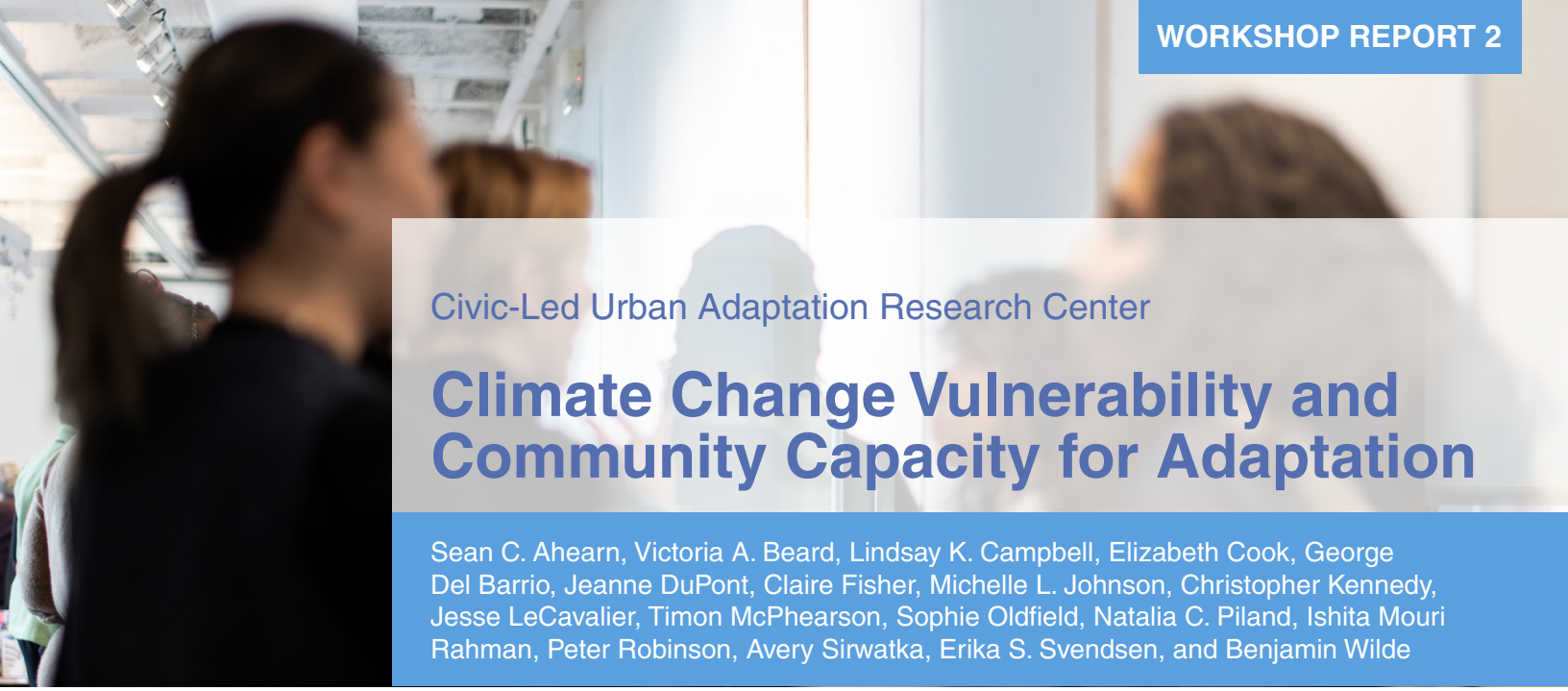

WORKSHOP REPORT 2

Civic-Led Urban Adaptation Research Center

Climate Change Vulnerability and Community Capacity for Adaptation

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Workshop Reports contain preliminary analysis, findings, and recommendations. They are circulated to stimulate timely discussion and critical feedback and to influence ongoing debate on emerging issues.

HIGHLIGHTS

» Community participants highlighted historic patterns of unequal public investment in New York City. This legacy reinforces patterns of social vulnerability and climate change vulnerability across the city.

» Residents in Brownsville and the Rockaways identified robust Systems of Care in their communities. However, further work is needed to better understand the degree to which these social networks can increase capacity to adapt and respond to growing climate hazards.

» Vulnerability indices, while providing accurate and critical information, lack sufficient granular detail to capture complex community dynamics. These indices could be improved with community input about household experiences with social vulnerability and climate change hazards and risks.

» Residents voiced concern that ongoing adaptation and planning efforts conducted by municipal, state, and federal agencies are not aligned with the greatest vulnerabilities in New York City. Further work is needed to quantify how well climate hazard adaptation efforts overlay with community vulnerability to these hazards.

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PROJECT OVERVIEW

The project is a one-year planning grant from the National Science Foundation (NSF) to develop a new Civic-Led Urban Adaptation Research Center (CIVIC-UARC, or the Center) for New York City. The project brings together urban experts from across multiple disciplines and institutions, civil society organizations, and communities to support equitable, sustainable, and inclusive approaches to urban adaptation, assisted by innovative technologies. The team also engages NYC-based government agencies and private industry. Beyond creating new knowledge specific to New York City, the new Center aspires to produce useful research for cities across the U.S. that are grappling with climate change in the context of rising inequality and a legacy of environmental injustice. It will educate and train the next generation of investigators, change agents, and decision-makers working on just and equitable urban climate change adaptation. The work for the planning grant and the work of the new Center focus on three core research areas:

1. Adapting to Multiple and Cascading Climate Change Hazards and Risks

Effective, equitable, and timely adaptation planning requires a nuanced and comprehensive understanding of the hazards and risks associated with a rapidly changing climate. This research area, including a workshop on February 14, 2024, focuses on improving our understanding of how climate change hazards are spatially distributed across the city and how human behavior and activity, the urban built environment, and natural processes interact with one another. This research area is focused on multiple and cascading climate change hazards and the drivers of those hazards. The goal is to shed light on critical climate resilience challenges, with particular attention to pluvial and coastal flooding, urban heat and heat waves, and air pollution.

2. Climate Change Vulnerability and Community Capacity for Adaptation

An understanding of underlying community vulnerabilities and the capacity to respond to emerging climate threats is necessary for the equitable and effective allocation of climate adaptation resources. This report focuses on this research area and its associated workshop on February 15, 2024. Through them, the project team seeks to understand household and community capacity for care and climate vulnerabilities in two selected neighborhoods in New York City: Brownsville in Brooklyn and the Rockaways in Queens. The workshop drew on multiple data sources and existing vulnerability indices, but prioritized learning from residents' lived experiences and knowledge of sources of vulnerability and capacity.

3. Developing a Digital Twin for Climate Adaptation

Rapidly evolving digital technologies have the potential to support more coordinated and participatory urban interventions. This research area, including a workshop on March 15, 2024, examines the potential uses of a digital twin of New York City — a virtual representation of the city informed by live data streams from multiple sources — to support climate change adaptation. This workshop brought together panels of public sector and private industry experts. The aim is to create an open computational platform for decision-makers in the public and private sectors, researchers, civil society, and the general public to better understand climate-related issues and evaluate potential responses.

