

University of Massachusetts Boston

ScholarWorks at UMass Boston

Graduate Masters Theses

Doctoral Dissertations and Masters Theses

8-2020

Listening to Greater Boston's Climate Change Concerns

Anna I. Valdez

Follow this and additional works at: https://scholarworks.umb.edu/masters_theses



Part of the [Climate Commons](#), and the [Environmental Health and Protection Commons](#)

LISTENING TO GREATER BOSTON'S CLIMATE CHANGE CONCERNS

A Thesis Presented

by

ANNA I. VALDEZ

Submitted to the Office of Graduate Studies,
University of Massachusetts Boston,
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

August 2020

Environmental Science Program

© 2020 by Anna Valdez

All rights reserved

LISTENING TO GREATER BOSTON'S CLIMATE CHANGE CONCERNS

A Thesis Presented

by

ANNA I. VALDEZ

Approved as to style and content by:

Ellen Douglas, Associate Dean
Chairperson of Committee

Paul Kirshen, Professor
Member

Elizabeth L. Sweet, Assistant Professor
Member

Juanita Urban-Rich, Program Director
Environmental Sciences Program

Robert F. Chen, Interim Dean
School for the Environment

ABSTRACT

LISTENING TO GREATER BOSTON'S CLIMATE CHANGE CONCERNS

August 2020

Anna I. Valdez

B.S., Environmental Engineering, Worcester Polytechnic Institute
M.S. School for the Environment, University of Massachusetts Boston

Directed by Associate Professor Ellen M. Douglas, PhD

As climate change threatens our communities, it reminds us of the importance of preparing for the future. Cities and towns are trying to understand how climate change will place their citizens at risk. To create resiliency measures and adaptation plans, they will need climate related parameter information. The Greater Boston Research Advisory Group (GBRAG) knew it was necessary to listen to the needs of stakeholders in Greater Boston about the climate parameter information they need to prepare resilient communities. To accomplish this goal, GBRAG held community workshops, collected a survey, and reviewed their Municipal Vulnerability Preparedness reports. These three methods allowed GBRAG to gain a comprehensive understanding of the information needed by the 101 Greater Boston communities. GBRAG also evaluated the inclusive and exclusive language surrounding the

participant's responses. This allowed GBRAG to understand if the outreach produced tones that accounted for all community groups. The engagement methods and their findings were analyzed and critically studied to understand how future engagement processes could be improved. The process of engaging with the public is challenging but ensures that the GBRAG report will hold information that is needed by the public to create adaptive and resilient communities.

DEDICATION

This thesis is dedicated to my parents, whose continual support, advice, and ability to listen helped me through the process of writing this thesis.

To Anthony, for your unwavering support and for always believing in me even when I did not always believe in myself.

And to my female science and engineering teachers and peers – for representing that anything is possible and allowed me to realize my potential.

My greatest wish is to do the same for others someday.

ACKNOWLEDGEMENTS

To Ellen Douglas, for being my advisor, without your support and encouragement, I would not be in the position to write these words. It has been inspiring to work with you the last year and a half and could not have asked for a better advisor.

Thanks to my committee, Paul Kirshen and Elizabeth L. Sweet, for always being available and willing to help with my thesis.

Thank you to Kristin Uiterwyk and Kim Starbuck from Urban Harbors Institute. They were beyond helpful with the engagement process and I learned so much from working with them.

Thank you to Darci Schofield from the MAPC for her insight on the engagement process and was instrumental in helping organize the workshop meetings.

Thank you to the Steering Committee members for their contribution, feedback, and distribution of the engagement methods.

Thank you to the Barr Foundation, which funded this research.

To my colleagues and peers at the University of Massachusetts Boston, thank you for your encouragement, comradery, and support throughout my time at UMass Boston.

TABLE OF CONTENTS

DEDICATION	vi
ACKNOWLEDGEMENTS	vii
LIST OF FIGURES	xi
LIST OF TABLES	xii
CHAPTER	Page
1.0 INTRODUCTION	1
1.1 Climate Change	1
1.1.1 Climate Change Boston	1
1.1.2 Climate Justice.....	5
1.2 Background	6
1.2.1 Boston Research Advisory Group	6
1.2.2 Greater-Boston Research Advisory Group.....	7
1.3 Research Questions	8
1.4 Greater Boston Region	9
1.4.1 Physical.....	9
1.4.2 Demographics.....	12
1.4.3 Infrastructure	14
1.4.4 Adaptation and Mitigation.....	19
2.0 METHODS	21
2.1 Data Collection.....	21
2.1.1 Community Outreach Methods	22
2.1.1.1 Municipal Vulnerability Preparedness Reports	22
2.1.1.2 Community Workshops	23
2.1.1.3 Survey	27
2.1.2 US Census Data.....	30
2.2 Analysis Process.....	30
2.2.1 Dedoose	30

CHAPTER	Page
3.0 LITERATURE REVIEW	32
3.1 Importance of Local Government’s Role in Climate Change and Establishing Networks for Communities	32
3.2 Engagement with Citizens and Stakeholders to Inform Government and Researchers on Important Climatic Impacts.....	36
3.2.1 National Climate Assessment.....	37
3.2.2 Analysis of User Needs for National Climate Scenarios.....	38
3.2.3 Climate Change Public Conversations Series	39
3.3 Engagement Methods.....	41
3.3.1 Community Engagement with Arnstein’s Ladder.....	41
3.3.2 White’s warning for community engagement	44
3.3.3 Tools for stakeholder engagement and their effectiveness.....	46
3.4 Importance of Engagement with Communities.....	47
3.4.1 Engaging marginalized and under-represented communities.....	48
3.4.2 Examples of engaging marginalized communities.....	50
4.0 RESULTS AND DISCUSSION.....	54
4.1 Results	54
4.1.1 Participants	54
4.1.2 Data Collected	60
4.1.2.1 Environmental.....	60
4.1.2.2 Public Health and Safety	62
4.1.2.3 Transportation.....	63
4.1.2.4 Infrastructure.....	64
4.1.2.5 Governance	67
4.1.2.6 Economic	67
4.1.3 Clusivity	68
4.2 Discussion	70
4.2.1 Discussion of Themes.....	70
4.2.1.1 Environment	70
4.2.1.2 Infrastructure.....	75
4.2.1.3 Clusivity.....	79

CHAPTER	Page
5.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS	85
5.1 Comparison and Discussion of Methods.....	85
5.2 Inclusion of Marginalized Communities’ Needs.....	90
5.3 Recommendations for Future Community Engagement Activities	94
5.3.1 Time and Funding.....	94
5.3.2 Methods Modifications.....	95
5.3.3 Participation Diversity.....	97
5.3.4 Social Scientist	98
5.4 Conclusion.....	99
APPENDIX.....	101
A. MVP REPORTS.....	101
B. COMMUNITY WORKSHOPS PRESENTATION.....	102
C. GROUPS CONTACTED	121
D. SURVEY QUESTIONS.....	128
E. CODE DEFINITIONS.....	154
F. RAW DATA	159
REFERENCES	174

LIST OF FIGURES

Figure	Page
1. Sea Level Rise Predictions for Boston	4
2. Extreme Heat Predications for Boston	5
3. Metropolitan Area Planning Council Map (MAPC)	9
4. GIS Map of Water and Green Resources of MAPC Region	11
5. Race of Greater Boston MAPC Area	13
6. Hispanic or Latino Population of Greater Boston MAPC Area	13
7. Massachusetts Energy Consumption Estimates 2018	15
8. MWRA Services Map	16
9. Major Road and Commuter Rail in Massachusetts	19
10. Community Engagement Handout	26
11. Participation by Region	56
12. Occupation of Participants by Method	59
13. Environmental Parameter Concerns	61
14. Public Health and Safety Code Count	63
15. Transportation Code Count	64
16. Infrastructure Code Count	65
17. Governmental Code Count	67
18. Coastal verse Inland Economic Code Count	68
19. Clusivity Code Count	69
20. Vulnerable Communities Code Count	70
21. Vulnerable Communities Code Count by Method	81

