

Using a Resilience Strategy to Address the Social Effects of Climate Change in Madison, Wisconsin

Prepared for The City of Madison

By

Brittaini Maul

Noah Roberts

Ryan Spaight

Vanessa Studer

Chris Webb

Claire Zautke

Workshop in Public Affairs

Spring 2019



**Robert M. La Follette
School of Public Affairs**
UNIVERSITY OF WISCONSIN-MADISON

©2019 Board of Regents of the University of Wisconsin System
All rights reserved.

For an online copy, see
www.lafollette.wisc.edu/research-public-service/workshops-in-public-affairs-publications@lafollette.wisc.edu

The Robert M. La Follette School of Public Affairs is a teaching and research department of the University of Wisconsin–Madison. The school takes no stand on policy issues; opinions expressed in these pages reflect the views of the authors.

The University of Wisconsin–Madison is an equal opportunity and affirmative-action educator and employer.
We promote excellence through diversity in all programs.

Contents

Foreword	iv
Acknowledgements	v
Glossary	vi
Executive Summary	viii
Introduction	1
Frontline and Vulnerable Populations Face Significant Risks from Madison’s Changing Climate	3
Disproportionately Affected Populations	3
Physically Vulnerable Populations	3
Frontline Population Plan Districts	4
Heat and Temperature	6
Flooding	8
Resilience	12
Strengths and Challenges for Resilience Planning in the City of Madison	12
City of Madison Strengths	12
City of Madison Challenges	13
Benefits of a Resilience Strategy	15
Building a Resilience Strategy	16
Case Studies	18
Background on Cities	18
City Challenges: The Impetus for Resilience Planning	19
Acute Shocks	19
Chronic Stresses	19
Planning Process	20
Community Engagement	21
Support, Leadership, and Staffing	23
Considerations	25
Staff Capacity and Cost	25
Program Costs	25
Political Context	26
Intergovernmental Constraints	26
Recommendations to the City of Madison Common Council and Mayor	27
Recommendations to the SMC	27
Recommendations to City of Madison Departments	28
Conclusion	29
Appendix A: Identification Methodology Full Data Tables for Frontline Plan Districts	30
Methodology and Population Identification (Data Collection Strategy)	30
Detailed Tables: Frontline Plan Districts and Income, Transportation, and Housing	31
Appendix B: Data Collection Strategy and Neighborhood Interview Findings	33
Interviews with City and County Stakeholders	33
Residents’ Perceptions of Extreme Climate Change Events in Madison	33
Resilience Planning Data Collection	33
Extended Findings: Neighborhood Interviews	33
Appendix C: Interview Protocol	35
Cluster A: Expertise Interviews	35
Cluster B: Community Interviews	35
Cluster C: Chief Resilience Officer Interviews	36
Appendix D: Case Study—City Goals and Actions	38
Berkeley	38
Pittsburgh	39
Minneapolis and Saint Paul	40
Bibliography	41

Foreword

This report is the result of collaboration between the Robert M. La Follette School of Public Affairs at the University of Wisconsin–Madison and the City of Madison. The objective of this project is to provide graduate students at the La Follette School the opportunity to improve their policy analysis skills while contributing to the capacity of partner organizations.

The La Follette School provides students with a rigorous two-year graduate program leading to a master's degree in public affairs. Students study policy analysis and public management, and they may pursue a concentration in a specific policy area. The authors of this report are in the final semester of their degree program and are enrolled in the Public Affairs 869 Workshop in Public Affairs. Although studying policy analysis is important, there is no substitute for engaging actively in applied policy analysis as a means of developing policy analysis skills. The Public Affairs 869 Workshop gives graduate students that opportunity.

The City of Madison, and especially the Engineering Division, has a strong history of working with La Follette School students to perform rigorous research. This report includes an analysis of administrative data, as well as interviews and other research, with the goal of helping the City to improve services for residents, especially in vulnerable neighborhoods, as part of an overall focus on sustainability.

I am grateful to the City of Madison for partnering with the La Follette School on this project. The students have collectively contributed hundreds of hours to this project, and in the process developed critical insights about City programs. The La Follette School is grateful for their efforts and hope that this report proves valuable for the City of Madison as it works on developing strategies to make the community more resilient in the face of a changing climate.

J. Michael Collins
Professor of Public Affairs

April 2019
Madison, Wisconsin

Acknowledgements

We would like to gratefully acknowledge our client, the City of Madison, for their support of this project. A special thank you is reserved for Jeanne Hoffman and Stacie Reece who provided superlative guidance and feedback on this report, and who were incredibly generous with their time. We would also like to express our gratitude to the faculty, staff, and students at the La Follette School of Public Affairs—especially to our advisor, Professor J. Michael Collins, for his invaluable insight. Thank you to our interviewees, Yogesh Chawla, Megan Christensen, Jessica LeClair, John McLellan, Colleen Moran, Kurt Paulsen, Keith Reopelle, Charles Tubbs, and Dan Vimont, who lent their expertise to the development of this report. Additionally, thank you to Kate Knuth, Russ Stark, and Katie Van Dyke who took the time to share what they have learned from years of resilience work. We also extend our sincere gratitude to Madison community members who shared their experiences with us for the purpose of this report. Finally, thank you to the Sustainable Madison Committee for their interest in resilience and for providing a space and audience for us to share our report.

Glossary

Term	Definition
100-Year Floodplain	The area that is predicted to flood during a 100-year flood event, which has a one percent chance of occurring in any given year.
500-Year Floodplain	The area that is predicted to flood during a 500-year flood event, which has a 0.2 percent chance of occurring in any given year.
Acute Shock	Sudden, sharp events that threaten a city, including, for example, earthquakes, floods, and disease outbreaks.
Area Median Income	The midpoint of a region's income distribution. Half of households in a region earn more than the median and half earn less than the median.
Bioswales	Landscape elements designed to absorb and remove pollution from runoff water of impermeable surfaces like roads and parking lots. Bioswales are generally shaped like gently sloping trenches and filled with vegetation that absorb and purify water, such as grasses and shrubs.
Chief Resilience Officer (CRO)	The top-level advisor to the city's mayor or chief executive. The CRO's task is to convene stakeholders from across government agencies and sectors of society, and to access all available resilience-building tools and experts to develop a resilience strategy.
Chronic Stress	Slow-moving disasters that weaken the fabric of a city. They include, for example, high unemployment, overtaxed or inefficient public transportation system, endemic violence, and chronic food and water shortages.
Climate Adaptation	Efforts intended to help adjust to a changing climate. This may include changes in structures, practices, or processes to curb potential damages or benefit from opportunities linked to climate change.
Climate Mitigation	Efforts intended to limit the magnitude (or rate) of global warming and its associated effect. This may include the reduction or prevention of greenhouse gas emissions.
Climate Resilience	A systematic framework that encompasses a range of strategies that communities may employ to adapt to the changing climate. It focuses on helping individuals and neighborhoods prepare for and recover from climate events.
Climate Sustainability	The physical development and institutional operating practices that meet the needs of present users without compromising the ability of future generations to meet their own needs, particularly regarding use and waste of natural resources. Sustainable practices support ecological, human, and economic health and vitality. Sustainability presumes that resources are finite and should be used conservatively and wisely with a view to long-term priorities and consequences of the ways in which resources are used.
Frontline Communities	Those affected first by climate change. These communities tend to have lower incomes and experience the effects of social disparities.
Frontline Plan District	Plan districts with a high concentration of frontline populations. Districts are identified as frontline plan districts if more than 50 percent of the Madison Metropolitan School District student population experiences economic disadvantage.
Madison Neighborhood Indicators Project	A point-and-click geospatial tracking system designed to follow neighborhoods' wellness over time. Geographies include the overall City of Madison, plan districts, and Neighborhood Associations.
Plan District	Madison plan districts, as identified in the Madison Neighborhood Indicators project.

Rockefeller 100 Resilient Cities Initiative	100 Resilient Cities – pioneered by The Rockefeller Foundation – is a nonprofit organization dedicated to helping cities around the world build resilience to the economic, social, and physical challenges that are increasingly part of the 21st century. 100 Resilient Cities provides member cities with access to a curated suite of resilience-building tools and services supplied by a carefully selected platform of partners from the private, public, academic, and nonprofit sectors.
Social Determinants of Health	Social and economic factors that affect a person’s health. Social and economic determinants of health include economic stability, housing, education, community and social context, the health care system and other factors.
Urban Heat Island Effect	The urban heat island effect is a phenomenon that magnifies the intensity of harmful climate-related impacts through a feedback loop sustained by urban-conditions, such as widespread concrete surface areas and concentrated metal structures. The risks of heat exposure are elevated in urban areas that don't take proactive measures to implement widespread cooling mechanisms such as shelters, specialized pavement, and green roofs.
Vulnerable Populations	In this report, vulnerable populations refer to populations that are more physically susceptible to the health-related effects of climate change. Examples of vulnerable populations include older adults (ages 65+), young children (ages 0-5), pregnant women, and people with disabilities.
Wet Bulb Temperature	Wet bulb temperature is a measure of combined heat and humidity that can be organized into four categories of severity. On our current path, the Midwest will likely see around 3 days per year of Category 4 conditions, which have never been experienced in the United States to date.

Executive Summary

The City of Madison's Engineering Division requested an analysis of how Madison can become more resilient to extreme climate events. Recent local events, including the August 2018 floods and the extreme cold of January 2019, have brought the need for resilience planning into stark focus. In particular, the City of Madison emphasized interest in learning about how extreme climate events disproportionately impact vulnerable and frontline populations and how a resilience strategy might help address these disparities.

This report addresses the following research question: "How does climate change threaten resilience in Madison, specifically for frontline and vulnerable populations, and what steps should city leaders, the Sustainable Madison Committee (SMC), and other stakeholders take?" The report is divided into three sections. The first section describes vulnerable and frontline populations in the city and provides an analysis of how Madison's changing climate is likely to affect the city overall as well as these particular populations.

The second section introduces the framework of resilience, identifies various strengths and challenges in Madison related to resilience, and concludes with four case studies. Selected cities (Berkeley, CA; Pittsburgh, PA; Minneapolis, MN; and Saint Paul, MN) share at least two of the following features with Madison: weather and climate, political environment, and social challenges.

The third section includes three sets of recommendations: to the City of Madison Common Council and Mayor, to the Sustainable Madison Committee, and to the City of Madison Departments.

Recommendations to the City of Madison Common Council and Mayor

- Hire a Chief Resilience Officer.
- Develop a Madison-specific climate adaptation and resilience task force.

Recommendations to the Sustainable Madison Committee

- Set accountability measures for a climate resilience strategy.
- Promote resilience as a way to approach cross-department city development that anticipates the broad effects of chronic stresses and acute shocks.
- Conduct stakeholder mapping.
- Assist the City of Madison with housing-quality mitigation and energy-efficiency improvements.

Recommendations to the City of Madison Departments

- Establish strategies to identify specific subsets of vulnerable populations.
- Target 2023 for completion of a formal resilience strategy.
- More strategically leverage nonprofit service providers, especially those who focus on older adults.
- Develop an equity-based climate risk assessment tool that city departments can modify and adapt to their responsibilities.
- Consult with surrounding community municipal stakeholders to determine potential buy-in for a regional resilience strategy.
- Develop Neighborhood Disaster Preparedness Liaisons.

Introduction

In August 2018, the City of Madison and Dane County endured historic rains and subsequent flooding that led to an estimated \$154 million worth of damage.^{1,2} Following the events, in January 2019, Madison experienced extreme cold, with temperatures reaching nearly 60 degrees Fahrenheit below zero, with the windchill.^{3,4} These extreme weather events are occurring more frequently with a magnified severity; they are becoming the new normal as a result of the changing climate.^{5,6}

Given the accelerating effects of climate change in the City of Madison, there exists an urgent need to adapt and build a more resilient city. Previous efforts often have focused on reducing greenhouse gas emissions through zero carbon emission goals, increasing reliance on renewable energy and sustainable resources, and increasing overall hazard mitigation planning.^{7,8} While sustainability and mitigation efforts are important steps to combating climate change, they must be implemented in tandem with resilience to rival the new normal and ultimately prove effective.

Climate resilience refers to “the ability to anticipate, prepare for, and respond” to dangerous climate events, trends, and disturbances.^{9,10} The goal of resilience is to minimize the social, economic, and environmental disruption of climate change by anticipating its inevitable effects. Resilience prepares communities for acute shocks, such as heavy downpours, extreme cold and heat, as well as chronic stressors, such as worsening air quality, deteriorating health, and rising lake levels.¹¹ Resilience is distinguished from sustainability and mitigation in its focus on helping individuals and neighborhoods prepare for and recover from climate events. It is a systematic framework that encompasses a range of strategies that communities may employ to adapt to the changing climate. The viability of the framework has continued to gain traction as communities across the globe have adapted the concept of resilience and applied it to policies, programs, and activities aimed to address climate change.^{12,13} For this report, the authors focus on the social impacts of acute climate events and how to build a more resilient Madison.

Acute climate shocks and chronic stressors have disproportionate effects on vulnerable and frontline populations, which exacerbates existing inequalities.¹⁴ Vulnerable populations refer to individuals with physical or mental limitations. Members of vulnerable populations may include children, older adults, and individuals with disabilities and/or chronic illnesses. Frontline populations refer to individuals who are more susceptible to the repercussions of climate change as a result of barriers to political, social, economic, and

¹ Keith Reopelle, interview with the authors, February 15, 2019, City County Building, Madison, WI.

² Dane County Emergency Management, “Dane County Flooding—Damage Estimates,” September 5, 2018.

³ Ibid.

⁴ Bill Novak, “Tony Evers Declares State of Emergency Due to Extreme Winter Weather,” January 29, 2019, Madison.com.

⁵ Martina K. Linnenluecke, Andrew Griffiths, and Monika Winn, “Extreme weather events and the critical importance of anticipatory adaptation and organizational resilience in responding to impacts,” *Business Strategy and the Environment* 21, no. 1 (2012): 17-32.

⁶ Dim Coumou and Stefan Rahmstorf, “A decade of weather extremes,” *Nature climate change* 2, no. 7 (2012): 491.

⁷ Dane County Natural Hazard Mitigation Plan, Dane County Emergency Management, September 28, 2017.

⁸ Jeanne Hoffman, interview with the authors, January 25, 2019, City County Building, Madison, WI.

⁹ Center for Climate and Energy Solutions, “Climate Resilience Portal,” December 19, 2018.

¹⁰ EPA, “Superfund Climate Resilience,” February 25, 2019.

¹¹ “Climate Resilience Portal,” Center for Climate and Energy Solutions, December 19, 2018.

¹² Stephen Tyler and Marcus Moench, “A framework for urban climate resilience,” *Climate and Development* 4, no. 4 (2012): 311-326.

¹³ Aditya Bahadur and Thomas Tanner, “Transformational resilience thinking: putting people, power and politics at the heart of urban climate resilience,” *Environment and Urbanization* 26, no. 1 (2014): 200-214.

¹⁴ US Global Change Research Program, “Fourth National Climate Assessment: Summary Findings,” November 23, 2018.

environmental resources. Members of frontline communities may include people and families with low incomes, who are experiencing homelessness, from racial and ethnic minorities, and whose native language is not English.¹⁵

The goal of this report is to develop a case for resilience and provide initial concrete steps that the Sustainable Madison Committee and other city stakeholders should take to build a climate-resilient community. The report is divided into three primary sections: Disproportionate Effects of Climate Change, Resilience, and Recommendations. The first section identifies vulnerable and frontline populations in Madison and discusses the disproportionate social effects of climate change and extreme weather events on these populations. The next section analyzes resilience within the context of these communities and the greater City of Madison, highlighting the city's strengths and weaknesses. It then identifies the benefits of a resilience plan, offers steps to develop a plan, and applies four case studies to understand the process of developing a resilience strategy. The final section acknowledges key considerations for achieving a resilient community and concludes with recommendations for building a more resilient Madison in the face of a changing climate.

¹⁵ Jessica LeClair, interview with the authors, February 12, 2019, Signe Skott Hall, University of Wisconsin–Madison, Madison, WI.

Frontline and Vulnerable Populations Face Significant Risks from Madison's Changing Climate

Each year in Wisconsin, about five people die from heat waves.¹⁶ Flooding frequently damages homes and health throughout the state. Because of the changing climate, Madison will see hotter, wetter years with more heat waves, more floods, and more impacts in the decades to come. At the same time, Madison is projected to experience dramatic growth over just the next 20 years, with an expected additional 70,000 residents by 2040.¹⁷ If current trends hold, about half of these new residents will have low to moderate household incomes of less than \$50,000, and many will be members of frontline communities. Frontline communities are those affected first by climate change, and they “tend to mirror those who are most affected by the social and economic determinants of health.”¹⁸ Social and economic determinants of health include factors such as economic stability, housing, education, community and social context, and the health care system.¹⁹

Frontline communities are likely to experience disproportionate impacts from the chronic stresses and acute shocks of climate change, due to limited access to resources and greater exposure to the elements.

Additionally, vulnerable populations such as older adults, young children, pregnant women, people with disabilities, and people with chronic health conditions are at greater health and safety risks from these events.

