

# A Landscape Study of Social Equity Data Needs and its Access and Availability to Support the Disaster Resilience of Marginalized Communities

## **Coastal Resilience Center**

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## EXECUTIVE SUMMARY

Federal agencies have noted the increase in worrisome trends surrounding climate change, particularly wildfires, hurricanes and flooding. One of the most enduring findings in disaster and climate change research is that socially marginalized communities are disproportionately more at risk from environmental hazards, and thus, less likely to recover fully and quickly. A community plan aimed at resilience could allow agencies to pro-actively identify support for mitigation based on community needs with equity as its foundation. However, existing data sources may be inadequate for measuring, monitoring and determining progress in the degree to which recovery plans and programs advance equitable and resilient outcomes.

A research team from the Coastal Resilience Center at the University of North Carolina at Chapel Hill was funded from November 2021 to June 2023 to identify a conceptual framework that would improve equitable support to marginalized groups as they prepare for the next hazardous event. This report represents the findings from the first eight months of data collection.

The purpose of this report is to provide evidence on how federal agencies can improve measurement of outcomes for marginalized groups to help guide resilience and disaster recovery planning. This research aims to provide insight on how to transform the hazard mitigation and disaster risk management community through embedded equitable practices that support all groups, including the most marginalized. To achieve this, we developed a social equity framework that is tailored specifically for decision makers that deal with community adaptation to disasters and climate change. We argue that using the framework will improve the measurement and monitoring of progress toward equitable and resilient outcomes for marginalized populations. Ultimately, this report can help facilitate a conversation around the creation of a nation-wide monitoring system to improve outcomes for federal organizations like the U.S. Department of Homeland Security (DHS), the National Oceanic Atmospheric Administration (NOAA) and others.

We use the following overarching research question to guide our analysis, “How can federal agencies improve the measurement of outcomes for marginalized groups to help guide disaster recovery plans?” To answer this pressing question, we focus on the subsequent three research topics:

1. Identify how different theoretical conceptions of equity can be applied to develop a framework to guide an assessment of how equity is utilized to support the resilience of marginalized people.
2. Compare different types of equity indicators and assess their validity using disaster recovery data.
3. Examine local plans and funding programs to identify gaps and opportunities to improve coordination in measuring and monitoring the resilience of marginalized populations.

### *Conceptual Framework*

With few examples of equity frameworks within the realm of community resilience to disasters, the team used literature from multiple disciplines such as education, economics, urban planning, public health, philosophy and business. These disciplines have extensive experience in using

equity as a framework within their spaces. Our review of 30 different equity frameworks revealed that most (80.0%) included a mission that stated a commitment to social justice as it relates to their topic of interest. Our findings revealed that within these frameworks, equity was used as a foundation for establishing change. It was not used as an add-on to a framework: such an approach would only promote surface-level changes rather than systemic ones. The equity frameworks also included a means to evaluate progress, a reflection of history and its connection to oppression, community input and perspective and the identification of the marginalized groups impacted.

The team constructed a conceptual framework for local, state and federal policymakers involved in disaster risk management based on the expansive literature review on equity frameworks. We established the following mission, “to measure, monitor and determine progress to advance equitable and resilient outcomes for marginalized populations.” Our framework contains three stages; (1) Identify inconsistencies, (2) Identify consistencies and build metrics, and (3) Reach an equitable approach. Within each stage, we focus on four subjects of analysis - historical context, plan-based indicators, social vulnerability indicators and community voice. Ultimately, gathering more data from each critical dimension brings us closer to ensuring that marginalized groups are not left behind through a disaster.

### *Methods*

The research team applied a mixed methods case study design that used qualitative and quantitative methods to build a new approach for local, state and federal policy makers in applying equitable measures. This approach works to highlight indicators that reflect progress to advance equitable and resilient outcomes for marginalized communities. To begin, we reviewed the literature of effective social equity frameworks across disciplines. This review allowed us to create a conceptual framework that guided our data collection process. We then conducted a literature review on vulnerability, social equity and disaster risk management which gave us further information on our data collection and analysis strategies. Next, we identified four North Carolina (NC) communities based on location, density, type of hazard, demographics and available recovery data to ensure sample diversity. From there we reviewed the historical context from each site, qualitative archival content from hazard mitigation plans (HMPs) and comprehensive plans (CPs) and analyzed vulnerability and disaster recovery metrics. Lastly, the team created an interview protocol for community members based on combining the results from each data source.

### *Summary of Findings*

Looking to our conceptual framework, we focused on the first stage where we explored the inconsistencies across the critical dimensions. These dimensions include historical data, planning documents (e.g., hazard mitigation and comprehensive plans), vulnerability metrics and community voice. Here, we provide a summary of our findings from the first stage, for each critical dimension and across four NC case study sites.

1. **Historical context shapes issues of oppression and injustice.** In our review of the four NC case study sites—Buncombe, Burke, Edgecombe and Mecklenburg Counties—the team noticed conflicting historical narratives and instances of clear winners and losers. Each site generated great wealth from the exploitation of and dependence on free labor

from indigenous populations and enslaved and free Blacks to construct roads and railroads. The Black and Brown people whose labor was formative to building these communities were not entitled to the wealth produced from their efforts, a legacy that manifests today in the form of racial wealth disparities.

2. **Qualitative data from hazard mitigation plans (HMPs) and comprehensive plans (CPs) tentatively revealed wide variability in the use of *Social Vulnerability* indicators between HMPs and CPs as well as between rural and urban sites.** Plans in Edgecombe County and Mecklenburg County received equally high scores for use of social vulnerability indicators, but the HMP in Buncombe County and both plans in Burke County had considerably lower scores. HMPs in all case study sites did not include indicators of *Legacies of Discrimination*, but two CPs (Ashville in Buncombe County and Charlotte in Mecklenburg County) did include such indicators. Three of four CPs included *Indicators of Access to Essential Facilities and Services*, but all HMPs did not. Three of the four CPs did not include *Disaster Impact & Recovery Indicators*; HMPs in all sites received higher scores than CPs for such indicators. Overall, our preliminary results indicate that plans are created in silos that may result in missed opportunities to determine inequalities in disaster risk and recovery and the ways in which marginalized groups were impacted by events. It is also important to note that the plan evaluation results derived during the first eight months should be treated only as preliminary.
3. **Quantitative data from the U.S. Census, CDC's Social Vulnerability Index and Justice40 yield different results on social vulnerabilities which may inform resource allocations.** Existing metrics yield divergent results regarding social vulnerability with little empirical basis for which to use and when. Post-disaster data can provide some insight on what metrics are empirically related to outcomes of interest. When comparing the CDC SVI to J40, the team noted inconsistencies in who is identified as disadvantaged or vulnerable. Both tools identify groups as *disadvantaged* or *vulnerable* that do not appear to be disadvantaged or vulnerable in the other tool; thus, using one tool to assess marginalized groups will likely mean leaving out others. We then reviewed FEMA Individual Assistance data to assess income distributions of eligible and ineligible applicants. Our findings showed that a large proportion of ineligible applicants' households had an income of less than \$15,000.
4. **Collecting divergent community voices strengthens the disaster planning process.** Disaster risk management spaces tend to lack representation from social and ethnic groups that are most directly impacted by events allowing for a monolithic perspective to speak for all. Whether unintentional or intentional, the process of excluding other voices perpetuates racist and oppressive practices that inhibit communal growth and resilience. It is vital to identify the voices that are present and missing. The literature suggests that it is necessary to identify the *counter-narratives* – that is the voices of those who are historically left out and who tend to not be in power. It is still important to continue collecting information from government officials such as planners, municipality officials, police and firefighters. However, it is equally important to also include community voices such as local business owners and staff, non-profit and faith-based organizations, school and school district personnel, children, migrants, unhoused persons and differently-abled



persons. This is not an exhaustive list; however, we provide additional examples in the text.

### *Limitations*

Generalizability of results is limited due to focus on one state. An expanded sample of local jurisdictions to different states is needed to improve the external validity of findings. An expanded sample will include states that include strong state local planning mandates and weak mandates. Prior research suggests that state planning mandates have a significant influence in the quality of plans. States are also requiring that planning prioritize equity principles to shape contents and formats of plans. An expanded sample will also include plans that are adopted in different geographic settings with different type of hazards, threats posed by climate change and social and economic factors that influence plans.

Caution should be used in interpreting the findings since this is a preliminary analysis. Our assessment of disaster recovery resources is currently limited to a single county after a single event, and the scope will be expanded in future work. The plan evaluation method used for this study has undergone continual refinement during Years One and Two. Consequently, the findings reported for the NC sample on this report are likely to change. The analysis of indicators of social vulnerability focuses on four counties and how certain metrics vary within them. Our results may not be applicable beyond those four counties. In addition, individual data sources may have their own limitations; for example, Census data may be affected by non-responses and incomplete coverage, especially in relatively small geographic areas.

### *Policy Recommendations*

Based on our literature review, review of social equity conceptual frameworks, exploration of historical context, assessment of HMPs and CPs, analysis of social vulnerability indicators and review of including community voices, we created the following list of recommendations for advancing equitable and resilient outcomes for marginalized populations.

- 1. Use multiple data sources to determine the best strategies to advance equitable and resilient outcomes for marginalized groups.**
  - Include multiple sources and methodologies to allow the data to speak to each other and identify what is missing.
  - Use the social equity framework to identify the inconsistencies between and across data points, specifically those that are geared to measure and improve outcomes for marginalized groups.
  - Collect data with equity in mind. This means that the questions are asked in a manner that highlights justice and uplifts groups that are typically left behind.
- 2. Investigate the history of a community through an equity lens.**
  - Investigate the historical context of a community related to oppression.
  - Examine historical injustices to provide the disaster risk management community with a clearer understanding of equity needs of the community.
- 3. Facilitate more integration between HMP and CP by community.**

- Construct HMPs and CPs jointly so that both documents speak to each other. Siloed plans cause missed opportunities to identify and address inequities in hazard risks and disaster outcomes.
- Improve sharing of different types of data that can be used for deriving equity indicators. Inadequate data sharing among local government agencies that are charged with different domains of planning and management (e.g., hazard mitigation, housing, spatial land use and provision of infrastructures) leads to duplication of efforts and inefficiencies.
- Coordinate equity indicators among plans to reduce conflicts and missed opportunities for successful aid delivery. If indicators are viewed as legitimate from the perspective of marginalized people, coordination among them is more likely to improve equitable and resilient outcomes from aid delivery systems.

**4. Use multiple quantitative metrics to assess needs among marginalized groups.**

- Quantitative indicators of social vulnerability often conflict with one another in identifying communities of concern for hazard mitigation and disaster recovery. Relying on a single indicator, such as elderly populations, can overlook other marginalized groups, such as the differently-abled or those who are linguistically isolated.
- Currently, there is little empirical basis for what indicators to use and when. Without clear evidence as to which indicators are particularly valid for a context or a community, using multiple indicators can offer a broader range of perspectives on groups that may benefit from additional support.
- Post-disaster data can provide some insight on what metrics are empirically related to outcomes of interest. While post-disaster data can only provide a specific lens on disaster impact and recovery, they can show who needs assistance after an event, who is receiving government support and in what form.

**5. Include community voice to gain a more holistic perspective.**

- Highlight community voices as experts – ones that know the most about their spaces and can provide the best insight on the overall needs and direction of the community.
- Include marginalized populations and voices, especially in spaces that bring together multiple actors within the disaster risk management community.
- Conduct interviews with members of the community who are typically excluded to ensure that communal recovery encompasses diverse voices.

*Future Direction*

The current project focused on *Stage One: Identifying inconsistencies* of the social equity framework. We suggest continuing with stage one by collecting additional information within each critical dimension for the existing four case study sites. In doing so, we also suggest assessing the legitimacy of different types of equity indicators from the perspective of marginalized populations and exploring archival databases to identify potentially underutilized equity indicators that could be applied to local disaster risk management practice. Lastly, we recommend expanding the sample from four sites in one state to 16 sites in four states. Selection

of states would be based on variations of hazards, geographic locations and strength of state mitigation policies and shared governance arrangements.

# INTRODUCTION

Federal agencies have noted the increase in worrisome trends surrounding climate change, particularly wildfires, hurricanes and flooding (DHS, 2012; FEMA 2021; NOAA, 2021; NASA, 2021; EPA, 2021). One of the most enduring findings in disaster and climate change research is that socially marginalized communities are disproportionately more at risk from environmental hazards and thus less likely to recover fully and quickly (Davis et al., 2021). A community plan aimed at resilience could allow agencies to pro-actively identify support for mitigation based on community needs with equity as its foundation. However, existing data sources may be inadequate for measuring, monitoring and determining progress in the degree to which recovery plans and programs advance equitable and resilient outcomes.

## The Purpose of the Report

Provide evidence on how an agency can effectively implement equitable strategies to support marginalized groups who face a hazard. To achieve this we:

- Reviewed relevant literature
- Constructed a social equity framework for the disaster risk management community
- Identified case study sites
- Reviewed historical context related to oppression
- Reviewed hazard mitigation and comprehensive plans to identify gaps
- Assessed the consistency of existing vulnerability metrics
- Defined community voice

Recent federal programs like BRIC and Justice40 that increase availability of equity funding are motivating communities to give greater attention to creating plans that apply an equity lens. An equity lens provides a framework to provoke acknowledgment of equity considerations during public engagement and decision-making processes, develop strategies that support equitable outcomes and institute accountability to track progress toward such outcomes.

A major feature of accountability is integration of equity indicators in local plans that include physical infrastructure strategies and different land development and management tools. Equity indicators can help communities develop a stronger fact base for local planning efforts, measure baseline conditions of marginalized populations, monitor the performance of local government plans in reducing inequalities and assess impacts of aid delivery programs by FEMA, HUD and others.

Quantitative indicators are often used by planners and emergency managers to identify groups that are especially vulnerable to a disaster. Vulnerability arises from a

combination of social, economic and political processes (Tate et al., 2021). Due to its inherent multidimensionality, many different indicators are relevant to vulnerability, including age, income, race and language. There have been several efforts to collapse these many relevant indicators into simpler metrics. Most well-known among them include the Centers for Disease

Control’s Social Vulnerability Index (SVI) and the University of South Carolina’s Social Vulnerability Index (SoVI ®). These have been used in a wide range of applications, including numerous state and local hazard mitigation plans, scientific publications and government tools (Centers for Disease Control and Prevention, 2022; University of South Carolina Hazards & Vulnerability Research Institute, 2022).

While the simplicity of a single indicator is attractive for end-users, questions remain about the validity of those composite metrics (Rufat et al., 2019; Spielman et al., 2020). The processes that collapse many indicators into one can make it difficult to tell which variables are driving the results. In addition, the single combined indicator may show vastly different results than other individual indicators, and those differences may be meaningful to local agencies. The data sources can also differ, even for a variable that is on the surface the same across indices (e.g., percent of households in poverty). Finally, vulnerability is context-specific; some factors will be more influential in some communities than others and uniform indices do not reflect that variation.



## The Significance of the Research

Our research aims to provide insight on how to transform the disaster risk management community so that equity is an embedded practice that encapsulates the needs of all, including the most marginalized.

In the subsequent sections, we will provide a brief history of vulnerability that shares an account of the evolution of vulnerability from the usage of terms to the formation of databases centered around identifying such groups. Next, we move to our explanation on the difference between equality and equity through the lens of the disasters risk management community. From there we identify social equity in plans nationally and describe how several municipalities adopted purposeful and equitable strategies to meet the needs of marginalized groups. Lastly, we introduce our conceptual framework that was used as a foundation for our research in our exploration of identifying equitable strategies for under-represented groups facing a hazard.

### *A Brief History of Vulnerability*

The emergence and evolution of the concept of vulnerability within the field of disaster resilience and risk management is closely tied to a paradigm shift around the concept of disaster itself that took place in the 1970s and 80s. Research during this period began to interrogate and push back on the more strictly scientific and technical approaches to hazard and disaster management that had long dominated the field. New studies illuminating the social, economic and political factors that pre-conditioned disaster called into question the “naturalness” of so-called natural disasters and began to draw attention to the human and societal aspects of risk (O’Keefe et al., 1976; Sen, 1981; Susman et al., 1983; Watts, 1983; Wisner, 1978; Wisner & Mbithi, 1974). The conceptual framework of vulnerability that began to emerge around this time was both a product and a driver of this shift. Conceived out of the need for an analytical framework to better understand and explain these human-driven aspects of risk, the vulnerability approach became a vehicle and driving force for reshaping how we think about, prepare for and respond to disaster.

Early definitions of vulnerability describe it as “the threat to which a community is exposed” (Gabor and Griffith, 1980), “the degree to which a system [...] may react adversely to the occurrence of a hazardous event” (Timmerman, 1981), “the degree of loss” resulting from a hazard (UNDRO, 1982), or the “capacity to suffer harm and react adversely” (Kates, 1985). At this early stage in conceptual development, there was significant overlap between the definitions of vulnerability and other related concepts like exposure and risk. At this point in time, vulnerability was measured largely in terms of actualized losses, to the extent that it was measured at all at.

Studies emerging at this time investigated the causes and implications of vulnerability and how it was influenced and shaped by human factors. Researchers were also beginning to explore how vulnerability and the impacts of disaster were experienced differently across race, class, ethnicity and gender (Maskrey & Romero, 1983; O’Keefe & Wisner, 1975; Winchester, 1986). Susman et al. (1983) contributed to this growing understanding of the differential nature of vulnerability, defining vulnerability as “the degree to which different classes in society are differentially at risk, both in terms of the probability of occurrence of an extreme physical event and the degree to which the community absorbs the effects of extreme physical events and helps different classes to recover” (p. 264).

The emergence of the vulnerability approach within disaster studies coincided and shared conceptual overlap with similar work happening in the field of international development. As a result, much of the early literature on this topic centered around case studies and analysis in the context of poorer nations. These accounts focused on the links between poverty, underdevelopment, and disaster risk and framed vulnerability as a product of wealth and resource disparities and political and economic marginalization within a capitalist system (Chambers, 1983; Susman et al., 1983).