LIST OF TABLES

Table	Page
1. MAPC Region MWRA Facilities	17
2. Number of MVP Reports by Subregion	23
3. Community Engagement Meetings	24
4. List of Organizations in Steering Committee	28
5. Climate Report and Method Matrix	42
6. Weighted Participation by Subregion	58
7. Coastal vs. Inland Impacts	62
8. Infrastructure Code Use Count by Method	66
9. Infrastructure, Wastewater, and Water Code Count	67
10. Climate Parameter and Impacts	74
11. MWRA Communities	77
12. Attributes of Methods	86

CHAPTER 1

INTRODUCTION

1.1 Climate Change

Climate change has an undeniable effect on natural and human systems. The United Nation's (UN) Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) continues to confirm the inevitable effects of greenhouse emissions on the planet (IPCC, 2014). Countries, regions, and cities around the globe are working to understand better what future impacts are anticipated. By having greater insight into the climate effects for their region, governments can increase the resiliency of their communities. Boston, Massachusetts, has been one of the communities that have felt the early impacts of climate change and have been proactive about starting to adapt and create resilient communities.

1.1.1 Climate Change Boston

As Massachusetts and the rest of the world continues to experience record setting values for temperatures, precipitation, and storms, people realize that climate change is an extremely urgent problem and will continue to worsen. Massachusetts has 1,519 miles of

coastline with its largest city, Boston, situated on Boston Harbor protected by the Massachusetts Bay. Known to have warm, humid summers and cold, harsh winters, Massachusetts has held an important role in United States history. Evidence gathered over past decades shows Massachusetts' climate is changing; Massachusetts' residents have faced increasingly destructive winter storms, tornados, extreme precipitation, droughts, and hurricanes. These events foreshadow for residents that climate change will be affecting their lives and future generations along with others around the globe.

Hurricane Sandy, in October of 2012, caused extensive damage to the northeast coast of the United States with strong winds, high tides, and flooding. It was reported that Hurricane Sandy “affect[ed] an estimated 60 million people living in 24 states” (Burger & Gochfeld, 2017, p.1262). In March of 2018, the impacts of back to back extratropical storms (known as Nor'easters) left the Greater Boston Area reeling from the multifaceted effects of extreme weather. Hundreds of thousands of residents were without power and suffered damages to public and private property. (Stout, 2018). Blue Hills Observatory recorded a total of 45 inches of snow for March 2018, which is the second snowiest March in their 133 year records (Iacono, 2018). In addition, 2019 was warmer and wetter than average (1981 to 2010) for the Boston Area (Iacono, 2020). The mean temperature was 1.6 degrees F and mean precipitation was 8.26 inches higher in 2019 than average (Iacono, 2020). Record temperatures were set in July, with several days recorded temperatures over 90 degrees Fahrenheit (Iacono, 2019). Increased health risks and demands for cooling centers was a significant concern among residents. These continued climate events tell the story that climate change is not excluding Massachusetts from feeling the effects now, or in the future.

In 2016, the Boston Research Advisory Group (BRAG) published a report recognizing the threats Boston will be facing related to climate change. In the next 80 years, Boston could see an increased intensity of winter and coastal storms like the Nor'easters of 2018; although, projections are uncertain due to multiple unknown contributors like the ocean and air temperatures. (B.R.A.G., 2016). Storms could lead to increased precipitation, winds, flooding, economic costs, and damage to housing and infrastructure. Increased coastal flooding will be of particular concern as sea level rises and increased extreme storms occur especially during high tide. Boston flood maps show extensive damage to primarily low-income communities in East Boston and Dorchester.

The sea level has been rising, but due to the ice sheets' gravitational effects while melting and other factors, Boston is expected to see a sea level rise higher than global averages (B.R.A.G., 2016). Figure 1 shows the sea level rise projections for the City of Boston. It reports a possible sea level rise of 7.4 feet by 2100 above the recorded sea level in year 2000. However, storm surges, high tides, and king tides could increase the sea level during particular storms or times of year. Natural coastal infrastructure like wetlands or saltwater marshlands will need to navigate to higher ground. Stormwater and wastewater outflows will also be impacted by increased sea level rise. Saltwater intrusion could be a growing issue for cities and towns who depend on groundwater for drinking water and increase flooding of coastal communities.

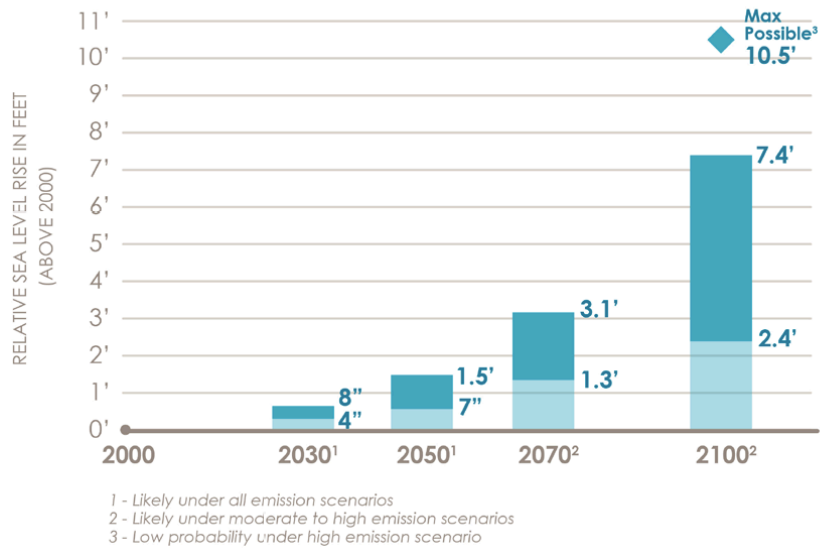


Figure 1: Sea Level Rise Predictions for Boston
 (B.R.A.G., 2016)

The report also states a likelihood of increased precipitation. While annual snowfall has decreased, there will likely be an increase in the amount of extreme rainfall. Inland communities, along with coastal communities, are already experiencing increased flooding due to higher rivers and groundwater levels. Aging stormwater infrastructure will increase these risks, especially for vulnerable communities. Flooding roadways, homes, and mass transit routes could lead to high impacts on citizens’ daily lives and business operations.

Residents could see an increase in the number of days over 90 degrees Fahrenheit and a decrease of days below freezing, as shown in Figure 2. Increases in extreme highs and extreme lows will place stress on residents and infrastructure. Projections of more and longer heatwaves, and the associated heat-related mortality is a related concern, especially with vulnerable communities.