The factors causing these disproportionate impacts—for example, indoor air quality in older housing units—often are difficult to identify and address systematically. New and creative strategies will be needed to address intractable, multi-sector issues such as community cohesion, transportation access, income, and housing quality. Madison's Comprehensive Plan outlines an equity goal of “[esteeming and fostering] the inherent worth of each individual [...], enabling them to reach their full potential.”²⁰ This goal demands a broad, people-focused approach to sustainability planning that helps ensure the resilience of individuals in addition to the resilience of city infrastructure and natural resources. To illustrate this need, this section describes vulnerable populations and frontline communities in Madison and explains the key ways climate change is likely to affect the city overall and these populations.

Disproportionately Affected Populations

This section describes two types of disproportionately affected populations in Madison: physically vulnerable populations and frontline populations identified through the lens of specific city plan districts. The Madison Neighborhood Indicators Project mapping tool demonstrates that the city's planning districts often roughly correspond to census tracts.

Physically Vulnerable Populations

Older adults. Several factors make older adults especially vulnerable to the chronic stresses and acute shocks of climate change. Older adults have physical vulnerabilities and higher susceptibility to disease, which increases mortality risk.²¹ Chronic conditions may increase susceptibility, and socioeconomic factors that increase social vulnerability—fixed incomes, limited mobility, social isolation—also increase the vulnerability of older adults.²² A few plan districts in Madison have large concentrations of older adults, and most plan districts

¹⁶ Milwaukee/Sullivan Weather Forecast Office, “Severe Weather Awareness – Heat Waves,” n.d., National Weather Service National Oceanic and Atmospheric Administration.

¹⁷ Imagine Madison: People Powered Planning, “City of Madison Comprehensive Plan,” August 2018: 3.

¹⁸ Public Health Madison Dane County, “Baseline Climate Change and Health Report,” [n.d.], (pre-publication): 6.

¹⁹ Kaiser Family Foundation, “Beyond Health Care: The Role of Social Determinants of Health in Promoting Health and Health Equity,” May 2018.

²⁰ Imagine Madison: People Powered Planning, “City of Madison Comprehensive Plan,” August 2018: 6.

²¹ David Filiberto, Elaine Wethington, Karl Pillemer, Nancy Wells, Mark Wysocki, and Jennifer True Parise, “Older people and climate change: vulnerability and health effects,” *Generations* 33, no. 4 (2009): 19-25.

²² *Ibid.*

have at least small concentrations of this population. Older adults also face unique challenges related to rising home prices and fixed incomes. In Madison, approximately 3,490 homeowner households have incomes less than 30 percent of the area median income and are extremely cost-burdened, meaning they spend more than 50 percent of their income on housing. These households are likely almost all older adult households.²³

Pregnant Women and Young Children. Children are especially susceptible to temperature-related changes, and they tend to spend more time outside, which increases exposure to environmental toxins.²⁴ Children also are potentially more vulnerable to stress-related effects from the acute shocks of climate change. In addition, climate change events might disrupt pregnant women's access to health care, increase psychological stress, and increase exposure to environmental toxins.²⁵ These exposures can have adverse impacts on birth outcomes and overall in vitro development. In Madison, almost all plan districts with a high concentration of young children (children ages 0-5) are in frontline plan districts. Vulnerabilities to climate change effects for these populations are likely compounded by the social determinants that place frontline communities at greater risk.

People with Disabilities. People with mobility and cognitive constraints are at particular risk during extreme climate events.²⁶ Mobility challenges may limit a person's ability to evacuate or seek shelter in a more appropriate environment during an extreme climate event. People with cognitive constraints may require assistance with seeking appropriate care and moderating their environment. Like older adults, most plan districts have at least some small concentrations of people with disabilities. About half of plan districts with a higher number or percentage of people with disabilities are also frontline plan districts. Two large census tracts on the outskirts of Madison have large populations of people with disabilities. In an extreme climate event, these populations may be isolated from important services. A census tract that overlaps with the Mineral Point and Greentree plan districts has the city's highest concentration of people with disabilities (27 percent).²⁷

Frontline Population Plan Districts

Based on data from the Madison Neighborhood Indicators project, several areas can be considered frontline plan districts—those with a high concentration of frontline populations (see Appendix A for full identification methodology and detailed data on these plan districts). Compared to the City of Madison overall, residents in these areas tend to be more diverse, are more likely to belong to families with children, are more likely to be renters, and are more likely to have incomes below the city median income (see Figure 1).

²³ Kurt Paulsen, "Dane County Housing Needs Assessment: 2019 Update," n.d., [pre-publication].

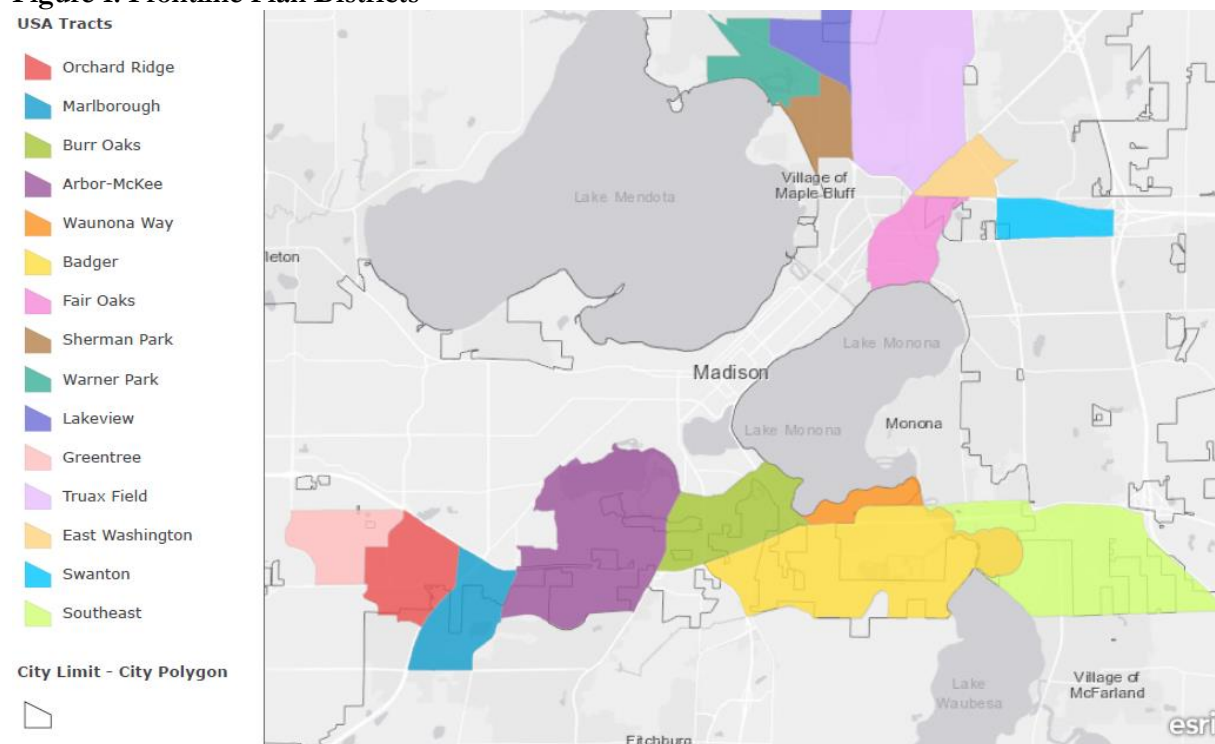
²⁴ John M. Balbus and Catherine Malina, "Identifying vulnerable subpopulations for climate change health effects in the United States," *Journal of occupational and environmental medicine* 51, no. 1 (2009): 33-37.

²⁵ Ibid.

²⁶ Ibid.

²⁷ American Community Survey, "2017 American Community Survey (ACS)," 2017, United States Census Bureau.

Figure 1: Frontline Plan Districts



Source: Madison Neighborhood Indicators Project 2017 Edition, 2017 American Community Survey (ACS), US Census, ESRI ArcGIS.

Madison has a legacy and an ongoing pattern of racial disparities and inequities, and frontline plan districts reflect these disparities.²⁸ Residents in frontline plan districts experience key social and economic determinants of health in the following ways:

Income: As of 2017, the median income in the City of Madison is \$59,387 (50 percent of households earn less than \$59,387); however, the average (mean) of all household incomes is \$79,063, suggesting relatively large income disparities. The average median income in frontline plan districts is \$50,026, about 84 percent of the city median income. Renter households comprise between 16 percent and 76 percent of these plan districts and have an average median income of \$34,578.²⁹ Incomes in these plan districts are well below BadgerCare eligibility limits for pregnant women.³⁰ Consequently, residents in frontline plan districts likely have less excess income after day-to-day expenses and savings compared to city residents overall, which increases their susceptibility to climate change events.

Transportation: Most families in frontline plan districts depend on public transit or a single vehicle for transportation. An average of 9.48 percent of residents in these districts do not have access to vehicular transportation, and 44.45 percent are dependent on one vehicle for transportation. Most residents in these districts have access to a transit stop within 0.25 miles of their home.

Housing: The rental housing market in the City of Madison is very competitive. According to the 2018 Dane County Housing Needs Assessment Update, a vacancy rate of 5 percent to 7 percent is considered indicative of a healthy rental market. With a low overall vacancy rate of 3.03 percent, Madison's rental market is skewed

²⁸ Race to Equity Project Team, *Race to Equity: A Baseline Report on the State of Racial Disparities in Dane County*, Wisconsin Council on Children and Families, 2013.

²⁹ American Community Survey, "2017 American Community Survey (ACS)," 2017, United States Census Bureau.

³⁰ ForwardHealth, "Information About Your Enrollment and Benefits," March 2019.

toward landlords.³¹ Median rents also are rising 2.3 percent per year, which “makes overall affordability worse, and imposes higher cost burdens on seniors and working families.”³² The median rent in the City of Madison is \$1,053 per month.³³ Overall, the City of Madison has 12,356 renter households with incomes below 30 percent of the Area Median Income (AMI).³⁴ There are only 4,320 rental units with rent affordable to these households, which means that there is an affordable rental housing gap of 8,045 units.³⁵ In frontline plan districts, up to 72.4 percent of households rent.³⁶ Average median income for these renters is \$34,578, but in some plan districts it is as low as \$24,722. Almost 40 percent of renters in these districts are spending more than one-third of their income on rent.

Most rental units in these districts were built before 1980, rent for less than \$1,000 per month (below the city median rent), and are 2+ bedroom units, or family units. Apartments built in the 1970s and 1980s were likely built during an apartment building boom and, as noted by Mueller, “Many are in poor condition and are a poor fit for the family households who inhabit them,” yet they “have become the largest stock of rental housing affordable to very low-income residents in most cities.”³⁷ These units are likely to use older appliances and be substantially less energy-efficient than newly developed homes or apartment buildings. For example, homes built in the 2000s use 15 percent to 35 percent less energy per square foot than homes built from 1960 to 1990.³⁸

Tenants in these types of units may be less likely to complain to city officials about an unresponsive or negligent landlord due to fear of eviction and subsequent inability to secure housing at a similar rent. This creates the potential for unidentified environmental health hazards, and avenues for intervention are limited. Apartments are required to meet building codes and are subject to inspections only before their first occupancy, and local governments are highly constrained in their ability to perform inspections without a formal tenant complaint.³⁹

Heat and Temperature

Between 1950 and 2006, Dane County experienced a net increase in average annual temperatures of 0.5 to 1.5 degrees Fahrenheit.⁴⁰ The Madison area can expect this warming trend to continue at an accelerated rate, with projections estimating a 7-degree increase by 2055. Madison can expect approximately 25 additional days each year where temperatures surpass 90 degrees.⁴¹ Studies suggest that the number of days where Madison experiences extreme heat could expand by 30 to 50 days by the end of the 21st century, with starker models indicating a 1-in-20 chance that Madison will experience an additional 75 to 100 days of extreme heat each year.⁴²

³¹ Kurt Paulsen, “Dane County Housing Needs Assessment: 2019 Update,” n.d., [pre-publication].

³² Ibid.

³³ Ibid.

³⁴ Ibid.

³⁵ Ibid.

³⁶ Madison Neighborhood Indicators Project, 2017 Edition.

³⁷ Elizabeth J. Mueller, “Old Apartments and New Plans: Reconciling Planning and Housing Goals in Two Texas Cities,” *Community Development*, no. 41 (2010): 121.

³⁸ Ashok Bardhan, Dwight Jaffee, Cynthia Kroll, and Nancy Wallace, “Energy Efficiency Retrofits for U.S. Housing: Removing the Bottlenecks,” *Regional Science and Urban Economics*, no. 47 (2014): 45-60.

³⁹ Kurt Paulsen, interview with the authors, University of Wisconsin–Madison Music Hall, February 20, 2019, Wis. Stats 66.0104(2)(e).

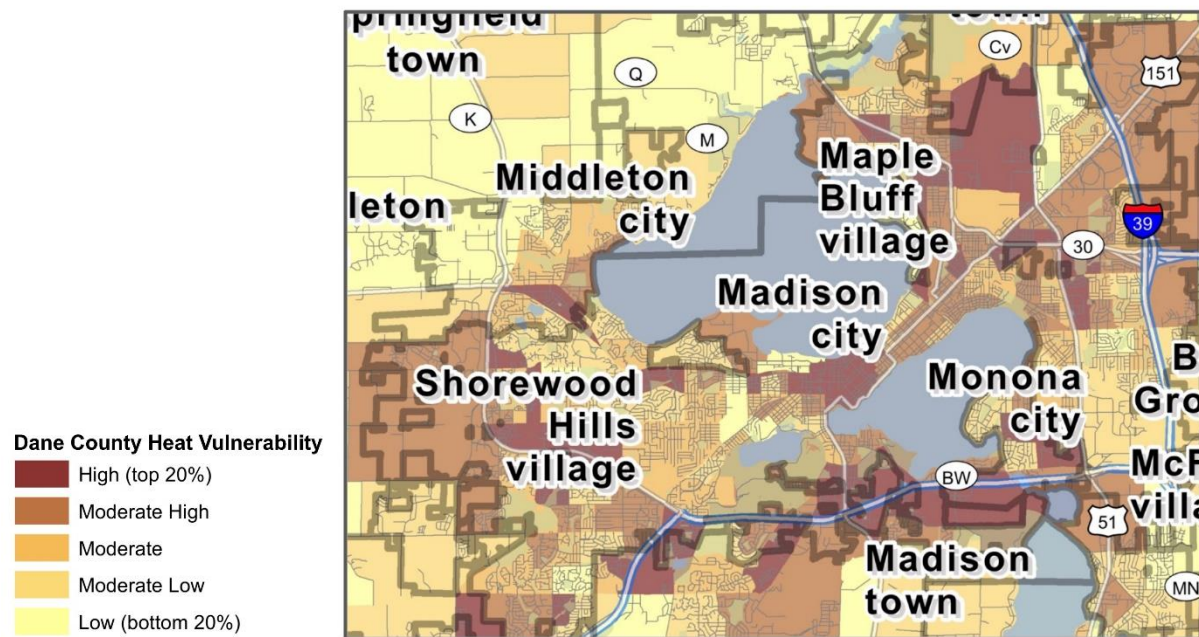
⁴⁰ The Wisconsin Initiative on Climate Change Impacts, “Climate Change: Overview,” n.d.

⁴¹ Ibid.

⁴² University of California–Berkeley, Rutgers University, Columbia University, Rhodium Group, “American Climate Prospectus,” October 2014.

Extreme heat presents far-reaching implications, posing a direct health risk to vulnerable populations such as older adults and infants.⁴³ People living in homes without air conditioning and those with limited access to cooling facilities, such as people experiencing homelessness, are more susceptible to heat-related risks, such as heat stroke and the exacerbation of existing chronic illnesses.⁴⁴ Furthermore, the combination of heat and humidity can create especially dangerous conditions. Madison's local ecosystem as well as the urban heat island effect heighten Madison's sensitivity and vulnerability to heat-related climatic changes. The urban heat island effect is a phenomenon that magnifies the intensity of harmful climate-related impacts through a feedback loop sustained by urban conditions such as widespread concrete surface areas and concentrated metal structures. The risks of heat exposure are elevated in urban areas that lack proactive measures for implementing widespread cooling mechanisms such as shelters, specialized pavement, and green roofs⁴⁵ (see Figure 2).

Figure 2: Dane County Health Vulnerability



Source: Wisconsin Department of Health Services. *Note:* The Wisconsin Department of Health Services has produced maps that illustrate heat vulnerability, calculated using multiple indicators, including environmental and socioeconomic conditions.

Two events in recent history illustrate the magnitude and severity of the risks of extreme heat days, especially for vulnerable and frontline populations. In 2003, vast swaths of Europe experienced a heat wave that claimed the lives of more than 30,000 people, most of whom were older adults, people with chronic illnesses, and those isolated from or lacking in adequate access to government services.⁴⁶ In 1995, as the midwestern United States experienced soaring temperatures, more than 750 people died in just over a week.⁴⁷ High energy costs due to older appliances and unit design can cause low-income families to forgo air conditioning during

⁴³ The Fourth National Climate Assessment, Volume II: Impacts, Risks, and Adaptation in the United States, U.S. Global Change Research Program (USGCRP).