Building off this earlier work, Blaikie et al.’s 1994 book *At Risk* sought to provide a more in-depth accounting and analytic framework to explain the various social processes that generate vulnerability. Their Pressure and Release (PAR) model outlines “a hierarchy of causal factors that together constitute the pre-conditions for disaster” (Wisner et al., 2004, p. 87): from unsafe

*One database is not enough to address equity. It is the combination and interaction of multiple sources that bring us closer to equity.*

conditions to economic and social pressures that generate those conditions to underlying root causes. Their analysis allows for points of intervention or mitigation to be identified at each step along that hierarchy, while ultimately arguing the importance of understanding and addressing the root causes, which they describe as economic, social, and political in nature, reflective of the exercise and distribution of power in society and connected to the function or disfunction of the state.

Over the 90’s and early 2000’s the conversation around vulnerability expanded and began to evolve in new and sometimes conflicting directions. There was growing interest in trying to

quantify and measure vulnerability in order to operationalize the concept for planning and policy purposes (Birkmann, 2006; Cutter et al., 2003; Hill and Cutter, 2001; UNDP, 2003). At the same time, other researchers were drawing attention to the more intangible aspects of vulnerability and to the cultural, psychosocial and subjective impacts of disasters that are difficult or impossible to capture with metrics and indicators (Oliver-Smith & Hoffman, 1999; Wisner et al., 2004). There was also increasing discussion of the ways people can move in and out of vulnerability, sometimes even in response to, or as an outcome of, hazard itself. This space, time and context dependency of vulnerability further complicates attempts to capture vulnerability in fixed indicators (Wisner et al., 2004).

Though initial vulnerability research focused largely on the developing world, studies in the 90s exploring how race, ethnicity and gender factored into differential impacts of disasters in the U.S. began to expand the conversation to the context of wealthier countries as well (Bolin & Stanford, 1998; Peacock et al., 1997). Researchers at this time also focused greater attention on the role of coping and resilience capacity, in a shift away from earlier weakness-or limitation-focused conceptualizations of vulnerability that painted people as passive victims of disaster (Anderson & Woodrow, 1998; Eade, 1998; IFRC, 1999; Wisner, 2003; Wisner, 2004). This capacity focused approach is captured in Anderson and Woodrow's (1998) definition of vulnerability as "long-term factors which affect the ability of a community to respond to events or which make it susceptible to calamities" (p. 10) and was the conceptual foundation for the development of local level, participatory vulnerability and capacity assessments (VCAs or CVAs) which began to emerge as an alternative to more abstracted, quantitative approaches to vulnerability assessment (Anderson & Woodrow, 1998; Brocklesby & Fisher, 2003; Buckle et al., 2000; Enarson et al., 2003; IFRC, 2001; King, 2001; Stephen & Downing, 2001; Trujillo et al., 2000).

As the concept of vulnerability has evolved over the span of the last five decades, researchers have repeatedly noted the lack of a commonly agreed upon definition and the difficulties that this conceptual ambiguity creates in attempts to measure, assess and mitigate it (Birkmann, 2006; Cutter, 1996; Timmerman, 1981). Many definitions and theoretical models have been developed over the years in attempts to address this gap and further refine and clarify the concept (see Birkmann, 2006; Cutter, 1993; and Wisner, 2016 for examples). But rather than resulting in a universally agreed upon framework, these attempts have instead just added to our understanding of the nuances and complexities inherent in vulnerability. There has been a convergence of thought around the importance of vulnerability assessment and the need to develop clear indicators of vulnerability, but there is ongoing tension between approaches that lean towards quantification and aggregation (to ease application in policy across multiple scales) versus approaches that rely on more qualitative and participatory methods that can get at some of the more intangible and context-dependent aspects of vulnerability (Birkmann, 2006; Wisner, 2016). Some have even questioned whether the concept itself is outdated and have critiqued ways in which use of the term may reproduce the very marginalization that it is often used to describe (Marino & Faas, 2020).

The term vulnerability has a long-standing history that has come to identify socially and historically marginalized groups who are more susceptible to being impacted by hazards. More recently, the term equity has entered into the disaster risk community, creating confusion around



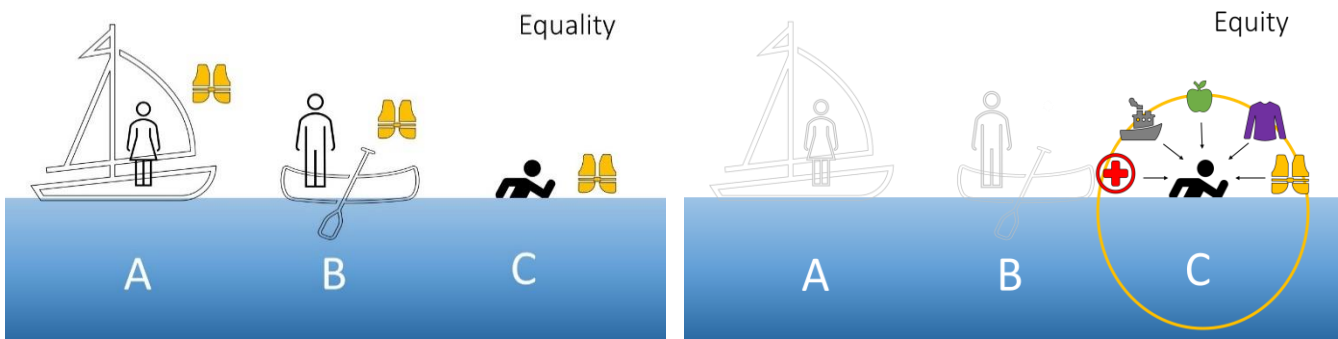
its usage and applicability. In the next section, we outline the difference between equality and equity, especially for personnel in the disaster risk spaces.

### *Equality vs. Equity*

The United Way (2022) defines equality as “the state of being equal, especially in status, rights and opportunities. Equality means each individual or group of people is given the same resources and opportunities, regardless of their circumstances” (para 2). Where equality is viewed as a mechanism to “level the playing field” across groups, it creates larger disparities for marginalized groups. Providing equal support to individuals who have experienced a disaster may seem appropriate to those within the disaster risk management community; however, this strategy will likely produce greater inequalities.

Figure 1 provides an example of how equal treatment towards impacted individuals may result in advantages for one and disadvantages for another. In Figure 1, we see three people experiencing a flood differently. Person A is in a sailboat, Person B is in a rowboat, and Person C is in the water. Using an equality perspective would suggest that we provide each person the same support to overcome an emergency. In this example, each person received a life jacket. Unfortunately, using an equality lens does not recognize or account for the social or historical context needed to equitably support individuals.

*Figure 1. Equality vs. Equity*



In contrast, equity provides a framework that acknowledges the imbalances between groups and provides appropriate support to individuals in need. Urban Strategies, Inc (2021) defines social equity as a tool to “first address the disparities and barriers on individual, systemic and structural levels, then use this information and data to provide opportunities for success to individuals based on their right of access and specific needs” (para 6). Using an equitable lens allows the disaster risk management community to assess history, context, environment and other attributes to determine the variation of needs and to provide appropriate support for the individual. In the right portion of Figure 1, Person C is provided an array of resources which will assist them through an event.



Research suggests that marginalized populations in the United States are more likely to represent Person C – an individual who, due to social, environmental, or historical factors, has fewer resources to leverage in preparing for, responding to and recovering from a hazardous event (Davis et al., 2021; Rodriguez-Díaz & Lewellen-Williams, 2020; Castel & Engberg, 2011). Marginalized populations are disproportionately more at risk to hazards and less able to recover fully and quickly (Davis et al., 2021). History tells us that this group tends to be people of color (Rodriguez-Díaz & Lewellen-Williams, 2020), people representing low-income households (Tierney, 2014; Baker & Cormier, 2015), individuals who are unhoused, differently-abled individuals (Stough et al., 2016), immigrants (Nguyen & Salvesen, 2014), women (Enarson, 2012), children (Peek, 2008; Davis, Cannon & Fuller, 2022), the elderly (Lieberman-Cribbin et al., 2020) and others (Davis et al., 2021).

This report will provide a conceptual approach on how agencies can move toward using an equity-based perspective to assess more clearly, resilient outcomes for individuals who represent Person C. Next, we provide examples of how municipalities incorporate equity within their planning.

### *Social Equity in Plans Nationally*

The research team sought to explore examples of how social equity has been used in local planning efforts across the country. We found that few communities incorporated equity within their plans; however, in the last decade, more attention has been given to equity within selected local planning efforts, particularly those aimed at increasing environmental justice and enhancing local resilience to climate change.

Select cities have appointed an environmental justice board to lead conversations around equity and the environment. Examples include Philadelphia’s Environmental Justice Advisory Commission (DEP, 2022) and Honolulu’s Equity & Environmental Initiative (HSOP, 2021). Other cities, like Seattle, Washington, have worked to create and expand green job opportunities for marginalized communities. The Seattle City Council’s legislative summary reads,

*Communities of color, immigrants, refugees, people of low-incomes, youth and limited-English proficiency individuals have pathways out of poverty through green careers, including careers related to environmental policy and program development (Resolution 31681, 2016, p.4).*

Portland, Oregon’s *Targeted Universalism Approach* centers on providing aid and support to the most marginalized populations first (Williams-Rajee & Evans, 2016). This approach was used in their 2015 climate action plan which uses an “equity lens that prioritized the needs of low-income communities and communities of color” (p.6).

Although these plans represent various communities who face different environmental disruptions, all address the importance of incorporating community voice. Our findings showed that plans and municipalities called for equity workshops and trainings, discussions on community resilience and identifying community liaisons to work with nonprofits and volunteers. Below we highlight an example of leadership in equitable resilience planning from

Boston, Massachusetts, where a series of plans were strategically and collectively designed with climate change, marginalized populations and future hazards in mind.

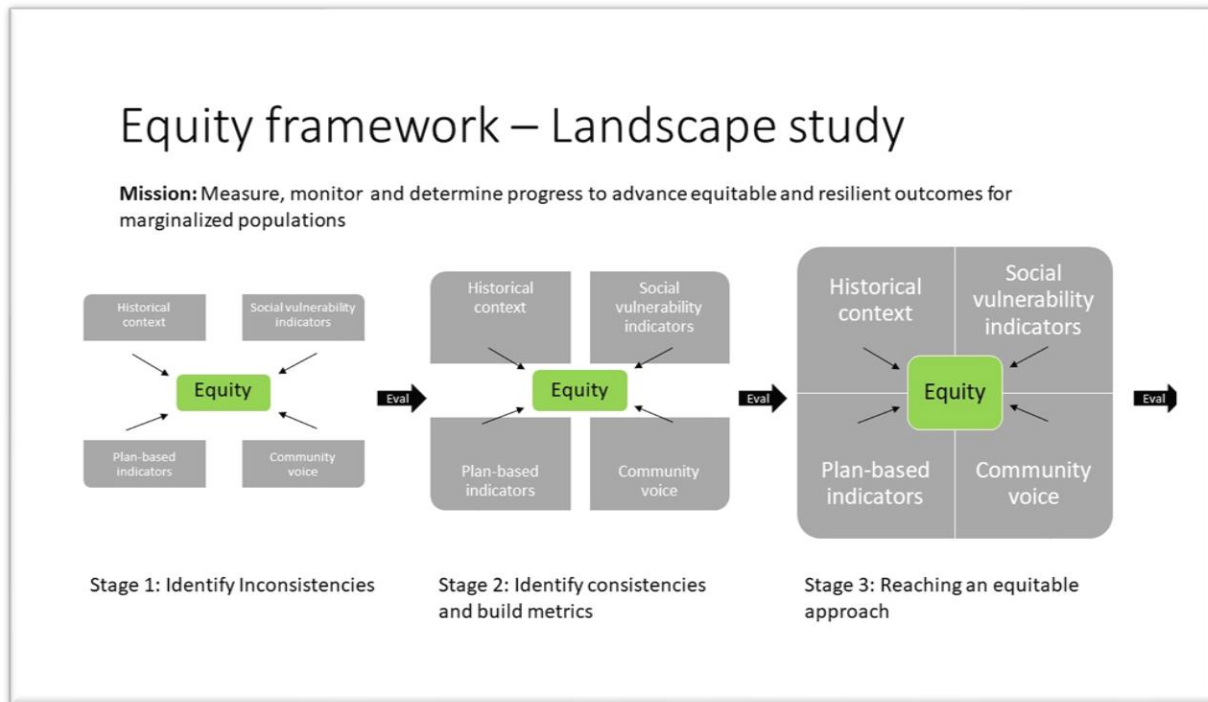
- Under *Resilient Boston*, the city facilitated a community conversation with a focus on advancing resilience and racial equity among its residents (Walsh, 2019). The community discussion resulted in long-term visions for Boston. One of those visions emphasized increased connectivity and adaptive capacity by calling for reliable public transportation, resilient infrastructure and improved collaboration within and between Boston communities to address environmental disruptions and other emergencies.
- *Greenovate Boston* empowers Boston residents to facilitate community-level actions around climate change that support community resilience (Walsh, 2019). The *Greenovate Boston* initiative launched several Community Leaders programs in 2017 to attract and collect diverse perspectives. One such group is known as the *Street Team* which is comprised of Boston residents (adults and children) representing marginalized populations and more than 70 community-based organizations. This group traveled throughout Boston to collect information from underrepresented groups and learn about their personal priorities in response to climate change. The *Street Team* attended 19 community events, interacted with more than 1,400 residents and commuters, conducted more than 700 surveys and administered 16 interviews with representatives from small business. Through these initiatives, Boston officials heard from diverse groups regarding their needs and impacts from climate change. Ultimately, the reflections from community members were used to inform resources on sustainability, climate change action and community engagement.

Our review of plans nationally showed few instances of municipalities using equity to support marginalized groups through a hazard. Given this finding, we introduce a conceptual framework that is tailored for the disaster risk community to measure, monitor and determine progress to advance equitable and resilient outcomes for marginalized populations.

### *Conceptual Framework*

The research team used the literature on social equity frameworks across disciplines, vulnerability and local planning efforts that incorporate equity to form a tailored social equity framework for the disaster risk management community (Figure 1). The mission of this framework is to advance equitable and resilient outcomes for marginalized groups. Current metrics are likely outdated. Here, we offer a holistic approach that requires collecting different topics of data to ensure the process is equitable. This image was constructed out of the culmination of the literature and provides a guide as to how decision makers can rethink how to integrate and support marginalized groups while using equity as a foundation. See Appendix A for the research team's process in creating the conceptual framework through review of 30 social equity frameworks from alternative disciplines.

Figure 2. Equity Framework for the Disaster Risk Management Community



To accurately assess needs and advance resilient outcomes for marginalized groups, it is vital to first get a sense of where we are and how marginalized groups are being identified. We argue that not one database, indicator, or data source, gets you to equity. It’s the combined effort of collecting, mining and understanding multiple sources that helps get you there. Also, it is knowing how to use and apply the data that will impact people in decision-making roles. Rather than relying on one metric or one database, it is vital to use multiple, diverse, context-relevant and validated data sources — with an acknowledgment that the data itself may not be enough.

This framework is broken into three stages.

In the first stage we identify inconsistencies among data sources. In the second stage we identify consistencies between data sources and build reliable metrics. And in the third stage, we can assess the most efficient and equitable approach. Within each stage, our critical dimensions center around (1) historical context related to oppression, (2) plan-based indicators, (3) social vulnerability indicators and (4) community voice. As we progress with each stage, we collect more data. As we move toward equity, our data should inform and verify each other. This means that what we see in the social vulnerability indices is also what we see in plans, what we hear from the community and what we find in the history. Within this report, we will focus on the first stage- identifying inconsistencies.

The disaster risk management community is already collecting this information. Our goal is to show the importance of collecting specified and targeted information from these four subjects so that marginalized groups are not left behind and unintentionally ignored. We also intend to show that relying on one data source, or one subject, is not equitable and can perpetuate oppressive tactics that ignore underrepresented groups.

## METHODS

The team applied a mixed methods case study design to answer the following exploratory question, “How can federal agencies improve the measurement of outcomes for marginalized groups to help guide disaster recovery plans?” Researchers use case study designs when they intend to take an in-depth look at a research problem across multiple sites using extensive data collection methods (Creswell, 2019). These types of designs are useful when researchers are interested in illustrating, comparing, evaluating and understanding a given topic. Here, the team collected data using a mixed methods approach to explore the extent marginalized groups are being identified and supported through hazardous events in four North Carolina counties. In this section, we provide our research procedure and the sample used to execute the project.

### *Procedure*

The team focused on six research procedures. In the first strategy, the team conducted an initial literature review on existing scientifically sound data sources that track and assess equity, marginalization, recovery and vulnerability. The literature review provided a vital foundation for data collection, analysis and the construction of the social equity framework.

In the second strategy, the team selected four North Carolina communities identified as either high-density (N=1), medium-density (N=1), or low-density (N=2) and conducted a case study analysis that focused on similarities and differences of measurements based on urbanicity and rurality. The team identified communities based on location, density, type of hazard impacting the community, racial and ethnic demographics and availability of relevant data to ensure diversity. Using this process allowed for the data to be more generalizable and applicable to different communities nationwide.

In the third strategy, the team reviewed qualitative archival content, specifically historical information on each NC case study site. The team reviewed historical notes of oppression based on NC sites to determine past instances of oppression.

In the fourth strategy, the team identified and reviewed hazard mitigation plans (HMPs) and comprehensive plans (CPs) within sample sites. We assessed different types of hazards and equity data included in these plans, evaluated for the presence of plan policies or strategies that support equity in hazard mitigation and disaster recovery and identified plan metrics that measure progress toward equitable, resilient outcomes. Some smaller, more rural communities did not have comprehensive plans, so the team reviewed the land use plan instead. Comparisons across these plans allowed us to identify gaps and opportunities in local planning efforts, particularly as related to the type and nature of data considered within the different plans.