Image credit: Cornell Mui Ho Center for Cities

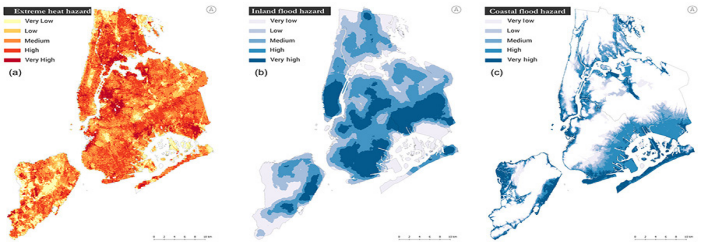


Image credit: Depietri, Dahal and McPhearson, 2018

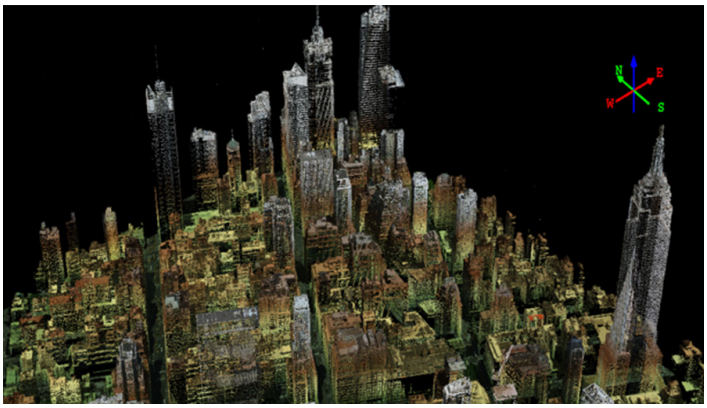


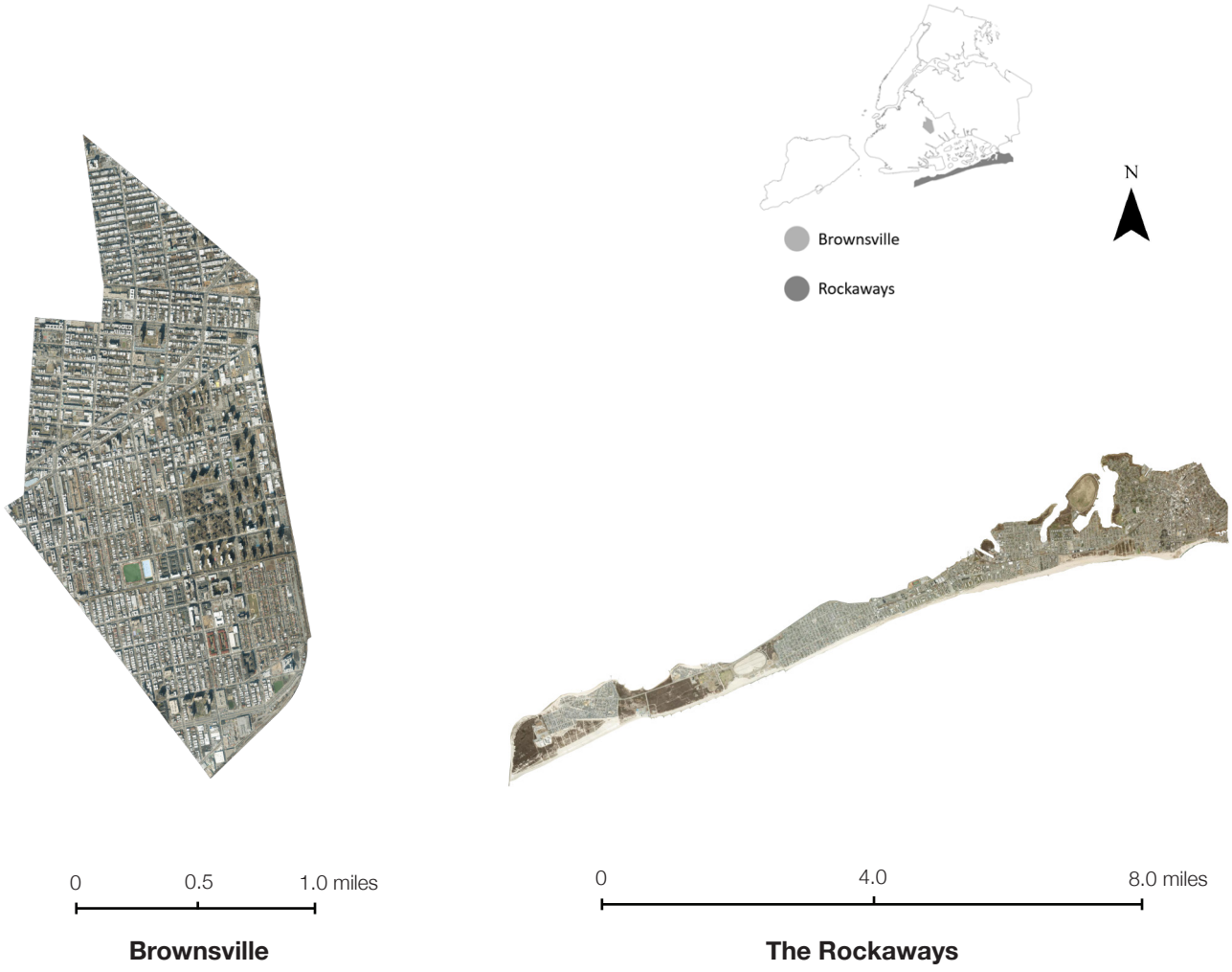
Image credit: Center for Analysis and Research of Spatial Information (CARSI Lab) at Hunter College – CUNY

WORKSHOP SUMMARY

The daylong "Climate Change Vulnerability and Community Capacity for Adaptation" workshop — held on February 15, 2024, at Cornell University's Gensler Family AAP NYC Center — was co-hosted by the CIVIC-UARC "research area two team" (RA2) and focused on understanding climate change vulnerabilities and capacities to respond to and adapt at the household and community level. The RA2 team is comprised of NYC-based civil society partners: the Rockaway Initiative for Sustainability & Equity (RISE) in the Far Rockaways and Universe City NYC in Brownsville, Brooklyn, as well as university-based researchers and researchers from the USDA Forest Service. The workshop brought together 65 participants, including 23 activists and residents from the Rockaways and Brownsville (Figure 1), as well as researchers and students, and six staff members from municipal agencies.

The civil society organizations represented at the workshop included: Brownsville Heritage House, Brownsville Partnership, Church Avenue Merchant Block Association (CAMBA), Church of God/Far Rockaway, COCG, Cypress Hills, Dr. Werled Groups: Delegates of The World Conference of Mayors – Environmental Committee, East New York Restoration, Edgemere Alliance, Far Rockaway Arverne Nonprofit Coalition (FRANC), Garden by the Bay, The Heart of Rockaway Civic Association, Horticultural Society of NY, Madhura Studios, NYC Plover Project, Power of the Pen WW Inc., The Real Edgemere, Redfern Houses Residential Council, RISE, The Rising Tide Effect, and Youth Design Center. The public-sector participants represented the following offices: NYC Mayor's Office of Climate and Environmental Justice and NYC Department of Parks and Recreation (NYC Parks).

Figure 1 - **Maps of Brownsville and the Rockaways Within the Larger Context of NYC**



PARTICIPATION AND RECRUITMENT

The research team recruited residents in Brownsville and the Rockaways through a variety of channels, including working with diverse civil society organizations and making presentations in their community mobilization meetings. The research team created fliers with information about the workshop which were shared via email and with various listservs. Finally, the research team consulted findings from the Stewardship Mapping and Assessment Project (STEW-MAP) to identify organizations to invite to the workshop. The following is a list of the workshop participants by stakeholder group (Table 1).

Table 1 - **Types of Workshop Stakeholders**

Sector	Participants
Community participants	23
Civil society	19
Public sector	3
Researchers	20
Total participants	**65**

Community members were informed that residents from Brownsville and the Rockaways who participated in the workshop would each receive a $112 participation payment to compensate them for their time and transportation expenses. Prior to the workshop, participants were informed via email that the workshop sessions would be recorded and the findings used for research purposes. Upon arrival to the workshop on February 15, every participant was informed of their rights as research participants, and verbal consent and signed photo release forms were obtained. The workshop focused on understanding each resident's Systems of Care and household and community vulnerabilities to climate change impacts, other environmental concerns, and socioeconomic factors.

In the first workshop session, participants drew diagrams depicting their networks of social and environmental care. In the second session, participants discussed a series of vulnerability maps of their communities and compared the maps with their lived experience. The third session examined the building blocks of a productive, trusting relationship between researchers and community members and identified common challenges and potential ways to balance differing objectives, timelines, and project expectations. Based on this discussion, participants and project team members jointly created a framework to nurture a sustained and meaningful partnership for all project members.

WORKSHOP PROGRAM

9:00 – 10:30 a.m. | Community and Project Introductions and Objectives of the Day

Introduction of Brownsville and Rockaways community members. Explanation and background on the purpose of the proposed Center on climate adaptation in New York City.

10:30 a.m. – 12:00 p.m. | Session 1: Community Capacity for Environmental Care

Discussion: What does community capacity to adapt to climate change mean? What are your networks for environmental care and climate change adaptation?

1:00 – 2:30 p.m. | Session 2: Household Vulnerability to Climate Change

Breakout groups: What does climate change vulnerability mean in your context? How do widely used vulnerability indices correspond to your lived experience? What is right, wrong, or missing?

2:30 – 3:30 p.m. | Session 3: Navigating Research and Community Partnerships

Panel: University-community relationships are notoriously difficult to navigate, given different needs, pressures, and expectations. This panel will discuss common challenges and potential approaches to these relationships.

3:45 – 4:00 p.m. | Summary, Next Steps, and Closing

SESSION 1: COMMUNITY CAPACITY FOR ENVIRONMENTAL CARE

EXERCISE FORMAT & DESCRIPTION

Session 1 used qualitative research methodologies to articulate an individual's System of Care. This approach centers a person's subjective understanding of who they work with to care for their communities, revealing connections between neighbors, surroundings, and the actions they take. These networks keep people connected through everyday relations and technologies, however intermittently (Chriswell and Huberts, 2023). As such, visualizing these networks and infrastructure can help identify the impacts of socioeconomic drivers of vulnerability and what communities are already doing to adapt to climate change, even when it's not called "climate adaptation."

Residents and representatives from civil society organizations in Brownsville and the Rockaways were invited to share their Systems of Care by hand-drawing diagrams depicting the key actors, institutions, resources, and relationships in their community (Photos 1 & 2). Through the exercise, we saw how long-term residents have multiple threads of connection both within and between neighborhoods, exemplifying how it is not solely the environmental circumstances that strengthen their ability to adapt to climate change.

Photo 1 - **Residents from Brownsville and the Rockaways diagram Systems of Care.**

Image credit: Marina Morgan

Photo 2 - **Examples of Systems of Care from residents of Brownsville and the Rockaways.**

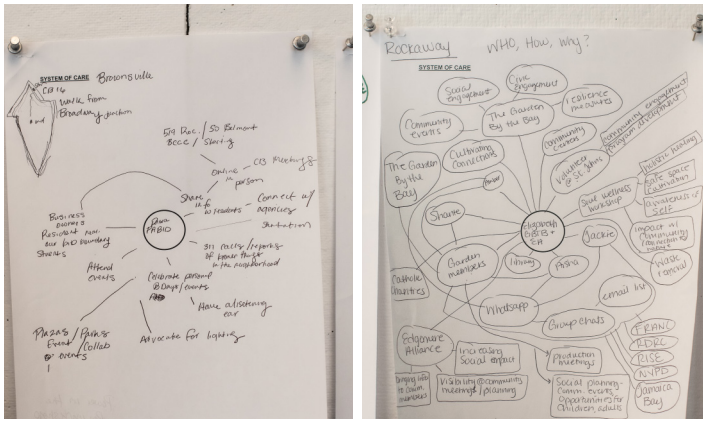


Image credit: Marina Morgan

KEY INSIGHTS

Participants from both communities described a wide variety of organizations, individuals, and agencies that act as barriers, motivations, and enabling conditions of care (Figure 2). They described neighbors, community-based organizations, and government agencies as the top three enabling conditions of care within their communities. Several major city agencies, such as NYC Parks, were frequently mentioned by participants as enabling conditions of care, alongside local community boards, councils, and tenant associations.