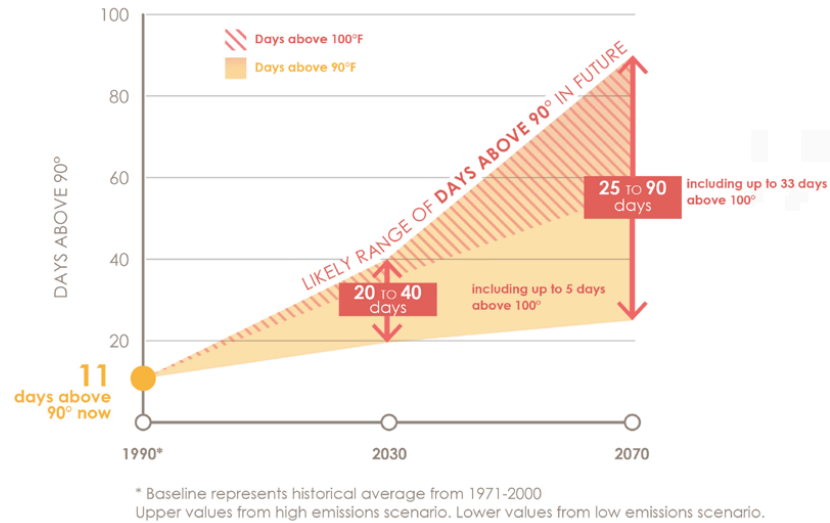


Figure 2: Extreme Heat Predictions for Boston
(Climate Ready Boston, 2016)

1.1.2 Climate Justice

As climate change becomes a more critical topic in the world, people are speaking out about the unequal impacts facing various communities. Within this context, the Climate Justice movement has emerged, which is closely related and can overlap with the Environmental Justice movement. The Environmental Justice movement advocates for “the fair treatment and meaningful involvement of all people with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies” (Environmental Justice, 2014). Climate activists, young and old, have been using social media and peaceful protests to draw attention to the risks climate change brings to the citizens of the world. They hope to communicate to world leaders the urgency of the threat and the immediate need for action. The younger generations, stewards of the planet for the next century, are angry that they will be living with the problems left to them by previous generation.

Greater Boston is home to diverse communities who will feel the impact of climate change in different ways. Climate Justice groups are concerned with climate gentrification in which wealthier, more privileged populations flee to areas less affected by climate change leaving behind marginalized communities bearing the burden of climate change in their cities and towns. Climate gentrification was first coined in a 2018 study of Florida’s Miami-Dade County housing market; it was observed that homes at lower elevations were less expensive but had an increased flood risk compared to more expensive homes at high elevations (Keenan et al., 2018). As temperatures and sea levels rise, and flooding risks increase, those who are most vulnerable to these climate events will feel the impact more than those who can afford to buy air conditioning units or move inland and to higher ground. It is important when learning about climate change to consider the needs of all communities and how some groups are at a higher risk than others. As Massachusetts communities prepare for the future, all of their citizens will need to be protected, not just the ones who can afford it. The City of Boston has minority and low-income neighborhoods that are at the greatest risk to climate change. It is important to understand these communities’ needs and the impact they will face to ensure they are protected in the future.

1.2 Background

1.2.1 Boston Research Advisory Group

In 2015, Professor Ellen Douglas and Professor Paul Kirshen from the University of Massachusetts – Boston were asked by the City of Boston to publish a report of Boston specific climate projections for sea level rise, coastal storms, extreme precipitation, and extreme temperatures (B.R.A.G., 2016). Several publications regarding climate change’s

impacts on the Boston area had projections that did not mirror each other (B.R.A.G., 2016). Private and public entities were creating action plans for the future, but the parameters and future predictions were not in agreement with each other, such as reports like Greenovate Boston Climate Action Plan, 2014, and The City of Cambridge Climate Change Vulnerability Assessment, 2015, (B.R.A.G., 2016). To accurately plan for the future the City of Boston knew a scientific consensus for climate change projections specific to Boston was needed. The Boston Research Advisory Group (BRAG) was established to develop this consensus report.

The management team gathered four teams of local and regional researchers prominent in their field, to address the four climate risk factors relevant for Boston: sea level rise, extreme precipitation, extreme temperatures, and coastal storms. Each team reviewed available, reliable scientific data to formulate their consensus for impacts in 2030, 2050, 2070, and 2100. Greenhouse gas (GHG) emission scenarios were used to present a scale and range of future impacts.

The scientific report was published on June 1st, 2016, by the BRAG. The City of Boston published its Climate Ready Boston report that used the data from the BRAG report to construct a citywide vulnerability assessment and the timeline for their adaptation and resiliency plans.

1.2.2 Greater-Boston Research Advisory Group

Several years after BRAG (2016), the scientific consensus for Boston needed to be updated and expanded to the greater Boston area. Several communities were using the

Boston specific information from the 2016 report when planning for the future of their towns. Due to the uncertainty of the projections, cities and towns could potentially focus on the wrong set of action items or resiliency strategies. For example, due to the physical location of Boston on the harbor, populations in the flood risk area, and the number and type of buildings, it faces specific climate concerns that more rural, and inland towns and cities do not face. The goal of expanding the domain was to give those communities more specific information for their region that will allow them to more effectively prepare for the future.

Using the Metropolitan Area Planning Council (MAPC) region as a border limit, the updated initiative was renamed the Greater-Boston Research Advisory Group (GBRAG), which includes 101 cities and towns surrounding Boston. The information from the previous report was to be updated, but the GBRAG team wanted to include the concerns of the surrounding communities. It was important to understand the needs of the diverse communities fully and to capture their needs within the report while delivering quality scientific information.

On February 1st, 2019, the first Greater-Boston Research Advisory Group Steering Committee was held to outline the goals of the next report. The steering committee was made up of individuals serving in public and private groups from a variety of professions covering governmental, environmental, nonprofit, and utility companies.

1.3 Research Questions

This thesis addresses three primary research questions. First, through community engagement, what climate change parameters/data needs are important to the Greater Boston communities? Secondly, does feedback from the community outreach produce the use of

clusive tones that account for all community groups of the Greater Boston Area? Thirdly, did the community engagement methods produce findings that mirror concerns raised by environmental justice groups?