In the fifth strategy, we identified appropriate quantifiable indicators to assess recovery and marginalization in North Carolina communities and assessed the availability of the data for these indicators. While there are numerous existing indices or indicators of social vulnerability, these often rely entirely on census data and are relatively coarse in geographic resolution, such as county- or city-scale. Here we used quantitative metrics from the Centers for Disease Control and Prevention – Social Vulnerability Index (CDC – SoVI), the U.S. Census and the Justice40

beta version. After we reviewed the existing quantitative data sources, we then considered how those data may be insufficient for capturing marginalization and recovery processes.

Lastly, the team generated an interview protocol to collect qualitative data from local government officials and community members to determine the validity of suggested quantitative indicators and identify qualitative indicators. The protocol will be used to understand better the lived experiences of marginalized populations living in urban and rural communities. The team did not collect interview data given limitations in time; however, we intend for the protocol to be used to gain a deeper understanding of equity processes within communities following a natural hazard.

### *Sample*

The research team reviewed data from 30 districts in NC that represented diversity by type of disaster, location, density and demographics. We observed that these 30 districts were ones that were consistently affected by hazards. We first noted the various hazards that impacted NC since 2010 as noted by FEMA Disaster Declarations. These types of hazards represented severe winter storms, flooding, landslides, mud slides, hurricanes, tornados and fires (FEMA, 2022). Then we identified districts by region within the state. Districts were identified as either mountains (western region), piedmont (central), or coastal (eastern region). From there we collected information on their population to assess their density. The NC Rural Center (2022) defined urban as a space with above average density with more than 750 people per square mile. Suburban is defined as a space with 250-750 people per square mile and rural is one with 250 people per square mile or less.

Research Procedure
<ul style="list-style-type: none"><li>- Conduct literature review</li><li>- Identify sampled sites</li><li>- Review historical archival content</li><li>- Review HMPs &amp; CPs</li><li>- Generate quantitative metrics</li><li>- Create an interview protocol</li></ul>

We then collected demographic information to assess diversity by race and social class. To assess demographics by race, we reviewed data from the U.S. Census and the statistical atlas. We used the NC Commerce County Distress Tier Designations (2022) that provided data on adjusted property tax base, population growth, median household income and unemployment for the 100 counties in NC. Counties designated as tier 1, or rank 1-40, represent a community that is most distressed within the state. Counties designated as tier 2, or rank 41-80, represent a community that is between most and least distressed while counties designated as tier 3, or rank 81-100, represent a community that is least distressed.

We then selected eight districts that provided a diverse representation of the sample. From there we reviewed archival data, maps and assessed the accessibility to CPs and HMPs. Lastly, we selected four counties based on our review of both quantitative and qualitative data. The counties and their demographics, can be found below in Table 1.

Table 1. Demographics of Sampled Sites

District Name	Region	Population (k) <sup>^</sup>	Urban/Suburban/Rural <sup>*</sup>	Non-White Pop <sup>~</sup>	NC Distress Ranking (2021) <sup>+</sup>	Medium Household Income (2018) <sup>+</sup>	Type of Hazard(s) <sup>1</sup>
<b>Buncombe</b>	Mountains	269	Suburban	16.1%	67	\$53,960	Severe winter storm; Fire; flooding; landslides; mudslides
<b>Burke</b>	Mountains	87	Rural	17.7%	30	\$44,946	Severe winter storm; Fire; flooding; landslides; mudslides
<b>Edgecombe</b>	Coastal	48	Rural	63.3%	1	\$38,818	Hurricane; flooding
<b>Mecklenburg</b>	Piedmont	1,115	Urban	48.5%	81	\$64,509	Flooding

<sup>^</sup> [https://www.northcarolina-demographics.com/counties\\_by\\_population](https://www.northcarolina-demographics.com/counties_by_population)

<sup>\*</sup> <https://www.ncruralcenter.org/about-us/>

<sup>~</sup> <https://www.census.gov/quickfacts/NC>

<sup>+</sup> [https://files.nc.gov/nccommerce/documents/Research-Publications/2021-Tiers-memo\\_asPublished\\_113020.pdf](https://files.nc.gov/nccommerce/documents/Research-Publications/2021-Tiers-memo_asPublished_113020.pdf)

<sup>1</sup> [https://www.fema.gov/disaster/declarations?field\\_dv2\\_state\\_territory\\_tribal\\_value=NC&field\\_year\\_value=All&field\\_dv2\\_declaration\\_type\\_value=All&field\\_dv2\\_incident\\_type\\_target\\_id\\_selective=All](https://www.fema.gov/disaster/declarations?field_dv2_state_territory_tribal_value=NC&field_year_value=All&field_dv2_declaration_type_value=All&field_dv2_incident_type_target_id_selective=All)

# FINDINGS

## I. Historical Context

The first critical dimension is the historical context as it relates to oppression. In this component, we provide a summary of historical events per NC case study site. Investigating past occurrences can help expose reasons for present day inequities. These types of findings would then enable a better understanding of how to equitably support marginalized groups impacted by hazards. In this section, we address one primary research question:

RQ 1: What are some historical context and unique characteristics of selected NC sites?

Our research process for this section includes an exploration around historical instances of oppression by NC case study sites. The team reviewed archival records that specifically addressed instances of inequality to determine the extent that past injustices affect modern day vulnerabilities.

### *RQ1: History and unique characteristics of sites*

The research team reviewed the historical archives of each NC sampled site. North Carolina has a vast history that expands back to 1,000 A.D. which includes the movements of indigenous populations, colonial settlement, the enslavement and subsequent emancipation of Black and Brown bodies, to the immigration of migrant workers. For this section, we intentionally focused on how marginalized groups were historically harmed, excluded and ignored. Providing historical insight on such actions can help inform how to work towards an equitable approach in the disaster risk management community. Here, we included a condensed summary of historical notes by county (*Figure 3*) and then followed up with more detail below.

*Figure 3. Historical notes by county*

Buncombe	<ul style="list-style-type: none"><li>•The exploitation of indigenous groups and Blacks to construct roads and railroads</li><li>•Health tourism destination</li></ul>
Burke	<ul style="list-style-type: none"><li>•Site of the largest historic indigenous settlement in NC</li><li>•Manufacturing was the primary source of employment after the Civil War</li></ul>
Edgecombe	<ul style="list-style-type: none"><li>•The oldest incorporated Black community in the U.S.</li><li>•The county line debate</li></ul>
Mecklenburg	<ul style="list-style-type: none"><li>•Ongoing economic boosts</li><li>•Drawn out de-segregation process</li></ul>



*Buncombe County.* Archaeologists noted that earliest settlement of indigenous peoples in the region dates to roughly 8,000 BC (Cutshall, 2021; Sondley, 1930). This region was largely inhabited by the Cherokee People, but evidence also shows other groups such as the Catawba People occupying the land. It was not until European settlement of the region that the numbers of indigenous groups sharply declined due to smallpox outbreaks and violent land appropriations (Foster, 1930).

By the early 19<sup>th</sup> century, Buncombe became a community where residents primarily worked in agriculture. It was difficult to import and export goods, but with the backing of wealthy landowners, interest groups lobbied for safer routes to help boost the western economy (Cutshall, 2021). It was through the exploitation of indigenous populations as well as enslaved and freed Blacks that roads and railroads were constructed. Even after the Civil War, railroad companies exploited Black and Brown bodies who were incarcerated on petty crimes and forced them to work in dangerous and unhealthy conditions. An example of such risk can be found in the construction of railways and the Swannanoa Tunnel (Buncombe County Special Collections, 2017).

The ease and access to roads and railroads brought in tourists and new residents, all of which greatly improved the economy for the region. Buncombe County became known as the most popular health tourism destination in the nation by the late 19<sup>th</sup> century, opening it up for millionaire George W. Vanderbilt to purchase 125,000 acres and build an estate (Cutshall, 2021). Even today, Buncombe County remains a destination for millions of tourists annually, drawn to places like Asheville and the Biltmore Estate. However, the county still struggles with issues of racial inequality that can be traced back to the history of land theft, forced labor and exploitation of Black and Brown bodies that the county's economy was founded on. With an awareness of the past, Asheville's City Council members passed a resolution on July 14, 2020, in support of reparations for Black residents to "[make an] amends for wrong one has done, by paying money to or otherwise helping those who have been wronged" (City of Asheville, 2022).

*Burke County.* This county has a rich history tied to indigenous settlement dating back to about 1,000 AD (Burke County, 2022). Archaeologists uncovered the Mound Builder settlement of Joara, situated on roughly 12-acres and deemed one of the largest Native American villages in NC (Coe et al., 1995; Burke County, 2022). As in Buncombe County, smallpox and other diseases brought over by European settlers decimated the indigenous population around the late 16<sup>th</sup> century. Shortly thereafter, Native Americans and European settlers abandoned the region altogether. Almost 200 years later, English, German and Scotch-Irish yeoman colonialists returned to the region and largely worked separately (Burke, 2022).

The county was known for its textile industry. In the 19<sup>th</sup> century several manufacturing companies emerged and became a way for households to generate income (Worker's Legacy, 2020). In 1910s, Schneck-Warlick Mill opened in Lincolnton and was the first cotton mill in the region. In 1880s, Morganton Trading Company built a hosiery mill, and the Dunavant Cotton Manufacturing Company built a cotton mill, both in Morganton. In the 20<sup>th</sup> century, the Drexel Furniture Company, Garrou-Morgantown Full-Fashioned Hosiery Mills and Nylon Hosiery were all in operation in Burke County. As prosperous as these manufacturing companies were,



children and women were called to work long days (Tyack, 2020). In many instances, their health and safety proved to be dispensable.

Our historical review showed that manufacturing was the primary source of employment after the Civil War (Burke, 2022; Worker's Legacy, 2020). Even through World War I, North Carolina textile companies generated large revenue from the government and made materials, including uniforms and tents to assist with war efforts (Worker's Legacy, 2020). Even in the 21<sup>st</sup> century, manufacturing continues to be the largest employer and represents about half of the workforce in Burke County (Wilkie, 2019).

*Edgecombe County.* Named after Lord Richard Edgecombe of the English Treasury, Edgecombe County was established as a new precinct in 1741 (Edgecombe County, 2021). The Royal Governor George Burrington designated the area south of the Roanoke River to accommodate the growing population of new settlers. Although the Tuscarora Indians and other indigenous groups had inhabited the land for generations prior to European settlement, they were ultimately forced off or killed in the course of the Tuscarora War, and in some instances sold into slavery (Srikanth, 2016).

Edgecombe County holds NC's 9<sup>th</sup> oldest incorporated town, Tarboro, and one of the oldest incorporated Black communities in the US, Princeville. Princeville, initially known as Freedom Hill, was purchased by newly freed slaves following the Civil War (Mizelle, 2016; Cooper, 2019). It was racism that permitted newly freedmen to occupy a hazardous area prone to tropical storms, flooding and swampy terrain (Davis et al., 2021).

Borders, property and county lines have been key subjects of debates, intersecting with politics, economics, and racial issues since the 19<sup>th</sup> century (DRMM, 2016). Political officials and businesspersons made a series of successful attempts to alter the county line in ways that benefited White residents and detract power from residents of Color. Most recently, borders have been altered to re-adjust for school funding allocations (DRMM, 2016) and voting redistricting (Bonner, 2021).

*Mecklenburg County.* Like the other counties, Mecklenburg was home to indigenous populations such as the Catawba, Cheraw and Waxhaw Peoples for millennia prior to European settlement (Griffin, 2021). The Catawba Peoples' population was the largest in the region and estimated at over 8,000. But like other Native American communities in the NC, these indigenous groups experienced a significant decline in their numbers due to diseases from European settlers, war, appropriation of land and forced enslavement.

At the end of the 18<sup>th</sup> century, a young man named Conrad Reed discovered a 17-pound sparkling rock and gave it to his parents to use as a doorstep (Hanchett, 2022). A traveling merchant paid \$3.50 for the rock, later to be known as the first piece of gold uncovered in North America. By the 19<sup>th</sup> century, merchants and miners traveled to Mecklenburg to take advantage of the gold rush. From gold, came the railroads, which helped boost the economy and provided a way to connect the Carolinas. From there came textiles, and then wartime industry, followed by the growth of the furniture industry.

Over the centuries, Mecklenburg had the capability to generate great wealth; but much of this wealth was generated through exploitation of the free or low-wage labor of Black and Brown people and has disproportionately benefited White communities. Wealth inequality (Thomas et al., 2019), equitable and affordable access to housing (Adu, 2021) and access to quality schools (Grundy, 2017) have remained pressing issues in Mecklenburg through the 20<sup>th</sup> and 21<sup>st</sup> century.

## II. Plan-based Indicators

The next critical dimension focuses on the plan-based indicators. In this phase of the research we focused specifically on hazard mitigation plans and comprehensive land use plans. The research team sought to gain a more thorough understanding of how plans account for equity and highlight the needs of marginalized populations who face hazards. In this component, we address two primary research questions:

RQ 1: To what extent are equity indicators used in different sectors of local planning?

RQ 2: How well coordinated are local agencies in sharing data used for equity indicators?

Our research process for this section included a literature review to identify a range of potential equity indicators that can be incorporated into local government plans, creation of a draft plan evaluation protocol to determine presence of indicators in plans, development of a multistep procedure to score application of the indicators and rationale for selecting different types of plans to be evaluated in each community. See Appendix B for additional information on the methods used to analyze plan content.

In the first research question, we assess the use of equity indicators within the CPs and HMPs within the four NC counties. In the second research question, we highlight the extent comprehensive and hazard mitigation plans coordinate and draw from each other within each county.

### *RQ1: The use of equity indicators in planning*

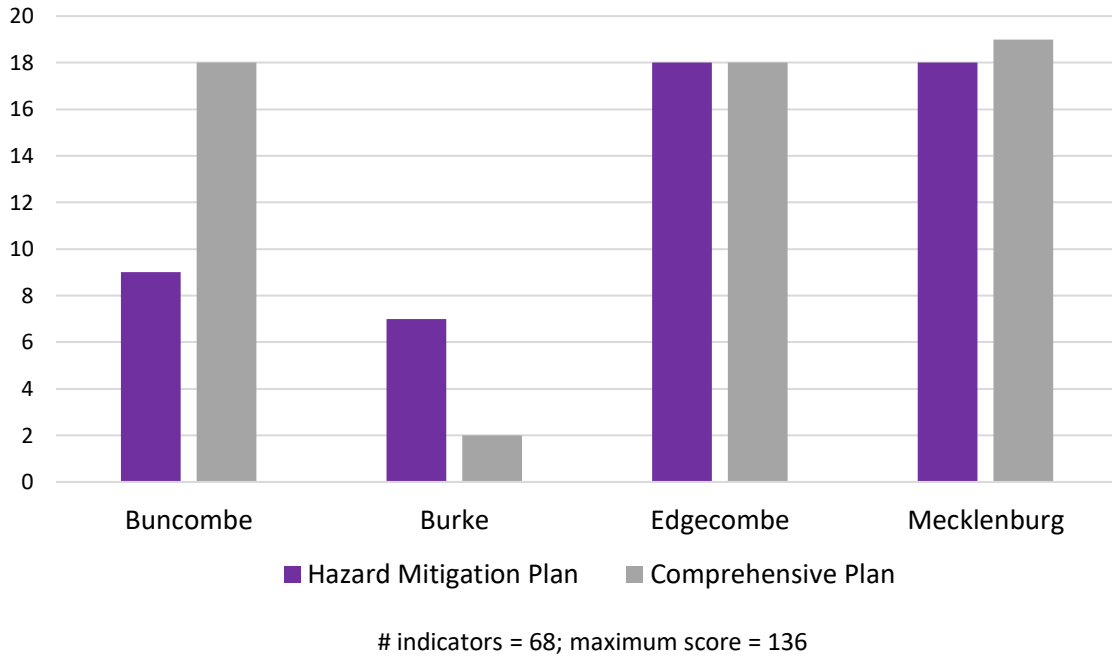
We present five sets of preliminary findings on the extent to which CPs and HMPs use indicators to measure social vulnerability, access to critical services and facilities, legacies of discrimination, disaster loss and recovery and presence of hazards.

*Social vulnerability indicators.* Social vulnerability refers to the characteristics of population groups that might make them more (or less) vulnerable when they are exposed to the impacts of a hazard event. Population characteristics like age, gender, income, and race and ethnicity are indicators often correlated with loss from hazard events and ability to cope, respond and recover from disaster events.

Our literature review identified 68 social vulnerability indicators that could be incorporated into plans. Figure 4 indicates high variability in the use of social vulnerability indicators. Comprehensive plans adopted by Edgecombe County and Charlotte in Mecklenburg County

plans received equally highest scores for use of these indicators, while Burke County received the lowest scores for both types of plans. Asheville in Buncombe County had a high score for use of vulnerability indicators in their CP, but Buncombe County’s HMP scored comparatively low.

Figure 4. Social vulnerability indicators (e.g., demographic, economic and housing)



Though these indicators can be useful in identifying populations or neighborhoods that are more likely to be vulnerable to hazards, sole reliance on social vulnerability indicators and maps can be problematic. Goetz et al. (2020) observed that social vulnerability maps are often used to “problematize certain groups (people of color, low-income households) while valorizing others (Whites, the affluent).” Social vulnerability maps generally don’t reveal other structural dynamics, such as the presence or absence of community assets like public facilities and other amenities that may reduce disaster impacts and build capacity to adapt to adverse events. As a result of this omission, vulnerability is often conflated with population characteristics like race or income, eliding the significant role that legacies of discrimination or the distribution of community infrastructure and assets plays in shaping local geographies of risk and vulnerability.