Figure 2 - **Barriers, Motivations, and Enabling Conditions of Systems of Care in Brownsville and the Rockaways**

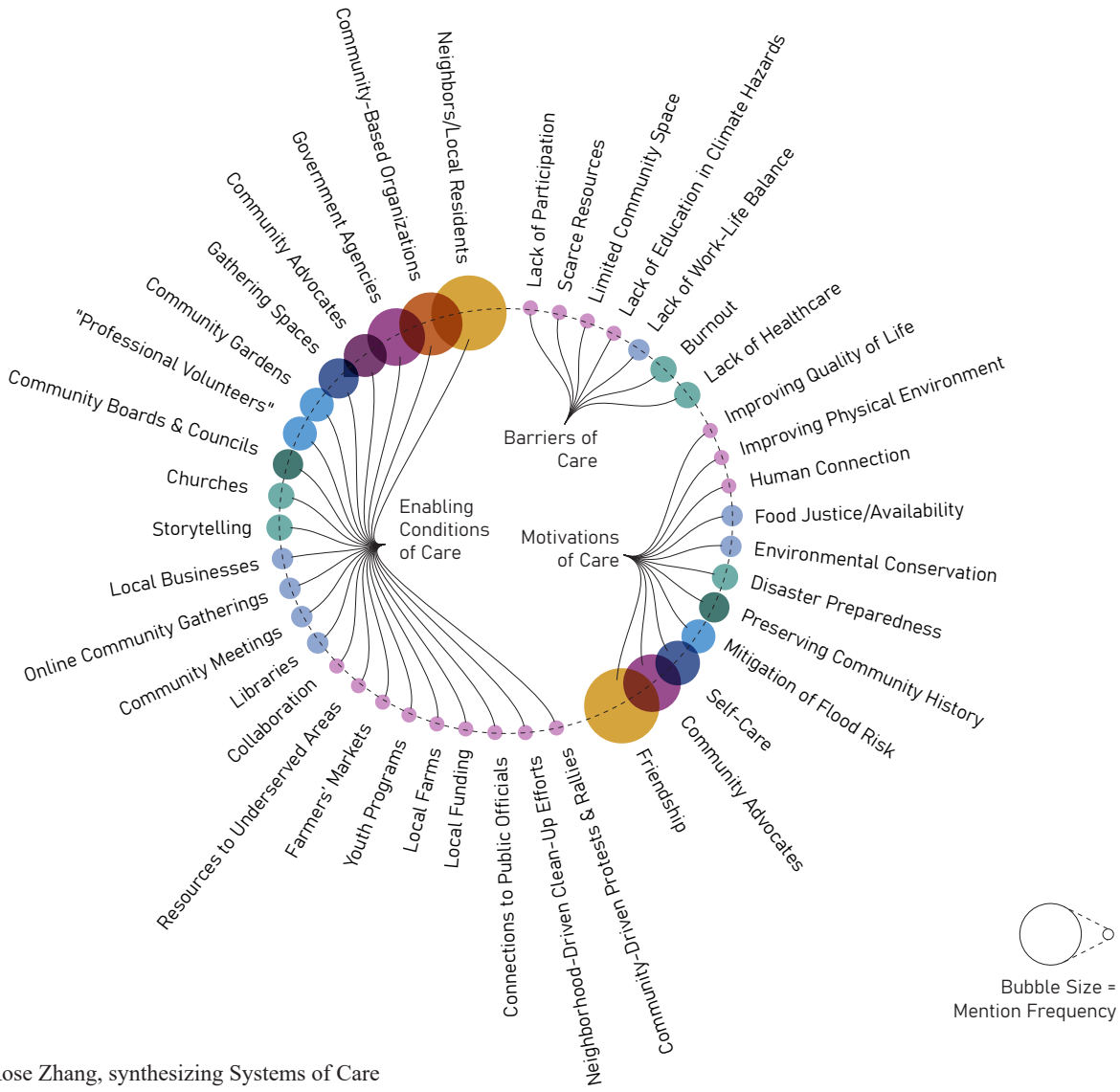


Image credit: Rose Zhang, synthesizing Systems of Care drawing elements provided by workshop participants.

In small group discussions, workshop participants also described the degree to which they care for one another—for friends, relatives, neighbors, and fellow community advocates—and the importance of interpersonal relationships and community ties in adapting to climate change. Several participants mentioned how these relationships fill the gaps in the services available in their neighborhood, noting differences between what they experienced in their neighborhoods and the level of services available elsewhere in the city. Community members stated, "We want things to be accessible in our community," and suggested that amplifying their neighbors' concerns and giving voice to the community as a whole were strategies to address gaps in services.

Participants also emphasized a desire to prepare for disasters, protect shorelines, mitigate flood risk, and altogether reduce negative environmental impacts on their communities. In addition, participants spoke about wanting to preserve their community's history through the use of community archives, libraries, writing sessions, and other forms of arts programming.

When asked about barriers to providing care, numerous participants raised concerns about burnout when it comes to caring for their community. One participant described themselves as a "professional volunteer" who cares for others but often faces difficulties in taking care of themselves. Participants noted that there are insufficient resources (primarily financial) to facilitate community-based work. One community member stated that information dissemination between government and the community is often slow, making it difficult to know what is happening in the community, even during time-sensitive incidents such as extreme weather events.

Perceived and/or experienced differences between Brownsville, the Rockaways, and neighboring communities were also cited as challenges to equitable community development. Participants from the Rockaways noted large socioeconomic differences between the two halves of the peninsula, and their perception that the eastern half of the peninsula historically received less funding and resources than the western half. Similar concerns were raised by Brownsville residents about local disparities due to gentrification in nearby neighborhoods, but participants also noted the significance of history and culture in Brownsville that are embedded in community spaces such as the Brownsville Heritage House, Betsy Head Park, and the many community green spaces.

AREAS FOR FURTHER RESEARCH

Session 1 prompted community members to visually depict their Systems of Care and discuss how they are connected to people and organizations both within and beyond their neighborhoods. The open explanation of Systems of Care by the research team and thus the open interpretation by the workshop participants aimed to articulate the everyday relationships that community members rely on to take care of each other. These relations did not always explicitly address adaptation to climate change hazards and risks such as flooding, extreme heat, and poor air quality.

A next step in better comprehending the neighborhood Systems of Care would entail explicitly connecting these first depictions to environmental stewardship, climate change adaptation (in both the short and long term), and how these systems might (or might not) be activated in a time of climate emergency.

The Systems of Care depicted also are greatly enhanced by the narratives that participants gave the visuals to enliven them. However, these narratives could not be fully captured in this workshop. Future iterations of the exercise could gather the narratives as well as the drawings and prompt sharing about the characteristics of the relationships (i.e., strength of the relationships, relationships based on expectations of reciprocity, identity, or trust).

Future work could include creating an aggregate System of Care for a community or a neighborhood. This expansion of the exercise would require more time for people to take their individual drawings and find the overlapping nodes (or individuals, organizations, and elements) and those that are only present for some individuals. With more time, community members could also include more organizations and individuals that they know about but do not directly work with. An aggregate depiction could lead to more actionable discussions around power and inequity.

Finally, expanding the exercise into discussing power and inequity would give way to a deeper understanding of community vulnerabilities and capacities. Analysis of the narratives with visual depictions and more information about scales of social organization can provide insight into the impact of socioeconomic, demographic, and background characteristics of the individuals creating the Systems of Care and the relationships they have for dealing with crises (Henig and Knight, 2023).

Questions that could influence Systems of Care are: How long have they lived in their community? What do they consider to be parts of their "self" and their "community"? How is this influenced by their culture? Where do they work and spend most of their time? What are their mobility patterns? The research team will continue to refine methods for capturing information about individual and community Systems of Care, particularly as they relate to climate change hazards, risks, and vulnerabilities as well as capacities to adapt and plan for the future.

A next step in better comprehending the neighborhood Systems of Care would entail explicitly connecting these first depictions to environmental stewardship, climate change adaptation, and how these systems might (or might not) be activated in a time of climate emergency.