1.4 Greater Boston Region

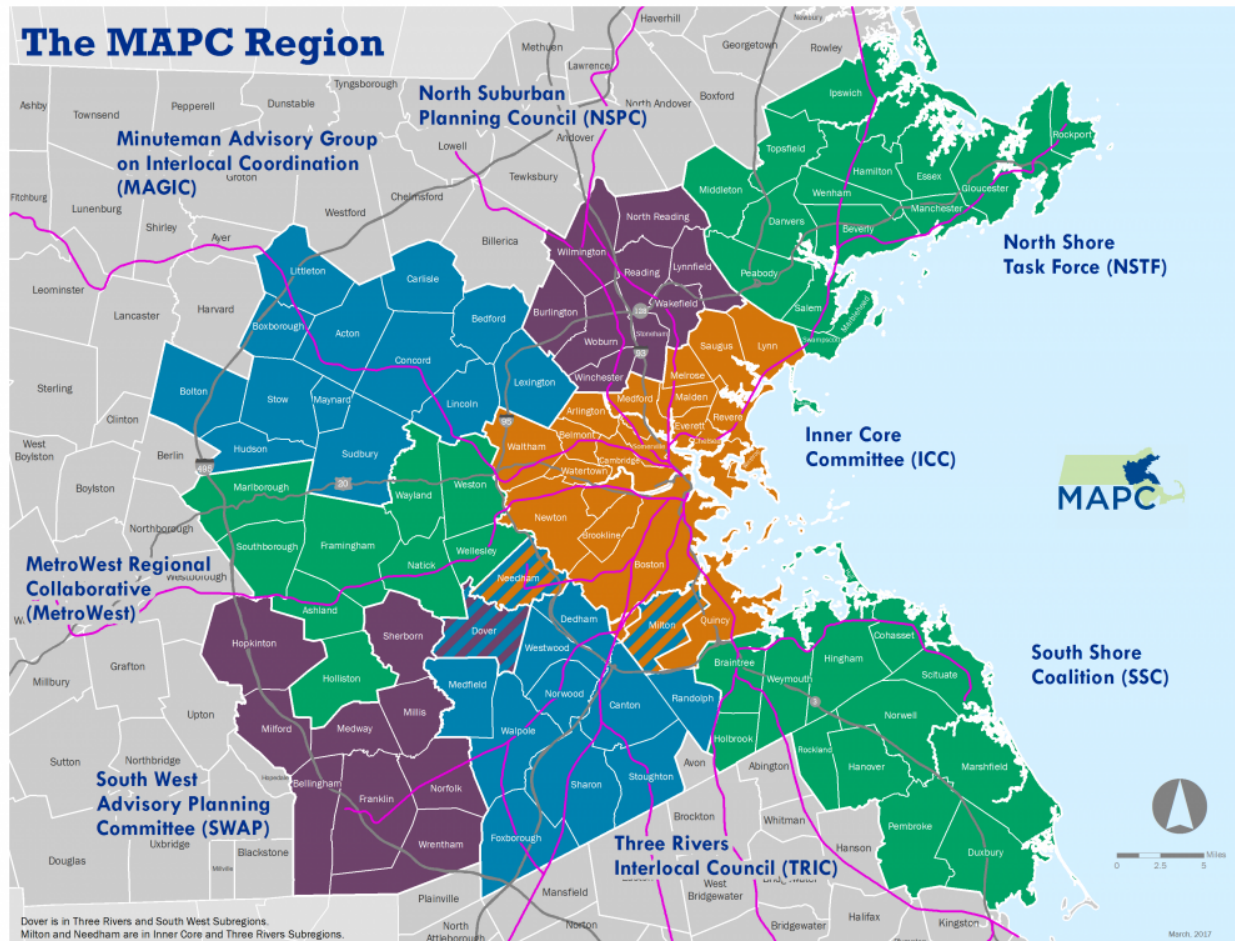


Figure 3: Metropolitan Area Planning Council Map (MAPC) (Subregions, n.d.)

1.4.1 Physical

The Greater Boston region is located in eastern Massachusetts, with a coastline adjacent to Massachusetts Bay. The last ice age transformed the landscape into the physical

terrain as we know it today. The coastline is known for its beaches, marshlands, and rocky shorelines while the interior is filled with forests, farmlands, and freshwater rivers, lakes, and wetlands. The forests consist of a mixture of deciduous trees and coniferous evergreens (*Place in Massachusetts History*, n.d.). The seasons shift from warm, humid summers to cold, harsh winters. All of these physical features will experience the impacts of climate change.

The MAPC area, Figure 3, is made up of eight planning subregions with a total of 101 communities. The subregions are South Shore Coalition (SSC), Three Rivers Interlocal Council (TRIC), South West Advisory Planning Committee (SWAP), Metro West Regional Collaborative (MetroWest or MWRC), Minuteman Advisory Group on Interlocal Coordination (MAGIC), North Suburban Planning Council (NSPC), North Shore Task Force (NSTF), and Inner Core Committee (ICC). The region extends as far north as Ipswich, south to Duxbury, and westward to Bolton and Hopkinton.

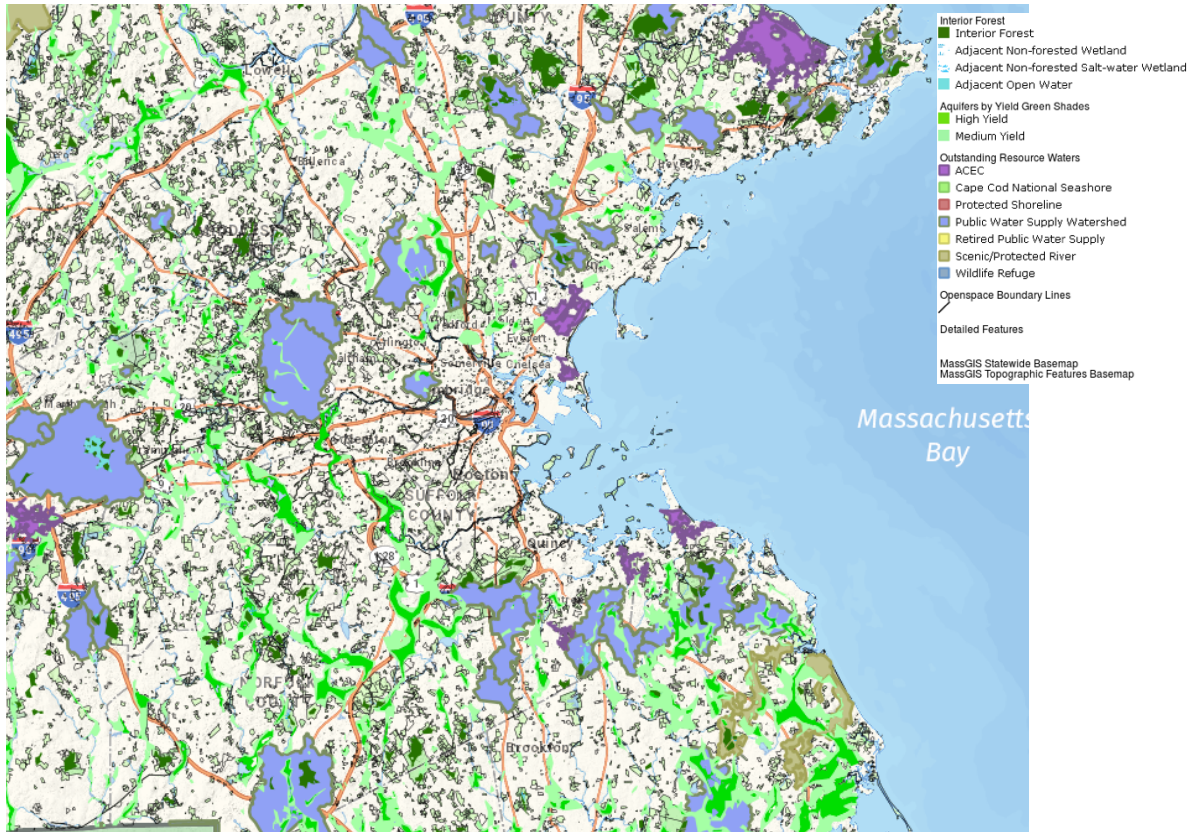


Figure 4: GIS Map of Water and Green Resources of MAPC Region (OLIVER, n.d.)

Within the MAPC region, the eight subregions contribute to ten of the 28 watersheds of Massachusetts (*Mass Rivers & Watersheds Map*, 2009). There are a variety of surface waters and aquifers as well; some of which are protected by law because they are used as water resources for communities. Figure 4 shows the water resources in blue, aquifers in light green, and forest resources in dark green. Many forested areas are open to the public to use and explore by the Department of Conservation and Recreation. Each subregion has unique resources and landscapes which shape how the cities and towns have developed over the years. Even today, these resources define the needs of the communities as they play a significant role in the plans and actions of the towns and cities in the future, especially when it comes to planning for climate change.

1.4.2 Demographics

Massachusetts 2010 census population was 6,547,629 people (*U.S. Census Bureau QuickFacts*, n.d.). The largest city in the subregions was Boston, with a population of 617,594 people. The entire MAPC region had a population of 3,161,712 as of the 2010 census, hence the GBRAG domain represents nearly 50% of the Massachusetts population (U. S. C. Bureau, n.d.). An average, for the state, 14.5% of the population is 65 years and older (U. S. C. Bureau, n.d.). For the state of Massachusetts, 10% of the population lives below the poverty level, while the median household income is \$77,378 (*U.S. Census Bureau QuickFacts*, n.d.). Data from the American Community Survey reported that 73% of Massachusetts citizens speak only English, while 27% speak a language other than English, as reported in the 2010 US Census. The MAPC region has a majority of white residents, as reported in the 2010 census, Figure 6 and Figure 6 below show the breakdown of the race in the MAPC (U. S. C. Bureau, n.d.).