⁴⁴ Ibid.

⁴⁵ U.S. Environmental Protection Agency, Heat Island Impacts, Accessed April 2019.

⁴⁶ Editors of Encyclopedia Britannica, "European Heat Wave of 2003," Encyclopedia Britannica, Accessed March 15, 2019.

⁴⁷ National Oceanic and Atmospheric Administration: National Centers for Environmental Information, "Climate History: July 1995 Chicago-Area Heat Wave," n.d.

extreme heat events, increasing health risks. In both events, those without air conditioning and those who could not afford to keep their air conditioning operating comprised the majority of fatalities.

The 1995 Midwest heat wave is the deadliest disaster recorded in Wisconsin history, claiming the lives of approximately 145 people, mostly located in urban centers.⁴⁸ In fact, heat waves are responsible for more premature deaths in Wisconsin over the past 50 years than tornados, severe storms, and floods combined. However, heat-exposure and heat-related deaths are entirely preventable.⁴⁹ Victims of extreme heat conditions are often people with limited social networks and those experiencing social isolation.

As detailed in the Race to Equity Report by Kids Forward, harsh disparities exist in Dane County between white and minority populations.⁵⁰ Heat-related stress and extreme events are likely to exacerbate these disparities. The poverty rate among African American children in Dane County is 57 percent.⁵¹ National data indicates that African American children are four times more likely to be hospitalized for asthma-related complications and 10 times more likely to die from asthma than white children.⁵² African Americans also face a 77 percent higher risk of getting diabetes.⁵³ Diabetes and asthma are the two chronic health conditions most susceptible to heat-related stress and extreme heat events.⁵⁴

The intense temperatures caused by the heat waves in 1995 and 2003 also caused costly damage to local infrastructure as roads buckled and the energy grid strained to meet increased demand for electricity.⁵⁵ In addition to extreme events, increased temperatures place chronic stress on municipal infrastructure, public transportation networks, and some working conditions for high-risk industries such as construction, agriculture, and other outdoor services.⁵⁶ Frontline populations bear the brunt of the impact when the energy grid is stressed, infrastructure is damaged, and transportation networks are disrupted. Infrastructure and transportation challenges can limit access to employment and essential services for people with lower incomes.⁵⁷ Without the implementation of climate resilience strategies, heat-related events will damage infrastructure and create higher demand for city services, causing increased pressure on and limited financial flexibility in municipal budgets.

Flooding

In August 2018, Madison faced a 500-year storm where parts of the city experienced 12 to 15 inches of rain in a matter of hours.⁵⁸ The historic flood provides a salient example of how acute climate events can drastically affect people in the City of Madison. It prompted more than 1,000 emergency (911) calls, including 80 for water rescues, and caused numerous injuries and one fatality.^{59, 60} The flood also led to millions of dollars in damage to commercial, government, and particularly residential property. Residential damage cost an estimated \$78.3 million, with five houses destroyed, 1,159 houses damaged, and 380 additional houses

⁴⁸ National Oceanic and Atmospheric Administration, National Weather Service: Severe Weather Awareness - Heat Waves, Accessed April 2019.

⁴⁹ City of Milwaukee, Wisconsin Heat Awareness, n.d.

⁵⁰ Race to Equity: A Baseline Report on the State of Racial Disparities in Dane County. 2013.

⁵¹ Ibid.

⁵² U.S. Department of Health and Human Services: Office of Minority Health. Asthma and African Americans.

⁵³ Jasmine Burns, "The Prevalence Of Diabetes In Minority Groups – Are Some Ethnic Groups More Affected With Diabetes Than Other Groups?" The Diabetes Council, August 2018.

⁵⁴ Wisconsin Department of Health Services, Climate and Health: Vulnerability, 2017.

⁵⁵ National Oceanic and Atmospheric Administration: National Centers for Environmental Information, "Climate History: July 1995 Chicago-Area Heat Wave," n.d.

⁵⁶ American Climate Prospectus. October 2014.

⁵⁷ Ibid.

⁵⁸ City of Madison, "Summer Flooding 2018," PowerPoint, 2019.

⁵⁹ Jeanne Hoffman, interview with the authors, January 25, 2019, City County Building, Madison, WI.

⁶⁰ Southern Wisconsin Integrated Warning Team, "Dane County Flooding," PowerPoint, February 5, 2019.

affected.⁶¹ The historic storm required extensive debris cleanup efforts and home renovations, ruined property beyond repair, and displaced individuals and families from their homes. Months after the flooding, the effects linger. Residents are uncovering mold in basements previously underwater, and many are facing health issues, including allergies and chronic illnesses. Issues related to infrastructure, transportation, and housing issues, such as deteriorated buildings, roads, and basements, also persist.⁶²

These types of extreme weather events are becoming more frequent and more severe as climate change progresses. The Wisconsin Initiative on Climate Change Impacts estimates that Madison could experience 25 percent more extreme precipitation events by the year 2055.⁶³

Extreme precipitation and flooding present serious health threats to vulnerable populations, such as older adults and people with disabilities. Statistics show that older adults who endure natural disaster have disproportionately worse health outcomes.^{64, 65} Older adults often already suffer from some combination of cognitive decline, chronic health conditions, and mobility issues, making them more susceptible to flood-related risks.^{66, 67} For instance, in the event of a flood that requires people to evacuate their homes and temporarily relocate, older adults living with dementia require substantial case management and/or community-based support.⁶⁸ Two Madison plan districts, Cherokee and Rattman, have a high percentage of older adult households. Due to their remote location, these plan districts are more socially isolated and disconnected from public services.⁶⁹ Without the necessary resources during times of crisis, residents in these plan districts often are vulnerable to and face the largest burden in recovering from extreme flooding events.

Flood-related events also pose possible devastating effects on Madison's frontline populations, especially as it pertains to housing. New York University's Furman Center FloodzoneData project demonstrates the increased exposure of frontline population housing to environmental hazards. The data identifies housing units in 100-year and 500-year floodplains by census tract, which roughly corresponds to plan districts. In frontline plan districts, approximately 35 percent of the 1,000 units in the floodplain are rental units. Families with low incomes who rent housing in the Badger planning district are particularly at risk to housing impacts from flooding-related events. The Badger planning district has nearly 100 rental units in a floodplain, and 88 percent of households have annual incomes less than \$25,000. In other frontline plan districts, risk is shared between renters and homeowners. According to the data, 70 percent of the all affected units (both rental units and owner-occupied units) have less than \$75,000 in household income.⁷⁰ Consequently, homeowners with low to moderate incomes, especially if they lack flood insurance, may be more susceptible to the negative effects of flooding and its financial repercussions.⁷¹

⁶¹ Dane County Emergency Management, "Dane County Flooding–Damage Estimates," 2018.

⁶² Jeanne Hoffman, interview with the authors, January 25, 2019, City County Building, Madison, WI.

⁶³ The Wisconsin Initiative on Climate Change Impacts, "Climate Change: Overview," n.d.

⁶⁴ William F. Benson, and N. Aldrich, "CDC's disaster planning goal: Protect vulnerable older adults," CDC Health Aging Program, 2007.

⁶⁵ Sarah Curtis, Alistair Fair, Jonathan Wistow, Dimitri V. Val, and Katie Oven, "Impact of extreme weather events and climate change for health and social care systems," *Environmental Health* 16, no. 1 (2017): 128.

⁶⁶ Evonne Miller and Lauren Brockie, "Resilience and Vulnerability: Older Adults and the Brisbane Floods," *Integrating Disaster Science and Management*, pp. 379-391. 2018.

⁶⁷ Trevor Houser, Robert Kopp, Solomon Hsiang, Michael Delgado, Amir Jina, Kate Larsen, Michael Mastrandrea et al., "American climate prospectus." *Economic Risks in the United States*. Rhodium Group, LLC (2014).

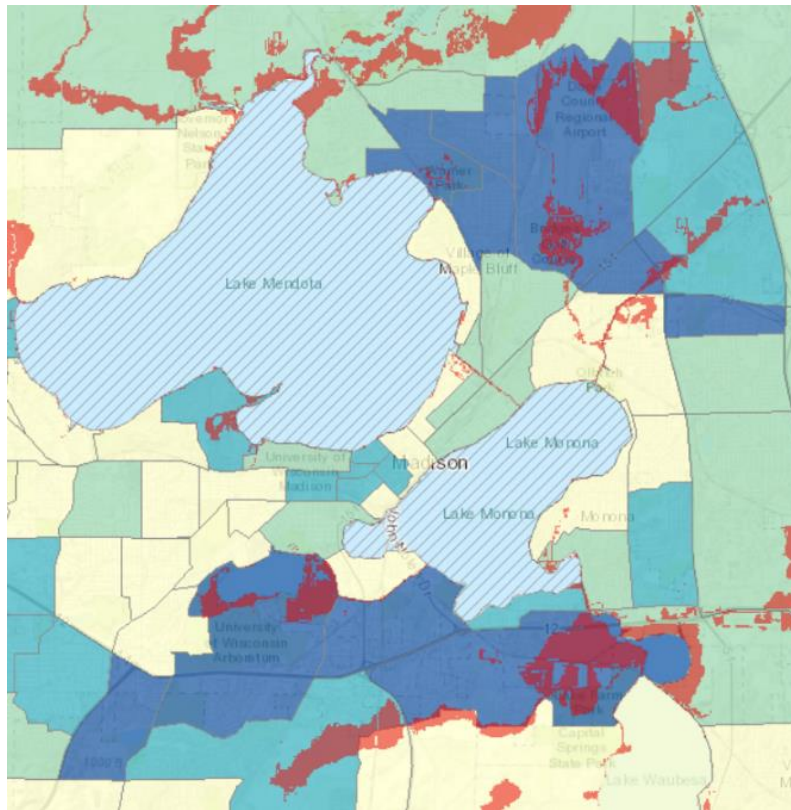
⁶⁸ John McLellen, interview with authors, March 25, 2019, phone.

⁶⁹ Carol Kretschman and Marsha Hendrickson, interviews with the authors, March 7-8, 2019, phone.

⁷⁰ FloodzoneData.usm, [describes the people and housing located in the US floodplain], 2019, NYU Furman Center.

⁷¹ Yogesh Chawla, interview with the authors, February 15, 2019, Horizon Co-Working, Madison, WI.

Figure 3: Federal Emergency Management Agency (FEMA) flooding vulnerability and Centers for Disease Control and Prevention (CDC) vulnerability index, City of Madison



Key: Red = flood hazards identified by FEMA; dark blue = most socially vulnerable identified by CDC
 Source: Wisconsin Department of Health Services

Individuals and families who live in frontline areas are not only more exposed to flood-related events but also are some of the most financially burdened by such events. In Dane County, approximately 33 percent of individuals are housing cost-burdened (more than one-third of income is spent on housing or rent payments).⁷² Consequently, housing damage and/or displacement as a result of extreme precipitation is expensive and, in some circumstances, cost-prohibitive for people living in frontline areas to remedy. Additionally, lower-income and economically disadvantaged individuals and families are more likely to live in areas where the housing is older, more susceptible to extreme climate events, and less resistant to shocks.^{73,74} These shocks can transition into sustained challenges and risks as unaddressed damages from flooding (e.g., mold, lack of electricity, pathogens, and other infrastructure challenges) create health risks.

Frontline populations are also more at risk for long-term public health impacts from flooding. After a flood, maintenance of the overall housing facility for renters might be subject to landlord discretion. Inadequate maintenance following flood events could increase exposure to mold and other respiratory irritants. The

⁷² J. Revel Sims, Ian Aley, Lexa Dundore, Taylor Laemmli, Sheila Long, Emily Lutz, Ruanda McFerren, “Evicted in Dane County, Wisconsin: A Collaborative Examination of the Housing Landscape,” 2016.

⁷³ U.S. Global Change Research Program, “Fourth National Climate Assessment: Built Environment, Urban Systems, and Cities,” 2018.

⁷⁴ Diana Hernandez, “Poor Families, Housing, and Health,” University of Wisconsin–Madison Institute for Research on Poverty, Winter 2016.

authors heard anecdotal stories of some landlords boarding up apartment basements following recurrent flooding events.⁷⁵ This strategy reduces tenant access to amenities like storage and laundry and permits mold to grow, which can have adverse effects on children's respiratory health and school attendance. Other possible health consequences of flooding particularly impacting frontline populations include stress-related mental health and substance abuse problems and worsened hypertension and diabetes.^{76, 77}

⁷⁵ Jessica LeClair, interview with the authors, February 12, 2019, Signe Skott Hall, University of Wisconsin–Madison, Madison, WI.

⁷⁶ Mark E. Keim, "Building Human Resilience: The Role of Public Health Preparedness and Response as an Adaptation to Climate Change," *American Journal of Preventive Medicine*, no. 5 (2008): 508-516.

⁷⁷ Dell D. Saulnier, Kim Brolin Ribacke, and Johan von Schreeb, "No Calm After the Storm: A Systematic Review of Human Health Following Flood and Storm Disasters," *Prehospital and Disaster Medicine*, no. 5 (2017): 568-579.

Resilience

The accelerating and disproportionate effects of climate change justify the need and urgency for climate resilience in Madison. Climate change has exposed the current social inequities in Madison and has begun to widen these disparities. Consequently, building resilience with a focus on vulnerable and frontline populations will produce a spillover effect for the entire city. Resilience accounts for both present and future climatic effects and creates a systematic, equitable plan to continuously adapt to a changing climate.

This section focuses on building a resilient Madison, particularly among vulnerable and frontline populations. It examines the City of Madison's strengths and challenges that might affect its ability to develop a meaningful resilience strategy. It then discusses the benefits of building a resilient community, provides an analysis of how plans are developed, and contextualizes these plans through case studies of four cities. Each of these resilience-driven cities shares common qualities with Madison. The case studies highlight the impetus for each city's resilience strategy, the development of goals and strategies to achieve resilience, the level of stakeholder engagement throughout the process, and information on city-level support and leadership needed to implement a strategy.

Strengths and Challenges for Resilience Planning in the City of Madison

City of Madison Strengths

Certain strengths exist that will aid the city of Madison in its development of a resilience strategy.

The City of Madison's political environment is conducive to resilience planning. Environmental issues were addressed as part of the 2019 mayoral race and viewed as an important issue by Mayor Rhodes-Conway⁷⁸ Additionally, she proposed initiatives around social and racial justice.⁷⁹ Resilience plans sit at the nexus of these two platform items, so if properly leveraged, a resilience strategy would likely align with the priorities of Mayor Rhodes-Conway. More broadly, the prioritization of these items in the mayoral race suggests that the culture of Madison is amicable to the creation of a resilience strategy.

The City of Madison is already engaging in meaningful work related to equity. In 2014, the Department of Civil Rights within the City of Madison launched the Racial Equity and Social Justice Initiative (RESJI). Its mission is to “establish racial equity and social justice as core principles in all decisions, policies and functions of the City of Madison.”⁸⁰ Stakeholder interviews highlighted that all city departments undergo RESJI training, and many planning efforts incorporate RESJI tools, creating a staff culture that prioritizes racial equity.⁸¹ There is potential for the team tasked with creating a resilience strategy to coordinate with the Department of Civil Rights through work under RESJI.

The City of Madison enjoys a strong working relationship with Dane County. Several interviewees mentioned a high level of coordination between the City of Madison and Dane County. This coordination was evident during extreme climate events, but it is also present in day-to-day operations.⁸² In interviews, a public health professional and former county employee praised the collaboration between the City of Madison and Public Health Madison & Dane County in Neighborhood Resource Teams (NRTs), which is a program with a goal

⁷⁸ Satya Rhodes-Conway for Mayor, “Issues,” 2019.

⁷⁹ Ibid.

⁸⁰ City of Madison, “Racial Equity and Social Justice Initiative,” Department of Civil Rights, 2019.

⁸¹ Jessica LeClair, interview with the authors, February 12, 2019, Signe Skott Hall, University of Wisconsin—Madison, Madison, WI.

⁸² Patty Prime, interview with the authors, March 1, 2019, phone.

of promoting racial equity and improving communication between neighborhood residents and the City of Madison.⁸³

There is significant engagement among Madison residents around issues of sustainability and climate change. The Sustainable Madison Committee (SMC) is a citizen committee in the City of Madison with an advisory role on issues of sustainability. The SMC is one of the more active committees in the city and has taken on substantial projects, including creating a sustainability plan in 2011.⁸⁴ Furthermore, interviews with neighborhood association presidents in Madison suggested that many city residents care deeply about these issues. A representative from a neighborhood association on the isthmus said this is the strongest effect of the 2018 floods that she has noticed.⁸⁵ She cited the creation of the “Isthmus Flood Prevention Coalition” as evidence of significant engagement in the community.⁸⁶ The coalition has representatives from all four isthmus neighborhood associations, and it has the stated purpose of engaging the public, the City of Madison, and the County on issues related to flooding. In March 2019, the coalition delivered an eight-point plan in the form of a petition to Dane County.⁸⁷

The City of Madison is home to a world-class research institution, the University of Wisconsin. This connection provides the City of Madison with access to empirical research and data sources on a host of issues to better inform its decisions. Potential university-affiliated collaborators on resilience work could include the Nelson Institute for Environmental Studies, the La Follette School of Public Affairs, the Institute for Research on Poverty, and the Applied Population Lab.