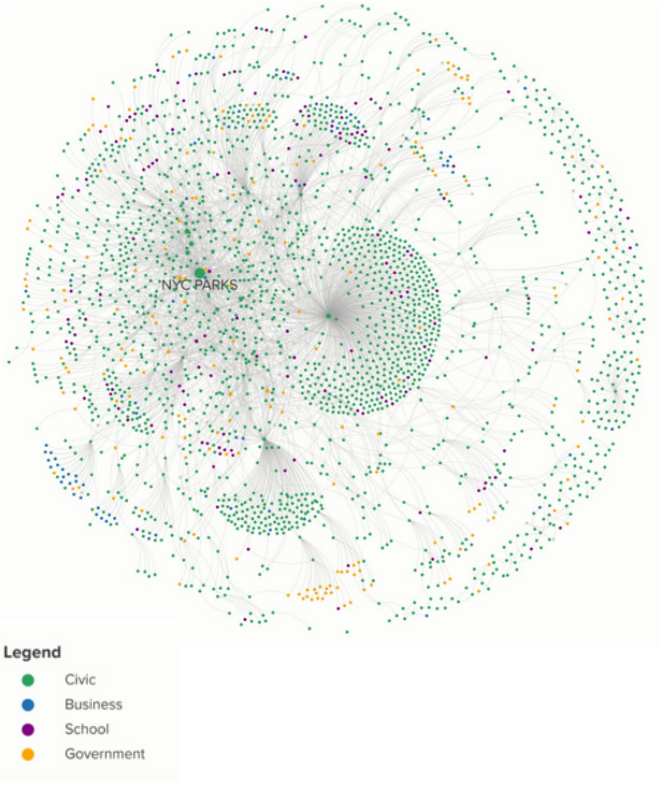
EXPLANATION OF THE STEWARDSHIP MAPPING PROJECT (STEW-MAP)

Following the Systems of Care mapping exercise, project team members from the USDA Forest Service (USFS) provided information about STEW-MAP, a citywide database of civic stewardship groups managed by the USFS that shows where each organization works and provides measures of stewardship capacity for each organization, such as staffing and network links. Stewardship groups include not only environmental groups but also a wide range of civic groups focused on youth, social services, housing, and seniors that engage in acts of environmental caretaking. The STEW-MAP data, collected in 2007 and 2017, includes group-level capacity measures that can be summarized and aggregated by census block and neighborhood.

Participants were shown a snapshot of what these networks look like across the whole of NYC (Figure 3).

The USFS team also provided an example of the stewardship network for RISE in the Rockaways (Figure 4). In the future, the USFS may conduct another round of the survey citywide and add specific questions to assess knowledge about civic capacities to address climate change hazards (i.e., flooding, extreme heat, and air quality).

Figure 3 - **Environmental Stewardship Map for All of NYC in 2017**



Note: Every dot represents a stewardship group connected to a broader web of community stewards across NYC. Data were created from a survey (Landau et al. 2019).

Figure 4 - **RISE's Environmental Stewardship Network in 2017 (image from STEW-MAP 2017)**

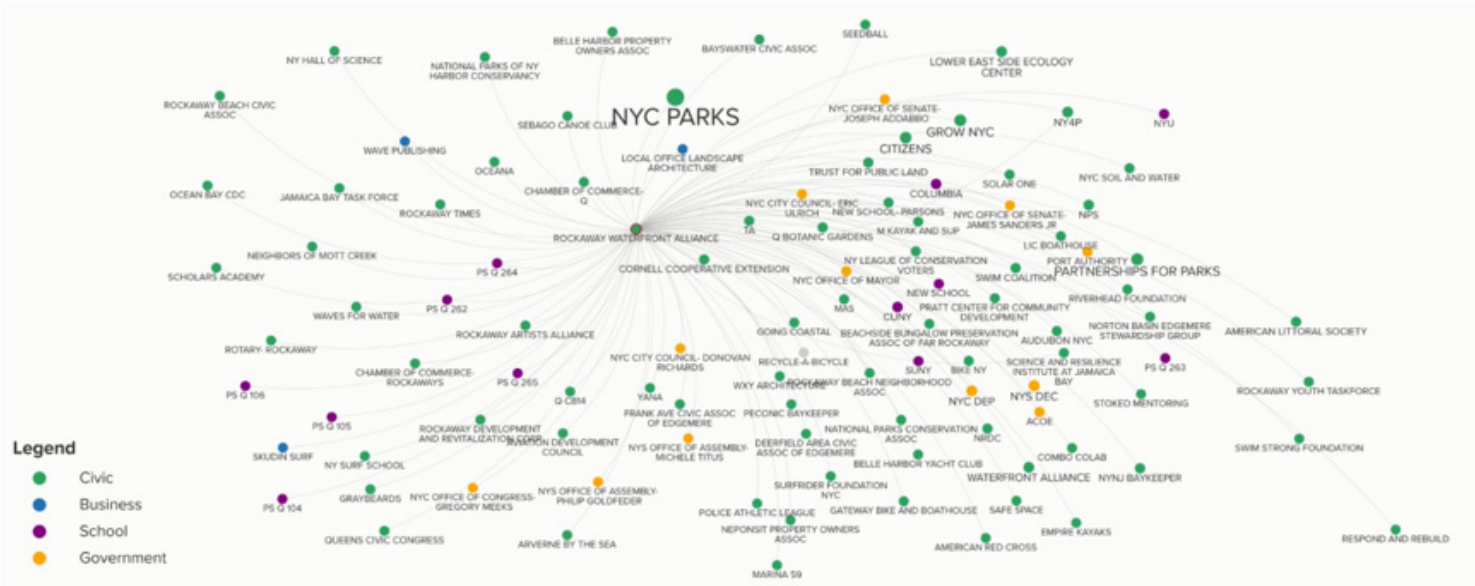


Image credit for Figure 3 and 4: U.S. Forest Service

SESSION 2: HOUSEHOLD AND COMMUNITY VULNERABILITY TO CLIMATE CHANGE

Vulnerability indices are used widely to measure the susceptibility of different populations to climate change hazards. They can assist public sector officials to determine how to distribute resources and can provide information to better inform city planning and urban policy decisions. However, there are limitations to the usefulness of these indices. Because vulnerability indices typically rely on socioeconomic and demographic data and are aggregated, they may obscure heterogeneity and complex community dynamics within a neighborhood. In addition, there is little evidence that these indices incorporate qualitative, community-based feedback to validate their construction. Given this, the project team wanted to discern to what extent and in what ways the vulnerability maps accurately represent or misrepresent the lived experience of residents from Brownsville and the Rockaways.

Prior to the workshop, the research team gathered and mapped various vulnerability indices in Brownsville and the Rockaways. The team shared maps representing five vulnerability indices during the workshop (Table 2). These maps of the vulnerability data, along with a set of prompts, were used to stimulate a discussion with workshop participants about the degree to which these indices correspond to their lived experiences with climate change impacts in their communities.

Table 2 - **The Five Vulnerability Indices Evaluated During the Workshop**

INDEX	INDICATORS	DATA SOURCES
Social Vulnerability Index (16 factors, equally weighted)	1 racial/ethnic minority status 5 household characteristics 5 housing type & transportation 5 socioeconomic status	American Community Survey
Heat Vulnerability Index (5 factors, equally weighted)	1 access to green space measure 1 daytime summer surface temperature 1 median household income 1 percent of households with air conditioning 1 percent of residents who are Black or Latinx	American Community Survey, NYC Department of Health and Mental Hygiene; NCY Office of Information Technology; LiDar, U.S. Census, ECOSSTRESS thermal imaging, NASA, U.S. Census Housing and Vacancy Survey
Flood Susceptibility to Harm Recovery Index (12 factors, aggregated with geometric averaging)	1 homeownership 1 race/ethnicity 2 age 2 disability 2 social isolation 4 income	U.S. Decennial Census, American Community Survey (McPhearson et al., 2024)
Air Quality Data (6 factors)	1 black carbon 1 fine particulate matter (PM2.5) 1 nitric oxide (NO) 1 nitrogen dioxide (NO2) 1 summer average for ozone (O3) 1 winter average for sulfur dioxide (SO3)	NYC Department of Health and Mental Hygiene
Environmental Justice Index (36 factors, equally weighted)	1 racial/ethnic minority status 1 water pollutant 2 housing type 3 built environment 3 transportation 4 air pollution 4 household characteristic 5 chronic disease burden 6 potentially hazardous and toxic site 7 socioeconomic status	American Community Survey, Centers for Disease Control and Prevention PLACES Data, EPA Watershed Index, TomTom MultiNet Enterprise Dataset, U.S. Mine Safety and Health Administration Mine Data Retrieval System, EPA National Air Toxics Assessment, EPA Air Quality System, U.S. Census Bureau

EXERCISE FORMAT & DESCRIPTION

This exercise involved researchers from the CIVIC-UARC team leading breakout discussions with small groups of community residents from Brownsville and the Rockaways. The objective was to elicit community responses to the vulnerability results of the five indices listed in Table 2.

The exercise began with a discussion informed by the following questions:

- What do you love about your community?
- When someone says climate change, what do you think of?
- Are there climate change hazards in Brownsville and the Rockaways? How would you describe them?
- Are there climate change hazards that you have experienced personally?
- Which climate change hazards are you most concerned about and why?
- When someone says community vulnerability to climate change, what do you think of?
- Do you feel that households in your community are vulnerable to climate change?
- What are the main sources of climate change vulnerability in your community?
- Do you personally feel vulnerable to climate change?

The participants then were asked a series of questions specifically tailored to the vulnerability maps of their communities.

The breakout group moderators asked the following questions to guide the discussion:

- When someone says [social/heat/flood] vulnerability, what do you think of?
- Does this map align with how you experience [social/heat/flood] vulnerability in your community?
- This map indicates that [Brownsville/the Rockaways] has a [high/low] level of social vulnerability. Do you agree? Disagree? Why? What is driving this?
- What is missing from this map?
- What else is important when thinking about social vulnerability?