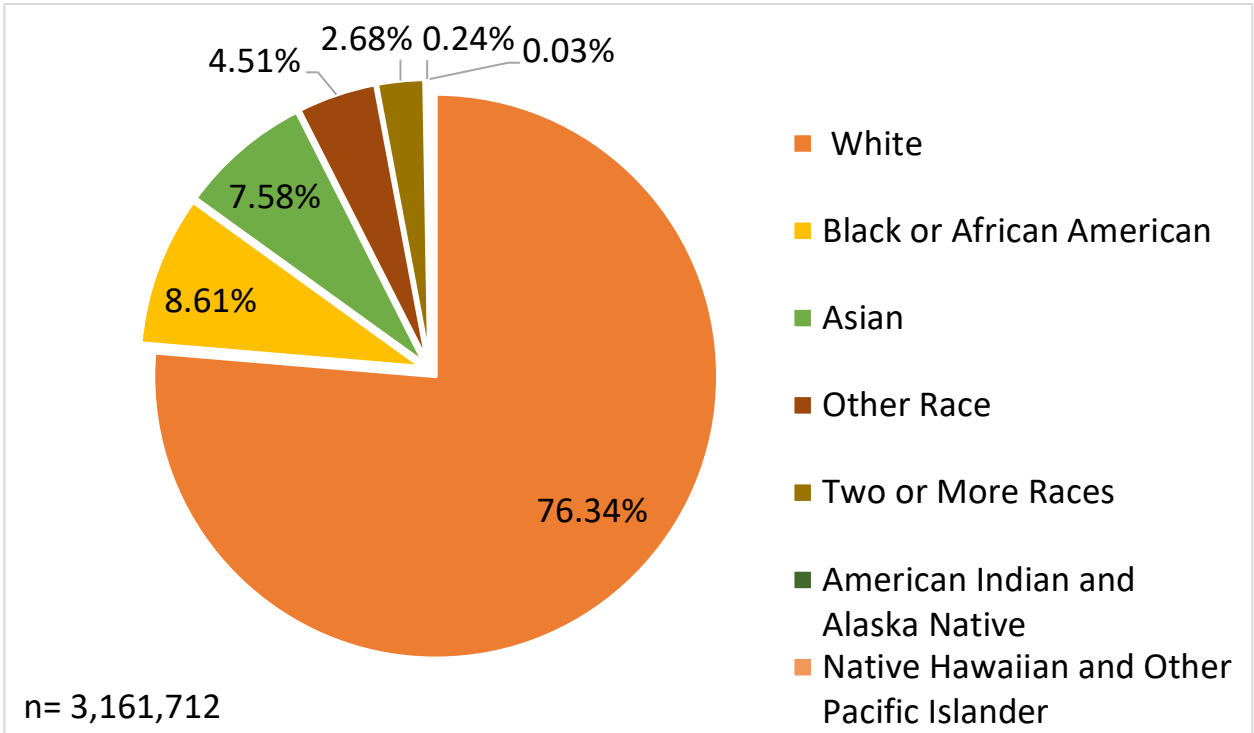


Figure 5: Race of Greater Boston MAPC Area
 (U. S. C. Bureau, n.d.) Includes persons reporting only one race

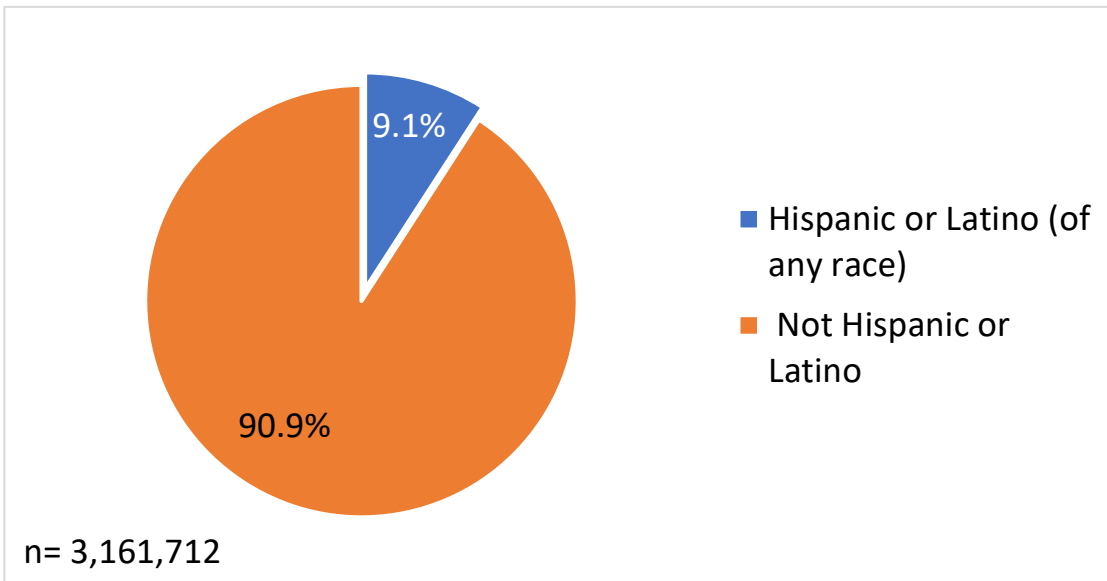


Figure 6: Hispanic or Latino Population of Greater Boston MAPC Area
 (U. S. C. Bureau, n.d.) Hispanics may be of any race, are included in applicable race categories.

1.4.3 Infrastructure

For the MAPC region, three electrical utility providers are used by communities: NSTAR Electric (doing business as Eversource Energy), Massachusetts Electric (doing business as National Grid), or Municipal owned (*Massachusetts Document Repository*, n.d.). Natural Gas utility providers in the MAPC region are Columbia Gas, Eversource, National Grid, or Municipal owned (*Massachusetts Document Repository*, n.d.). U.S. Energy Information Administration (EIA) reported that 67% of energy came from Natural Gas, while electrical production was made of nuclear and renewable power, seen in Figure 7 (*Massachusetts - State Energy Profile Overview*, n.d.). The state was ranked the 6th lowest for total energy consumed per capita in the United States in a 2017 report by the EIA (*United States - Rankings*, n.d.). Transportation, residential, and commercial each represent about 30% of energy consumption for the state while industry represents 10.9% (*Massachusetts - State Energy Profile Overview*, n.d.).