City of Madison Challenges

Based on interviews with residents, service providers, and other sources, several possible challenges for resilience planning efforts were identified.

Racial and health disparities in the City of Madison’s frontline populations. Frontline plan districts have neighborhoods with more people of color and more families than the City of Madison overall. Racial disparities in Madison are among the worst in the country. While the city is engaged in meaningful work to address these disparities, the Race to Equity report highlights the need for “sustained and robust advocacy” and “more energy, time, and effort” to be invested in the small, under-resourced, and disconnected neighborhoods where frontline communities live.⁸⁸ Engaging frontline communities in resilience planning and identifying and addressing their unique needs can build on the work city stakeholders are already doing and help reduce those disparities over the long term.

Varying levels of neighborhood cohesion and engagement in city planning efforts. A limited selection of interviews with Madison neighborhood association presidents indicates that while some neighborhoods have strong working relationships with the City, others may feel excluded or neglected in current sustainability planning efforts. Similarly, neighborhoods experience varying levels of internal cohesion. One neighborhood reported that “resilience comes from the community” while another suggested an environment that requires residents to fend for themselves. Based on these interviews, further work may be needed to improve engagement and working relationships with all neighborhoods, especially under-resourced neighborhoods.⁸⁹

Resident focus on flooding versus broader effects of climate change. The same selection of interviews indicates that resident attention on climate change events is focused on flooding and other acute disasters. The SMC and

⁸³ Jessica LeClair, interview with the authors, February 12, 2019, Signe Skott Hall, University of Wisconsin–Madison, Madison, WI.

⁸⁴ Stacie Reece, interview with the authors, February 27, 2019, City County Building, Madison WI.

⁸⁵ Service provider, interview with the authors, March 1, 2019, phone.

⁸⁶ Ibid.

⁸⁷ Ibid.

⁸⁸ Race to Equity: A Baseline Report on the State of Racial Disparities in Dane County. 2013.

⁸⁹ Community resident interviews with the authors, March 1, 5, 7, and 8, 2019, phone.

city stakeholders may need to develop communication strategies to explain the urgency of other types of climate risks and generate city-wide buy-in for resilience planning.

Potential political isolation from the rest of the state. While the current governor and related executive branch agencies recognize the need for climate change mitigation and adaptation strategies, Wisconsin's political climate may isolate the city of Madison.⁹⁰ State government is currently divided, with a Republican majority in the State Legislature, and a political divide exists between rural Wisconsin and the metropolitan centers of Madison and Milwaukee.⁹¹ These conditions may make it difficult for the City of Madison to seek state funding.

Some City of Madison data collection efforts are limited to city-only data, creating a regional silo. Many Dane County-based organizations collect and publish data for all county municipalities; however, easy-to-access and easy-to-use neighborhood-level resources like the Neighborhood Indicators Project reflect only City of Madison data. This creates a regional silo: residents who live in municipalities surrounding or contained directly within the broader city boundaries use many of the same resources that City of Madison residents use (work, transportation, schools, etc.), but demographic and housing information for these municipalities is not reflected in the data tool. Expanding resources like the Madison Neighborhood Indicators Project to include data on residents of the Madison metro area will help the City of Madison and surrounding municipalities improve resilience strategies.

⁹⁰ Mark Sommerhauser, "Tony Evers Joins Governors Group Fighting Climate Change by Pursuing Reduced Carbon Emissions," February 13, 2019, Wisconsin State Journal.

⁹¹ Katherine J. Cramer, *The Politics of Resentment: Rural Consciousness in Wisconsin and the Rise of Scott Walker*, Chicago: University of Chicago Press, 2016, 55.

Benefits of a Resilience Strategy

Cities realize at least four primary benefits when implementing a resilience strategy.

Help the city and individuals cope with, recover from, and adapt to the effects of stresses and shocks. Resilience planning involves a comprehensive assessment of the chronic stresses and acute shocks that affect a city and its residents. By setting goals and developing projects focused on addressing these resilience challenges, a city can reduce and perhaps prevent the impact of stresses and shocks on its residents, physical environment, and economy. In addition, city plans with built-in resilience principles may improve recovery time from predictable shocks and may increase resident awareness of critical issues, which greatly reduces residents' burdens after these events.⁹²

Strengthen community and city relations. From the beginning stages of planning, a resilience strategy requires a city to engage collaboratively with residents to obtain an on-the-ground view of issues affecting their communities. Members of the community—often represented by community-based organizations and neighborhood groups—are asked to contribute to the planning process so that the shocks and stresses they perceive as a threat to the city are incorporated into the resilience strategy.⁹³ In addition, resilience serves as an umbrella principle that is integrated into plans touching on a range of issues, from building a sustainable economy to having an effective provision of services. Because of this wide scope, the City of Madison can involve residents—especially those in under-resourced neighborhoods—on a variety of issues they traditionally have ignored.

Create a common understanding of resilience and resilience planning among regional stakeholders. The resilience planning process involves educating residents and other key stakeholders about the what, why, and how of resilience. With a foundational understanding of resilience, city stakeholders can ensure that resilience principles are applied to existing and future projects. A resilience strategy is integrative and connects objectives and actions across departments, which encourages those departments to work collaboratively. This collaborative work incentivizes departments to share data, pool resources, and carry out projects aimed at addressing resilience challenges together.⁹⁴ For the City of Madison, this can create a thread between its existing efforts to improve racial equity like the RESJI, its efforts to improve neighborhood support like the NRT, and its various sustainability efforts. In addition, the resilience framework can be leveraged with neighboring cities to increase coordination around projects that address regional shocks and stresses. This may include more targeted data-sharing among municipalities and more resource sharing through joint grant applications.

Leverage strategy with resilience-focused business partners. Because of the increasing frequency and intensity of extreme weather events, resilience is an increasingly important principle for developers. The business case for developers embracing resilience is threefold: they have an interest in protecting their buildings and land from climate change risks due to potential catastrophic damage and its associated repair costs; they support protecting other sectors like agriculture and tourism from climate risks because of ripple effects on real estate markets; and properties built with resilience in mind are more attractive to financiers and buyers.⁹⁵ The SMC could leverage the City of Madison's resilience strategy to generate local partners' interest in contributing to resilience-related projects. Support from the business community and developers can make the implementation of a resilience strategy easier, especially if funding for resilience efforts is limited.

⁹² The Rockefeller Foundation, "Resilience Prospectus," 2018.

⁹³ Moraci, Francesca, Maurizio F. Errigo, Celestina Fazio, Gianluca Burgio, and Sante Foresta, "Making Less Vulnerable Cities: Resilience as a New Paradigm of Smart Planning," *Sustainability* 10, no. 755 (2018). DOI: 10.3390/su10030755; Resilient Europe. "Urban Resilience: A Concept for Co-Creating Cities of the Future," 2016.

⁹⁴ Moraci et al., "Making Less Vulnerable Cities."

⁹⁵ Urban Land Institute, "Returns on Resilience: The Business Case," 2015.

Building a Resilience Strategy

The structure and contents of the City of Madison's resilience strategy will be unique and incorporate the needs, goals, and projects that are most relevant to the city and its residents. This section provides city leadership with guidance on how it might plan and build a resilience strategy. Following this overview, case studies illustrate how four cities formed their resilience strategies and how they are being leveraged to build cultures of resilience.

The guidelines for building a resilience strategy below are based on information in resilience strategies from four cities that participated in The Rockefeller Foundation's 100 Resilient Cities—Atlanta, Dallas, Norfolk, and Pittsburgh.^{96, 97, 98, 99}

Phase One. Building a resilience strategy begins with an extensive planning process. This process is often conducted in two phases. Phase 1 should begin with an agenda-setting workshop. Objectives of the workshop include: introducing the concept of resilience to residents and stakeholders; starting to identify needs, priorities, assets, and key stakeholders in the plan development process; generating excitement and catalyzing political will about the plan development process and the role of resilience leaders; identifying champions and key players for future engagement activities, and getting commitment from workshop participants; and recognizing the city's existing efforts, identifying how its strengths and expertise can contribute to the process. Participants in this workshop should represent a diverse cross section of the city and include residents and representatives from local government, businesses, nonprofit organizations, and higher education.

Next, resilience staff should complete a comprehensive public outreach campaign. The purpose of the outreach campaign is to engage residents and other stakeholders in a discussion about how they perceive the city's resilience-related strengths and weaknesses, as well as the city's cross-agency coordination. The campaign may consist of an online survey, community meetings, and other public outreach activities. Concurrently, staff should inventory existing resilience-related initiatives and projects and identify gaps between resident and stakeholder perceptions and what the City of Madison is already doing. After discussing these gaps with the public through workshops, the city's identified shocks and stresses will be refined. The City of Madison can then determine the key focus areas of its resilience strategy. In Dallas, the Office of Resilience remained in contact with the city's top executive staff and relevant city council committees throughout this process to keep them informed about the progress of their analysis and findings.¹⁰⁰ To ensure sufficient support, the City of Madison's resilience staff should similarly engage with city leadership throughout the development and implementation of its resilience strategy.

Phase Two. The key focus areas developed in Phase 1 serve as the basis of the scope of work in Phase 2 of the resilience planning process. To further explore these focus areas, resilience staff should create working groups, led by a collaborating city department, with each group focusing on one challenge area. To ensure a cross-section of city representation, members should consist of department staff, community partners, and residents from a variety of neighborhoods. In Atlanta, these residents were chosen through an open nomination process to facilitate open participation and engagement with the community.¹⁰¹ Selected leaders from each working group should form a steering committee that meets with resilience staff often—perhaps as often as weekly—to discuss and advance their work and recognize where it intersects with the efforts of other working groups. This work will consist of researching and identifying specific strategies to make

⁹⁶ City of Atlanta, "Resilient Atlanta," 2017.

⁹⁷ City of Dallas, "Resilient Dallas," 2018.

⁹⁸ City of Norfolk, "Norfolk, Virginia," 2015.

⁹⁹ City of Pittsburgh, "Resilient Pittsburgh," 2017.

¹⁰⁰ City of Dallas, "Resilient Dallas," 2018.

¹⁰¹ City of Atlanta, "Resilient Atlanta," 2017.

improvements in each key focus area. Finally, Phase 2 culminates in the creation of goals, initiatives, and actions under each focus area.

Defining goals, initiatives, and actions. After the planning process, development of the City of Madison's resilience strategy will continue by explicitly connecting the identified resilience goals with relevant initiatives and actions to address shocks and stresses. These connections serve as the community's roadmap throughout the implementation of the resilience strategy.

Figure 4 provides an example of how Madison might present its goals, initiatives, and actions in its published resilience strategy. Goals that address the city's resilience challenges should be stated upfront, with proposed initiatives for each goal and specific actions to support each initiative. Under each action, the lead department responsible for execution, partnerships that can be leveraged, and a launch timeframe should be clearly indicated. The launch timeframe sets a goal for the city, which can also act as an accountability measure during implementation. Lastly, a resilience value for each action should be included, indicating how the action contributes to the city's ability to handle shocks and reduce stresses. This resilience value gives the action purpose and justifies its inclusion in the overall strategy. Presenting information in this way would benefit implementation of the city's resilience strategy by making it more easily understandable to all stakeholders—especially residents.

Figure 4: Example presentation of goals, initiatives, and actions

INITIATIVE
What the City will do to tackle each goal

ACTION
Specific programs or policies the City and its partners will undertake within each initiative

LEAD
The department(s) taking the lead on each action

Goals and Initiatives

Goal 1: State a goal. _____

Provide a one-sentence description of the goal and its purpose. _____

1A Describe initiative. _____

1A.1 Describe specific action under the initiative. _____

1A.2 Describe another action under the initiative. _____

1B Describe initiative. _____

1B.1 Describe specific action under the initiative. _____

PARTNERS
Key public, private, and nonprofit collaborators that will help implement actions

LAUNCH TIMEFRAME
Estimate of when each action will begin

RESILIENCE VALUE
How the action will contribute to Madison's ability to withstand multiple shocks and stresses

Source: Authors, adapted from The City of Dallas' Resilience Strategy, "Resilient Dallas," accessed February 28, 2019, <http://www.100resilientcities.org/wp-content/uploads/2018/06/Resilient-Dallas-Strategy-Reduced-PDF.pdf>.

Case Studies

To better understand how the resilience planning process might look in Madison, this section of the report analyzes how other cities implemented resilience plans, including lessons learned throughout the process. These cities are Berkeley, Pittsburgh, Minneapolis, and Saint Paul. These four cities have more populous metropolitan areas than Madison; however, they share at least two of the following features: weather and climate, political environment, and social challenges.

Information was gathered for these case studies from the cities' resilience strategies and from interviews with current or former resilience staff. Specifically, the authors spoke with the Chief Resilience Officer (CRO) of Saint Paul, the former CRO of Minneapolis, and the Climate Action Program Manager from Berkeley. This information includes background on the cities, the planning process, community engagement, and identified resilience challenges. Detailed information about the cities' goals and actions that resulted from its planning process are in Appendix D.

Background on Cities

Berkeley is located across from San Francisco on the eastern shore of the San Francisco Bay, bordering Oakland, California. The city is home to the highly regarded University of California–Berkeley, which had a fall 2018 enrollment of 42,519 undergraduate and graduate students—roughly 2,000 fewer than UW–Madison.^{102, 103} Like Madison, Berkeley is known as a highly liberal city. However, this identity is increasingly in conflict with the city's social disparities, including soaring median rent prices and a lack of affordable housing, which have contributed to rising homelessness.¹⁰⁴ The homeless population in Berkeley has increased from 680 in 2009 to more than 1,000 today.¹⁰⁵ Berkeley was chosen to participate in The Rockefeller Foundation's 100 Resilient Cities initiative, along with its neighbors San Francisco and Oakland.

Pittsburgh is a city of just over 300,000 people situated at the center of a larger metropolitan area. Pittsburghers have a strong sense of neighborhood identity with where they reside and grew up.¹⁰⁶ This connection extends beyond physical spaces into the shared connections with people and experiences that define a neighborhood.¹⁰⁷ Pittsburgh's natural geography is defined by the waterways and hills that run through the heart of the city.¹⁰⁸ Major transportation routes generally run parallel to the rivers' paths and through some of the country's steepest hills.¹⁰⁹ The city is part of the 100 Resilient Cities initiative.

Minneapolis and Saint Paul belong to the same metropolitan area and are often referred to as “the Twin Cities.” The cities are built on the banks of the Mississippi, Minnesota, and St. Croix Rivers in east central Minnesota. Minneapolis has a population of about 420,000, and Saint Paul has a population of just over 300,000.¹¹⁰ Due to shared geographic features, Saint Paul faces many of the same resilience-related challenges as Minneapolis. This report analyzes both cities because Minneapolis belongs to the 100 Resilient Cities network and Saint Paul does not.¹¹¹ This distinction is ripe for analysis and could provide insight for Madison's path to a resilience strategy. This case study highlights key differences between operating inside

¹⁰² University of California–Berkeley Office of Planning and Analysis, “UC Berkeley Quick Facts,” 2018.

¹⁰³ University of Wisconsin–Madison, “UW Facts and Figures,” 2018.

¹⁰⁴ Rob Waters, “Berkeley's Liberal Image in Question Amid Homeless Crisis,” *The Guardian*, March 15, 2017.

¹⁰⁵ Ibid.

¹⁰⁶ City of Pittsburgh, “Pittsburgh's Resilience Strategy: Together We Move Forward As One Pittsburgh,” 2017.

¹⁰⁷ Ibid.

¹⁰⁸ Ibid.

¹⁰⁹ Ibid.

¹¹⁰ Minnesota State Demographic Center, “Population Data > Our Estimates,” Minnesota Department of Administration, n.d.

¹¹¹ City of Minneapolis, “Minneapolis Resilience Strategy,” 2018.

and outside of the 100 Resilient Cities initiative. Both Minneapolis and Saint Paul have yet to release a formal resilience plan, so these case studies focus specifically on process as opposed to outcome.

City Challenges: The Impetus for Resilience Planning

The cities studied illustrate that resilience challenges often include both climate change-related shocks and persistent chronic stresses.

Acute Shocks

All four of the cities are concerned with flooding. Pittsburgh, Minneapolis, and Saint Paul view extreme temperatures as a resilience challenge.

Berkeley's main resilience challenges include earthquakes, wildfires, and climate change impacts from drought and flooding. Effects from drought include higher food prices and stresses on forests and other ecosystems. An aging storm water system is degrading and does not have the capacity for today's changing climate. In addition, unpredictable rain and rising water levels and the city's location on the San Francisco Bay shoreline pose risks for flooding.¹¹²

Similarly, Pittsburgh is concerned with flooding. In August 2016, the city experienced flash flooding that put a main thoroughfare underwater. The same road flooded in 2014, resulting in four fatalities.¹¹³ The city is also concerned with winter storms and extreme temperatures. Pittsburgh has experienced three snowstorms that led to emergency declarations since 2003. In coming years, the region is expected to experience a greater number of major storms with average precipitation increases of 5 percent to 20 percent.¹¹⁴ Increased episodes of extreme heat and cold also are expected to affect the city. Leaders are particularly concerned with how extreme temperatures affect the city's aging population and infrastructure, including outdated heating and cooling systems that place vulnerable residents at risk for negative health effects.