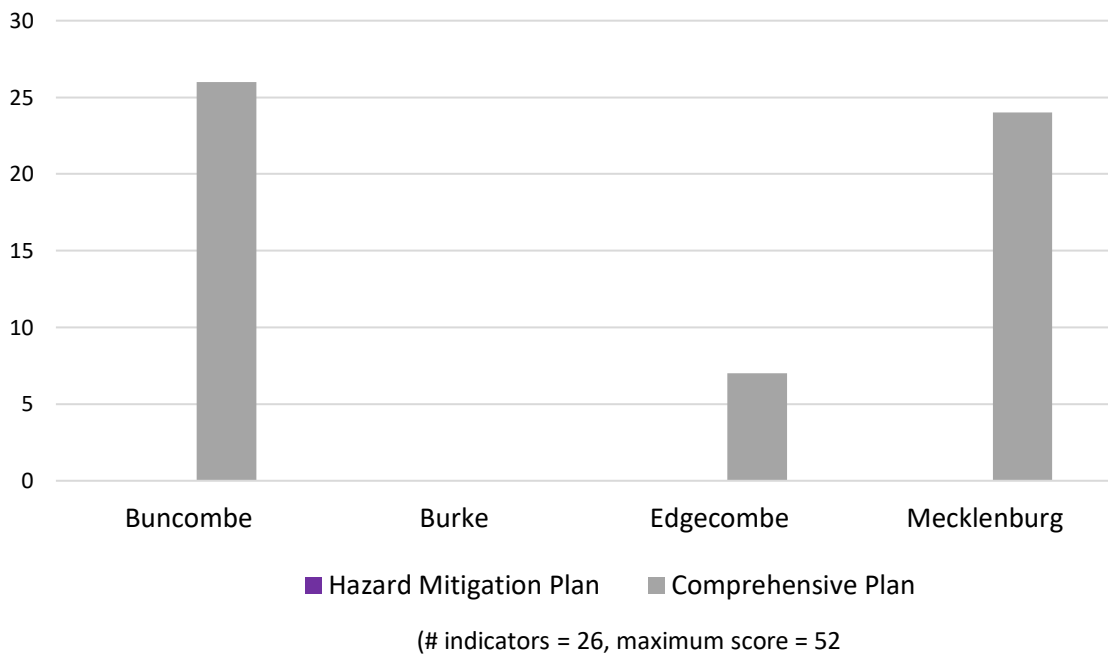
*Accessibility Indicators.* The social vulnerability concept would gain more utility by intersecting the scores for social vulnerability indicators with scores for the levels of access to assets in the same geographic areas. Examples of assets include infrastructure (e.g., safe streets, water and sewer, stormwater, parks), education and childcare services and healthy food. This enables determination of which groups have the greatest or least access to assets. Access to assets can enable people to overcome social barriers to achieve resilient outcomes.

We identified accessibility indicators for 26 types of community assets. Figure 5 indicates wide variation in use of accessibility indicators. Comprehensive plans in three of the four counties incorporate accessibility indicators (Asheville in Buncombe County, Charlotte in Mecklenburg

County and Edgecombe County), but Burke County’s CP does not. None of the HMPs include accessibility indicators.

A close examination of the CPs reveals additional insight on use of accessibility indicators. The Edgecombe County CP includes separate maps for accessibility indicators and social vulnerability indicators but does not include maps that intersect both sets of indicators or statistics that correlate access to services or facilities with different population groups in different geographic areas. In contrast, CPs adopted by the City of Asheville in Buncombe County and Charlotte in Mecklenburg County include maps and statistical summaries that reveal which population groups have the greatest or least access to assets.

Figure 5. Accessibility indicators (e.g., flood control, childcare, healthy food, parks)

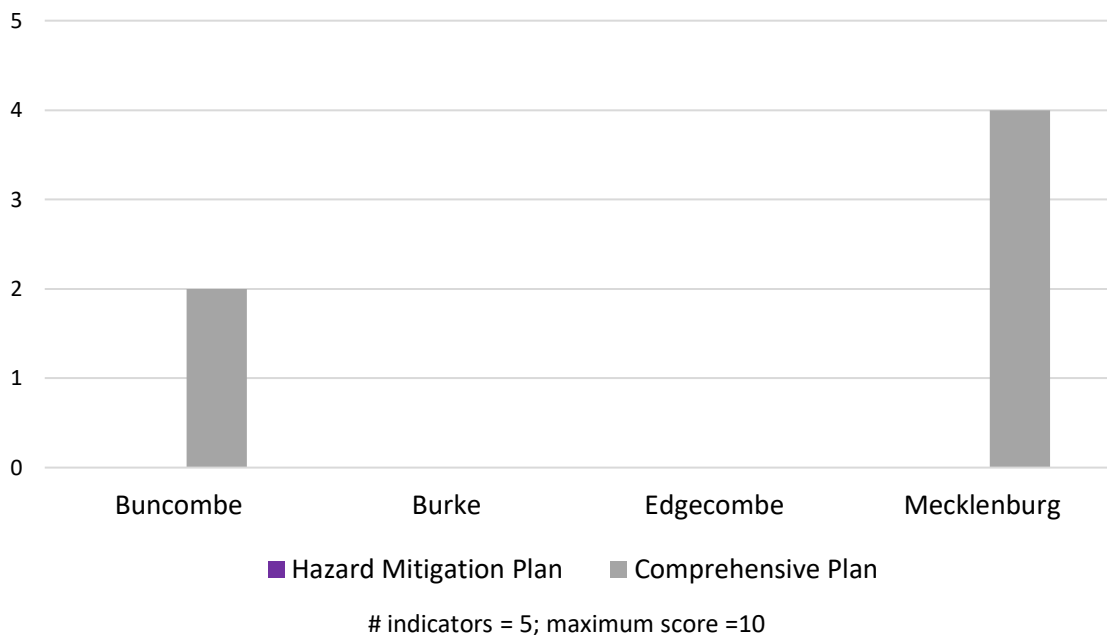


*Legacies of Discrimination Indicators.* We identified five types of indicators that reveal legacies of discrimination. Marginalized communities almost always experience a history of deep-rooted impacts of discriminatory land use and development practices such as divestment in infrastructure for hazard protection and adequate housing, redlining and racial zoning. These practices have historically and systematically deprived marginalized groups of basic assets and often cause forced displacement and spatial concentration of socially marginalized groups to hazard areas. Legacies of discrimination, injustice and inequity have been historically overlooked in plans and by planning institutions (Goetz et al., 2020). Suppression of this information in planning has had long-term impacts on health and well-being of marginalized communities making them more susceptible to health hazards and loss after a disaster.

Documentation of evidence of these practices in plans provides a justification for reconciliation focused on the contemporary effects of past practices. Yet, Figure 6 shows that local planning

gives limited priority to documentation of the legacies of discrimination. Such indicators were completely absent in the HMPs we reviewed and were present in only two of the CPs. Comprehensive plans for Asheville in Buncombe County and Charlotte in Mecklenburg County document discriminatory practices. Charlotte’s CP received the highest score by including multiple discriminatory practices. Examples in Charlotte’s plan include a historic redline map that prevented banks from making mortgage investment in redlined Black neighborhoods, racialized zoning practices that mandated larger lot sizes and precluded high density development in wealthier and whiter neighborhoods and descriptions of the use of racially restricted deeds.

Figure 6. Legacies of discrimination (legal segregation of infrastructure, redlining, racial zoning)



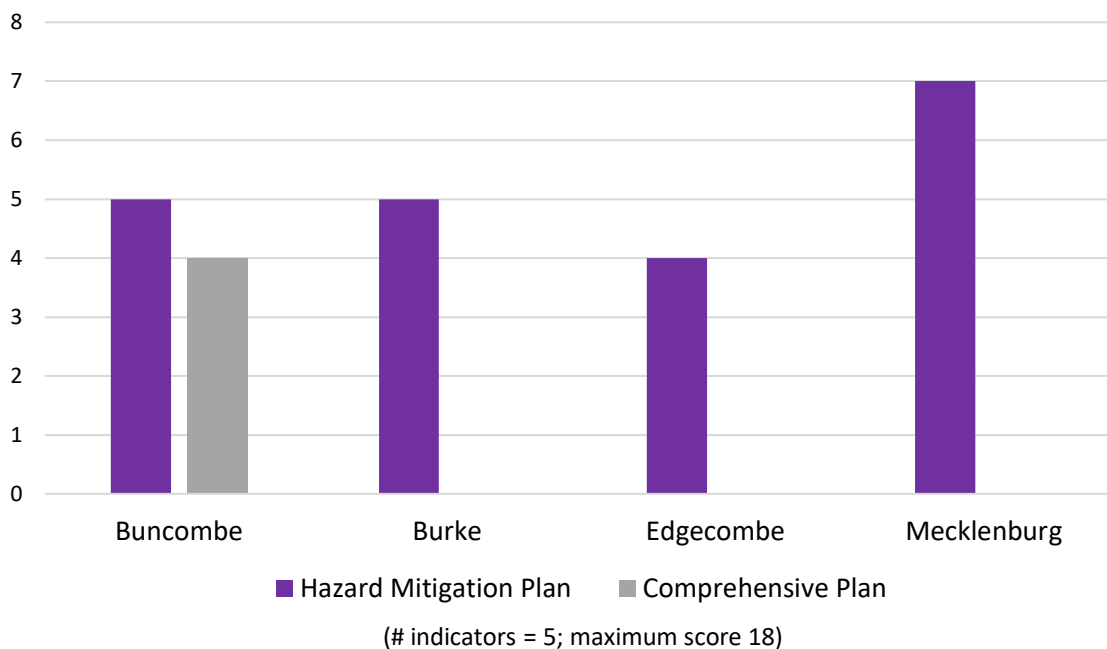
*Disaster Impact and Recovery Indicators.* Marginalized populations experience high levels of loss from disaster and experience the slower rates of post-disaster recovery. Indicators that track and evaluate losses and recovery rates of different population groups help prioritize mitigation and rebuilding investments in areas that are most socially vulnerable (Dominguey and Emrich 2019). Prior research indicates that when such information is accurately recorded and publicly available, it is possible to identify and improve government actions (e.g., compensation spending and rebuilding investments) that have historically been subject to institutionalized discrimination (Bullard and Wright 2012).

Figure 7 reveals that mitigation plans score higher than CPs in use of nine types of indicators that can be used to track disparities in loss and recovery rates. All four HMPs received comparatively high scores for tracking disaster loss and recovery, while three CPs did not include such indicators. Only the CP adopted by Asheville in Buncombe County includes loss and recovery

indicators, but the score for this plan is lower than the score for HMP that cover's Buncombe County.

More detailed examination reveals that even the plans that include data on disaster loss and recovery only include summary statistics at the scale of the entire local jurisdiction. Furthermore, the summary statistics of loss and recovery, are not cross tabulated with indicators (race, poverty etc.) of different population groups.

Figure 7. Disaster impact and recovery indicators

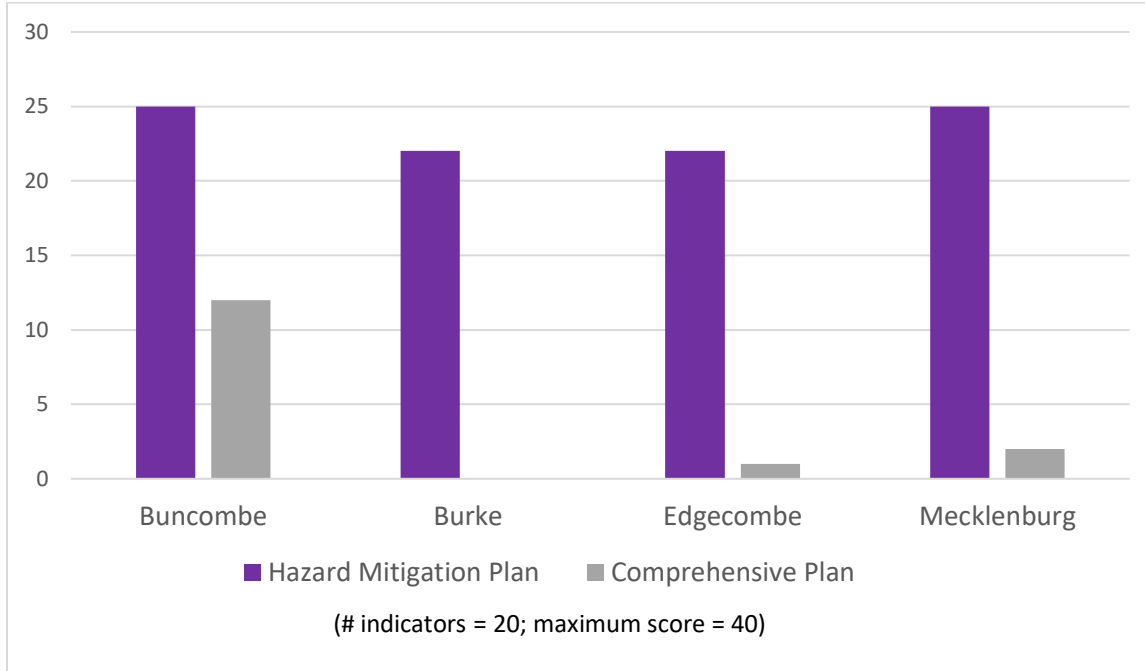


### RQ2: The coordination of local agencies

There are significant gaps in sharing of data needed to create equity indicator metrics to track disparities in resilient outcomes. Indicators used in one type of plan are often not included in the other plan in the same county. For example, the CP for Charlotte in Mecklenburg County includes a wealth of indicators of accessibility to facilities and services and legacies of discriminatory practices, but these indicators are absent in the Mecklenburg County HMP.

*Indicators of Hazards.* Figure 8 shows scores for the presence of 20 types of hazards included in plans. As expected, all HMPs have comparatively high scores for identification of hazards. Mitigation plans included many maps that spatially locate the type and potential severity of many hazards. Asheville's CP received a moderate score for identification of hazards, but all other CPs received low scores. This finding raises concern that the spatially oriented data in CPs for social vulnerability (Figure 4), accessibility to assets (Figure 5) and legacies of discrimination (Figure 6), and to a lesser extent loss and disaster recovery data (Figure 6), cannot be intersected with locations exposed to different hazards.

Figure 8. Different types of hazards



All HMPs include maps and data on hazards, but CPs rarely mention or include maps that identify presence of hazards. Due to siloed planning efforts and gaps in data sharing, the wealth of equity indicators (accessibility and legacies of discrimination) included in some of the CPs are not being intersected with the hazard data to identify hazard vulnerability of marginalized populations.

Our preliminary results reveal that, using current plan-based metrics, it is not possible to identify “hot spot” locations that spatially identify the most marginalized populations in the four NC counties. High variability in the use of different types of indicators and poor coordination among agencies charged with planning pose significant limitations to target the most socially marginalized people exposed to different hazards.

### III. Social Vulnerability Indicators

The next critical dimension focuses on the social vulnerability indicators used to measure vulnerability. The team determined that a more thorough understanding of how local governments are using quantitative indicators of vulnerability can enable more equitable disaster resilience and recovery plans and investments. In this component, we address two primary research questions:

RQ 1: What quantitative indicators are currently used to inform equity in resilience plans and investments, and what are the implications of those choices?

RQ 2: What indicators of social vulnerability are empirically supported by disaster impact and recovery data?

In the first research question, we analyze the current landscape of social vulnerability metrics and their level of agreement or disagreement. The geographic scope is the four North Carolina counties. In the second research question, we draw on existing disaster impact and recovery data to identify indicators that are related to lack of access to financial support for disaster recovery. We focus on public funds for disaster relief and investigate need and eligibility on different dimensions.

### *RQ1: Current use of quantitative indicators*

An initial literature review examined a wide range of databases for measuring vulnerability, as well as reports summarizing key sources and their differences (Cutter et al., 2019; Edgemon et al., 2020). Based on the results, we chose the following five indicators of community vulnerability, marginalization or disadvantage to include in this analysis.

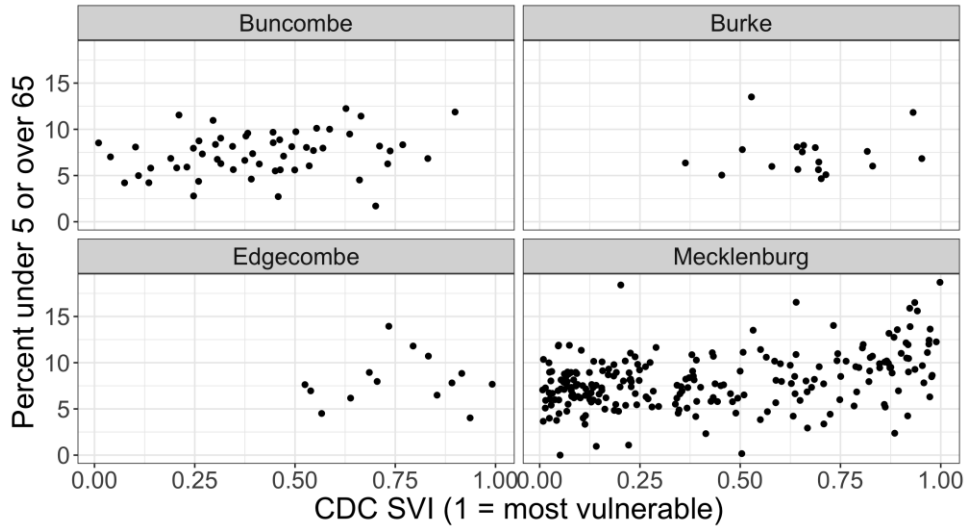
1. *Centers for Disease Control's Social Vulnerability Index (SVI).*
2. *Climate and Economic Justice Screening Tool ("Justice40").*
3. *Percent people of color.*
4. *Percent of vulnerable ages.*
5. *Median household income.*

We do not include the University of South Carolina's Social Vulnerability Index because the most recent data are not publicly available. A more in-depth description of each indicator is in Appendix C.

Comparing the age indicator to the CDC's SVI, we find little relationship between the two (Figure 2). Tracts with high shares of the population in vulnerable age categories have both high and low SVI scores, and vice versa. The overall correlation coefficient between the two indicators is 0.32 (where 0 = no correlation and 1 = perfect correlation). Given that age is commonly used in our subset of analyzed plans, this suggests that local governments would identify very different communities of concern if they used the CDC's SVI instead.