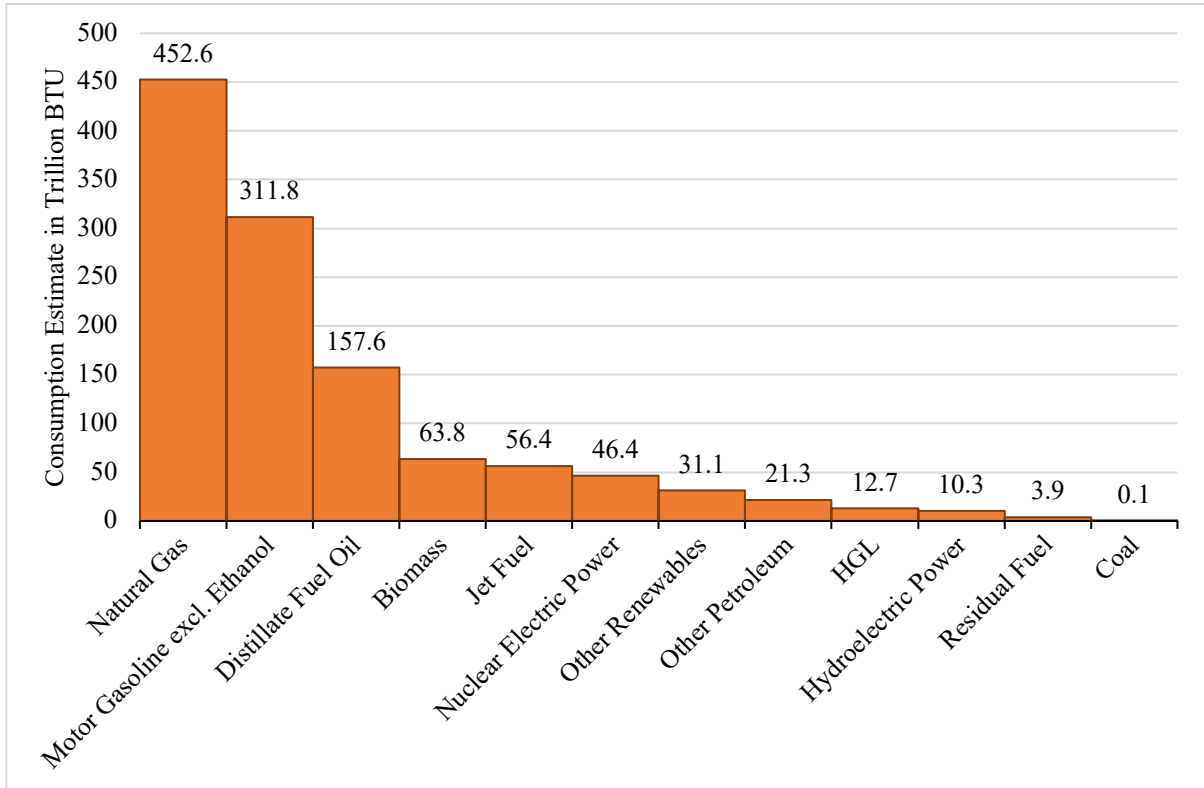


Figure 7: Massachusetts Energy Consumption Estimates 2018
 (Massachusetts - State Energy Profile Overview, n.d.) (NGL = Natural Gas Liquids)

Massachusetts' renewable resources are hydroelectric, biomass, solar, and wind, labeled *Other Renewables* in Figure 7. There are 30 dams in the state; several are within the MAPC subregion. Biomass is produced from primarily municipal solid waste and landfill gas (*Massachusetts - State Energy Profile Analysis*, n.d.). Legislation for an offshore wind farm south of Cape Cod was to begin construction in 2019 before legislative trouble slowed progress on the project. The offshore wind could represent an estimated 20% of renewable electricity for the state (*Vineyard Wind 1*, n.d.). In 2019, Massachusetts had the highest net generation from both utility and small-scale solar facilities in New England and the eighth highest in the country (*United States - Rankings*, n.d.). Massachusetts saw an increase in the net generation of 9% from 2018 (*Electricity Data*, n.d.).

Massachusetts Water Resources Authority (MWRA) provides water and sewer services to 61 cities and towns. Of the 101 MAPC communities, 53 are a part of the MWRA for either water, sewer, or both services, seen in Figure 8.

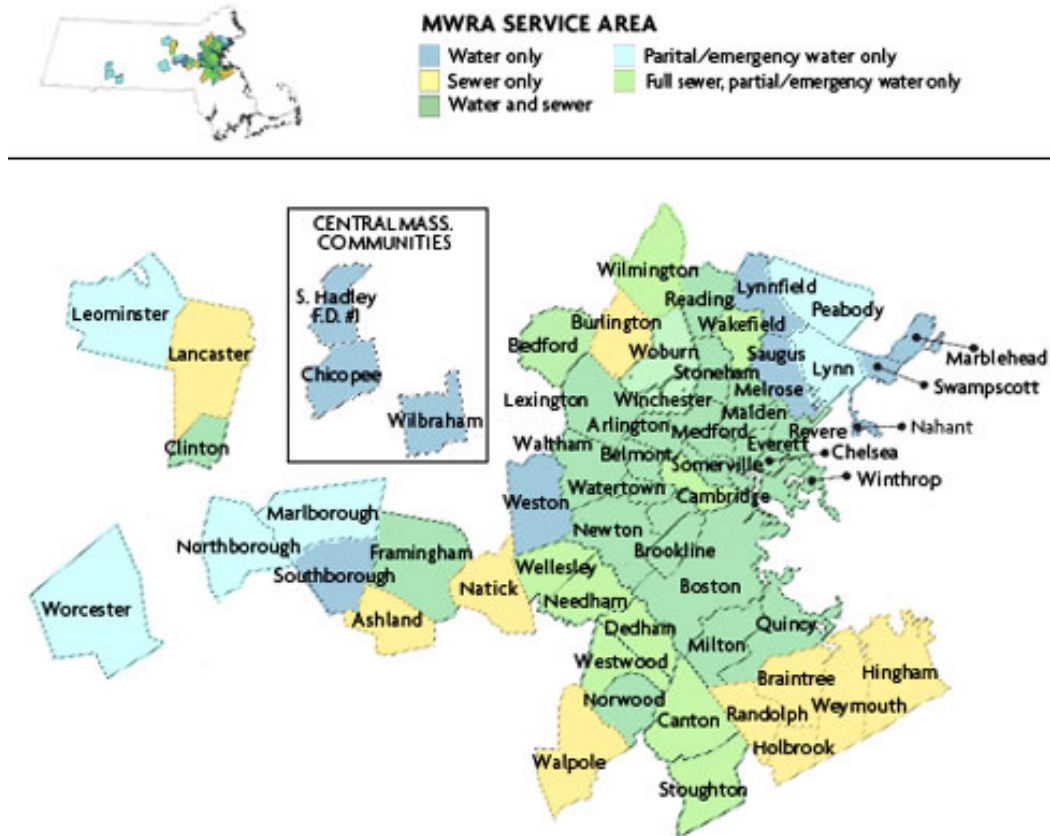


Figure 8: MWRA Service Map
(MWRA: About MWRA, n.d.)

Table 1 breaks down the number of communities within the MAPC region and what MWRA facilities the communities use. 53% of cities and towns within the MAPC region use the MWRA water and sewer facilities. By using the MWRA drinking water it decreases the need to rely on groundwater and surface water sources nearby. The use of the shared sewer plant facility decreases the need for upstream cities and towns to have treatment plants of their own, which would be costly and require effluent to obtain higher regulatory standards.

Facilities provided by MWRA	Number of cities and towns within the MAPC Region
Sewer Only	7
Water Only	9
Sewer and Water	22 (18 from ICC subregion)
Water (partially supplied) and Sewer	11
Water (emergency backup only) and Sewer	1
Water (partially supplied)	3

Table 1: MAPC Region MWRA Facilities
(MWRA: *About MWRA*, n.d.) (communities are not double counted)

MWRA service provides water to communities from the Quabbin Reservoir and Wachusett Reservoir. The Quabbin holds 477 billion gallons or enough water to supply the MWRA communities for five years. In the year 2019, the average MWRA communities receive 191.95 million gallons of water per day (*MWRA - Water Supply and Demand*, n.d.). The system has several backup reservoirs in case of a drought in the region.

The MWRA sewage treatment plant is located on Deer Island and has primary and secondary treatment. The plant improved the Boston Harbor water quality, which led to an improvement in the region’s health, economy, and environmental ecosystems. In 2000, the treatment plant extended its outfall structure into the Massachusetts Bay, which was the completion of the plant project. During primary treatment, particles that float (scum) or sink (sludge) are removed from the water. The scum is sent to landfills while the sludge is repurposed into fertilizer (*MWRA Sewer System Mainpage*, n.d.).