The discussion and reporting of key insights in the following sections is organized according to the vulnerability indices that were analyzed.

KEY INSIGHTS

The exercise elicited different responses from the participants based on communities where they lived, highlighting the importance of local knowledge and perceptions of vulnerability when assessing community vulnerability. While residents largely agreed their neighborhoods have critical locations of vulnerability, the consensus was the indices do not always incorporate sufficient information at a fine enough scale to represent the lived experience in their communities. In addition, residents noted the historic and structural inequities that significantly influence current vulnerabilities, as well as the many ongoing initiatives in each community to increase community capacity and resilience.

Photo 3 - **Residents from Brownsville and the Rockaways discuss vulnerability indices in their communities.**

Image credit: Marina Morgan

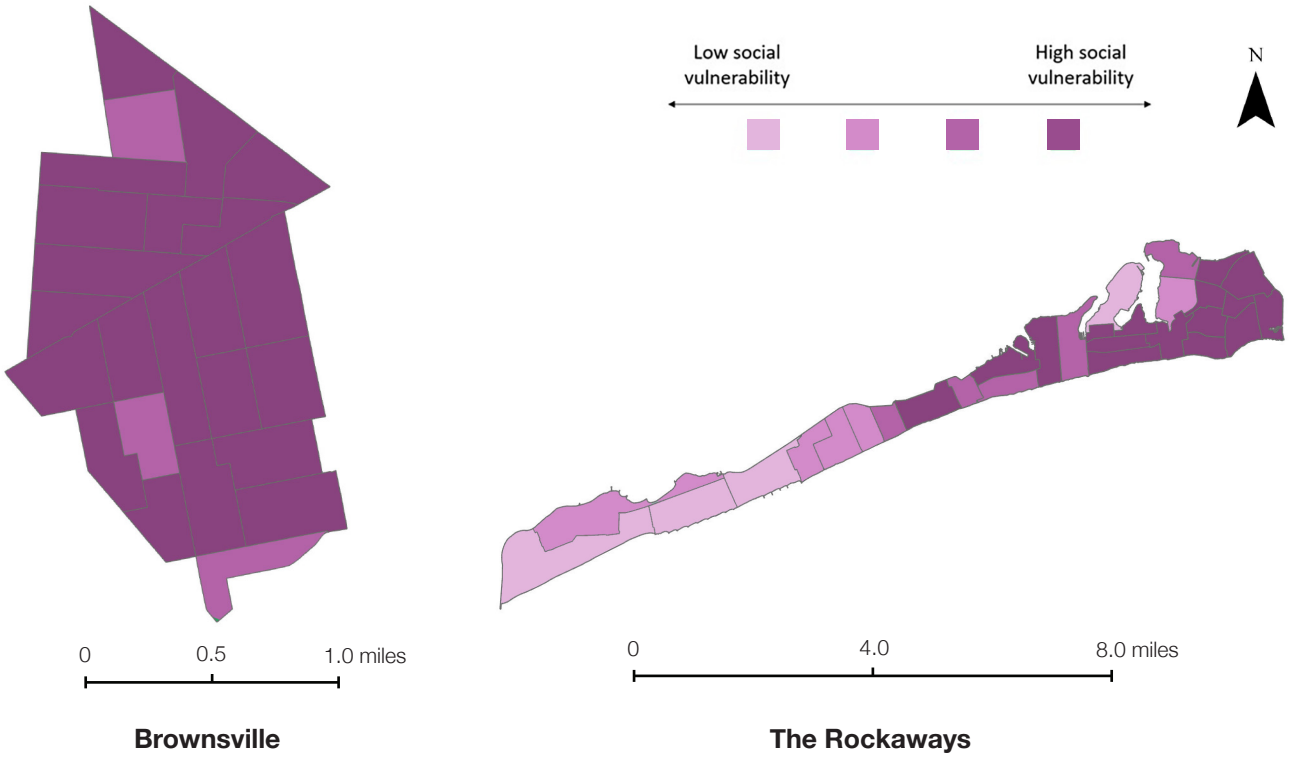
Social Vulnerability

Participants from Brownsville were critical of the Centers for Disease Control (CDC)'s Social Vulnerability Index (SVI) for their community, which classifies almost all of the neighborhood as having "very high" vulnerability (Figure 5). They said the data were not granular enough to accurately capture the nuances of the neighborhood. One person noted that the SVI relies on U.S. census data and said the index may reflect biases in census data collection practices. When asked what they felt was missing from the index, community members cited indicators such as access to public transportation, vehicle ownership, traffic measurements, and proximity to schools and hospitals. This feedback highlights the critical importance of incorporating community participation to understand the specific nature of and dynamics of social vulnerability locally.

In contrast, community members from the Rockaways broadly agreed with how the SVI assessed social vulnerability in their community (Figure 5), with generally high vulnerability on the eastern half of the peninsula and low or very low vulnerability on the western half of the peninsula. Rockaway participants described a "dividing line" corresponding to the 116th Street A Train, aligning with the geographic, social, racial, and economic differences between the two sides of the peninsula. One person did note that the scale of the maps might obscure the presence of highly vulnerable individuals in some areas. Community members suggested additional indicators, such as housing type, which can vary greatly on the peninsula, could more comprehensively assess social vulnerability.

Respondents in both communities agreed that the history of their respective neighborhoods contributed to the different degrees of social vulnerability represented by the indices. One participant from the Rockaways said that the fact that the peninsula has large socioeconomic divisions between west and east was not an accident, but because the peninsula "was built that way [intentionally]." The project team assumes this statement references the historical inequalities on the peninsula, including the spatial distribution of single family homes on the west side and public housing on the east side of the peninsula. Similarly, a participant from Brownsville described strikes and service restrictions in the 1970s that first caused "discord" in the neighborhood, followed by hospital closures and the introduction of public housing projects, all of which contributed to the present levels of social vulnerability.

Figure 5 - **Social Vulnerability Index Scores for Brownsville and the Rockaways**



Heat Vulnerability

The NYC Department of Health and Mental Hygiene (DOH)'s Heat Vulnerability Index (HVI) shows all of Brownsville as highly vulnerable to heat exposure. It also shows the eastern Rockaways and portions of the western side of the Rockaways as highly vulnerable, while the remainder of the peninsula is represented as having low heat vulnerability (Figure 6).

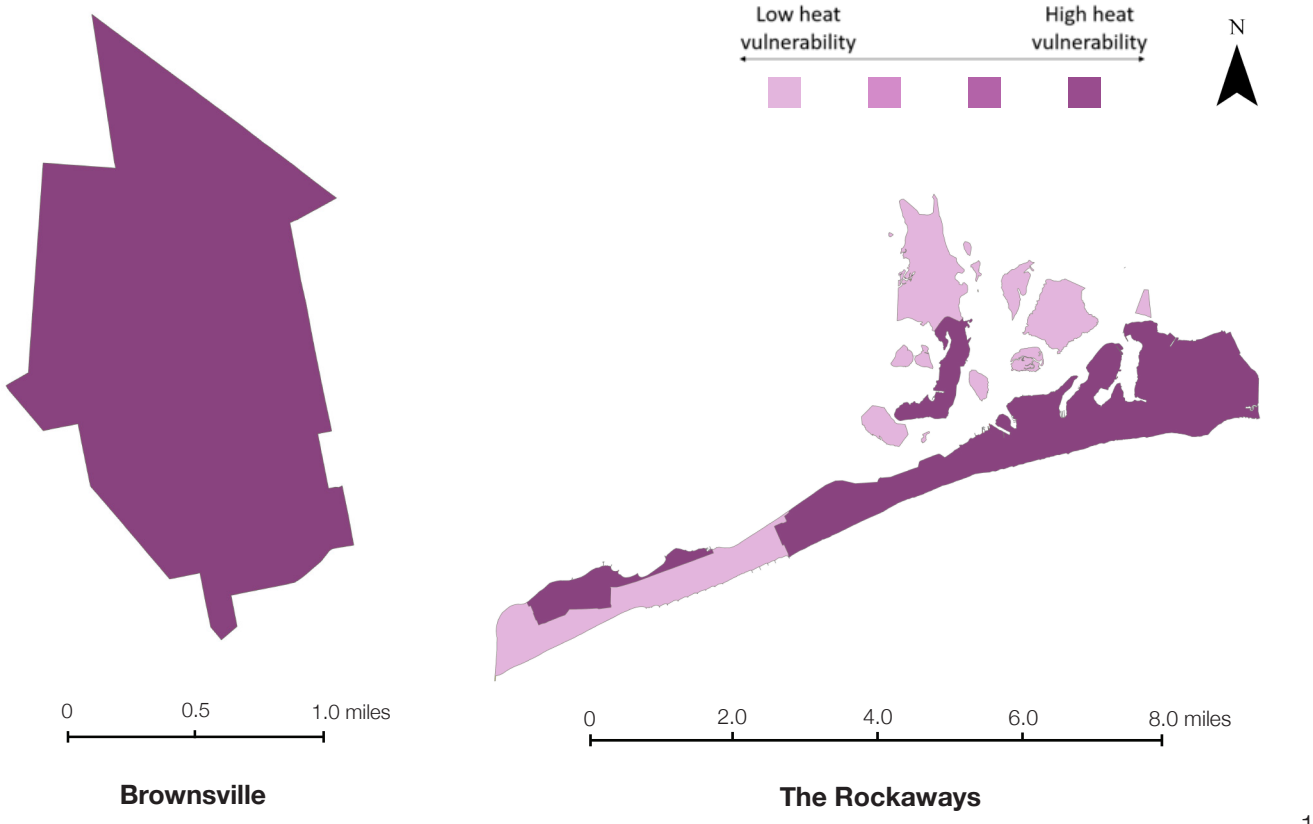
Some residents from Brownsville spoke about difficulties in using environmental features to decrease heat risk in their neighborhood. For example, they noted that trees cannot be planted on elevated train stations to offer a means of cooling—though the tracks themselves offered some shade on the street below. They also said that under past city administrations, trees were destroyed, and it became more difficult to grow new ones.