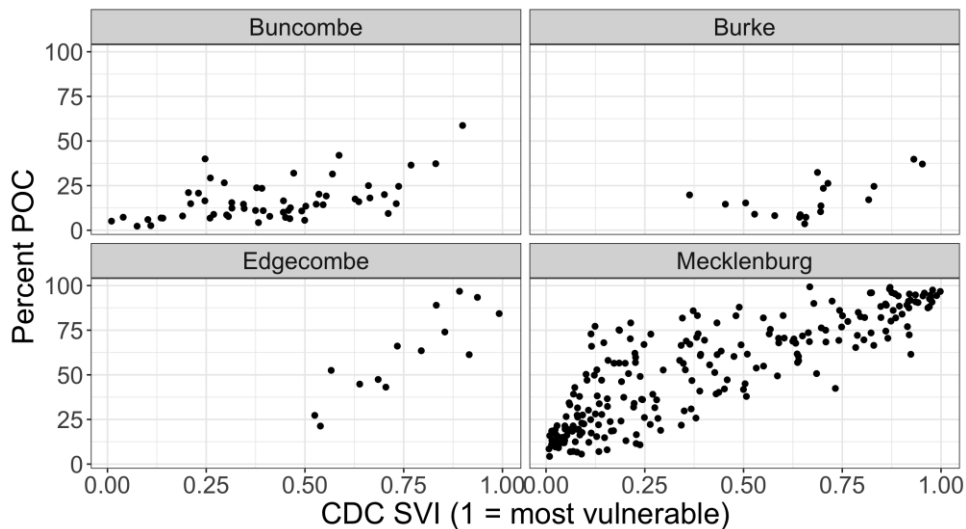


Figure 9. Share of the population in vulnerable age groups vs. CDC SVI. Each point represents a census tract, and tracts are grouped by county



The share of people of color within a census tract is more closely linked to the CDC’s SVI (Figure 10). The overall correlation coefficient is 0.64, and the relationship is much more easily visible than for age. For example, there is a clear upward trend in Edgecombe County and in Mecklenburg County, with tracts with higher CDC SVI values also having higher shares of people of color.

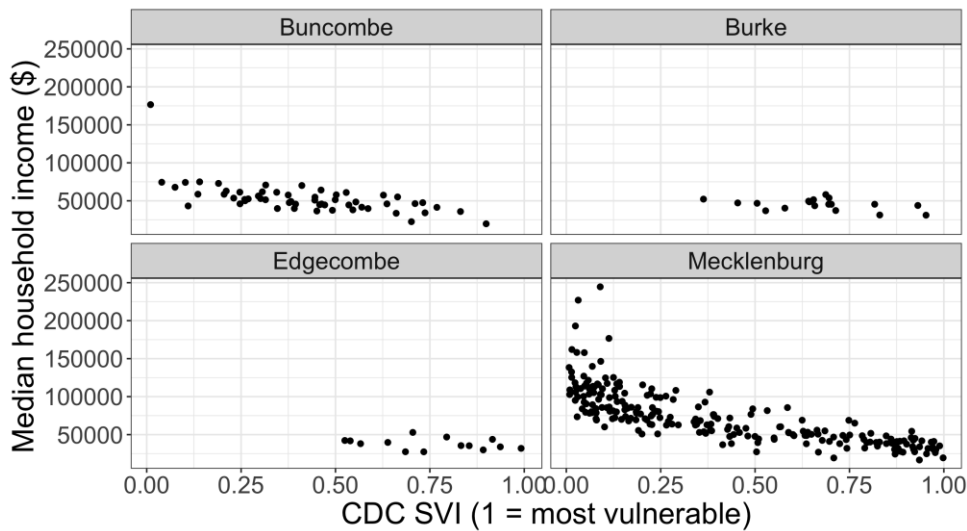
Figure 10. Percentage people of color vs. CDC SVI. Each point represents a census tract, and tracts are grouped by county



Median household income is also clearly linked to the CDC SVI, with SVI decreasing as income increases (Figure 11). The correlation coefficient is -0.75, though the magnitude is likely driven by the extremely high-income levels observed in Mecklenburg County. For example, the

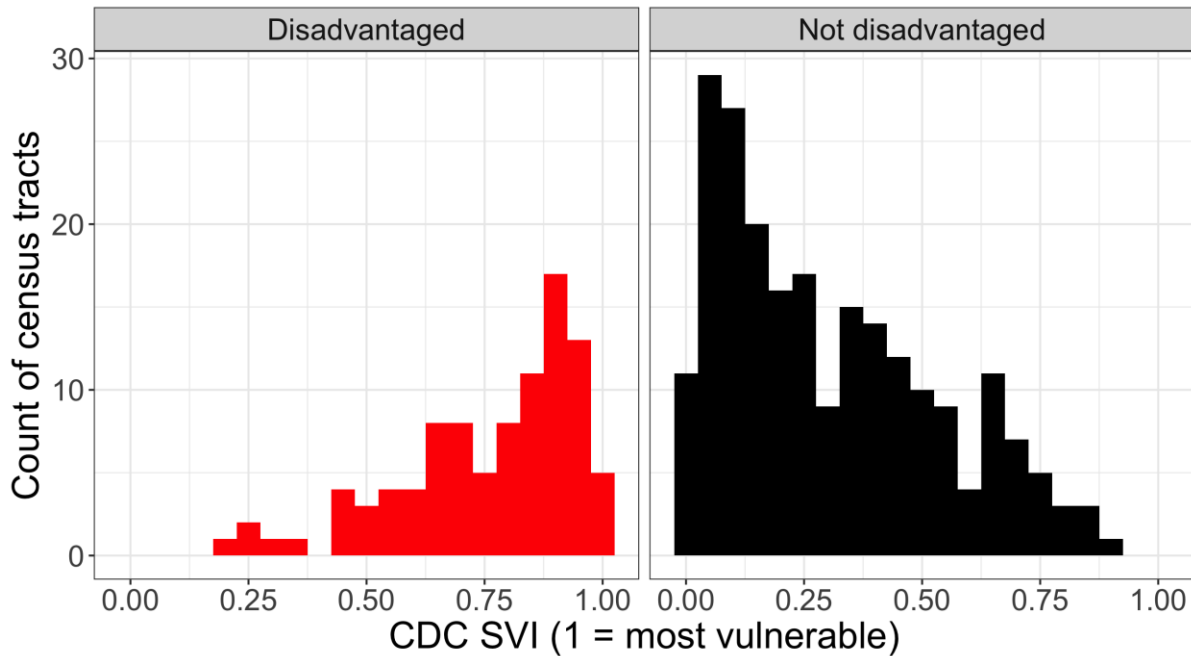
communities in Mecklenburg County with median incomes above \$150k are all less vulnerable than communities with median incomes under \$50k. One notable difference between the CDC SVI, which reports a percentile, and the absolute median income measure, is how differences across levels are represented. For example, in Buncombe County, there is one tract with significantly higher median income than the others. The gap in the vertical dimension is much larger than the gap along the horizontal because the CDC shows a percentile, which ignores the magnitude of the difference in incomes.

Figure 11. Median household income vs. CDC SVI. Each point represents a census tract, and tracts are grouped by county



Finally, we compare the Justice40 screening tool with the CDC SVI (Figure 12). Because Justice40 is a binary classification, we group the tracts based on that classification and examine the distribution of CDC SVI scores. We find that the two are often finding the same tracts as vulnerable: most of the disadvantaged tracts score in the top half of the CDC SVI and vice versa. However, there are notable exceptions in both directions. There are tracts considered in the upper quartile of the CDC SVI that are *not* considered disadvantaged by the Justice40 tool, and there are tracts considered disadvantaged that are in the bottom quartile of the CDC SVI. The full set of county-by-county maps for each indicator can be found in Appendices D-H.

Figure 12. Comparing Justice40 disadvantaged and not disadvantaged census tracts as a function of the CDC SVI



Note: The panel shows the distribution of CDC SVI scores for the tracts that are considered disadvantaged (left) or not disadvantaged (right).

*RQ2: Empirical indicators of social vulnerability*

In the aftermath of major floods, affected households have access to multiple sources of support. The first and fastest source is flood insurance, which is predominantly supplied by the National Flood Insurance Program. If people are not insured or have inadequate coverage, there are federal support programs. Individual Assistance (in particular, the Individual and Household Program, IHP) provides limited resources to assist with immediate housing needs. The Small Business Administration also provides loans at relatively low interest rates for households that meet creditworthiness standards.

Here, we use data collected by FEMA to examine need for and access to FEMA’s IHP assistance. While the information available about the household is relatively limited (for example, race is not reported, and the smallest geographic unit is zip code), it still provides some empirical insight into the extent to which certain groups face strong needs for IHP (that is, they are not insured or are inadequately insured) and the extent to which they receive support from the IHP.

Among our four study counties, Edgecombe County has recently experienced a major flood, so it is the focus of this analysis. Over 2,500 households applied for IHP assistance after Hurricane Matthew in 2016. They were concentrated in Tarboro and Princeville, as shown in Figure 13 and Figure 14.

Figure 13. Geographic distribution of applicants to IHP after Hurricane Matthew in Edgecombe County

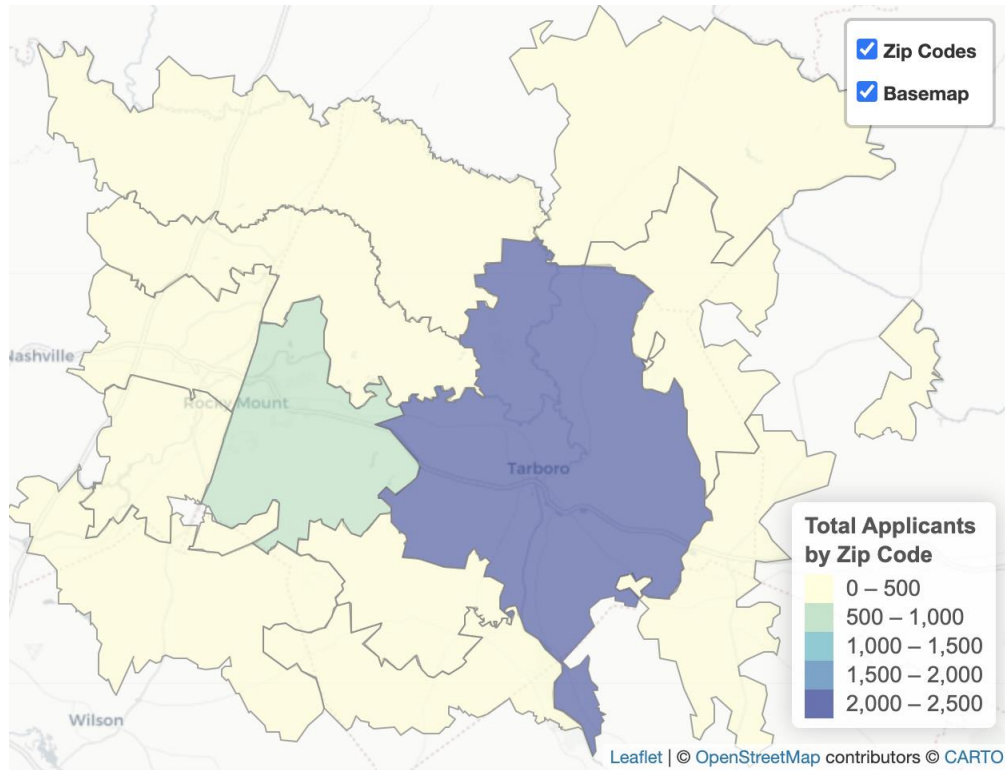
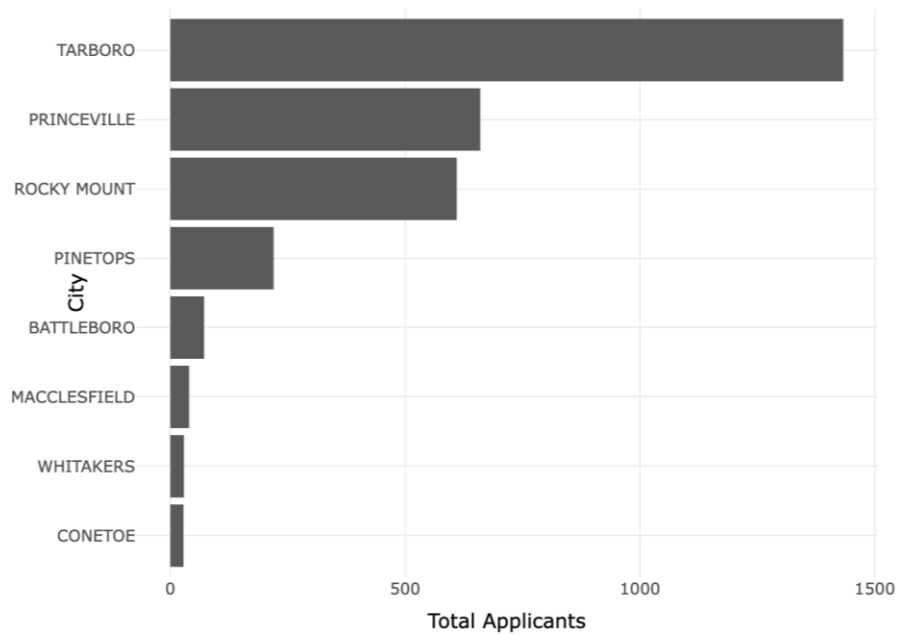


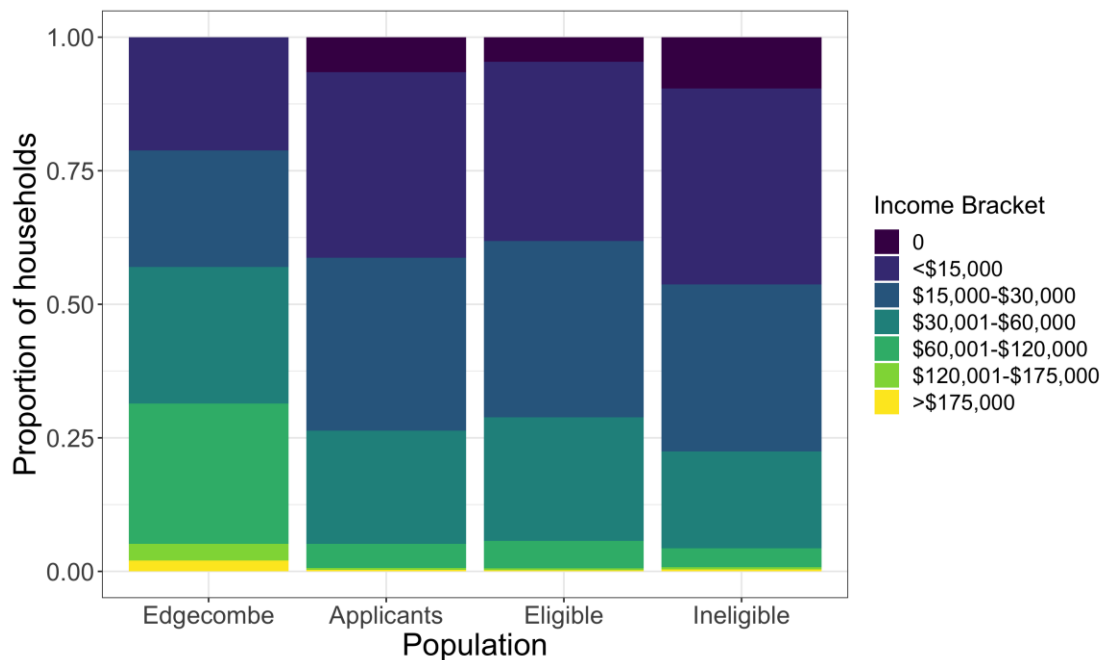
Figure 14. Cities of applicants to IHP after Hurricane Matthew in Edgecombe County



The income distribution of all of Edgecombe County is shown in the left-hand most column of Figure 15. The next column shows the income distribution of the pool of people applying for IHP assistance. A larger share of people in the applicant pool come from the lowest income brackets, \$0 and <\$15k, relative to their share in the county population. Very few applicants for IHP have incomes of \$120k or higher, either because they were not damaged or because they did not need IHP.

However, not all applications are approved for assistance. On the righthand side of Figure 15, we compare the income distributions of the eligible and ineligible applicants. A larger proportion of ineligible applicants are from the bottom two income brackets. There are many reasons for ineligibility, including insufficient damage to the property, having flood insurance and lack of documentation to show ownership or residence in the property. Future analysis will more closely investigate the reasons for ineligibility to identify why some of the lowest-income applicants are unable to access IHP assistance.

*Figure 15. Income distribution of: Edgecombe County population, applicants to IHP, eligible applicants to IHP and ineligible applicants to IHP*



#### IV. Community Voice

The last critical dimension focuses on the community voice, specifically the ways in which communities are deemed as experts within their own spaces. The research team determined that a more thorough understanding of who are deemed community members and what information is needed from them to assess equity. In this component, we address two primary research questions:

RQ 1: Whose voice is most relevant?

RQ 2: What questions are needed to assess social equity, disaster impact and planning processes in marginalized communities?

### *RQ1: Identifying relevant voices*

The literature revealed that disaster risk management spaces tended to lack representation or inclusiveness of non-governmental individuals or groups (Gartrell et al., 2020). In some instances, language and culture became significant barriers that prevent marginalized groups from participating (Lucas et al., 2003; Siddiqi et al., 2009; Wu et al., 2005). The findings suggest that without a diversity of perspectives to support disaster risk management, this allows for one monolithic perspective to speak for all.

Critical Race Theory (CRT) provides an explanation as to why groups are left out and why this action is problematic. The theory states that whiteness oppresses and marginalizes groups that are identified as the other (Davis et al., 2021; Delgado & Stefancic, 1995; Ladson-Billings, 2010; Ladson-Billings, Tate & Tate, 1995; Bell, 2004). Whiteness is a social construct that upholds Eurocentric practices as superior above other cultures and ethnicities (Hughes et al., 2016). CRT scholars argue that whiteness ignores and undermines voices from marginalized groups, but, that these voices are necessary to enrich the body of knowledge (Dixson & Rousseau, 2006; Ladson-Billings & Tate; Shujaa, 1993; Stanfield, 1985). According to scholar John O. Calmore (1995), voices of marginalized groups are valid resources that also empower their listeners.