Minneapolis cites the need to actively prepare for climate-related risks such as heavy rainfall, strong wind storms, and heat waves.¹¹⁵ The draft of Saint Paul's resilience strategy includes scenarios of extreme heat and precipitation events. Additionally, Saint Paul has experienced significant flooding events, which is a focal point of its draft plan.¹¹⁶

Chronic Stresses

Each of the cities recognize racial disparities among residents as a chronic stress.

Berkeley recognizes racial disparities in its residents' health outcomes, income, and educational attainment. Poor health conditions put racial minorities in the area disproportionately at risk from the impacts of natural disasters related to climate change. Berkeley is located near several major fault lines—including one that runs directly through the city—and low-income neighborhoods are at the highest risk of damage, along with businesses and utilities.¹¹⁷

Pittsburgh leaders identified the city's chronic stress as “significant challenges with social, racial, and economic inequalities that have persisted for decades” which “have led to unequal access to housing, transportation, employment, and services.”¹¹⁸ Other chronic stresses include aging infrastructure, poor air and water quality, challenges with housing affordability and gentrification as the city redevelops, an aging

¹¹² City of Berkeley, “Berkeley Resilience Strategy,” 2016.

¹¹³ City of Pittsburgh, “Pittsburgh's Resilience Strategy,” 2017.

¹¹⁴ Ibid.

¹¹⁵ City of Minneapolis, “Minneapolis Resilience Strategy,” 2018.

¹¹⁶ Russ Stark, interview with the authors, March 21, 2019, phone.

¹¹⁷ City of Berkeley, “Berkeley Resilience Strategy,” 2016.

¹¹⁸ City of Pittsburgh, “Pittsburgh's Resilience Strategy,” 2017.

population and workforce, and fragmentation of effort among nonprofit organizations and the government that impedes efforts to address the community's challenges.¹¹⁹

People of color in Minneapolis experience profound racial disparities—citing a four-year high school graduation rate for black students of only 36 percent and a three times higher unemployment rate for black residents when compared to white residents.¹²⁰ This disparity suggests a lack of social cohesion, which represents one of the main stresses cited by Minneapolis in its draft resilience strategy. Other notable shocks and stresses include the fact that “city officials are concerned that a [hazardous materials] incident could impact up to a quarter of the city’s population, straining response capabilities that would need to span multiple agencies.”¹²¹

Saint Paul has identified racial disparities in numerous areas, including unemployment, per capita income, and homeownership.¹²² Furthermore, Saint Paul struggles with housing affordability and racial disparities in health and educational outcomes.

Planning Process

Berkeley and Pittsburgh followed the two-phase resilience planning process as described in this report’s preceding section. In Berkeley, more than 1,100 community members contributed to the process through online surveys, public workshops, city council and city commission meetings, and events hosted by community-based organizations. Berkeley’s objective for the planning process was to build or improve connections between residents and organizations within the community to identify multi-benefit, multi-stakeholder actions for improving the city’s resilience.¹²³ Pittsburgh added a third phase that focused on implementation of the plan, led by the Resilient Pittsburgh team.¹²⁴ The team includes the city’s CRO, staff members of the Division of Sustainability and Resilience, the RAND Corporation as a strategy partner, and 100 Resilient Cities as a funder and collaborator.¹²⁵

In December 2016, Minneapolis convened an agenda-setting workshop that brought together about 100 stakeholders to begin exploring resilience in the city. This group of community and institutional leaders spent a day “learning about city resilience and working to better understand the state of resilience in Minneapolis.”¹²⁶ Themes and action items emerged as a result of this agenda-setting workshop, and laid the groundwork for writing the Minneapolis 100 Resilient Cities grant to the Rockefeller Foundation.

Minneapolis initially followed the standard 100 Resilient Cities phased strategy. During Phase 1 of its strategy, Minneapolis had city council elections, which, according to former CRO Kate Knuth, made it difficult to generate consistent buy-in to her proposals.¹²⁷ The planning process was put on pause in February 2018, when Knuth stepped down her position, which halted the process for a little over a year. On March 6, 2019, Ron Harris was named Minneapolis’s new Chief Resilience Officer, and it is anticipated that Minneapolis will resume this standardized phased strategy.

During Knuth’s tenure as Chief Resilience Officer of Minneapolis, she secured approval for a half-time intern to work with her on resilience planning.¹²⁸ She emphasized the need for cities to invest in staff and

¹¹⁹ Ibid.

¹²⁰ City of Minneapolis, “Minneapolis Resilience Strategy,” 2019.

¹²¹ Ibid.

¹²² City of Saint Paul, “Racial Equity Metrics,” 2018.

¹²³ City of Berkeley, “Berkeley Resilience Strategy,” 2016.

¹²⁴ City of Pittsburgh, “Pittsburgh’s Resilience Strategy,” 2017.

¹²⁵ Ibid.

¹²⁶ City of Minneapolis, “Resilience-strategy, process,” 2018.

¹²⁷ Kate Knuth, interview with the authors, March 7, 2019, phone.

¹²⁸ Ibid.

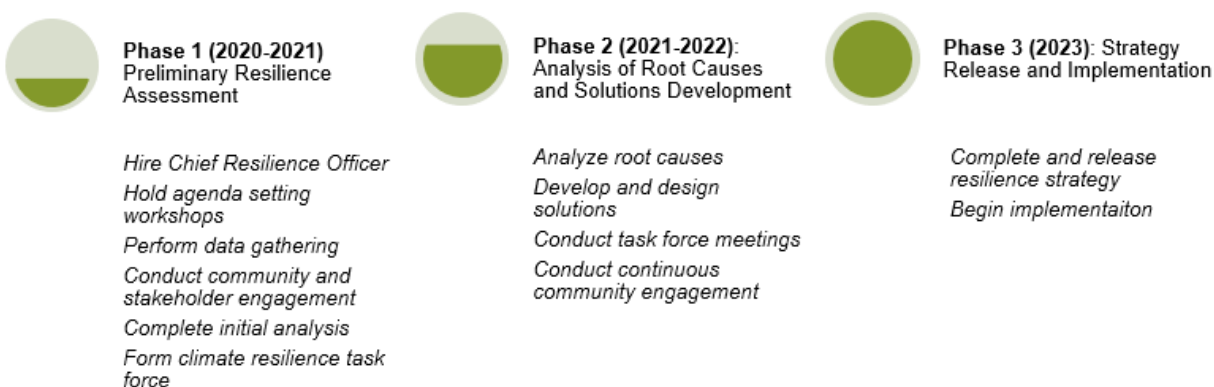
infrastructure to support CROs. She stated directly her belief that a half-time intern was not enough support, but it represented a start.¹²⁹

Saint Paul’s resilience planning efforts began with the mayoral election in 2017 and a subsequent restructuring of city government to align with the mayor’s platform of resilience, equity, and innovation.¹³⁰ As a result, the city created three full-time equivalent citywide policy advisory positions with the following titles: Equity, Innovation, and Resilience chief officers.¹³¹ Each of these positions reports directly to the mayor.¹³² Saint Paul conducted initial planning on its draft resilience strategy by convening stakeholders for a day-long workshop led by Saint Paul’s Sustainability Policy Director. Participants included representatives from the emergency management department, the city’s emergency preparedness team, the sewer division, the county’s public health department, and community nonprofit organizations as well as technical experts of other stakeholders.

Saint Paul is not a member of the Rockefeller 100 Resilient Cities initiative, so it is the only city discussed in the report that needed to appropriate its own funds toward the position. The City of Madison would face a similar challenge if it hired a CRO. Without a Rockefeller grant to fund the Chief Resilience Officer position, all department budgets contributed to funding Saint Paul’s position.¹³³ However, in addition to this interdepartmental funding, according to Saint Paul CRO Russ Stark, local philanthropy played a significant role in funding the position.¹³⁴ In 2019, \$520,692 was appropriated toward the three chief officer positions (equity, innovation, and resilience), with \$105,000 specifically for the CRO’s salary.¹³⁵

Figure 5 provides a sample timeline for the resilience strategy planning process, including key tasks and milestones.

Figure 5: Potential Timeline for a City of Madison Resilience Strategy



Source: Report Authors, April 14, 2019

Community Engagement

The idea of resilience was ingrained in the Berkeley community before the city started planning its resilience strategy.¹³⁶ According to Berkeley’s Climate Action Program Manager, stakeholders supported resilience-related principles—like preparing the community for disasters and solving climate change issues through

¹²⁹ Ibid

¹³⁰ Russ Stark, interview with the authors, March 21, 2019, phone.

¹³¹ City of Saint Paul, “2019 Adopted Budget,” 2019.

¹³² Russ Stark, interview with the authors, March 21, 2019, phone.

¹³³ Ibid.

¹³⁴ Ibid.

¹³⁵ Ibid.

¹³⁶ Katie Van Dyke, interview with the authors, March 19, 2019, phone.

multi-benefit solutions—even if the term resilience was not used regularly within the community at the time.^{137,138} Similarly, there are numerous projects in Madison that embody resilience principles and would fit naturally into its strategy, despite the current lack of stakeholder understanding around resilience. During the planning process, Berkeley developed an online survey and received more than 800 responses that were key to identifying the city’s priorities. As an equity initiative, Berkeley is still striving to engage with hard-to-reach residents.¹³⁹ This may include communities of color and low-income communities, and a consultant will help identify where outreach is needed over the next year.¹⁴⁰ The city has also established a Community Resilience Center Program, which “gives community organizations in the City of Berkeley the tools, resources, and training needed to serve as hubs for assistance and information during and following disasters.”¹⁴¹ The city’s Office of Emergency Services provides free emergency kits and trainings to these community centers, which already are engaged with populations that are difficult to reach.¹⁴² The City is also expanding this program to include low-income apartment buildings.

Pittsburgh engaged its constituents throughout the resilience planning process in numerous ways. In Phase 2 of the its process, cross-sector working groups developed the strategy’s goals and action items. These groups had eight to 12 members, including representatives of city and county government, local nonprofit organizations, universities, consultants, and research groups as well as the philanthropic, technology, and banking sectors, among others.¹⁴³ The working groups reviewed the data gathered in Phase 1 related to their respective topic areas and were tasked with developing a single, high-level goal and multiple measurable objectives for that area during two workshops. The final goals and objectives became part of the city’s formal resilience strategy.¹⁴⁴

The Resilient Pittsburgh team also hosted numerous public events. During a series of Deliberative Democracy forums, attendees participated in facilitated small-groups discussions, had the opportunity to ask questions of an expert panel, and completed a survey.¹⁴⁵ Other public engagement events included steering committee meetings; a resilience fair with local speakers and resource tables to showcase the city’s resilience initiatives and highlight opportunities for residents to become involved in the process, and a speaker series.^{146,147} The city also is also running an initiative called Love Your Resilient Block where local nonprofit organizations are invited to propose projects for building resilience in their neighborhoods with up to \$1,500 of city funds.¹⁴⁸ Past projects supported through the initiative’s grants include rain barrels, retention basins, rain gardens, and bioswales to absorb excess water; various beautification efforts; and emergency preparedness efforts such as establishing phone trees, gathering and distributing 72-hour preparedness kits, and hosting public information sessions.¹⁴⁹

Minneapolis’ CRO Knuth described her vision of conducting 100 conversations about resilience in 100 days, which was her way of creating a systematic and targeted process to invoke community engagement.¹⁵⁰ She also created focus groups and a community survey to meet this same goal.¹⁵¹ Knuth exited the CRO position

¹³⁷ Katie Van Dyke, interview with the authors, March 19, 2019, phone.

¹³⁸ Katie Van Dyke, communication with the authors, April 15, 2019, email.

¹³⁹ Katie Van Dyke, interview with the authors, March 19, 2019, phone.

¹⁴⁰ Katie Van Dyke, communication with the authors, April 15, 2019, email.

¹⁴¹ City of Berkeley, “Community Resilience Center Program.”

¹⁴² Katie Van Dyke, interview with the authors, March 19, 2019, phone.

¹⁴³ City of Pittsburgh, “Pittsburgh’s Resilience Strategy,” 2017.

¹⁴⁴ Ibid.

¹⁴⁵ Ibid.

¹⁴⁶ Ibid.

¹⁴⁷ Green Building Alliance, Resilient Pittsburgh’s Resilience Fair,” 2016.

¹⁴⁸ City of Pittsburgh, “About LYRB,” n.d.

¹⁴⁹ City of Pittsburgh, “LYRB Projects & Ideas,” n.d.

¹⁵⁰ Kate Knuth, interview with the authors, March 7, 2019, phone.

¹⁵¹ Ibid.

during the community engagement phase, so it is unclear how the new CRO, Ron Harris, will proceed with community engagement.

Because Saint Paul's resilience strategy is still in draft form, CRO Russ Stark, said that the engagement and outreach phase is in its infancy. He anticipated that the engagement process would take three to four months and would include public outreach and information sessions that highlight Saint Paul's draft resilience strategy.

Support, Leadership, and Staffing

Interviews with resilience leaders revealed useful information regarding the level of support needed from city officials, leadership qualities, and staffing required for successful implementation of a resilience strategy.

Perhaps the most important factor in the success or failure of a resilience strategy is the level of support resilience staff receive from the mayor, the common council, department leaders and staff, and other city leaders. Every resilience leader interviewed indicated that support from city officials is necessary for successful implementation of a resilience strategy. Berkeley's Climate Action Program Manager recognized that resilience-related initiatives involve work being done by other departments, so key stakeholders must be invested in the process for it to succeed.¹⁵² Saint Paul's CRO said that his city is able to make resilience a priority because of strong support from the mayor.¹⁵³ In addition to buy-in from city officials, resilience staff should solicit support from community members and residents to ensure city-wide engagement and reduce difficulties during implementation.¹⁵⁴

Institutionalizing resilience principles within city government is challenging, given the significant amount of time it can take for people to change how they think.¹⁵⁵ A CRO must have the skills to cultivate and maintain support for resilience work among city officials. To be successful, CROs should possess strong interpersonal skills.^{156, 157} A significant part of a CRO's job is to bring people together and bridge gaps within the city, so this person must be a strong leader who communicates well and builds relationships with ease. Saint Paul's CRO indicated that while possessing technical knowledge is valuable, experience communicating and engaging with the public is more important.¹⁵⁸ In addition, a CRO should always be thinking of what city leaders need, including the resources required to reach resilience goals and how those resources can be obtained.¹⁵⁹ Strong relationships with city officials are particularly useful for a CRO when attempting to access data across departments. Lastly, a CRO should know the city in which they work, including its structure and how departments work together.^{160, 161} This can make coordinating projects and other implementation issues easier to handle.

Institutionalizing resilience and building solid relationships to reach the city's goals is likely too much work for one person. The optimal staffing level depends on where the city is in the resilience strategy process and on various city-specific characteristics. Berkeley indicated that more staff is likely needed at the beginning of the planning process, during which time the city had four part-time consultants.¹⁶² Beyond the planning stage, Berkeley's Climate Action Program Manager recommends that staff should be retained for implementing the

¹⁵² Katie Van Dyke, interview with the authors, March 19, 2019, phone.

¹⁵³ Russ Stark, interview with the authors, March 21, 2019, phone.

¹⁵⁴ Katie Van Dyke, interview with the authors, March 19, 2019, phone.

¹⁵⁵ Ibid.

¹⁵⁶ Ibid.

¹⁵⁷ Russ Stark, interview with the authors, March 21, 2019, phone.

¹⁵⁸ Ibid.

¹⁵⁹ Katie Van Dyke, interview with the authors, March 19, 2019, phone.

¹⁶⁰ Russ Stark, interview with the authors, March 21, 2019, phone.

¹⁶¹ Kate Knuth, interview with the authors, March 7, 2019, phone.

¹⁶² Katie Van Dyke, interview with the authors, March 19, 2019, phone.

resilience strategy, if possible.¹⁶³ In Minneapolis, there was initially no staff allocated for resilience planning, although the CRO could ask others for help when needed and a part-time intern was hired late in the process.¹⁶⁴ Minneapolis' former CRO recommends having more than one staff person, whether that person reports directly to the CRO or is in another city department.¹⁶⁵ In Saint Paul, there is no additional resilience-focused staff, but staff in the mayor's office perform intermittent or project work as needed.¹⁶⁶ Given the disparities in the staffing levels of the cities studied, Madison should carefully weigh the work ahead—including planning its resilience strategy, working city-wide with stakeholders ranging from residents to department heads, coordinating projects, and building solid relationships—against the expected benefits and personnel costs.

¹⁶³ Ibid.

¹⁶⁴ Kate Knuth, interview with the authors, March 7, 2019, phone.

¹⁶⁵ Ibid.

¹⁶⁶ Russ Stark, interview with the authors, March 21, 2019, phone.