Rockaway residents described the prevalence of parks across the peninsula. However, residents emphasized that a number of these wetland and shoreline sites (i.e., Dubos Point) are underdeveloped or inaccessible (i.e., the beach being closed to public access to protect the nesting ground of the piping plover).

Brownsville residents also described difficulties accessing public facilities that would offer relief on hot days. There are three pools in Brownsville, but the cost to swim is unaffordable for some residents. Importantly, respondents noted that a lack of access to pools reduced residents' knowledge of water safety and their ability to swim, which makes this important heat mitigation resource unsafe for some residents.

Responding to the heat vulnerability map and the indicators used to create the maps, residents from the Rockaways questioned how the NYC DOH gathered data about individual air conditioning unit ownership in their neighborhood, which workshop participants agreed is a critical variable when assessing heat vulnerability. Rockaway residents agreed with the spatial differentiation of risk across the peninsula, but they generally perceived the risk as lower than the HVI suggested. The water, ocean breeze, and shoreline make it "feel cooler in Rockaway," they said, though they noted that certain populations, such as older adults, may be unable to benefit from this proximity to the coast.

Figure 6 - **Heat Vulnerability Index Scores for Brownsville and the Rockaways**



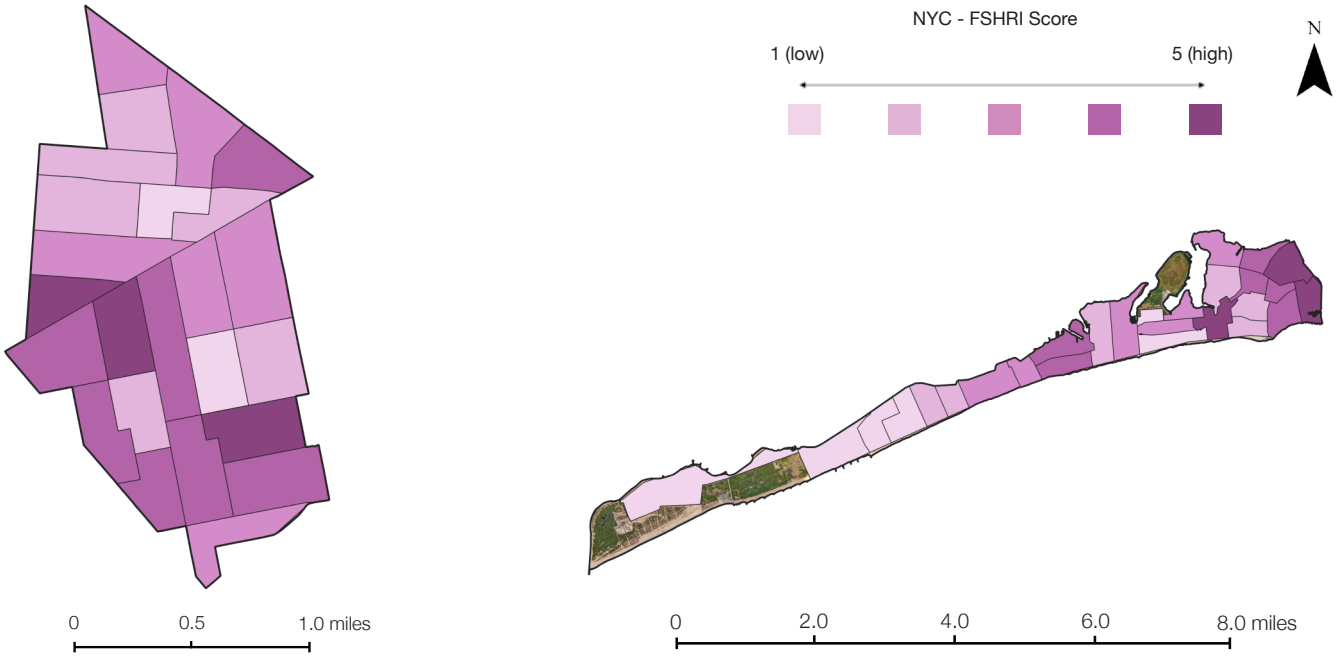
Flooding Vulnerability

The participants in both communities were shown the new flood susceptibility to harm recovery index map (Figure 7). Residents of Edgemere in the Rockaways stated that "Edgemere looks okay on this map — but it always floods, why?" In Brownsville, the participants noted the extreme differences in scores even within the neighborhood, in which a high scoring area of the neighborhood was adjacent to a low scoring area.

The project team and participants had difficulty explaining the variation in social vulnerability to flooding within the Brownsville map.

Flooding is less of a concern for Brownsville residents. However, residents in both communities associated flooding with more frequent and extreme precipitation events. Overall, individuals in both communities perceive an increase in rain intensity. And as with multiple climate change impacts, residents made it clear that the effects are not distributed equally among the whole of NYC. People in poor housing, the unhoused, the elderly, mobility-impaired residents, and immigrants are all negatively impacted by increasing rain intensity and have a higher flood risk.

Figure 7 - **Social Vulnerability To Flood Susceptibility Index Scores for Brownsville and the Rockaways**



Brownsville **The Rockaways**

During the discussion about flood vulnerability, it was clear that participants from the Rockaways feel very threatened by this hazard. For this community, climate change is synonymous with flooding. Statements such as "streets that never used to flood now flood," and "the water comes into Broad Channel nearly all the way to my house," and "you can see it on the A train: the water is rising" were commonplace. In addition, it was clear that the impact of Hurricane Sandy was still very fresh for these residents, 14 years later. Participants offered recollections of how Hurricane Sandy affected them and their neighbors: "Our old neighbor, their house in Sandy shifted off the foundation"; "I lost everything during Sandy." They described their dreams where water from both sides of the peninsula met in the middle.

Community-based Systems of Care were of obvious importance as coping mechanisms during periods of flooding. Residents discussed the importance of knowing which areas of the neighborhood were on higher ground during flood events and highlighted informal agreements between neighbors to be a "rescue spot" for community members needing assistance. As at many other points during the day, the community participants expressed a perceived lack of communication coming from city government about emergency management and preparedness. They shared that they did not know of any evacuation routes, disaster plans, or other contingencies in the event of an emergency, and highlighted this lack of preparedness as a source of frustration and as a factor contributing to a lack of trust in city government.

Air Quality

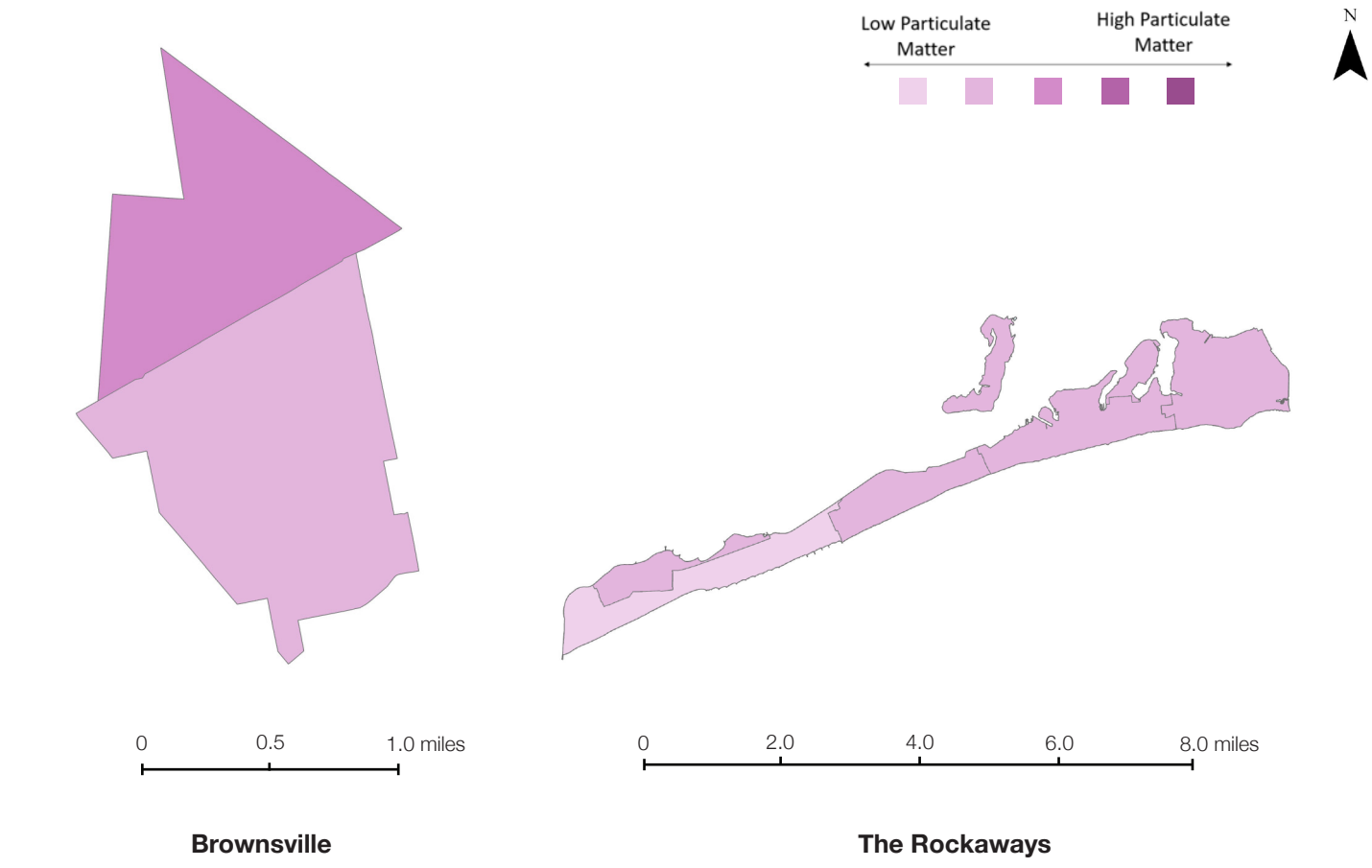
Because of the length of the discussion of the previous maps, the residents from Brownsville did not discuss the air quality data from the NYC DOH in detail. However, in another air quality discussion, municipal experts and residents of Brownsville highlighted the degraded air quality in Brownsville and the role "peaker plants" play in contributing to poor air quality in various parts of the city.