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*The mere exclusion of multiple voices upholds racism, oppression and maintains inequity, regardless of the intent.*

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Historically, the social victors created history, formed policy, and validated knowledge (Ladson-Billings-Tate, 1995; Milner, Lui, & Ball, 2020). Due to this structure, they maintain dominant cultural storylines and narratives (Bamberg & Andrews, 2004). CRT scholars demand *counter-narratives*, that is as Richard Delgado (1995) stated, “the counter-reality that is experienced by subordinate groups, as opposed to those experiences of those in power” (p.194). Ladson-Billings & Tate (1995) defined *counter-narratives* as the “voice” or “naming one’s own reality” through “parables, chronicles, stories, counterstories, poetry, fiction and revisionist histories to illustrate the false necessity and irony of much of current civil rights doctrine” (p.56). Similarly, Dixson and Rousseau (2005) argued that *counter-narratives* must be included in research to counter dominant perspectives and challenge the narrative.

The mere exclusion of multiple voices upholds racism, oppression and maintains inequity, regardless of the intent. Given the history of racism and injustice towards marginalized groups, it is vital to include their voices. Figure 16 provides a list of possible voices to pull from in the future.

Figure 16. Collecting Diverse Voices

### Community Members

- Current and former residents
- Local business owners
- Personnel from non-governmental agencies (e.g., non-profits)
- Personnel from faith-based institutions
- School and school district personnel (e.g., principals, teachers, counselors, grounds keeper, etc.)
- Children, youth, & the elderly
- Migrant populations
- People whose primary language is not English
- Unhoused persons
- Differently-abled persons

### Governmental Officials

- Emergency managers
- Local and state city planners
- Local municipality officials
- Federal agents representing the location
- Police and firefighters

### *RQ2: Questions for protocol*

The team constructed an interview protocol based off the literature, historical review, qualitative content analysis from plans and quantitative analysis from vulnerability metrics. The purpose of the protocol will be to help guide emergency managers and researchers with collecting information on equity. The questions for the protocol can be found in Figure 17 and the full layout is in Appendix I.

Figure 17. Questions for Protocol

### **Background**

1. Please share your name, role and why you decided to speak to me today?
2. Can you tell me about your connection to this community?
  - a. If you live here, how long have you been here?
3. What do you love about your community? What do you wish would improve?
4. What type of people live here?
5. Describe for me the biggest risks the community faces (e.g., safety, food, access, weather-related events, etc.)?
6. How, if at all, is/are this risk being addressed? And by whom?

### **Disaster Impact**

7. What disasters have affected the community in recent memory?
8. Who are the most impacted by these events?
  - a. How are they impacted?
  - b. To what extent are they supported through recovery?
9. Who else is impacted? And how, if at all, are they supported through a disaster?
10. Who, if at all, is left out of receiving support? And why?

### **Planning**

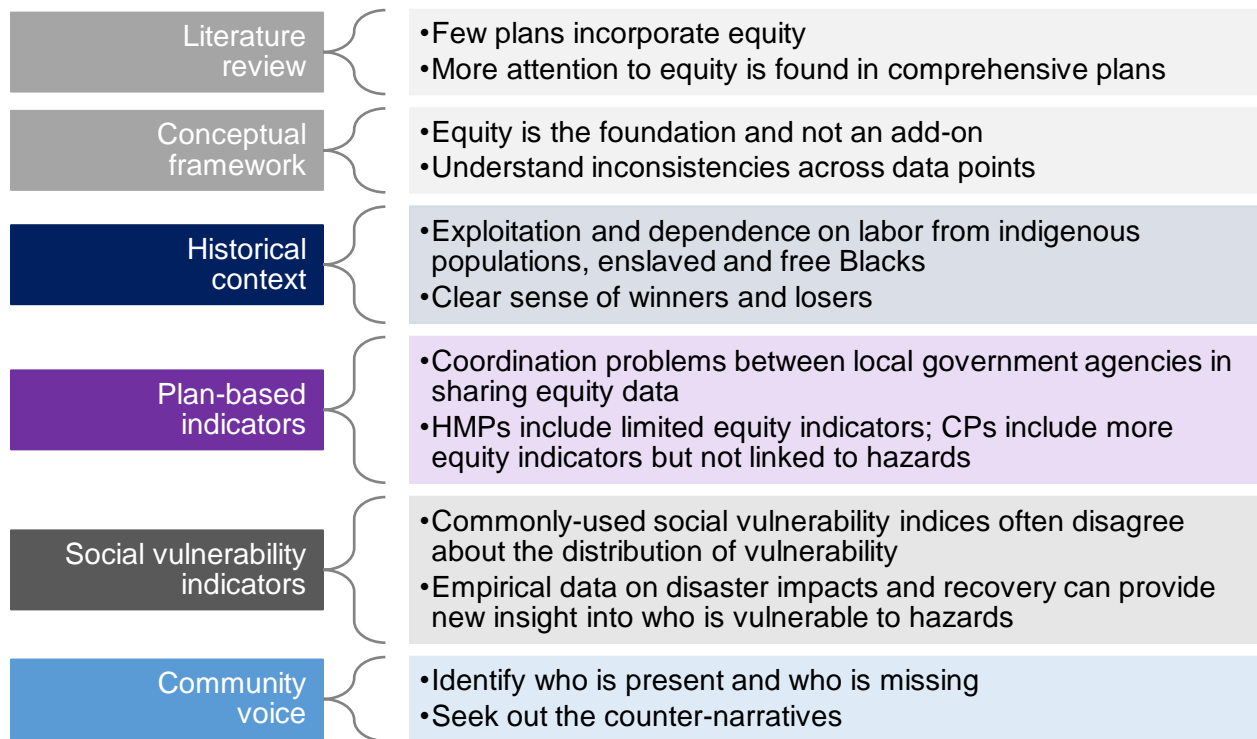
11. How do you plan for future disasters?
12. What, if any, strategies has your community used in preparation for future disasters?
13. What, if any, ways have governmental agencies assisted in preparing for future events?
14. What types of plans are needed to be most effective in supporting groups that are most in need in your community?



## V. Summary of Findings

The following section provides a summary of the overall findings from the literature review, historical review, content analysis of plans and quantitative analysis of vulnerability metrics. Overall, the research team sought to determine how federal agencies can improve the measurement of outcomes for marginalized groups to help guide disaster recovery plans. The relevance of our work can help transform how the disaster risk management community intentionally embed equity in their practices. A brief overview of results can be found in Figure 18, followed by a description of each summary point.

Figure 18. Summary of Findings by Research Procedures



In the first stage of the conceptual framework, we investigated the inconsistencies across existing data sources used to measure outcomes for marginalized populations. These data sources include, historical data, planning documents (e.g., HMPs and CPs), vulnerability metrics and literature on community voice. Here, we provide a summary of our findings from the first stage, for each critical dimension and across four NC case study sites.

1. **Historical context shapes issues of oppression and injustice.** In our review of the four NC case study sites—Buncombe, Burke, Edgecombe and Mecklenburg Counties—the team noticed conflicting historical narratives and instances of clear winners and losers. Each site generated great wealth from the exploitation of and dependence on free labor from indigenous populations and enslaved and free Blacks to construct roads and railroads. The Black and Brown people whose labor was formative to building these

communities were not entitled to the wealth produced from their efforts, a legacy that manifests today in the form of racial wealth disparities.

- 2. Qualitative data from hazard mitigation plans (HMPs) and comprehensive plans (CPs) tentatively revealed wide variability in the use of *Social Vulnerability* indicators between HMPs and CPs as well as between rural and urban sites.** Plans in Edgecombe County and Mecklenburg County received equally high scores for use of social vulnerability indicators, but the HMP in Buncombe County and both plans in Burke County had considerably lower scores. HMPs in all case study sites did not include indicators of *Legacies of Discrimination*, but two CPs (Ashville in Buncombe County and Charlotte in Mecklenburg County) did include such indicators. Three of four CPs included *Indicators of Access to Essential Facilities and Services*, but all HMPs did not. Three of the four CPs did not include *Disaster Impact & Recovery Indicators*; HMPs in all sites received higher scores than CPs for such indicators. Overall, our preliminary results indicate that plans are created in silos that may result in missed opportunities to determine inequalities in disaster risk and recovery and the ways in which marginalized groups were impacted by events. It is also important to note that the plan evaluation results derived during the first eight months should be treated only as preliminary.
- 3. Quantitative data from the U.S. Census, CDC’s Social Vulnerability Index and Justice40 yield different results on social vulnerabilities which may inform resource allocations.** Existing metrics yield divergent results regarding social vulnerability with little empirical basis for which to use and when. Post-disaster data can provide some insight on what metrics are empirically related to outcomes of interest. When comparing the CDC SVI to J40, the team noted inconsistencies in who is identified as disadvantaged or vulnerable. Both tools identify groups as *disadvantaged* or *vulnerable* that do not appear to be disadvantaged or vulnerable in the other tool; thus, using one tool to assess marginalized groups will likely mean leaving out others. We then reviewed FEMA Individual Assistance data to assess income distributions of eligible and ineligible applicants. Our findings showed that a large proportion of ineligible applicants’ households had an income of less than \$15,000.
- 4. Collecting divergent community voices strengthens the disaster planning process.** Disaster risk management spaces tend to lack representation from social and ethnic groups that are most directly impacted by events, allowing for a monolithic perspective to speak for all. Whether unintentional or intentional, the process of excluding other voices perpetuates racist and oppressive practices that inhibit communal growth and resilience. It is vital to identify the voices that are present and missing. The literature suggests that it is necessary to identify the *counter-narratives* – that is the voices of those who are historically left out and who tend to not be in power. It is still important to continue collecting information from government officials such as planners, municipality officials, police and firefighters. However, it is equally important to also include community voices such as local business owners and staff, non-profit and faith-based organizations, school and school district personnel, children, migrants, unhoused persons and differently-abled persons. This is not an exhaustive list; however, we provide additional examples in the text.

### *Limitations*

The ability to generalize results is limited due to focus on one state. An expanded sample of local jurisdictions to different states is needed to improve the external validity of findings. An expanded sample will include states that include strong state local planning mandates and weak mandates. Prior research suggests that state planning mandates have a significant influence in the quality of plans. States are also requiring that planning prioritize equity principles to shape contents and formats of plans. An expanded sample will also include plans that are adopted in different geographic settings with different type of hazards, threats posed by climate change and social and economic factors that influence plans.

Caution should be used in interpreting the findings since this is a preliminary analysis. Our assessment of disaster recovery resources is currently limited to a single county after a single event, and the scope will be expanded in future work. The plan evaluation method used for this study has undergone continual refinement during Years One and Two. Consequently, the findings reported for the NC sample on this report are likely to change. The analysis of indicators of social vulnerability focuses on four counties and how certain metrics vary within them. Our results may not be applicable beyond those four counties. In addition, individual data sources may have their own limitations; for example, Census data may be affected by non-responses and incomplete coverage, especially in relatively small geographic areas.

## **POLICY RECOMMENDATIONS**

Based on our literature review, review of social equity conceptual frameworks, exploration of historical context, assessment of HMPs and CPs, analysis of social vulnerability indicators and review of including community voices, we created the following list of recommendations for advancing equitable and resilient outcomes for marginalized populations. This work is compiled from the first eight months of the study which reflects early results that should not yet be used for policy making. We are currently refining our methods to ensure for more robust results.

- 1. Use multiple data sources to determine the best strategies to advance equitable and resilient outcomes for marginalized groups.**
  - Include multiple sources and methodologies to allow the data to speak to each other and identify what is missing.
  - Use the social equity framework to identify the inconsistencies between and across data points, specifically those that are geared to measure and improve outcomes for marginalized groups.
  - Collect data with equity in mind. This means that the questions are asked in a manner that highlights justice and uplifts groups that are typically left behind.
  
- 2. Investigate the history of a community through an equity lens.**
  - Investigate the historical context of a community related to oppression.
  - Examine historical injustices to provide the disaster risk management community with a clearer understanding of equity needs of the community.
  
- 3. Facilitate more integration between HMP and CP by community.**
  - Construct HMPs and CPs jointly so that both documents speak to each other. Siloed plans cause missed opportunities to identify and address inequities in hazard risks and disaster outcomes.
  - Improve sharing of different types of data that can be used for deriving equity indicators. Inadequate data sharing among local government agencies that are charged with different domains of planning and management (e.g., hazard mitigation, housing, spatial land use and provision of infrastructures) leads to duplication of efforts and inefficiencies.
  - Coordinate equity indicators among plans to reduce conflicts and missed opportunities for successful aid delivery. If indicators are viewed as legitimate from the perspective of marginalized people, coordination among them is more likely to improve equitable and resilient outcomes from aid delivery systems.
  
- 4. Use multiple quantitative metrics to assess needs among marginalized groups.**
  - Quantitative indicators of social vulnerability often conflict with one another in identifying communities of concern for hazard mitigation and disaster recovery. Relying on a single indicator, such as elderly populations, can overlook other marginalized groups, such as the differently-abled or those who are linguistically isolated.
  - Currently, there is little empirical basis for what indicators to use and when. Without clear evidence as to which indicators are particularly valid for a context

or a community, using multiple indicators can offer a broader range of perspectives on groups that may benefit from additional support.

- Post-disaster data can provide some insight on what metrics are empirically related to outcomes of interest. While post-disaster data can only provide a specific lens on disaster impact and recovery, they can show who needs assistance after an event, who is receiving government support and in what form.

**5. Include community voice to gain a more holistic perspective.**

- Highlight community voices as experts – ones that know the most about their spaces and can provide the best insight on the overall needs and direction of the community.
- Include marginalized populations and voices, especially in spaces that bring together multiple actors within the disaster risk management community.
- Conduct interviews with members of the community who are typically excluded to ensure that communal recovery encompasses diverse voices.

## NEXT STEPS FOR RESEARCH

The current project focused on *Stage One: Identifying inconsistencies* of the social equity framework. We suggest continuing within stage one by collecting additional information within each critical dimension for the existing four case study sites. We also recommend expanding the same from four sites in one state to 16 sites in four states. Selection of states would be based on variations, geographic locations and strength of state mitigation policies and shared governance arrangements.

We provide a breakdown of next steps for research for each critical dimension. Collecting additional information will assist the research team in identifying appropriate measures to advance equitable resilient outcomes for marginalized populations.

### *Historical Context*

The team used publicly available text largely from the internet to collect information about the historical context of each community. In the next step, the team will expand their research by including non-traditional spaces to collect historical context. As the literature suggest, it is imperative to seek out information from the non-dominant voices and counter-narratives.

Next, the team will begin to track the relationship between historical injustices and present-day inequities in risk and vulnerability. Tentative research questions will be used to guide analysis of the historical context.

- To what extent do we see that historically redlined areas are in environmentally hazardous locations?
- How, if at all, have past issues of oppression shaped present day inequities?
- To what extent do we see similar findings statewide and nationally?

### *Plan-based indicators*

The team will also conduct a deeper assessment of local planning. The team will refine the plan evaluation methods, apply coding procedures to improve data reliability, conduct additional statistical analyses to include more detailed descriptive analyses that disaggregate index scores of equity indicators. Through this process, the team would assess correlations between equity indicator scores and strength of equity strategies included in plans.

Tentative research questions to guide the analysis of plan-based indicators include:

- What are the actual applications of equity indicators (e.g., develop baselines, formulate equity strategies, measure progress in equity outcomes, apply for federal funding)?
- For each application: Speculate on whom may benefit, be harmed, or whom has been left out.
- What are the obstacles to more effective use of equity indicators (e.g., missing data, local government capacity, misalignment between outside aid and needs of local people, inadequate cross sector coordination)?

With the additional 12 case study sites, the team will identify potential sources of data to improve local capacity and better deliver outside assistance. The team will include a more diverse sample of plans for each community and examine the extent to which indicators of equity have been used to formulate mitigation strategies.

### *Social vulnerability indicators*

Our initial analysis of vulnerability indicators in our four counties show meaningful discrepancies across indicators, and the relationships between indicators differ across counties. While age appeared frequently within the plans in our study communities, it bore little correlation with other commonly used measures of vulnerability. Future work in this critical dimension will analyze the use of quantitative indicators of vulnerability in a larger sample of communities. It will also connect these indicators at the tract level to indicators of flood impacts and recovery.

Using disaster assistance data, we find that low-income groups in Edgecombe County were more likely to apply for government assistance after Hurricane Matthew, but they were less likely to be deemed eligible. There are several ongoing and future areas for expansion within this research question.

Tentative research questions to guide the analysis of social vulnerability indicators include:

- To what extent do we see similar trends with IHP differences as a function of housing type in the NC case study sites?
- Who has access to SBA loans and to what extent does having that form of support improve recovery?
- What, if any, additional challenges and gaps form with the singular use of vulnerability metrics?
- What are recommendations for ways equitable resilience could be better supported from the perspective of local people?

### *Community Voice*

Our analysis showed that marginalized voices are typically left out of the discussion of disaster recovery. The research team constructed an interview protocol that could be used to collect the voices of those who tend to be ignored. Our next steps include validating the interview instrument, identifying the counter-narratives by case study site, conducting interviews with community members and highlighting commonalities and differences between groups. We will also interview the disaster risk management community to assess how vulnerability indicators are chosen and how those indicators are currently operationalized in planning and recovery efforts. Through the interviews, we will get a sense of what indicators people feel to be most relevant in their community contexts.

Tentative questions to guide the analysis of the community voice include:

- Whose voice is most relevant?

- To what extent do we see similarities and differences in the voices of those who are most relevant based on case study sites?
- Whose voice is least relevant?
- What steps, if any, are needed to uplift silenced voices?



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## APPENDIX A

### Social Equity Frameworks

Equity frameworks are models that can help visually outline a process to implement equity. These frameworks have been used in research to demonstrate how a specific process can promote equity in a variety of scenarios. Given the limited resources on equity within the disaster risk management field, the research team sought out social equity frameworks from alternative disciplines such as education, economics, urban planning, public health, philosophy and business. In alignment with past work on social equity, the team selected frameworks where notions of justice and oppressions were present. The team reviewed 30 social equity frameworks to highlight similarities and differences of conceptual and visual components. Conceptual components are defined as the concepts used in the equity frameworks, while visual components or the visual aspects or elements of an equity framework. The following section presents the findings from each group.