The Interstates 495 and 95 connect the MAPC region by making a half-circle around Boston with the interstate 93 running through Boston, represented by green roadways on the map in Figure 9. The Massachusetts Turnpike (Interstate 90) is a toll road that runs from

Boston to the western border. A 2015 Massachusetts Department of Transportation report indicated that, out of approximately 3.2 million Massachusetts workers, 2.3 million people commute to work by their car, and 405,000 use public transit (MassDOT, 2015). Others walk, bike, or work from home.

The purple lines in Figure 9 are the 12 Massachusetts Bay Transit Authority (MBTA) Commuter Rail routes with all routes beginning at either North or South Station in Boston. An average of 121,000 people ride the commuter rail each week (*MBTA Performance Dashboard*, n.d.). The MBTA also has a subway system, which has four rail lines that connect 11 cities and towns. An average of 678,000 people (students, tourist, workers, and more) ride the subway each week (*MBTA Performance Dashboard*, n.d.). There are also buses and a ferry system that connect the Greater Boston region. The ferry has three route options with two additional routes during summer seasons. The transit systems all connect in downtown Boston; this forces people with limited car access to go into downtown Boston to transfer for a different route or subway line.

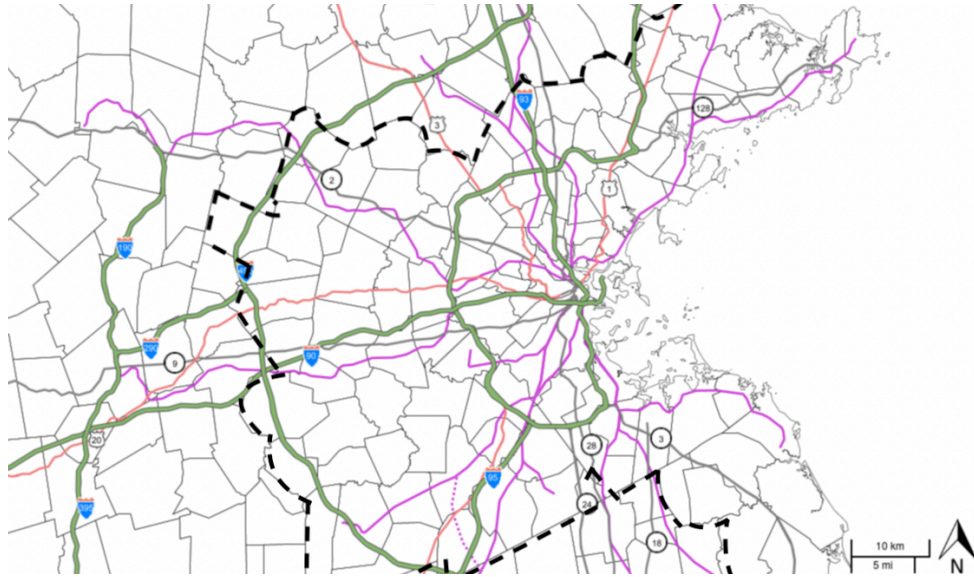


Figure 9: Major Road and Commuter Rail in Massachusetts (OLIVER, n.d.) (Black line is city and town bounties, Black Dashed line is MAPC boundary, Green Line is Interstate, Grey and Red lines are major highways, Purple lines are Commuter Rail lines, Purple dashed line is seasonal Commuter Rail line)

1.4.4 Adaptation and Mitigation

Adaptation and mitigation measures are important for countries, regions, and cities to work toward decreasing impacts of climate change and preparing for it. Mitigation of climate change is the act of decreasing greenhouse gases and other measures to reduce the effects of climate change. These measures could consist of increasing renewable energy while creating more green spaces. There is an abundance of ways to reduce climate change, and each can help reduce the effects of climate in the future. As important as mitigation measures are, it is equally as important to adapt cities, regions, and countries for the effects of climate change, which will be present for centuries even with increased mitigation measures. Adaptation measures might include increasing the size of stormwater drains for increased precipitation or increasing the number of cooling centers available to residents for the increased number of high heat days.

The Commonwealth of Massachusetts, under Governor Baker, created a *2018 Hazard Mitigation and Climate Adaptation Plan*, which defines the state's plan for adaptation and mitigation measures (*2018 Hazard Mitigation and Climate Adaptation Plan*, 2018). Not only did the state create a plan targeting goals to prepare and decrease its negative contributions to climate change, but it developed a grant program for the cities and towns of Massachusetts to create their own adaptation plan. The Municipal Vulnerability Preparedness (MVP) programs allow cities to understand what their weakness and strengths are when it comes to climate change. The reports help the municipalities plan toward a more prepared future. After completing an MVP report, the city or town is eligible for additional funding to turn the plans into action.

The work of BRAG has increased the scientific consensus of the plans and projects worked on by the municipalities and private entities. The goal of GBRAG is to create the same consensus but increase the region from just Boston to the Greater Boston area.

CHAPTER 2

METHODS

2.1 Data Collection

Data from Municipal Vulnerability Preparedness reports, community workshops, a survey, and the U. S. census were analyzed to answer the three research questions about the Greater Boston community's climate change impact concerns and parameter needs for resiliency planning. A climate parameter is the elements of climate like temperature, precipitation, or sea level rise, which are intensifying due to increased greenhouse gases in the atmosphere. Parameters are measurable elements that scientists can use to predict climate impacts. Climate change impacts are the effect climate parameters have on a variety of different elements. For example, a climate impact could be the effects climate change has on housing, the economy, or plant life. A climate impact may be due to the interactions of one or more climate parameter. A combination of content analysis was used, which revealed key themes and issues of concern, as well as cross-tabulations of the data synthesized revelations.

2.1.1 Community Outreach Methods

2.1.1.1 *Municipal Vulnerability Preparedness Reports*

Cities and towns of Massachusetts can receive state-funded grants to understand better the climate change vulnerabilities facing their communities in a report called Municipal Vulnerability Preparedness (MVP) report. The program is specific to the state of Massachusetts, and specific grants are available to help cities and towns assemble the reports. The town or city is required to detect its strengths and weaknesses in the community now and the future. Further, the purpose is to identify and plan priority actions to create a resilient community and lessen climate change impacts felt by the citizens. The reports were written by either the towns themselves or consulting companies that were contracted to prepare them.

Each report had a similar layout; the reports typically first discuss an overview of the town, priority hazards, vulnerable areas, and current challenges. The reports discuss specific areas of concerns broken down into geography, environment, infrastructure, economy, and society. Next, the municipality lists the town's strengths and assets. The final piece of the report lists out high, medium, and low priorities for the town.

Each MVP's concerns were built from listening sessions and community workshops. The community workshops used the Community Resilience Builder (CRB) worksheet, which helps facilitate climate change preparedness discussions (*Community Resilience Building*, n.d.). CRB has questions to lead the discussion and uses a worksheet that works directly into the MVP layout. The communities also used municipal maps where the workshop groups could identify key assets or vulnerable locations; this allowed the team to visualize their communities better.

The MVP reports were helpful when collecting information on the cities and towns by allowing city governments to better understand what their impact concerns were. The reports clearly state which parameters they were concerned with, along with what environmental, infrastructure, and social areas they were concerned with. As of November 7, 2019, there were 50 cities and towns within the MAPC region that completed the MVP reports. Table 2 shows the breakdown of reports per subregion. A list of all MVP reports used in this study is in Appendix A.