Rockaways participants generally agreed with the maps of air quality that showed the entire area was at low risk for PM2.5 pollution (Figure 8). However, participants noted the presence of recycling and other industrial plants either within or adjacent to the peninsula as sources of air pollution. JFK Airport was also speculated to be a source of both air and water pollution. Participants noted that the map did not capture how they perceived a difference in air quality between the bay side and the ocean side of the peninsula, and disagreed among themselves on whether air quality has improved in the past decades. Rockaway residents, however, did agree that air quality is worse in other areas of the city.

Photo 4 - **Workshop participants discuss air quality in their neighborhood.**

Image credit: Marina Morgan

Figure 8 - **Air Quality (PM2.5) Vulnerability Index Scores for Brownsville and the Rockaways**



Environmental Justice

Brownsville residents generally agreed with the findings of the Environmental Justice Index (Figure 9), but noted it is a complicated issue. Legislative change is difficult, they noted, and there is a general sense of hopelessness that results in low community engagement and fragmentation. Many workshop participants noted that studies are done in communities like Brownsville and the Rockaways, but little to no action results from them. One participant also cited a lack of funding for environmental improvement projects, the process of which is often complicated and intimidating for smaller groups. Participants emphasized how these problems were multigenerational, and how government inaction persists despite successive projects led by academics.

Rockaway residents noted that numerous environmental injustices such as poor sanitation, a lack of clean air, and access to common green space are present within their neighborhood but not others. As one resident summarized, "[residents in the] Rockaways always feel that they're forgotten [and are] used to just always be[ing] the dumping ground for everything."

Expanding on this point, residents of the far Rockaways (the eastern side of the peninsula) described how the identification of an endangered bird's nesting site had restricted resident access to the beach for more than 23 years in order to protect nesting habitat, and how they found it unbelievable that the bird did not also nest several miles away in the western Rockaways, whose residents do not have the same beach access restrictions. They described having to travel to the western Rockaways and get "dropped off" to access a public beach.

Residents of the Rockaways noted environmental injustices such as poor sanitation, a lack of clean air, and access to green space. They described how the piping plover's nesting site had restricted their beach access for more than 23 years, and how they found it unbelievable that this species did not also need to nest several miles away in the western Rockaways, where residents continued to have beach access.