*Conceptual components.* Findings revealed that 24 of 30 frameworks (80.0%) included a mission that stated a commitment to social justice as it relates to their topic of interest. This element provided the space for an organization to express their commitment to working on issues of equity. The next most common component was community engagement, present in 20 of 30 frameworks (66.7%). Our findings revealed that most frameworks intentionally used language that included ways to incorporate community members to the solution. Next, the team identified policy across 16 of 30 frameworks (53.3%). In these cases, organizations used this component to include long-term procedures that would ultimately address policy, centered around social equity. We then identified 14 of 30 frameworks (46.7%) that addressed elements of cooperation. We defined this component as one that is dedicated to strengthening communication between different groups and improving impartiality and transparency. Next, 9 of 30 frameworks (30.0%) provided an evaluation. We saw evaluations being used as a mechanism to ensure that the process can be refined as necessary and tested for effectiveness. Lastly, roughly a quarter of the frameworks (26.6%) specifically mentioned marginalization or vulnerabilities. In some instances, vulnerabilities highlighted possible knowledge gaps.

*Visual components.* We then noted the ways in which social equity frameworks revealed similar and different visual components. The most common visual component used arrows with 22 of 30 frameworks (73.3%). Arrows were used to show progression in equity and oftentimes guided the viewers through a sequence of items that should be addressed. We then noted that 19 of 30 frameworks (63.3%) used color to help illuminate and differentiate aspects of their framework. Like the use of arrows, timelines were commonly used to show the directionality of progress over time. The team identified 16 of 30 frameworks (53.3%) that used a timeline to assess the life course of an event. Lastly, we noted the arrangement of content within the equity frameworks. We found various formatting techniques such as circular (N=13), linear (N=10), and triangular (N=3).

## APPENDIX B

### Methods for Analyzing Plans

#### *Literature Review*

We conducted a literature review to identify equity indicators that could be applied to community disaster resilience plans and programs. We searched the peer review literature and planning practice literature to identify high quality local mitigation plans and comprehensive plans that incorporated equity as a core theme or goal. Plans that include an equity theme and/or goal are more likely to include equity indicators. Websites of professional organizations (ICMA, APA, NHA) and Google Scholar were used to search for peer reviewed publications to identify the plans. Several search terms using Google Scholar include “Equity AND Plan AND (disaster OR hazard OR flood OR drought OR urban heat OR wildfire OR resilience OR climate change OR comprehensive plan).” The literature review revealed that hundreds of plans mention equity but only 5 mitigation plans and 7 comprehensive plans included equity goals, policies and indicators.

Based on the literature review of plans we classified indicators into four categories: social vulnerability, access to critical infrastructure and services, legacies of discrimination and disaster impact and recovery. We then supplemented the categories of equity indicators by drawing on existing indicator systems, indexes, interactive maps and literature about social determinants of community resilience (Cutter, 2015; Edgemon, 2020; Ricklin & Shaw, 2017). The study of local plans also included a list of 21 different types of hazards to identify hazards present in a community. Table 1 identifies examples of indicators that can be used to measure equity under each category.

Table 1: Indicators that Measure Equity (examples)

<ul style="list-style-type: none"> <li>• <b>Demographic</b> <ul style="list-style-type: none"> <li>• Age</li> <li>• Race/ethnicity</li> <li>• Language proficiency</li> <li>• Education</li> </ul> </li> <li>• <b>Economic</b> <ul style="list-style-type: none"> <li>• Income</li> <li>• Poverty rate</li> <li>• Labor force %</li> </ul> </li> <li>• <b>Housing</b> <ul style="list-style-type: none"> <li>• Tenure</li> <li>• Median value</li> <li>• Rental costs</li> <li>• Change in value over time</li> </ul> </li> </ul> <p style="text-align: center; background-color: #4a4a8a; color: white; padding: 2px;">Social Vulnerability</p>	<ul style="list-style-type: none"> <li>• <b>Health Care</b> <ul style="list-style-type: none"> <li>• Pharmacies</li> <li>• Clinics</li> <li>• Hospitals</li> </ul> </li> <li>• <b>Healthy Food</b> <ul style="list-style-type: none"> <li>• Groceries</li> <li>• Stores that accept SNAP</li> <li>• Food pantries</li> <li>• Farmers markets</li> </ul> </li> <li>• <b>Infrastructure</b> <ul style="list-style-type: none"> <li>• Transit</li> <li>• Sewer/water</li> <li>• Broadband</li> <li>• Parks/greenways</li> </ul> </li> </ul> <p style="text-align: center; background-color: #4a4a8a; color: white; padding: 2px;">Accessibility</p>	<ul style="list-style-type: none"> <li>• <b>Legacies of Discrimination</b> <ul style="list-style-type: none"> <li>• Redlining</li> <li>• Racial zoning</li> <li>• Legal segregation of infrastructure</li> <li>• Forced displacement</li> </ul> </li> <li>• <b>Disaster Impact &amp; Recovery</b> <ul style="list-style-type: none"> <li>• Death/injuries</li> <li>• Crop damage</li> <li>• # homes damaged</li> <li>• Acres burned</li> </ul> </li> </ul> <p style="text-align: center; background-color: #4a4a8a; color: white; padding: 2px;">Legacies &amp; Impacts</p>
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#### *Pilot Study in Four NC Counties*

We then used the list of equity indicators and hazards to develop a draft protocol to evaluate the presence of indicators in plans. We piloted the protocol to evaluate hazard mitigation and comprehensive land use plans in four case study counties across North Carolina: Buncombe, Burke, Edgecombe and Mecklenburg. Two plans were evaluated for each county (see Table 2):

their multi-jurisdictional or regional hazard mitigation plan and their county comprehensive land use plan (Burke County and Edgecombe County) or the comprehensive plan of their largest municipality (Asheville in Buncombe County and Charlotte in Mecklenburg County). Multiple rounds of testing the coding protocol on plans outside the study area were conducted following standard code development procedures (Krippendorff 2004).

*Table 2: List of Plans Included the Pilot Study*

County	Year	Title	Plan Type
Buncombe	2021	Buncombe Madison Hazard Mitigation Plan	Hazard mitigation
	2018	Living Asheville: A Comprehensive Plan for Our Future	Comprehensive
Burke	2019	Unifour Regional Hazard Mitigation Plan	Hazard mitigation
	2016	Blueprint Burke: A Strategic Land Use Plan	Comprehensive
Edgecombe	2020	Nash-Edgecombe-Wilson Regional Hazard Mitigation Plan	Hazard mitigation
	2014	Edgecombe County Comprehensive Plan	Comprehensive
Mecklenburg	2020	Mecklenburg Multi-jurisdictional Hazard Mitigation Plan	Hazard mitigation
	2022	Charlotte Future: 2040 Comprehensive Plan	Comprehensive

*Rationale for Selection of Plans*

We narrowed our preliminary evaluation to two types of plans that figure prominently in local resilience practice and have the potential to either further entrench existing inequalities or help remedy them. The comprehensive plan is the primary local government planning document. It serves a central role in coordinating multiple community land use and development programs, and ultimately settlement patterns in hazard areas. The hazard mitigation plan is the most ubiquitous plan adopted by local governments to reduce hazard risk and vulnerability. Mitigation plans are important because local governments must have a mitigation plan approved by FEMA to be eligible for access to significant federal funding for pre-disaster mitigation and post-disaster recovery.

*Scoring Plans*

Plans were then scored based on the number of indicators included and the degree to which each included indicator tracks the effects of planning efforts aimed at meeting the needs of marginalized and vulnerable populations. Indicators that were reported only at the communitywide scale received a score of +1. Indicators that differentiate measurements at the sub-community scale received a score of +2. For example, a measure of age could be reported for an entire county or city, while a more spatially explicit measure would identify age for different geographic areas with a county or city, allowing for the identification of differences across the planning area.

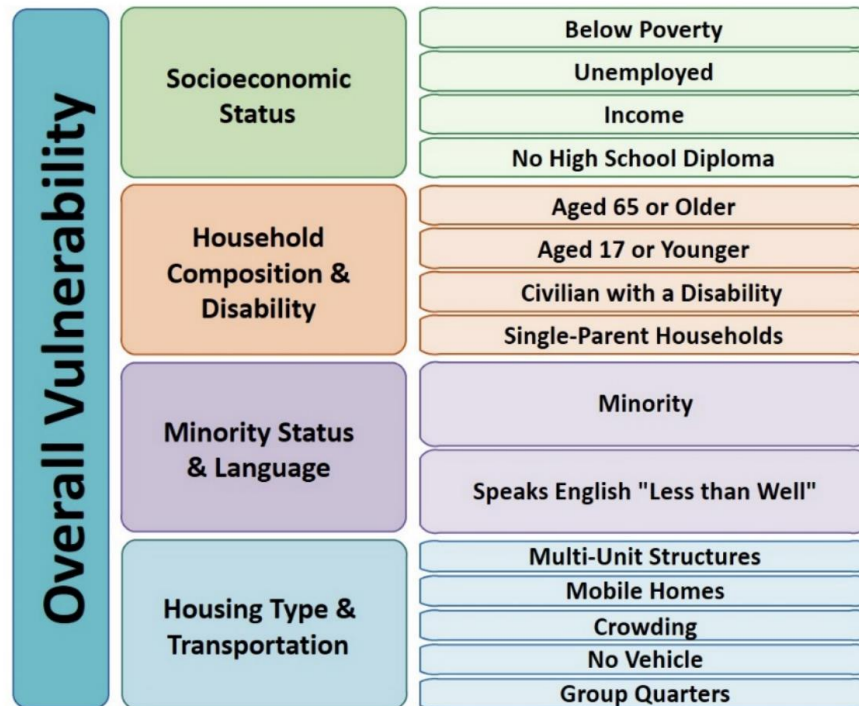
Sub-community scale indicators received a higher score because they help identify critical geographic areas at the neighborhood scale that are at greater risk and lack resources that support equitable outcomes. Once the areas are identified, communities can set goals and action strategies for each area and then revisit the measure periodically to monitor and evaluate progress. The measures could also enable communities to explore equity issues and analyze the intersection between socioeconomic status, hazard exposure, accessibility to critical facilities and environmental amenities, and post-disaster recovery rates.

## APPENDIX C

### Current Use of Quantitative Indicators

*Centers for Disease Control's Social Vulnerability Index (SVI)*. This government-produced index is composed of the indicators shown in the figure below. Each indicator is scaled to a percentile and summed within each of the four themes. The sums are rescaled to percentiles and then summed again. The final index is the percentile for that community of the final sum. It draws entirely on data from the US Census Bureau and provides its data at the census tract scale.

Figure 19. Composition of CDC's Social Vulnerability Index



Note: The individual indicators (right) are grouped into themes (middle) and combined into an overall vulnerability index.

*Climate and Economic Justice Screening Tool ("Justice40")*. This new classification system has been proposed for the implementation of the Biden administration's Justice40 executive order. It classifies census tracts as either disadvantaged or not disadvantaged. The methodology relies on numerous indicators and applies a threshold-based approach, classifying tracts as disadvantaged if they are above a certain percentile. The threshold varies by category, which include clean energy and energy efficiency, climate change, clean transit, affordable and sustainable housing, legacy pollution, water and wastewater infrastructure, health burdens and training and workforce development. Data sources include the US Census Bureau and the Federal Emergency Management Agency.

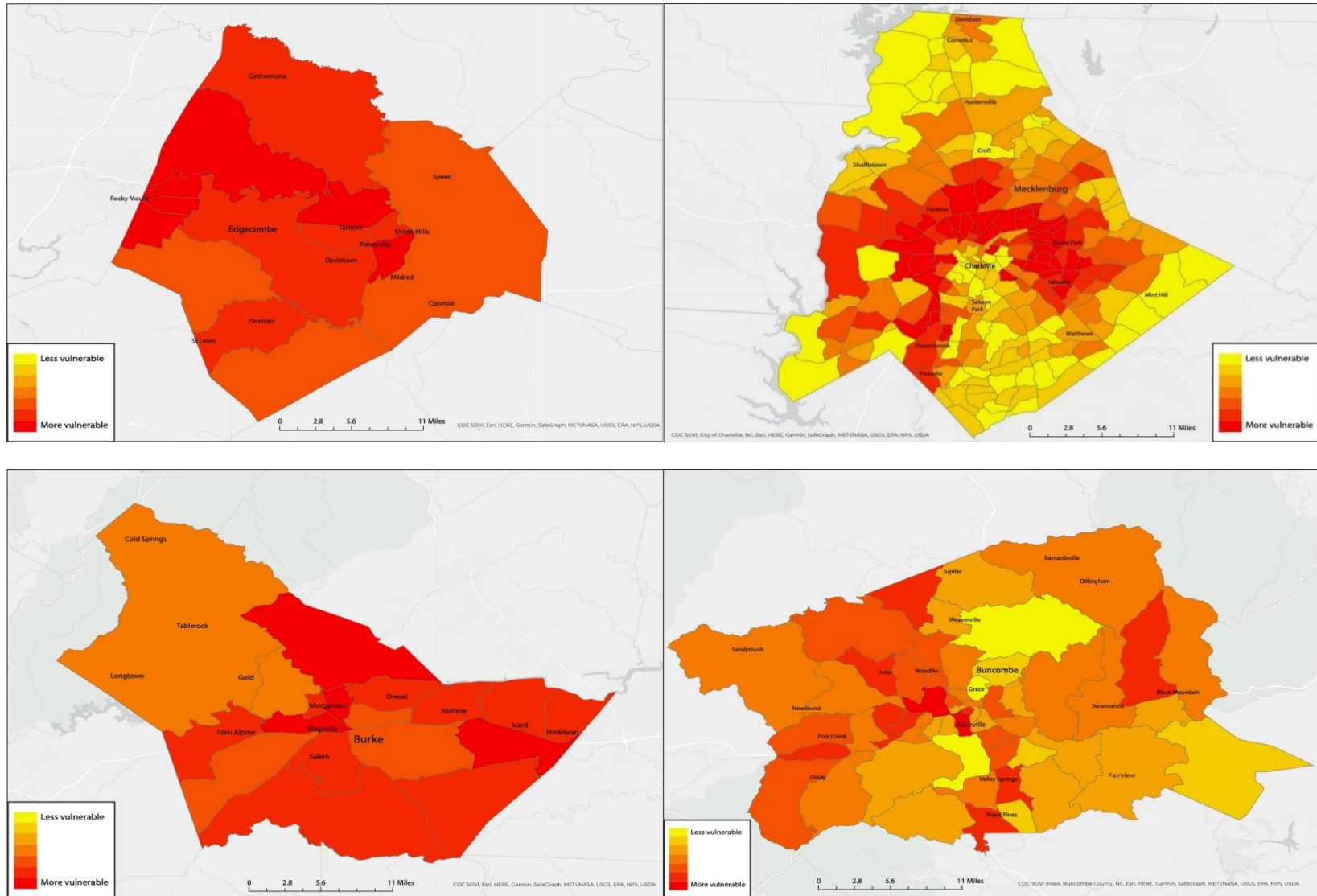
*Percent people of color*. Race is a well-established indicator of social vulnerability. We extract the estimate of the percentage of people in the tract that identify as non-white from the American Community Survey.

*Percent of vulnerable ages.* Young children and the elderly face additional needs and barriers in disaster settings, such as more difficulty evacuating. Age was the most commonly used indicator of social vulnerability within the plans that we evaluated for this report. We aggregated the share of the population below age 5 and above age 65, based on the American Community Survey.

*Median household income.* Financial resources are critical to withstanding the shocks from a disaster. We extract tract-level median household income estimates from the American Community Survey.

# APPENDIX D

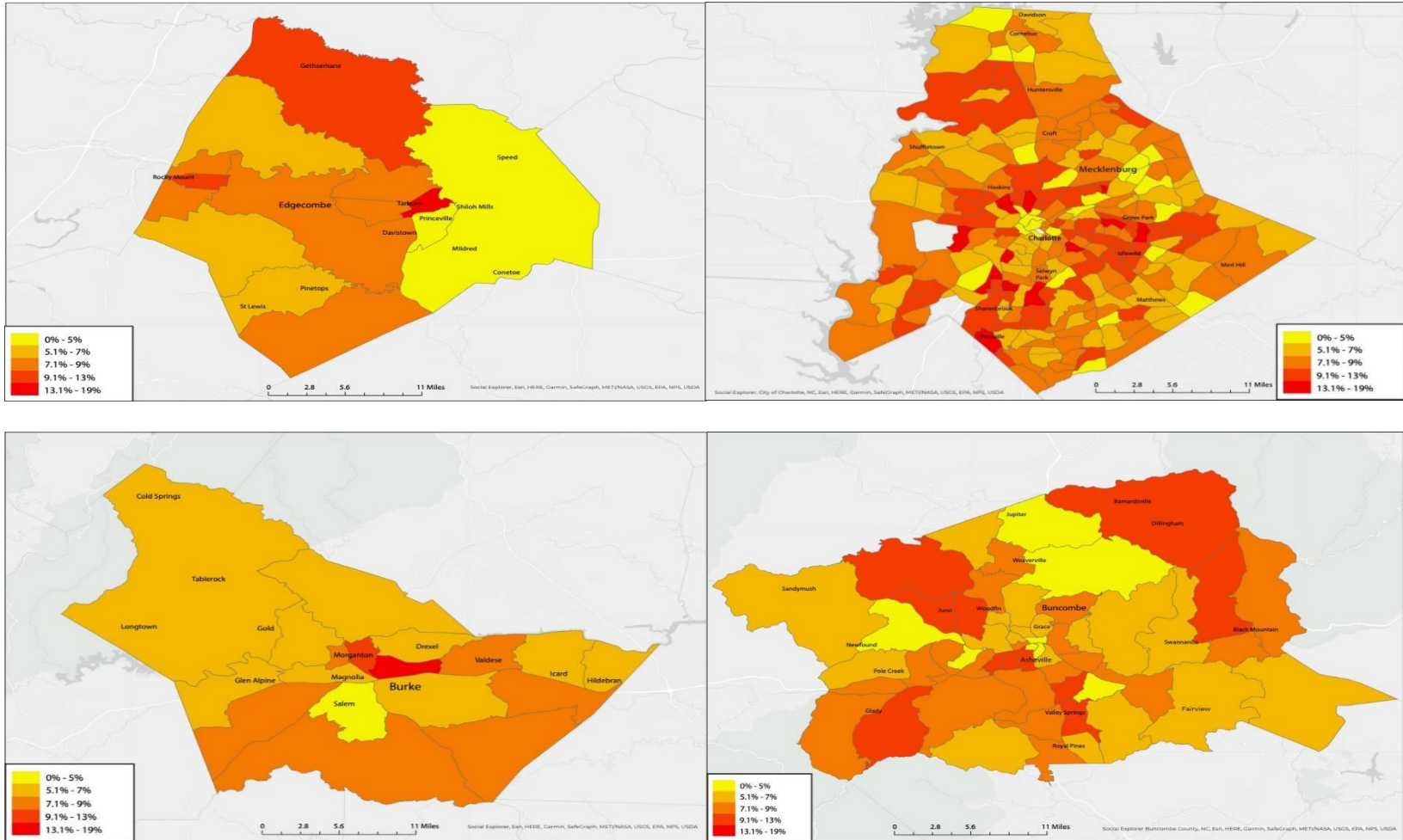
CDC SVI. All maps use the same color scale.