Considerations

When deciding how to act upon this report's recommendations and implement a resilience plan, city leaders should consider several practical and political factors. Failure to incorporate these considerations into the resilience and implementation plans could limit the plans' effectiveness. Reserving enough time for implementation planning and internal stakeholder engagement would help ensure these considerations are addressed and their related potential pitfalls are mitigated.

Staff Capacity and Cost

Resilience planning is a highly complex process involving several strategic components. The planning and implementation process will require various skills, including data collection, stakeholder engagement, and policy analysis. Staff possessing expertise and skills required by resilience planning likely exist within the City of Madison's current employee population. For example, the city's Neighborhood Resource Teams develop relationships between city staff and residents. Staff who serve on NRTs are natural internal stakeholders to engage in the resilience planning process due to their firsthand knowledge of community needs and existing relationships with residents. However, care should be taken to ensure existing staff are not overburdened by new resilience planning and implementation tasks. Current employees may have little excess capacity to assume new responsibilities. Consequently, implementation of resilience planning with fidelity may require expanding current staff capacity through new employees or contract workers. Even work completed by volunteer committees is not without cost. Regardless, current staff capacity should be evaluated and taken into consideration before assigning them new long-term and substantive responsibilities related to resilience planning.

Additionally, measured expectations should be set regarding the city's ability to hire a single resilience officer possessing the wide-ranging skillset required to create and implement a high-quality resilience strategy. Interviews suggest that the scope of work in resilience planning is so great that it may exceed the capacity of one staff member.^{167, 168} Hiring several staff members dedicated to resilience planning may increase the City of Madison's ability to develop and implement a resilience strategy with an expedited timeline. Consequently, the number of dedicated resilience staff as well as their time and skill capacity should be considered when developing a resilience plan's timeline, benchmarks, and goals. Because staff are the principal driver of a resilience strategy's cost, city leaders will need to balance the competing interests of cost and programmatic goals when determining the number of staff members dedicated, in full or in part, to resilience work.

Program Costs

Costs to the city and public should be considered when identifying a resilience plan's goals and action items. The city's capacity to pay for projects may be limited and should be at the forefront of all resilience planning discussions. For example, a plan could call for capital improvement projects such as building water retention basins to address flooding or installing cooling units in the homes of low-income older adults to help during extreme heat events. However, the city's budget may not immediately allow for such large projects or purchases. Therefore, staff members developing a resilience strategy should ensure it is aligned with the city's financial capacity to adopt and successfully implement it.

Staff developing a resilience strategy also should consider how goals and action items may impose costs upon community members and firms. For example, proposing heightened energy efficiency standards for housing complexes may impose new costs on developers. Likewise, retrofitting older buildings may create a cost for property owners who would pass some of the cost on to their residents. Thoughtful attention to indirect

¹⁶⁷ Kate Knuth, interview with the authors, March 7, 2019, phone.

¹⁶⁸ Katie Van Dyke, interview with the authors, March 19, 2019, phone.

costs of a plan's recommendations will increase the likelihood of successful implementation and reduce the potential for unintended negative consequences as well as community pushback.

Political Context

While this report focuses heavily on the effects of climate events on vulnerable and frontline populations, resilience planning will generate interest from a broader range of constituencies motivated by varying priorities. For example, some people will have an interest in ensuring the city spends residents' tax dollars responsibly. Others may wish to protect the status quo in their neighborhood or oppose changes that could affect their property. More broadly, resilience strategies that require adapting to the impacts of climate change may encounter resistance from community members whose behavior would need to change or who feel they are being asked to give up something.¹⁶⁹

Stakeholder mapping efforts as part of the resilience planning process should include consideration of these constituencies and interests. Understanding and accounting for the motivations and interests of constituencies outside of vulnerable and frontline populations during plan development will help ensure the smooth rollout and reception of the City of Madison's resilience strategy.

Intergovernmental Constraints

Climate change presents a broad range of challenges, and these challenges disproportionately affect vulnerable and frontline populations who interact with and rely on various government service providers. While the City of Madison plays a central role in maintaining and improving infrastructure and housing opportunities, many residents in Madison rely on social services provided by the State of Wisconsin and administered by Dane County. Resilience planning should account for the City's jurisdictional and financial limitations. As such, it is necessary for the City of Madison to engage its governmental partners in its effort to deploy resilience strategies. Madison will need to collaborate closely with Dane County on health and human services such as emergency response and post-incident public health efforts. Many of the social services currently provided by Dane County will be essential in the effort to counteract the negative health impacts of climate change and incorporate a comprehensive approach to address the social determinants of health. Coordination between levels of government is difficult for various reasons. However, with a well-designed resilience plan, Madison can leverage its partnership with Dane County and other local governments to effectively prepare for and adapt to the challenges of Madison's changing climate.

¹⁶⁹ Tori Jennings, "Transcending the Adaptation/Mitigation Climate Change Science Policy Debate: Unmasking Assumptions about Adaptation and Resilience," *Weather, Climate, and Society*, no. 4 (2011): 238-248.

Recommendations to the City of Madison Common Council and Mayor

Hire a Chief Resilience Officer. The CRO will be responsible for leading the development and implementation of a resilience strategy. To ensure continuous operations, the CRO position should be a permanent, full-time city employee whose position is included in the City of Madison's budget rather than grant-funded. Interviews with CROs from case study cities indicate that a successful CRO will possess strong leadership skills, strong interpersonal skills, and will be solution-focused. Technical knowledge related to resilience planning is desirable, but more important is experience with communication and engaging with the public. Additionally, a successful CRO needs to have a good grasp of the city government structure and how departments work together. A competitive salary range for a CRO in a city of Madison's size and cost of living is likely \$90,000 to \$110,000.

Develop a Madison-specific climate adaptation and resilience task force. This task force would be narrowly focused on these strategies and include technical and operational experts as well as a representative from the Sustainable Madison Committee (SMC). Numerous options for organizing the task force; however, the objective remains the same across all of them. The task force would provide a structure and mechanism to ensure that departmental leaders and technical experts are consistently engaging in cross-departmental collaboration as it relates to the implementation of the resilience strategies. Most strategies will require interdepartmental collaboration, while others will require intergovernmental collaboration.

Recommendations to the SMC

Set accountability measures for a climate resilience strategy. These should include annual goal setting, monitoring, progress tracking, strategy adjustment processes, and accountability structures. The overall framework should institutionalize cyclical process improvement. Like Madison's comprehensive plan, which lays forth a process for annual reviews before the Common Council, a process should be developed that outlines when and how members of the Council and the Sustainable Madison Committee will be updated on plan amendments and progress toward objectives. Goals should be specific, measurable, assignable, relevant, time-based (SMART) and aligned with developed benchmarks.

Build a culture and understanding of resilience to help city departments anticipate the broad effects of climate change-related chronic stresses and acute shocks in planning efforts and new initiatives. Resilience planning is similar to broad scale plans like the Imagine Madison Comprehensive Plan. Currently, the Comprehensive Plan covers goals and strategies that are closely related to resilience planning but does not explicitly connect those goals to climate change-related acute shocks and chronic stresses. The Sustainable Madison Committee could use an internal education strategy like the RESJI education strategy to spread a more complete understanding of the types of acute shocks and chronic stresses Madison is likely to experience, as well as the consequences of these changes for vulnerable and frontline populations. Training for employees and elected officials can help build a city-wide understanding of the urgency for resilience planning and help city stakeholders incorporate resilience concepts into their plans and objectives.

Conduct stakeholder mapping. The Committee should work with community members, city leadership, and staff to engage in stakeholder mapping. The effort will help resilience leaders to understand residents' wide range of interests and needs as well as generate buy-in for resilience efforts from constituents. Stakeholder mapping also should include efforts to build the business case for resilience planning. Demonstrating the need for and community-wide benefits of resilience planning will help build support among constituencies concerned about the economic effects or cost of resilience efforts.

Assist the City of Madison with housing quality and energy efficiency improvements. Strategy 6 under the Madison Comprehensive Plan is to "Support the rehabilitation of existing housing stock, particularly for first-time

homebuyers and people living with lower incomes.”¹⁷⁰ Actions under this strategy include increasing programmed building inspections and enforcement activities for rental housing maintenance, partnering with Madison Gas & Electric, the Madison Metropolitan Sewerage District, the Madison Water Utility, and others to provide incentives for rehabilitation, maintenance, and enhanced accessibility and sustainability of housing, and reviewing the use of first-time homeowner assistance programs, small cap tax incremental financing, and similar rehabilitation and ownership programs. These actions are interdisciplinary and involve various city departments. The SMC may be able to provide community support for initiatives already happening under these actions by identifying potential community partnerships or ways to extend their reach. Another potential role for the SMC is identifying new ways to support these actions on behalf of vulnerable populations and frontline communities that may not directly own property or have access to financing due to low incomes and poor credit.

Recommendations to City of Madison Departments

Establish strategies to identify specific subsets of vulnerable populations. Specifically, city officials should focus efforts on people with disabilities and non-native English speakers to improve service delivery. This report does not include data on these groups; however, strategies could include coordination with relevant businesses, service providers, and nonprofit and faith-based organizations.

Target 2023 for completion of a formal resilience strategy. Complete detailed 2020 Census data will have an availability lag. A target date of 2023 allows the City of Madison to develop support for resilience planning and gives stakeholders the opportunity to take advantage of up-to-date data that reflects the current state of Madison plan districts and related conditions. Allowing three years for the development and adoption of a resilience strategy is slightly more generous than the timelines of the cities in this report’s case studies.

Leverage nonprofit service providers, especially those who provide services to older adults. Madison has a robust service provider network, and interviews suggest that the city is not leveraging the resources from this network to its full capacity. For example, during periods of acute shocks such as flooding, city officials could utilize community service providers and networks to perform wellness checks on homebound older adults, identify more quickly people in need of assistance or relocation, and communicate updates. In general, community organizations serving older adults have positive interactions with city officials, including emergency responders to health workers, and would be willing to partner with the city on increased levels of care for their clients.¹⁷¹

Develop an equity-based climate risk assessment tool that city departments can modify and adapt to their responsibilities. This tool should help departments identify ways to reduce the disproportionate impacts of climate change on frontline populations. Each department and its work interfaces with the impacts of climate change in various ways. The City Planning Department can incorporate assessments pertaining to how future development may exacerbate or mitigate current disparities or disproportionately heighten climate-related risks. The Public Works Department can examine water-infrastructure vulnerabilities cross-referenced with resident and neighborhood resilience indicators to build capacity and flexibility as extreme precipitation events become more frequent. The effort could reduce flooding impacts to frontline populations. Each department should review and update the tools and criteria currently used to assess the impacts and ultimate success of a project.

Consult with surrounding community municipal stakeholders to determine whether there would be buy-in for a regional resilience strategy. Currently, some data exploration tools such as the Madison Neighborhood Indicators Project are limited to Madison city limits. This creates regional silos that limit data-sharing with communities like Monona, McFarland, and Middleton. Many residents outside of Madison use the city’s resources and are affected by weather shocks like flooding. Thus, data-sharing should be discussed with potential partners as

¹⁷⁰ Imagine Madison: People Powered Planning, “City of Madison Comprehensive Plan,” August 2018: 116.

¹⁷¹ Service provider, interview with the authors, March 8, 2019, phone.

one option for improving the resilience strategy development process across municipalities. This data could include demographic and housing information, and other information that would make a wide-reaching resilience strategy easier to implement outside of Madison's boundaries.

Develop Neighborhood Disaster Preparedness Liaisons. These liaisons may be especially helpful for building a social infrastructure within every Madison neighborhood to respond to acute shocks and chronic stresses. For example, the program may include a strategy for identifying people in the neighborhood who are at risk of experiencing increased exposure to a heat event due to lack of air conditioning or distance to key services like grocery stores or transportation to work. Neighborhood liaisons could check in on these residents, spread the word about nearby cooling centers, and help coordinate volunteers for grocery delivery. Liaisons would be part of a social network-building strategy. The social networks that support neighborhood residents during heat events also could be helpful for providing support during more acute, fast-response events like the August 2018 floods. This is similar to a proposed action in Berkeley to address its goal of building a connected and prepared community (see Appendix D).

Conclusion

As Madison's climate changes in coming years, residents can expect to experience more frequent and severe episodes of extreme weather such as heat and flooding. Vulnerable and frontline populations are particularly sensitive to the effects of these acute shocks. To pursue its equity priorities, the City of Madison will need to anticipate the short- and long-term effects of climate change for these populations. New interdisciplinary strategies and focused leadership on this issue will be critical.

The City of Madison can use a resilience strategy to meet these needs. City leaders should develop a resilience strategy in partnership with the community. The strategy's goals, initiatives, and action items should reflect the stated needs of communities throughout the city. By adopting a resilience strategy and hiring a Chief Resilience Officer, the City of Madison can institutionalize systems of support for individuals and neighborhoods in the face of a changing climate.

Appendix A: Identification Methodology Full Data Tables for Frontline Plan Districts

Methodology and Population Identification (Data Collection Strategy)

For population identification, the major data source utilized is the City of Madison’s Neighborhood Indicators Project. This tool identifies populations and data by Plan District, which often correspond neatly to 2010 Census Tracts. Other data sources include the US Census 2017 American Community Survey. This survey provides data at the Census Tract level. Census Tract-level data represents an average figure based on a five-year survey period.

Because much of the data in the Madison Neighborhood Indicators Project is from the 2010 Census, and data in the 2017 American Community Survey can have large margins of error, the data used in this report for frontline and vulnerable populations reflects estimates and trends. Data from the 2020 Census will provide a more current, up-to-date, and reliable estimate of these data points. Similarly, data presented about frontline populations tends to average out percentages from plan districts to illustrate overall trends in these districts. These averages are not household- or population-adjusted and should similarly be considered *estimates* of these data points.

To identify concentrations of frontline populations in the City of Madison, the major inclusion criterion used in this report is percentage of economically disadvantaged students greater than 50 percent. This metric is based on 2017 data from the Madison Metropolitan School District (MMSD) and reflects students whose household incomes are 185 percent or less of the Federal Poverty Limit (FPL) guidelines. This metric is used because it is more up to date than US Census data and reflects an important economic determinant of health. As the Neighborhood Indicators Project notes, “The financial stress of poverty is often tied to food insecurity, housing instability, healthcare access and a host of other factors that affect children’s well-being.” The Fair Oaks plan district in the analysis of frontline plan districts because the Darbo/Worthington neighborhood is located within this district. The Darbo/Worthington area is the site of a neighborhood resource team, which this report has indicated as a point of interest for the City of Madison. According to the city’s website, “The mission of the Neighborhood Resource Teams is to promote racial equity and improve the quality of life for all residents of Madison’s neighborhoods.”