Figure 9 - **Environmental Justice Scores for Brownsville and the Rockaways**

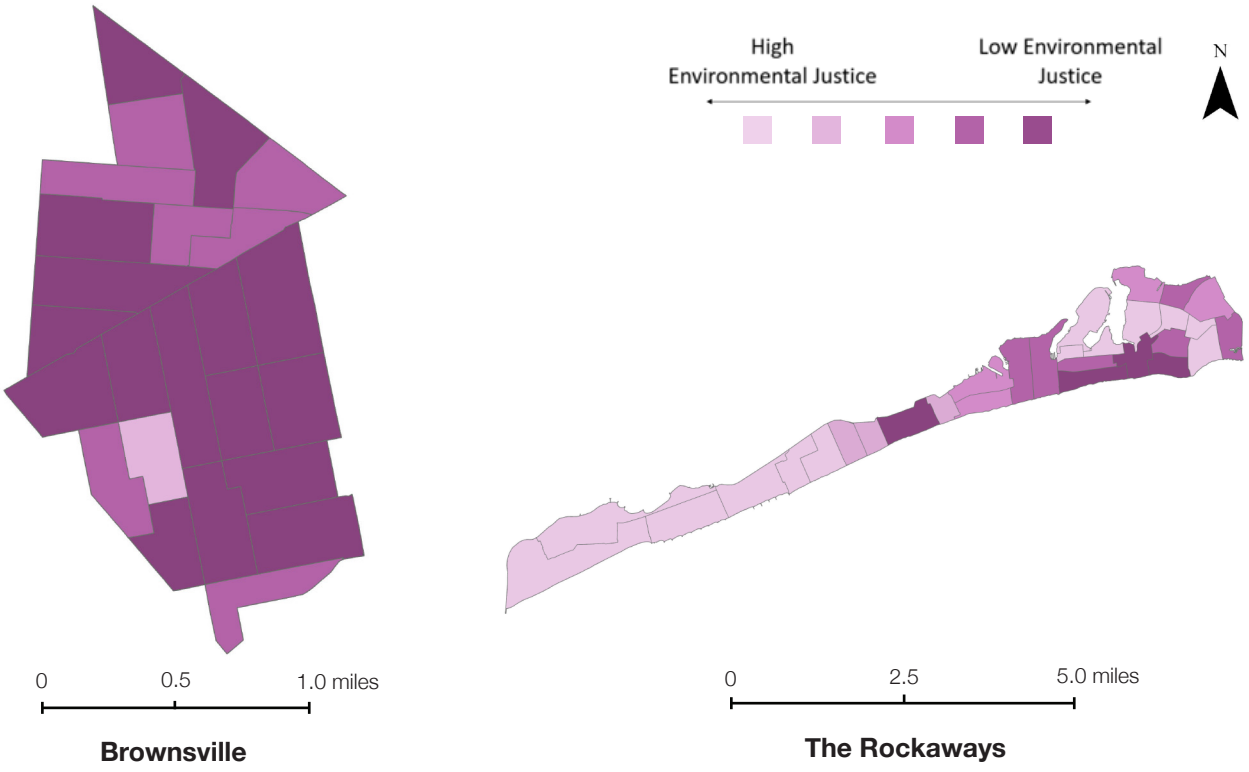


Figure 10 - **Sources of Vulnerability in Brownsville and the Rockaways**

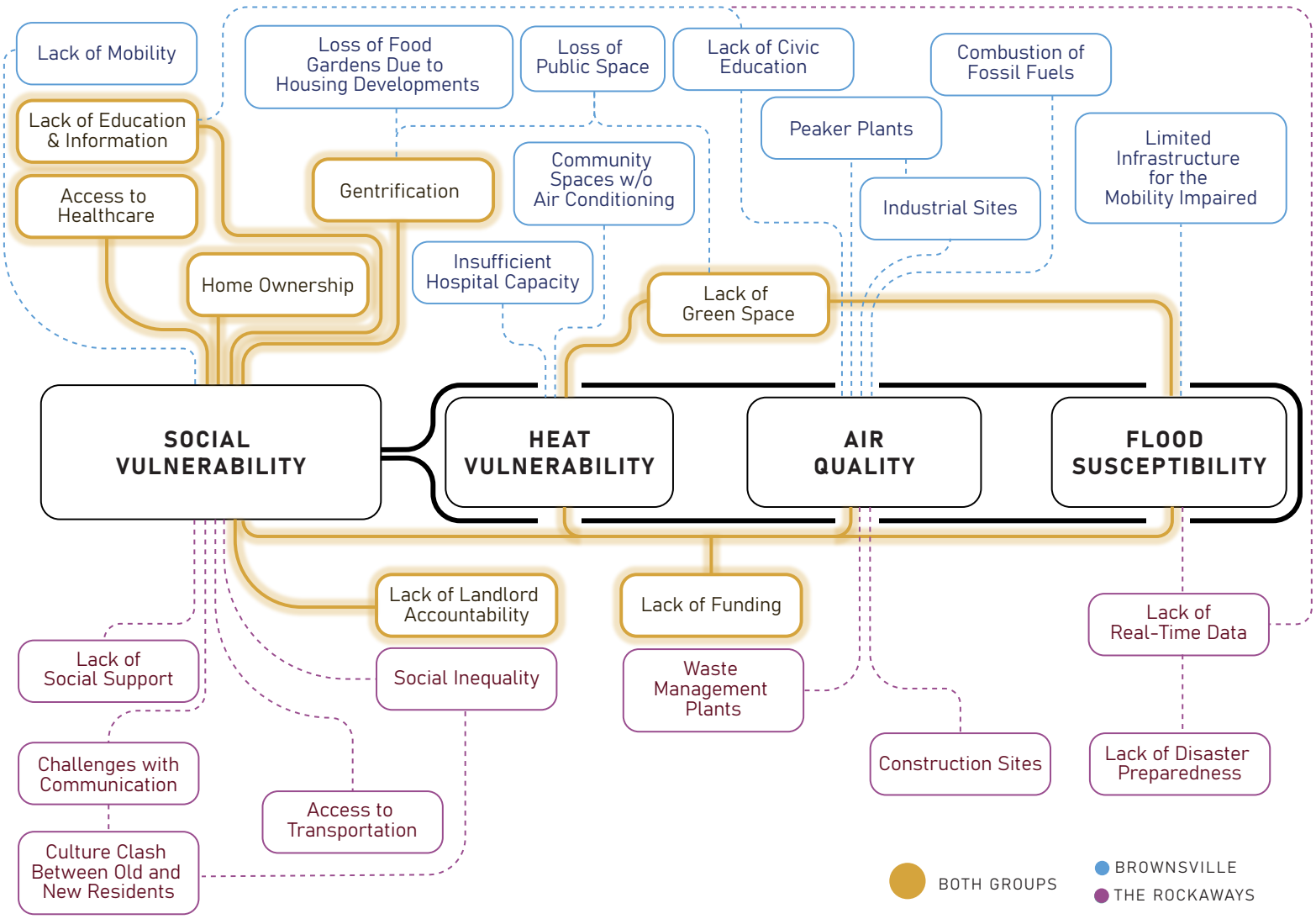


Image credit: Rose Zhang

Overall, the session provided the research team with a clearer understanding of how individuals in these communities experience various forms of vulnerability (Figure 10).

The session culminated with brainstorming about solutions to address the levels of vulnerability depicted by the indices. Residents emphasized the need for more community input in policy and planning, such as through workshops or grassroots messaging campaigns. They also stressed the need to have developers, funders, and policymakers in the same room with residents so the needs of residents could be heard and to have their needs and concerns addressed. Some participants emphasized the importance of infrastructure and service solutions. Some said they want to stop development, while others said it is critical to invest in infrastructure projects such as sewers and transportation systems.

Residents emphasized the need for more community input in policy and planning...[and] stressed the need to have developers, funders, and policymakers in the same room with residents.

AREAS FOR FURTHER RESEARCH

While indices may measure vulnerability to current climate change hazards, additional exploration is needed to understand fully how individual, household, and community vulnerability to climate change manifests and is experienced locally. As described by the workshop participants, these indices can often mask complex and nuanced community dynamics (i.e., socioeconomic dynamics, how people interact with their built environment and urban infrastructure systems, how policies and regulations affect communities) and how climate change hazards affect people's lives at various scales.

Vulnerability indices can point public officials, city planners, and policymakers to areas of the city with high or low vulnerability. However, the workshop findings reveal the importance of "ground-truthing" these indices and other publicly available sociodemographic, economic, and climate change-related data with community members and highlighted the limitations of using vulnerability indices to understand local, neighborhood-level conditions and dynamics. Future research in this area should continue to engage residents, households, and civil society representatives to address the gap between locally perceived vulnerabilities and conclusions reached when relying on large, aggregate datasets.

It also would be helpful to have had more structured socioeconomic, demographic, and background information about workshop participants. For example, how long have they lived in their community? Did they own or rent their home? What were their levels of individual experience with climate change hazards (i.e., have they lived through or experienced extreme weather events such as Hurricane Sandy)?

Across the three workshops, the CIVIC-UARC project team observed differences in the perceptions of municipal actors and community members regarding the level of activity and commitment to address climate change issues in NYC. Municipal experts participating in the workshops presented on the scope of work and levels of investment being made to prepare the city for climate change impacts. However, many community members felt abandoned, ignored, and marginalized by the government. The reasons for these divergent perceptions warrant further investigation and could help shape the direction of CIVIC-UARC's work moving forward.

Photo 5 - **Participants discuss community vulnerability and potential actions to address concerns.**

Image credit: Marina Morgan

SESSION 3: NAVIGATING RESEARCH AND COMMUNITY PARTNERSHIPS

EXERCISE FORMAT & DESCRIPTION

Research-community relationships are notoriously difficult to navigate, given the various stakeholders' different needs, pressures, and expectations. The purpose of this session was to start the conversation about what participants had learned from past experience, common challenges, and discuss potential approaches to improving research-community relationships and partnerships. This part of the workshop consisted of a panel, small-group discussions, and sharing with the larger group.

The session was led by Lindsay K. Campbell (research social scientist, USFS), Jeanne Dupont (founder and executive director, RISE, the Rockaways), George Del Barrio (creative director and executive producer, Universe City NYC, Brownsville). This session was moderated by Elizabeth Cook (assistant professor of environmental science, Barnard University).

In this session, each of the panelists shared past experiences with research-civil society-community engagements; what worked well and what was challenging; and their principles for engagement. Each panelist also shared their hopes for engaged work in the future.

In small groups, community residents and researchers discussed their experiences and developed lists of principles and aspirations to guide the relationships between the researchers and community members of CIVIC-UARC. These groups then shared their principles with the larger group and their collective reflections were captured in a revised framework and set of principles to guide community-researcher collaborations.

AREAS FOR FUTURE WORK

Our future work will aim to thoughtfully implement the agreed-upon principles as we continue ongoing collaborations with RISE, Universe City NYC, and other community partners.

Revised Community-Researcher Agreed Principles

- Mutual respect
- Base relationships on collaboration
- Coordinate; have a vision
- Work toward positive, tangible change, with realistic goals
- Acknowledge mistakes
- Hold meetings in community spaces
- Practice active listening and capturing lived experiences and stories; pay attention to language
- Integrate real-time data and open, accessible sharing of data and information
- Offer compensation in exchange for participation and knowledge sharing
- Reinvest in neighborhoods with educational programming
- Bring in additional partners (e.g., U.S. Army Corps of Engineers)
- Deliver on results, establish regular communication updates, community connections
- Share credit
- Translate information and stories for different needs/ audiences

KEY INSIGHTS

The principles co-developed by community partners, civic partners, and research partners are merely a starting point. The principles and framework will evolve and mature as the project grows and the consortium continues to learn from one another and coproduce new knowledge. Key principles include ensuring mutual respect, active listening, and prioritizing the community needs from the start, as well as sharing credit in the work, and delivering on and translating outputs for diverse audiences. Overall, the team agreed that it remains challenging to navigate among the various drivers and constraints for different partners. For example, when researchers are motivated to support communities, they often face institutional mandates that are not supportive and a lack of resources for implementation. On the other hand, civil society organizations stress the urgency for change on the ground and the need to tangibly improve people's lives.

NEXT STEPS

This workshop is one step in the foundation of the new Civic-Led Urban Adaptation Research Center.
Below are next steps in the preparation process:

- Share the workshop report with the workshop participants and incorporate community stakeholder feedback.

» Use what was learned in the workshop to guide the next phase of the proposal preparation, which includes examining public sector investment in climate change adaptation.
» Prepare a peer-reviewed journal article submission about the strengths and limitations of using vulnerability indices and capacity measures in urban planning and public policy.
» Continue to build the relationship with our civil society partners and expand our network of partners to other geographies in New York City.
» Develop a theory of change that will inform the new Civic-Led Urban Adaptation Research Center.

We also will consult the key insights from the two other research workshops and continue to advance and refine our ideas in consultation with the two other research areas.

REFERENCES

Chriswell, K., Huberts, A. (2023). "Collective Action Infrastructure: The Downstream Effects of Urban Neighborhood Organizing." Comparative Political Studies, 00104140231193018. https://doi.org/10.1177/00104140231193018.

Henig, D., Knight, D. M. (2023). "Polycrisis: Prompts for an Emerging Worldview." Anthropology Today 39 (2): 3–6. https://doi.org/10.1111/1467-8322.12793.

Landau, L., Campbell, L K., Johnson, M., Svendsen, E., Berman, H. (2019). "STEW-MAP in the New York City Region: Survey Results of the Stewardship Mapping and Assessment Project." NRS-GTR-189. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. https://doi.org/10.2737/NRS-GTR-189.

McPhearson, T., Towers, J., Balk, D., Horton, R., Madajewicz, M., Montalto, F., Neidell, M., Orton, P., Rosenzweig, B., Bader, D., Chen, Z., DeGaetano, A., Evans, C., Golkhandan, M. R., Gurian, P., Kaatz, J., Herreros-Cantis, P., Lo, R., Ortiz, L., Braneon, C., Branco, B., Campbell, L., Dubay, F., Graziano, K., Jiang, L., Johnson, M., Kennedy, C., Kioumourtzoglou, M.-A., Kleyman, J., Kleyman, J., Knowlton, K., Limaye, V., Matte, T., Munoz Perez, S., Reed, D., Shakya, M., Svendsen, E., Tipaldo, J., Zoraghein, H. (2024). New York City Town+Gown Climate Vulnerability, Impact, and Adaptation Analysis Final Report. New York City Mayor's Office of Climate and Environmental Justice.

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Image credit: Marina Morgan