# APPENDIX E

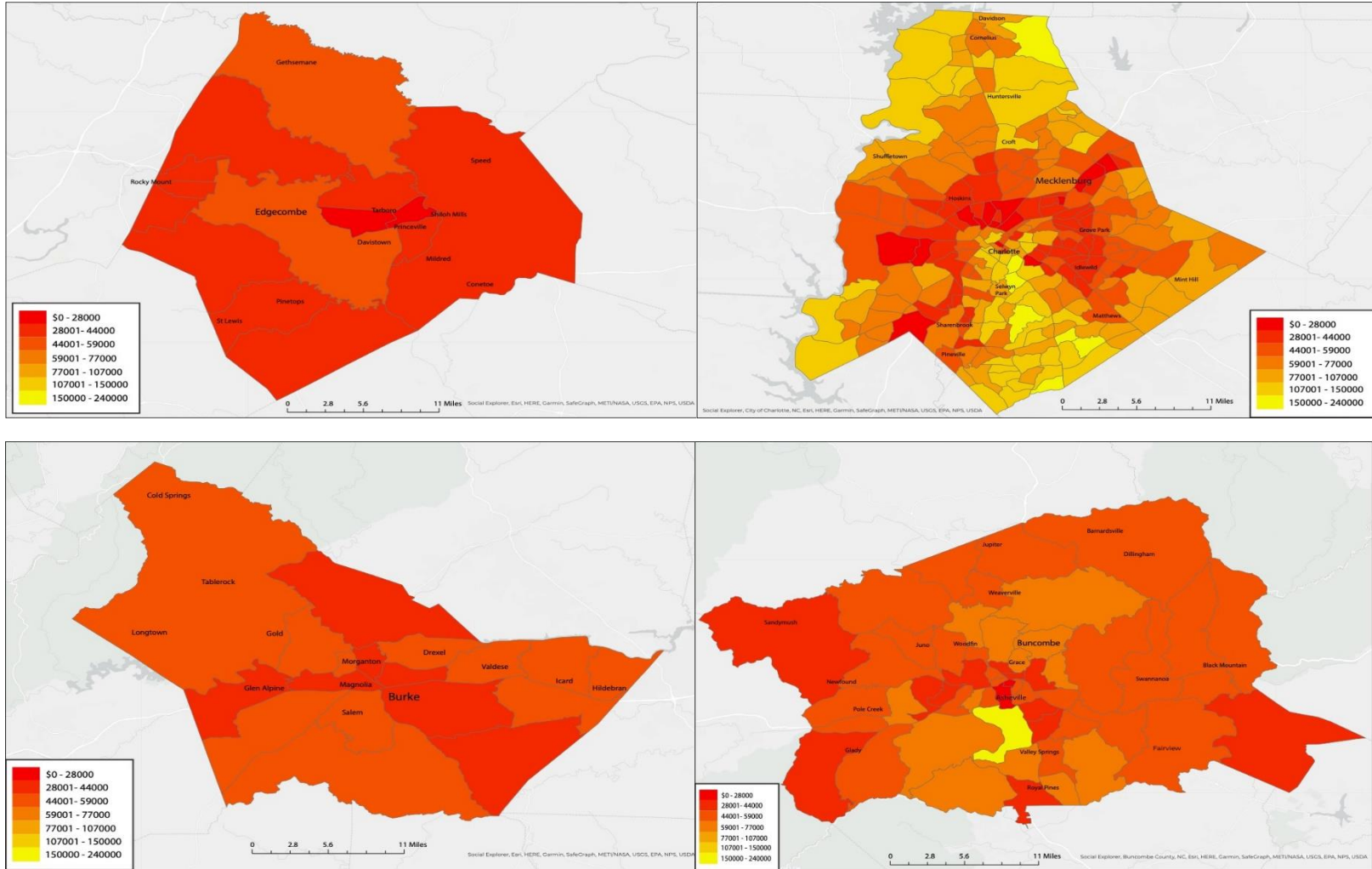
Share of population in vulnerable age categories (American Community Survey). All maps use the same color scale.





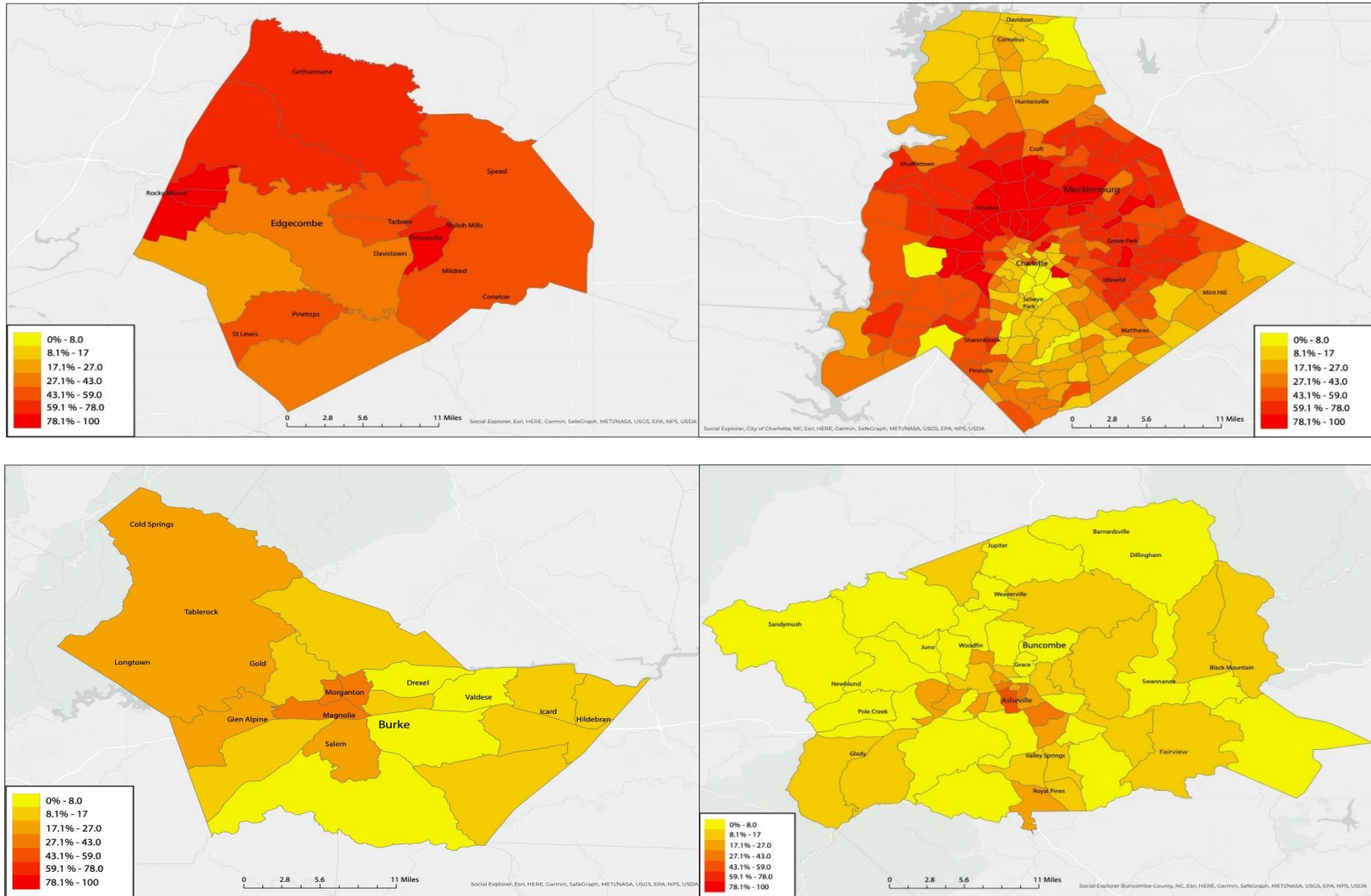
# APPENDIX F

Median household income (American Community Survey). All maps use the same color scale.



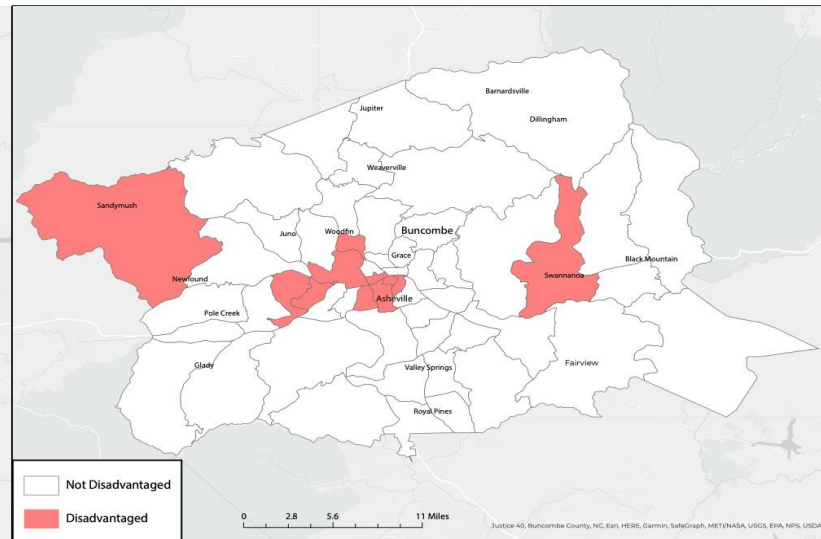
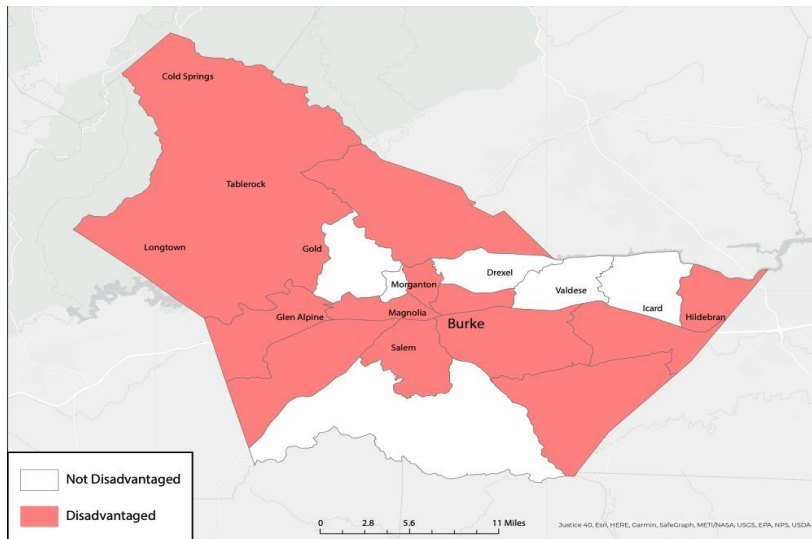
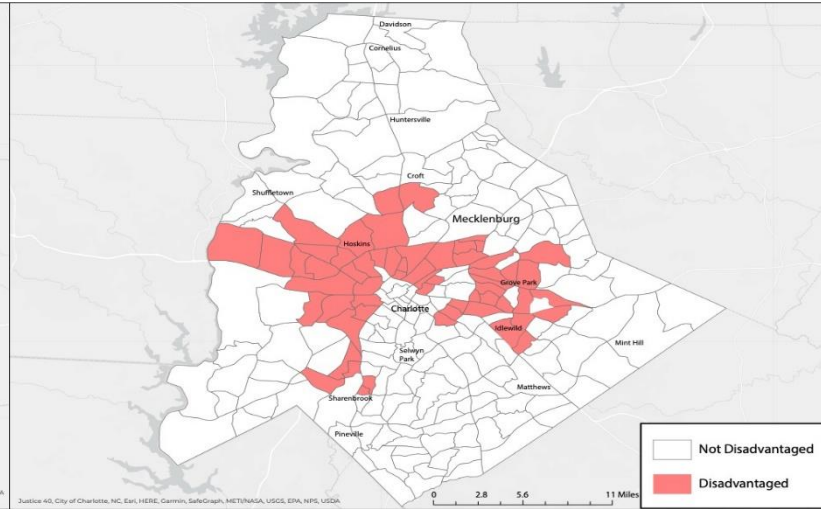
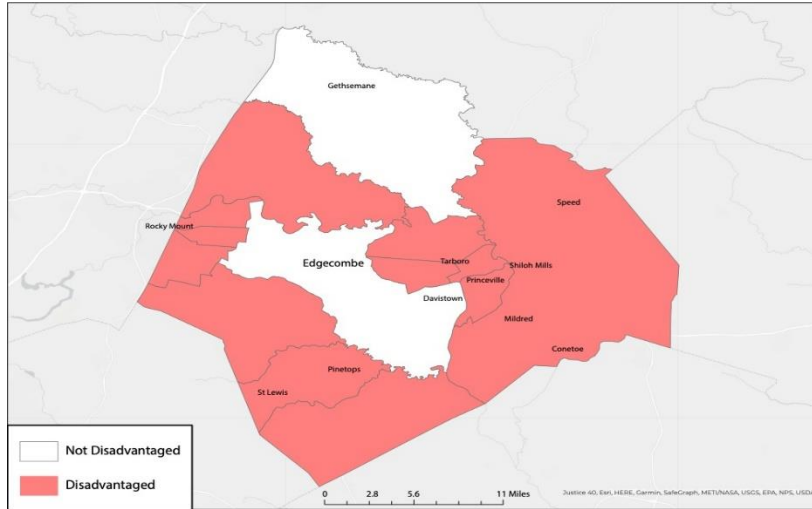
# APPENDIX G

Share of people of color (American Community Survey). All maps use the same color scale.



# APPENDIX H

## Justice40 Screening Tool



## **APPENDIX I**

### **Interview Protocol**

**Name of Researcher:**

**Date/Time:**

**Location:**

#### **Background**

1. Please share your name, role, and why you decided to speak to me today.
2. Can you tell me about your connection to this community?
  - a. If you live here, how long have you been here?
3. What do you love about your community? What do you wish would improve?
4. What type of people live here?
5. Describe for me the biggest risks the community faces (e.g., safety, food, access, weather-related events, etc.).
6. How, if at all, is/are this risk being addressed? By whom?

#### **Disaster Impact**

7. What disasters have affected the community in recent memory?
8. Who are the most impacted by these events?
  - a. How are they impacted?
  - b. To what extent are they supported through recovery?
9. Who else is impacted? How, if at all, are they supported through a disaster?
10. Who, if at all, is left out of receiving support? Why?

#### **Planning**

11. How do you plan for future disasters?
12. What, if any, strategies has your community used in preparation for future disasters?
13. What, if any, ways have governmental agencies assisted in preparing for future events?
14. What types of plans are needed to be most effective in supporting groups that are most in need in your community?

*Thank you for your participation in this interview. You will receive a \$30 gift card for your assistance. You will also receive the final report from us once we finish with data collection and analysis.*

## ABOUT THE AUTHORS



**Cassandra R. Davis, Ph.D.**, is an Assistant Professor in the Department of Public Policy at UNC-CH. Dr. Davis's research focuses on environmental disruptions to schooling communities, specifically low-income communities of color.



**Philip Berke, Ph.D.**, is a Research Professor, Department of City & Regional Planning; and Director of the Center Resilient Communities and Environment, Institute for the Environment of the University of North Carolina–Chapel Hill.



**Miyuki Hino, Ph.D.**, is an Assistant Professor in the Department of City & regional Planning. Dr. Hino is an environmental social scientist working on monitoring and measuring the impacts of climate change.



**Fern Hickey, M.A.**, is a recent graduate from the Department of City & Regional Planning, where her studies focused on climate change adaptation, hazard mitigation, and resilience planning.



**Christy Fierros** is a graduate student from the Department of City & Regional Planning



**Will Anderson** is a graduate student from the Department of City & Regional Planning



**Ruth Fetaw** is a recent graduate from the Departments of Public Policy and holds the role as the Research Assistant for this project. Ms. Fetaw hopes to support communities of color through reoccurring hazards.





**Sarah Haynes** is a recent graduate from the Departments of Public Policy and Sociology. Ms. Haynes hopes to impact K-12 public education by diminishing opportunity gaps between BIPOC and white students.



**Priya Kosana** was a member of the UNC Public Policy Capstone Team. Priya recently graduated from UNC with majors in Biology and Public Policy.



**Patience Foster** was a member of the UNC Public Policy Capstone Team. Patience graduated from UNC with a double major in Public Policy and Peace, War, and Defense and a minor in Spanish for the Legal Professions.



**Syndi Walker** was a member of the UNC Public Policy Capstone Team. Ms. Syndi graduated from UNC with a double major in Public Policy and Human Development and Family Studies.



**Evan Johnson, Ph.D.**, is a Teaching Assistant Professor at UNC-CH. He previously served as a Research Fellow at the U.S. Environmental Protection Agency. His research focuses on innovation and public policy, with specific foci including energy innovation, climate stabilization and the impacts of Federal R&D funding on firms.