Frontline Plan Districts: Selected Demographics

Plan District	Economic Factors (Percent)		Income (Dollars)	Age and Family Characteristics (Percent)			Race/Ethnicity (Percent)			
	Renter Households	Economically Disadvantaged Students	Median	Young Children (0-4)	Older Adults (65+)	Families with Children	White	African American	Asian	Hispanic or Latino
<i>All (City of Madison)</i>	51	46.8	59,387	5.8	9.6	20.8	75.7	7.1	7.3	6.9
Arbor-McKee	64	78.1	41,300	7.80	9.2	25.5	59.1	18.5	4.7	13.1
Badger	42	76.1	47,533	8.90	5.9	31.7	52.	11.6	5.7	26.6
Burr Oaks	76	84.0	44,615	9.40	5.8	32.8	24.1	24.0	19.0	28.5
East Washington	45	73.7	40,821	5.80	9.3	21.4	67.7	9.8	3.7	14.7
Fair Oaks	44	37.5	60,132	6.20	6.2	22.4	80.7	9.5	2.5	4.4
Greentree	56	75.6	61,005	7.00	13.1	24.7	63.5	18.3	4.4	9.7
Lakeview	45	76.6	43,179	7.10	9.3	25.5	60.8	16.5	8.9	9.7
Marlborough	72	92.0	38,261	11.60	4.1	39.6	32.2	33.7	5.1	24.2
Orchard Ridge	31	55.3	64,589	6.70	17.1	25.2	75.3	10.5	3.6	7.3
Sherman Park	46	70.9	47,833	7.60	13.5	20.7	71.2	14.9	3.3	7.0
Southeast	16	79.1	86,384	13.20	2.8	46.9	69.7	11.1	6.7	7.8
Swanton	74	75.9	48,380	8.90	10.7	32.3	58.8	15.2	3.7	17.7
Truax Field	47	91.2	36,513	7.40	9.8	20.9	61.1	14.4	6.8	12.5
Warner Park	47	78.5	37,155	10.00	10.2	32.3	56.8	21.3	6.8	9.0
Waunona Way	56	82.4	52,692	7.30	10.7	24.1	63.0	13.9	4.2	16.2

Source: Madison Neighborhood Indicators Project 2017 Edition, 2017 American Community Survey (ACS), US Census

Detailed Tables: Frontline Plan Districts and Income, Transportation, and Housing

Frontline Plan Districts: Income

Plan District	Median Income (Dollars)	Families with Children (Percent)	Renter Households (Percent)	Median Renter Income (Dollars)
Arbor-McKee	41,300	25.5	64.1	32,111
Badger	47,533	31.7	41.5	30,289
Burr Oaks	44,615	32.8	76.4	31,571
East Washington	40,821	21.4	44.6	27,714
Fair Oaks	60,132	22.4	44.3	30,724
Greentree	61,005	24.7	55.5	43,797
Lakeview	43,179	25.5	44.5	26,047
Marlborough	38,261	39.0	72.4	35,055
Orchard Ridge	64,589	25.2	31.3	29,055
Sherman Park	47,833	20.7	45.7	31,354
Southeast	86,384	46.9	16.3	70,476
Swanton	48,380	32.3	74.2	39,673
Truax Field	36,513	20.9	47.1	30,179
Warner Park	37,155	32.3	46.6	24,722
Waunona Way	52,692	24.1	55.6	35,903
Average	50,026	28.4	50.6	34,578

Source: Madison Neighborhood Indicators Project 2017 Edition, 2017 American Community Survey (ACS), US Census

Frontline Plan Districts: Transportation Access

Plan District	Transit Stop Access (Percent)	Pavement Condition Rating (Scale 1-10, 8.7 city high)	No Vehicle (Percent of Households)	1 Vehicle (Percent of Households)
Arbor-McKee	99.5	6.4	10.3	44.5
Badger	63.7	6.1	7.5	39.0
Burr Oaks	94.0	5.6	12.3	53.4
East Washington	64.8	5.9	8.8	49.8
Fair Oaks	98.9	5.9	9.2	55.1
Greentree	99.1	7.1	4.3	40.1
Lakeview	85.2	6.1	9.5	38.6
Marlborough	99.3	6.4	7.7	44.6
Orchard Ridge	98.6	6.7	8.4	31.0
Sherman Park	94.0	6.4	12.7	45.0
Southeast	57.1	7.0	12.8	55.6
Swanton	90.4	6.3	15.1	34.9
Truax Field	49.7	6.3	10.5	52.5
Warner Park	77.1	5.9	5.7	44.0
Waunona Way	76.1	6.6	7.5	39.0
Average	83.1	6.3	9.5	44.4

Source: Madison Neighborhood Indicators Project 2017 Edition, 2017 American Community Survey (ACS), US Census

Frontline Plan District Renter Households and Renter Household Income

Plan District	Percent of Households	Median Income (Dollars)	Income Below 50% of AMI (Percent of Households)	Income Below 30% of AMI (Percent of Households)
Arbor-McKee	64.1	32,111	55.7	28.3
Badger	41.5	30,289	60.3	19.4
Burr Oaks	76.4	31,571	29.5	25.2
East Washington	44.6	27,714	60.1	33.0
Fair Oaks	44.3	30,724	53.6	32.4
Greentree	55.5	43,797	34.2	21.1
Lakeview	44.5	26,047	64.5	37.5
Marlborough	72.4	35,055	49.8	18.4
Orchard Ridge	31.3	29,055	60.7	35.6
Sherman Park	45.7	31,354	55.4	31.8
Southeast	16.3	70,476	30.4	12.5
Swanton	74.2	39,673	42.5	20.1
Truax Field	47.1	30,179	60.8	35.3
Warner Park	46.6	24,722	71.7	37.3
Waunona Way	55.6	35,903	47.2	27.4
Average	50.6	34,578	51.8	27.7

Source: Madison Neighborhood Indicators Project 2017 Edition, 2017 American Community Survey (ACS), US Census

Frontline Plan District: Housing Unit and Rent Characteristics

Plan District	Built Prior to 1980 (Units)	2+ Bedroom (Units)	Rent < \$1000 (% of units)	Median Rent (Dollars)	Gross Rent as a Percentage of Household Income > 35%
Arbor-McKee	63.3	78.3	70.0	921	38.1
Badger	70.4	88.8	68.8	923	42.9
Burr Oaks	63	67.1	85.9	764	40.9
East Washington	89.8	85.5	75.6	861	51.2
Fair Oaks	93.7	78.5	71.0	882	33.9
Greentree	65.0	91.5	43.2	1105	41.2
Lakeview	63.6	71.1	73.6	814	44.7
Marlborough	66.0	89.2	76.5	857	34.7
Orchard Ridge	86.9	92.3	65.3	917	55.9
Sherman Park	78.8	85.3	59.0	907	45.4
Southeast	14.6	43.5	45.2	1017	35.0
Swanton	57.3	84.3	57.0	967	40.0
Truax Field	54.6	80.9	69.7	900	40.5
Warner Park	65.5	94.8	67.8	854	47.5
Waunona Way	70.4	88.8	68.8	923	42.9
Average	66.9	81.3	66.5	907	39.9

Source: Madison Neighborhood Indicators Project 2017 Edition, 2017 American Community Survey (ACS), US Census

Appendix B: Data Collection Strategy and Neighborhood Interview Findings

Interviews with City and County Stakeholders

For the purpose of this report, researchers interviewed several current and former Dane County leaders to better understand how government stakeholders view climate change and resilience-related priorities, and vulnerable and frontline populations in Madison. Those interviewed include:

- Keith Reopelle, Director, Dane County Office of Energy and Climate Change
- Jessica LeClair, former Public Health Madison Dane County Nurse
- Jeffery Lafferty, Epidemiologist, Public Health Madison Dane County
- Yogesh Chawla, Dane County Board of Supervisors, District 6

Residents' Perceptions of Extreme Climate Change Events in Madison

To identify residents' perceptions of extreme climate events in Madison, researchers requested interviews with nine neighborhood association leaders using contact information from the City of Madison's website. Researchers also interviewed service providers and representatives from businesses (the Chamber of Commerce) and property management companies over a two-week period. Throughout the report, exact identities of these individuals are obscured to protect their confidentiality.

Resilience Planning Data Collection

Researchers performed a literature review to determine applicable frameworks for resilience strategy formation and execution. To provide insight into how other cities approach resilience planning, case study cities were identified using information from the Rockefeller Foundation 100 Resilient Cities Project. From that cross-section of cities, researchers developed a selection of case study cities. Researchers performed reviews of resilience-related materials from those cities to identify commonalities and trends related to the formation of the city's resilience plan and extrapolated trends and lessons learned from those materials for the City of Madison. When possible, these materials were supplemented by interviews with the city's Chief Resilience Officers.

Extended Findings: Neighborhood Interviews

Of the nine Neighborhood Association presidents that were contacted for this project, one was no longer active and four did not respond to the request or were unavailable. All of the neighborhood representatives interviewed indicated that their neighborhoods were affected to some degree by the August 2018 flooding.¹⁷²

Two of the representatives interviewed are located on the Isthmus and were directly impacted by flooding in Tenney Park and from the Yahara River. These neighborhoods, which have a range of income diversity, single-family homes, and apartment buildings intermixed, were alarmed by the 2018 floods and responded with community-based organizing. These neighborhoods reported a strong relationship with the City of Madison, with a perception that city leaders should be doing more to address resilience planning and the lake levels in particular.

One of the neighborhood representatives described his neighborhood as experiencing recurrent flooding over the past 10 years. This neighborhood is about two-thirds apartment homes and one-third single-family homes, with "two different experiences depending on where you live." Both the single-family homes and apartments have experienced recurring flooding since 2008, and the neighborhood overall "has been neglected by the city," with little attention paid to the flooding issues until Tenney Park flooded, the

¹⁷² Community resident interviews with the authors.

representative said. This neighborhood representative did not report a strong relationship with the city. The final neighborhood representative is from a mixed-income, traditionally working-class neighborhood that experienced smaller impacts from the August 2018 flood. This neighborhood representative felt that the city could do more to address acute climate events and did not feel like the neighborhood is represented or involved in resilience planning for the city but would like to be.

Conversations about climate change events with neighborhood representatives focused primarily on flooding. Neighborhood representatives did not report major concerns about extreme cold or heat events. Two neighborhood representatives reported sentiments to the effect of, “This is Wisconsin, we’re used to the cold.”

Appendix C: Interview Protocol

Before each interview, researchers recorded the first and last name of the interviewee, interviewee's professional title, researchers present, time and date, and interview location. Researchers then delivered the following explanation of the project:

Before we get started, I'd like to provide a quick explanation of the project that we're doing. We are a group of six graduate students at the University of Wisconsin's La Follette School of Public Affairs. Our capstone project involves working with the City of Madison to develop a plan that supports vulnerable populations during extreme climate events. The purpose of this interview is to gather information for that report. If you were to be cited or quoted in the report, how would you want us to cite you (name, title)?

Cluster A: Expertise Interviews

This project's client (Jeanne Hoffman, Facilities and Sustainability Manager Engineering Division, City of Madison) referred interviewees to the researchers based on their expertise in a given area relevant to the project. Interviewees were also recruited via chain or snowball referrals—wherein interviewees referred the researchers to their colleagues with relevant backgrounds and experience. Interviewees were contacted via email to ask for their participation in the project. The interview date and location were established via email and the questions were sent to the participants ahead of time.

Sample Questions

Topic 1: Vulnerable populations

- In the context of recent extreme climate events, such as the August 2018 flooding and the January 2019 extreme cold, could you talk about which cross-sections of Madison residents are more at risk for outcomes deleterious to their well-being?
- What might these outcomes look like for vulnerable populations?

Topic 2: Inventorying the City of Madison's response to extreme climate events

- Looking back on the August 2018 flooding, what went well? What were some of the major challenges you observed?
- There is this idea that Madison specifically is insulated from some of the effects of climate change given that it is not a coastal city; could you speak to the veracity of that idea, or about how Madison is uniquely situated?
- What is Madison currently doing (programs, initiatives, spending, etc.) around the topic of resilience?

Topic 3: Improving the City of Madison's response to extreme climate events

- Can you think of any tangible ways that the city could improve its response in the future to these extreme climate events?
- How can the City of Madison improve its work in building resilience?

Topic 4: Expertise-specific questions

- These questions varied depending on the interviewee.

Cluster B: Community Interviews

These interviews were conducted to better understand Madison's strengths and weaknesses in terms of cohesive and engaged communities and climate change event response. Individually, researchers engaged

leaders from Madison neighborhood associations and community organizations. Researchers asked a set of standard questions during a 20- to 30-minute telephone interview.

Sample Questions

Topic 1: Can you describe your neighborhood for me, briefly?

- What are the different neighborhood constituents you work with frequently?
- What are some of the things you love about your neighborhood?
- What are some of the current issues your neighborhood is aware of or working on?

Topic 2: Who would you describe as vulnerable in your neighborhood?

- How are these groups engaged in neighborhood initiatives?

Topic 3: Can you describe your neighborhood's response to the August 2018 flooding event?

- What went well?
- What could have gone better?
- What are some of the lingering effects of the August 2018 flooding event for your neighbors?

Topic 4: When thinking about long-term climate change resilience planning, and resilience planning means the ability of a community to bounce back from a chronic stress or an acute shock, such as the August 2018 floods, do you think the City of Madison is prioritizing resilience efforts appropriately, too much, or not enough?

- Do you feel like your neighborhood is represented in this planning?

Topic 5: What do you view as the chronic stresses and acute shocks of climate change facing your neighborhood?

Cluster C: Chief Resilience Officer Interviews

These interviews informed the report's case study analysis section and helped the researchers understand how case study cities prioritized resilience and moved from informal efforts to formal efforts. Researchers interviewed Chief Resilience Officers from case study cities during 30- to 45-minute telephone conversations, asking them a standard set of questions so that researchers could identify trends in responses.

Sample questions

Topic 1: What led to the formal creation of your role and the city's resilience plan?

- How did you recognize the need?
- Was there an inciting event?
- Were there key people or stakeholder roles that identified the need?
- How important was the role of climate change and related events in justifying the need for the plan?

Topic 2: Could you walk us through the process of creating a resilience strategy in [city]?

- We're especially interested in the early stages of this process, because that's where Madison is at temporally.
- How did the city create buy in for a formal resilience plan?
- What groups were involved?
- What communication strategies or mechanisms did you use to work with those groups?
- How long did it take to raise awareness of the need for a formal resilience plan?

Topic 3: What were some of the challenges in developing and implementing the resilience plan?

Topic 4: A major focus of this project is how the city of Madison can better collect data; do you have any insights about particularly effective or meaningful data collection strategies/data points that were helpful to the work that you did?

Topic 5: Do you have any advice for a city like Madison that is just getting started with resilience work, especially about the process of getting started?

Appendix D: Case Study—City Goals and Actions

Berkeley

Building a connected and prepared community: The city will improve the ability of all community members to prepare for, respond to, and recover from natural disasters. To reach this goal, Berkeley is fostering neighbor-to-neighbor connections to prepare residents for disasters in case the city cannot assist residents until days after a disaster. Working with local nonprofit and community leaders, the city will identify Neighborhood Disaster Preparedness Liaisons who serve as leaders and organizers within a neighborhood, acting as conduits for residents to training, information, and support provided by the city and partner organizations.¹⁷³

Accelerating access to reliable and clean energy: The city will increase its energy assurance and reduce greenhouse gas emissions by decentralizing and greening the energy it consumes. To reach this goal, Berkeley plans to develop a Solar Action Plan to meet 50 percent of the city’s energy needs by 2030. The plan would remove barriers to solar adoption, including expedited solar permitting and free solar technical assistance. In addition, the plan will prioritize opportunities for installing solar panels for low-income households.¹⁷⁴

Adapting to the changing climate: The city will embrace and implement innovative, multi-benefit natural resource management, urban planning, and infrastructure design solutions. To reach the goal, Berkeley will integrate consideration of climate impacts into capital and land-use planning. The city recognizes that the latest climate science needs to be incorporated into urban design and development to best protect and modify existing assets and design new infrastructure. It will collaborate with San Francisco to learn how it is accounting for rising sea levels with its projects. In addition, the city will provide guidance to city departments and private developers on how to understand and incorporate a range of climate impacts into future projects.¹⁷⁵

Advancing racial equity: The city will provide proactive leadership to identify and eliminate institutional barriers to racial equity. To reach this goal, Berkeley will develop a Racial Equity Action Plan. Partners include the Government Alliance on Race and Equity (GARE), the City Personnel Board, and the National Association for the Advancement of Colored People (NAACP). Components of the plan include: advancing workforce diversity through city department training for equitable hiring and promotion practices and career development for entry-level staff; improving city outreach and community engagement processes to open up decision-making and increase participation; and integrating a racial equity lens into the city’s budget and procurement processes.¹⁷⁶

Working together within city government to better serve the community: The city will develop integrated solutions to solve big challenges and improve access to services and information for the community. To reach this goal, Berkeley will implement opportunities for multi-departmental input on major city plans and projects. The aim of this action is to increase “cross-silo” coordination within the city government and to institutionalize multi-departmental review. A current mechanism that the city uses that could be replicated is its interdepartmental roundtable meetings used by the city’s Land Use Planning staff. Early in the design phase of large private development projects, city staff in urban planning, economic development, parks, sustainability, and other areas meet to review the design in the context of city requirements and provide design guidance beyond those requirements.¹⁷⁷

Building regional resilience: The city will work with other Bay area cities to develop actionable strategies that match the scale of the social, economic, and physical challenges faced by the region. To reach this goal, Berkeley will form regional alliances for policy advocacy. Because of the regional nature of many resilience

¹⁷³ City of Berkeley, “Berkeley Resilience Strategy,” 2016.

¹⁷⁴ Ibid.

¹⁷⁵ Ibid.

¹⁷⁶ Ibid.

¹⁷⁷ Ibid.

challenges, the city will continue to participate in action-oriented regional collaboration. Examples of these collaborations include partnerships with other cities that have developed resilience strategies to share lessons learned, and participation in the East Bay Corridor Initiative, which emphasizes standardizing ordinances regarding building upgrades for earthquake damage mitigation among neighboring cities.¹⁷⁸

Pittsburgh

Pittsburgh's resilience strategy strives to meet four major goals commonly referred to as the four Ps.

People: "Pittsburgh will empower all residents to contribute to thriving and supportive communities by ensuring that basic needs are met. We will be an inclusive city of innovation that celebrates our diversity, and all residents will have equal access to resources and opportunity."¹⁷⁹

Place: "Pittsburgh will use land to benefit all residents; to increase social cohesion, connectivity, public and ecological health; and to protect against current and future risks. We will design, scale, and maintain our infrastructure for current and future needs, providing benefits and services to our neighborhoods during times of calm and crisis."¹⁸⁰

Planet: "Pittsburgh will achieve long-term environmental health through wise stewardship, improved use of our resources, and a reduced carbon footprint."¹⁸¹

Performance: "Pittsburgh will work closely with neighbors and partners for improved planning and decision-making."¹⁸²

The Pittsburgh resilience strategy contains 44 action items. Unlike many other 100 Resilient Cities, such as Berkeley, Pittsburgh's action items are not individually nested under one specific goal. Rather, action items can be tied to multiple goals and objectives. Examples of action items that may be relevant to the City of Madison's efforts include:

Creating green and healthy homes: "Efforts to 'green' Pittsburgh's housing stock abound, as do approaches to make the city's homes healthier and safer places to live. These include a range of players, such as county- and city-administered federal funding for lead issues, private companies offering incentives and programs to improve energy efficiency, public service providers and city departments conducting home-safety inspections, and non-profits offering programming to help residents to reduce their utility bills."¹⁸³

Encouraging neighborhood-based resilience efforts: "Because Pittsburgh is a city of neighborhoods, the city's resilience efforts often take place at a neighborhood level, led by a set of engaged and innovative neighborhood coalitions. These groups promote resident engagement and aim to solve some of the most pressing issues to Pittsburghers, from repurposing vacant land to organizing around affordable housing."¹⁸⁴

Putting city facilities to their best and highest uses: "The City's Strategic Investment and Maintenance Plan for city assets includes an assessment of the current state of city facilities and the establishment of maintenance schedules and long-term investment plans so each facility will be put to its 'best and highest use.' It also extends beyond city facilities to begin to develop plans for city streets and sidewalks; for the city's vehicle fleet; for city-owned walls, steps and fences; for urban forests and hillsides; and for public spaces and monuments, among other assets."¹⁸⁵

¹⁷⁸ City of Berkeley, "Berkeley Resilience Strategy," 2016.

¹⁷⁹ City of Pittsburgh, "Pittsburgh's Resilience Strategy," 2017.

¹⁸⁰ Ibid.

¹⁸¹ Ibid.

¹⁸² Ibid.

¹⁸³ Ibid.

¹⁸⁴ Ibid.

¹⁸⁵ Ibid.

Upgrading and improving the resilience of the power grid: “District Energy Pittsburgh is the focus of a memorandum of understanding with the U.S. Department of Energy to use district energy systems to upgrade Pittsburgh’s aging electrical grid with 21st century clean technologies and solutions. It will optimize existing systems and infrastructure, support infill development to connect to existing systems, and develop new systems in order to create a distributed energy system that has the capacity to support innovative renewable energy solutions.”¹⁸⁶

Minneapolis and Saint Paul

Because Minneapolis and Saint Paul do not have fully developed resilience plans, their goals and actions are not available.

¹⁸⁶ City of Pittsburgh, “Pittsburgh’s Resilience Strategy,” 2017.

Bibliography

- American Climate Prospectus. October 2014.
https://gspp.berkeley.edu/assets/uploads/research/pdf/American_Climate_Prospectus.pdf.
- American Community Survey. “2017 American Community Survey (ACS).” 2017. United States Census Bureau. <https://www.census.gov/programs-surveys/acs/news/data-releases.html?#>.
- Ashok, Bardhan, Dwight Jaffee, Cynthia Kroll, and Nancy Wallace. “Energy Efficiency Retrofits for U.S. Housing: Removing the Bottlenecks.” *Regional Science and Urban Economics*, no. 47 (2014): 45-60.
- Bahadur, Aditya, and Thomas Tanner. “Transformational resilience thinking: putting people, power and politics at the heart of urban climate resilience.” *Environment and Urbanization*, 26, no. 1 (2014): 200-214.
- Balbus, John, M., and Catherine Malina. “Identifying vulnerable subpopulations for climate change health effects in the United States.” *Journal of occupational and environmental medicine* 51, no. 1 (2009): 33-37.
- Benson, William F., and N. Aldrich. “CDC’s disaster planning goal: Protect vulnerable older adults.” CDC Health Aging Program (2007). https://www.cdc.gov/aging/pdf/disaster_planning_goal.pdf
- Bergquist, Lee. “UW Computer Model Reveals Vulnerability of Madison's Isthmus During Historic Rain Events.” Milwaukee Journal Sentinel, August 2018.
<https://www.jsonline.com/story/news/local/wisconsin/2018/08/24/uw-computer-rain-model-reveals-vulnerability-madisons-isthmus/1084546002/>.
- Burns, Jasmine. “The Prevalence Of Diabetes In Minority Groups – Are Some Ethnic Groups More Affected With Diabetes Than Other Groups?” The Diabetes Council. August 2018.
<https://www.thediabetescouncil.com/the-prevalence-of-diabetes-in-minority-groups/>
- Center for Climate and Energy Solutions, “Climate Resilience Portal,” December 19, 2018,
<https://www.c2es.org/content/climate-resilience-overview/>.
- Chawla, Yogesh. Interview with the authors. February 15, 2019. Horizon Co-Working. Madison, WI.
- City of Atlanta. “Resilient Atlanta.” 2017.
<http://www.100resilientcities.org/wpcontent/uploads/2017/11/Atlanta-Resilience-Strategy-PDF-v2.pdf>.
- City of Berkeley. “Berkeley Resilience Strategy.” 2016.
<http://www.100resilientcities.org/wpcontent/uploads/2017/07/Working-Documents-3-23.pdf>.
- City of Dallas. “Resilient Dallas.” 2018.
<http://www.100resilientcities.org/wpcontent/uploads/2018/06/Resilient-Dallas-Strategy-Reduced-PDF.pdf>.
- City of Madison. “Racial Equity and Social Justice Initiative.” Department of Civil Rights. 2019.
<https://www.cityofmadison.com/civil-rights/programs/racial-equity-social-justice-initiative/mission-vision>.

- City of Madison. "Summer Flooding 2018." PowerPoint. 2019.
<http://www.cityofmadison.com/council/district/districtfiles/district19/documents/2018-11-27-wexfordNHAmeeeting.pdf>.
- City of Minneapolis. "Minneapolis Resilience Strategy." 2018.
<https://www.100resilientcities.org/cities/minneapolis>.
- City of Norfolk. "Norfolk, Virginia." 2015.
http://www.100resilientcities.org/wpcontent/ploads/2017/07/Norfolk_Resilient_Strategy_October_2015.pdf.
- City of Pittsburgh. "About LYRB." n.d. <http://pittsburghpa.gov/oca/aboutlyrb>.
- City of Pittsburgh. "Pittsburgh's Resilience Strategy: Together We Move Forward As One Pittsburgh." 2017.
https://www.100resilientcities.org/wpcontent/uploads/2017/07/Pittsburgh_Resilience_Strategy.pdf.
- City of Saint Paul. "2019 Adopted Budget." 2019.
<https://www.stpaul.gov/departments/financialservices/budget/2019-adopted-budget>.
- City of Saint Paul. "Racial Equity Metrics." n.d.
<https://www.stpaul.gov/departments/planningeconomic-development/racial-equity-metrics>.
- "Climate Resilience Portal." Center for Climate and Energy Solutions. December 19, 2018.
- Coumou, Dim, and Stefan Rahmstorf. "A decade of weather extremes." *Nature climate change*, 2, no. 7 (2012): 491.
- Cramer, Katherine J. *The Politics of Resentment: Rural Consciousness in Wisconsin and the Rise of Scott Walker*. Chicago: University of Chicago Press (2016): 55.
- Curtis, Sarah, Alistair Fair, Jonathan Wistow, Dimitri V. Val, and Katie Oven. "Impact of extreme weather events and climate change for health and social care systems." *Environmental Health*, 16, no. 1 (2017): 128.
- Dane County Emergency Management. "Dane County Flooding—Damage Estimates." September 5, 2018.
https://danedocs.countyofdane.com/webdocs/pdf/press/95_Flooding_Damage_Estimates_Submitted.pdf.
- Dane County Natural Hazard Mitigation Plan. Dane County Emergency Management. September 28, 2017.
- Editors of Encyclopedia Britannica. "European Heat Wave of 2003." Encyclopedia Britannica. March 15, 2019. <https://www.britannica.com/event/European-heat-wave-of-2003>.
- Filiberto, David, Elaine Wethington, Karl Pillemer, Nancy Wells, Mark Wysocki, and Jennifer True Parise. "Older People and Climate Change: Vulnerability and Health Effects." *Generations* 33, no. 4 (2009): 19-25.
- FloodzoneData.usm. [describes the people and housing located in the U.S. floodplain]. 2019. NYU Furman Center. <http://furmancenter.org/floodzonedata/map>.

- ForwardHealth. “Information About Your Enrollment and Benefits.” March 2019. <https://www.dhs.wisconsin.gov/publications/p0/p00079.pdf>.
- “Green Building Alliance, Resilient Pittsburgh’s Resilience Fair.” 2016. <https://www.goba.org/events/resilient-pittsburghs-resilience-fair/#lightbox/0>.
- Hendrickson, Marcia. Interview with the authors. March 8, 2019. Phone.
- Hernandez, Diana. “Poor Families, Housing, and Health,” The University of Wisconsin–Madison Institute for Research on Poverty. Winter 2016. <https://www.irp.wisc.edu/wp/wpcontent/uploads/2018/11/foc331e.pdf>.
- Hoffman, Jeanne. Interview with the authors. January 25, 2019. City County Building. Madison, WI.
- Houser, Trevor, Robert Kopp, Solomon Hsiang, Michael Delgado, Amir Jina, Kate Larsen, Michael Mastrandrea, et al. “American climate prospectus.” *Economic Risks in the United States*. Rhodium Group, LLC (2014).
- Imagine Madison: People Powered Planning. “City of Madison Comprehensive Plan.” August 2018: 3-6. <http://plan.imaginemadisonwi.com/comprehensive-plan-part-1>.
- Jennings, Tori. “Transcending the Adaptation/Mitigation Climate Change Science Policy Debate: Unmasking Assumptions about Adaptation and Resilience.” *Weather, Climate, and Society*, no. 4 (2011): 238-248.
- Kaiser Family Foundation. “Beyond Health Care: The Role of Social Determinants of Health in Promoting Health and Health Equity.” May 2018. <http://files.kff.org/attachment/issuebrief-beyond-health-care>.
- Keim, Mark E. “Building Human Resilience: The Role of Public Health Preparedness and Response as an Adaptation to Climate Change.” *American Journal of Preventive Medicine*, no. 5 (2008): 508-516.
- Knuth, Kate. Interview with the authors. March 7, 2019. Phone.
- Kretschman, Carol and Marsha Hendrickson. Interviews with the authors. March 7 and 8, 2019. Phone.
- LeClair, Jessica. Interview with the authors. February 12, 2019. Signe Skott Hall, UW–Madison. Madison, WI.
- Linnenluecke, Martina K., Andrew Griffiths, and Monika Winn. “Extreme weather events and the critical importance of anticipatory adaptation and organizational resilience in responding to impacts.” *Business Strategy and the Environment*, 21, no. 1 (2012): 17-32.
- “LYRB Projects & Ideas.” City of Pittsburgh. n.d. Accessed March 15, 2019. <http://pittsburghpa.gov/oca/projects-ideas>.
- Madison Comprehensive Plan*. City of Madison. August 2018. 3-116.
- Madison Neighborhood Indicators Project. 2017 Edition.
- McLellen, John. Interview with authors. March 25, 2019. Phone.

- Meyer, David, Lynn Lee, Patty Prime, and Lisie Kitchel. Interviews with the authors. March 5, 7, 1, and 8, 2019. Phone.
- Miller, Evonne, and Lauren Brockie. "Resilience and Vulnerability: Older Adults and the Brisbane Floods." *Integrating Disaster Science and Management*, pp. 379-391. 2018.
- Minnesota State Demographic Center. "Population Data > Our Estimates." Minnesota Department of Administration, n.d. <https://mn.gov/admin/demography/data-by-topic/populationdata/our-estimates/>.
- Moraci, Francesca, Maurizio F. Errigo, Celestina Fazia, Gianluca Burgio, and Sante Foresta. "Making Less Vulnerable Cities: Resilience as a New Paradigm of Smart Planning." *Sustainability* 10, no. 755 (2018). DOI: 10.3390/su10030755.; Resilient Europe. "Urban Resilience: A Concept for Co-Creating Cities of the Future." 2016. https://urbact.eu/sites/default/files/resilient_europe_baseline_study.pdf.
- Mueller, Elizabeth J. "Old Apartments and New Plans: Reconciling Planning and Housing Goals in Two Texas Cities." *Community Development*, no. 41 (2010): 121.
- National Oceanic and Atmospheric Administration: National Centers for Environmental Information. "Climate History: July 1995 Chicago-Area Heat Wave." Accessed on March 27th, 2019. <https://www.ncdc.noaa.gov/news/climate-history-july-1995-chicago-area-heatwave>.
- Novak, Bill. "Tony Evers Declares State of Emergency Due to Extreme Winter Weather." January 29, 2019, www.Madison.com.
- Paulsen, Kurt. "Dane County Housing Needs Assessment: 2019 Update." n.d. [pre-publication].
- Paulsen, Kurt. Interview with the authors. UW–Madison Music Hall. February 20, 2019.
- Prime, Patty. Interview with the authors. March 1, 2019. Phone.
- Public Health Madison Dane County HMDC. "Baseline Climate Change and Health Report." n.d. (pre-publication): 3.
- Race to Equity Project Team, Race to Equity: A Baseline Report on the State of Racial Disparities in Dane County. Wisconsin Council on Children and Families. 2013. <http://racetoequity.net/wp-content/uploads/2016/11/WCCF-R2E-Report.pdf>.
- Reece, Stacie. Interview with the authors. February 27, 2019. City County Building. Madison, WI.
- Reopelle, Keith. Interview with the authors. February 15, 2019. City County Building. Madison, WI.
- Satya Rhodes-Conway for Mayor. "Issues." 2019. <https://www.satyaformadison.com/>.
- Saulnier, Dell D., Kim Brolin Ribacke, and Johan von Schreeb. "No calm after the storm: a systematic review of human health following flood and storm disasters." *Prehospital and disaster medicine*, 32, no. 5 (2017): 568-579.
- Sims, J.R., Ian Aley, Lexa Dundore, Taylor Laemmli, Sheila Long, Emily Lutz, Ruanda McFerren. (2016). *Evicted in Dane County, Wisconsin: A Collaborative Examination of the Housing Landscape*. Madison, WI.

- Soglin for Mayor. “Who is Paul Soglin?” 2019. <https://www.soglinformayor.com/>.
- Sommerhauser, Mark. “Tony Evers Joins Governors Group Fighting Climate Change by Pursuing Reduced Carbon Emissions.” February 13, 2019, Wisconsin State Journal. https://madison.com/wsj/news/local/govt-and-politics/tony-evers-joins-governors-group-fighting-climate-change-by-pursuing/article_a09462b4-fd2e-520e-abe8-1e9dada5ebda.html.
- Southern Wisconsin Integrated Warning Team. “Dane County Flooding.” PowerPoint. February 5, 2019.
- Stark, Russ. Interview with the authors. March 21, 2019. Phone.
- The Fourth National Climate Assessment. Volume II: Impacts, Risks, and Adaptation in the United States. US Global Change Research Program (USGCRP). <https://nca2018.globalchange.gov/>.
- The Rockefeller Foundation. “Resilience Prospectus.” 2018. <http://100resilientcities.org/wpcontent/uploads/2018/10/Resilience-Prospectus-United-States-2018.pdf>.
- The Wisconsin Initiative on Climate Change Impacts. “Climate Change: Overview.” n.d. www.wicci.wisc.edu/climate-change.php.
- Tyler, Stephen, and Marcus Moench. “A framework for urban climate resilience.” *Climate and Development*, 4, no. 4 (2012): 311-326.
- United States Department of Health and Human Services: Office of Minority Health. Asthma and African Americans. <https://minorityhealth.hhs.gov/omh/browse.aspx?lvl=4&lvlid=15>.
- United States Environmental Protection Agency. “Superfund Climate Resilience.” February 25, 2019. <https://www.epa.gov/superfund/superfund-climate-resilience>.
- United States Global Change Research Program. “Fourth National Climate Assessment: Built Environment, Urban Systems, and Cities.” <https://nca2018.globalchange.gov/chapter/11/>.
- United States Global Change Research Program. “Fourth National Climate Assessment: Summary Findings.” November 23, 2018. <https://www.globalchange.gov/nca4>.
- University of California-Berkeley Office of Planning and Analysis. “UC Berkeley Quick Facts.” 2018. <https://opa.berkeley.edu/campus-data/uc-berkeley-quick-facts>.
- University of California-Berkeley, Rutgers University, Columbia University, Rhodium Group. “American Climate Prospectus.” October 2014. https://gspp.berkeley.edu/assets/uploads/research/pdf/American_Climate_Prospectus.pdf.
- University of Wisconsin–Madison. “UW Facts and Figures.” 2018. <https://www.wisc.edu/about/facts/>.
- Urban Land Institute. “Returns on Resilience: The Business Case.” 2015. <https://uli.org/wpcontent/uploads/ULI-Documents/Returns-on-Resilience-The-Business-Case.pdf>.
- Van Dyke, Katie. Communication with the authors. April 15, 2019. Email.

Van Dyke, Katie. Interview with the authors. March 19, 2019. Phone.

Waters, Rob. "Berkeley's Liberal Image in Question Amid Homeless Crisis." *The Guardian*. March 15, 2017, <https://www.theguardian.com/us-news/2017/mar/15/berkeley-california-homeless-identity-crisis>.

Wisconsin Department of Health Services. Climate and Health: Vulnerability. 2017. <https://www.dhs.wisconsin.gov/climate/wihvi.htm>.

"Wisconsin Heat Awareness." Official Website of the City of Milwaukee. Accessed March 26, 2019. <https://city.milwaukee.gov/wisconsinheatawareness#.XMMMeDuhKiU1>.