<i>MAPC Subregion</i>	Number of MVP Reports	Total Number of Communities in Subregion
<i>ICC</i>	11	21
<i>MAGIC</i>	8	13
<i>MWGMC</i>	4	9
<i>NSPC</i>	3	9
<i>NSTF</i>	10	15
<i>SSC</i>	5	12
<i>SWAP</i>	4	10
<i>TRIC</i>	5	13

Table 2: Number of MVP Reports by Subregion

2.1.1.2 Community Workshops

There were eight community workshops held within two months (March and April 2019). Each workshop took place during an already scheduled monthly MAPC sub-region meeting, shown in Table 3. The purpose of the workshops was to gain a better understanding of the needs of the communities. The meetings took place in townhall meeting rooms, the MAPC office, and a restaurant, and the attendees were typically city planners or other government workers. During each of the meetings, GBRAG was allocated 30-60 minutes to conduct the workshop. The meetings listed **Error! Reference source not found.** were during t

he day, which made it hard for citizens who were not able to leave their job, depend on public transportation, or require childcare to attend the events. Each workshop was run by two or more members of the GBRAG team.

Date	Time	Subregion(s)	Location
3/19/2019	9:30 am	TRIC/SWAP	Norfolk, MA
3/21/2019	9:00 am	NSPC	Wilmington, MA
3/21/2019	1:00pm	SSC	Norwell, MA
3/27/2019	12:30 pm	Metropolitan Mayors Coalition	Boston, MA
4/3/2019	9:00 am	ICC	Boston, MA
4/4/2019	1:00pm	MAGIC	Concord, Ma
4/18/2019	9:00 am	NSTF	Danvers, MA
4/25/2019	8:30 am	MetroWest	Ashland, MA

Table 3: Community Engagement Meetings

The same presentation, included in Appendix B, was given to each group. The presentation started with an introduction to GBRAG, its goal, what it is they are trying to accomplish, and how they hope to accomplish their goal. Next was the brainstorming session, and the technique of *Think, Pair, Share* was used.

Think, Pair, Share was chosen as an effective technique to facilitate thinking and to conduct quality conversations and feedback. Typically used in classroom settings, educators find that *Think Pair Share* “increase[s] student engagement and create[s] active learning communities” (Fitzgerald, 2013, p. 90). The purpose of *Think, Pair, Share* is to allow the participant to contemplate questions for a couple of minutes; this allows individuals to write down their perspective before sharing with others. The *Pair* portions of the breakout gathered two to five participants into a group to compare their answers and to gain a more comprehensive understanding of the questions. During the *Share* portion, each group was

allowed to share one or more impacts their group was concerned with. The GBRAG team wanted to ensure each individual had a chance to let their concerns be heard. The following two questions were asked to initiate the thinking process:

1. What concerns you about how climate change may impact transportation, housing, public health, the economy/business, governance, environmental resources, and social justice and equality, or others in the Massachusetts communities where you work and live?
2. What climate change information and projections would help you address these impacts?

Each individual was given a sheet to write down their thoughts; this would allow us to collect their concerns and make sure each person was heard. They were asked, but required, to write down their names, email addresses, occupations, and where they live and work. An example of the sheet that was handed out is below in Figure 10. The discussion and worksheet were designed to guide the participants into writing clear impacts they were concerned with. The presenters informed participants that if they did not fully know what information they needed but know the impact, the GBRAG would help link impacts with parameter needs.

GBRAG Worksheet

Name (Not Required): _____ Email Address (Not Required): _____

TOPICS	Climate Change Impact 1	Needed Information	Climate Change Impact 2	Needed Information
EX: Transportation	Flooded Streets	Extreme Precipitation	Road Rutting	Groundwater and Sea Level Elevations

Figure 10: Community Engagement Handout

The participants were encouraged to write down climate impacts and parameters they were concerned with throughout the *think pair share* process. However, notes from the meetings were not included in the content analysis. Not only did individuals write down their responses but some groups did additional group sheets that were collected as well. These group sheets were counted as a participant since they were not labeled differently than an individual participant's sheets.

The meeting would conclude with contact information and the collection of sheets. The sheets were then given an ID number, for example, A-3. The letter would represent which meeting the sheet was from, and the number represented which sheet number it was. Each sheet was uploaded into an Excel spreadsheet for analysis. Most of the writing was legible, and information that was not legible was marked with a question mark for review.

Since most sheets were not linked with a name or contact information, it was up to the review team to try and read the illegible writing as best they could; although it was not always successful.

2.1.1.3 Survey

The second method GBRAG used was an online survey. The survey's purpose was to engage a larger number of professionals than would be possible with face to face interactions within the limited time available to GBRAG. The GBRAG team and the steering committee was able to receive a total of 396 responses from the online survey.

The steering committee, a group of public and private organizations listed in Table 4, played an essential role in editing and distributing the survey used to reach a broad group of professionals who work and live in the Greater Boston area. Their job was to ensure the engagement methods provided quality feedback, and their input was important to ensure that the parameters the researchers and scientists focused on were the most important to the metropolitan Boston region. The steering committee tested and gave feedback on the survey before distribution. GBRAG members and the steering committee sent then out the survey to their contacts. The link to the survey was also posted on the GBRAG website and Facebook page. During the community workshop meetings, the link was also shared with the participants. City and town planners within the MAPC region were emailed the survey. Professional societies were also targeted. When the survey was released for a second time the fishing, medical, union, and religious communities were targeted due to their low participation during the first release of the survey. A list of groups that were contacted is found in Appendix C.

Metropolitan Area Planning Council	Boston Harbor Now	Liveable Street Alliance
Metro Mayors' Climate Preparedness Task Force	Northeastern University	Clean Water Action
National Grid	Barr Foundation	Neighborhood of Affordable Housing
National Oceanic and Atmospheric Administration	Mystic River Watershed Asso.	Great Marsh Coalition
Massachusetts Office of Coastal Zone Management	Partners HealthCare	Green Ribbon Commission
MA Division of Ecological Restoration	City of Boston	University of Massachusetts - Boston
Department of Conservation and Recreation	United States Geological Survey	Massachusetts Marine Trades Association
Climate Action Business Association	Charles River Watershed Association	Massachusetts Fishing Partnership
Division of Marine Fisheries	Massachusetts General Hospital and Partners	MassPort
Environmental Protection Agency	A Better City	

Table 4: List of Organizations in Steering Committee

There was originally going to be two surveys, one for planners and engineers and another for participants who work in non-engineering and planning occupations. However, it was decided that by modifying the questions, a single survey would be more useful. A test survey was sent to the Steering Committee for comments and feedback before sending it out to the public. After modifications and adjustments of the wording of the survey, the final survey was distributed. The survey questions can be seen in Appendix D.

The survey was open to responses from March 29 to April 29, 2019. In order to get a broader range of stakeholder responses, the survey was re-opened from May 3 to July 8, 2019. The first survey had 228 responses, with a 75% completion rate, while the second time, the survey had 168 responses with a 69% completion rate. The percent completion is how

many people completed the entire survey over the number of people who started the survey. A total of 396 survey responses were collected over 99 days.

The survey was created to reach as many professionals in the Greater Boston region as possible to understand what climate change impacts they were concerned with. The platform Survey Monkey© (www.surveymonkey.com) was used due to the ease and ability to transfer information to Excel and use the platform's analysis to make graphics. The survey was broken up into two parts: introduction information and impact questions.

The introduction information questions covered occupation, location of work and home, and if climate change is/will impact the participant's communities. The background information allowed the GBRAG to know if an area or occupation was being reached more or less compared to the others. All cities and towns within the MAPC were listed, as well as a list of occupations. All of the questions and answer choices can be found in Appendix C.

The impact questions were phrased the same but focused on nine topic areas. The questions asked if there was a concern surrounding the topic, what climate conditions could impact the topic, and if so, how conditions were impacting the topic. The topics were transportation, housing, public health and safety, economy and business, governance, environmental resources, social justice and equality, and other topics. These topics were chosen to represent anticipated areas of concern. The first question, if there was a concern, was a yes or no answer. The second question, what climate condition could impact the topic, was multiple-choice questions with five options: sea level rise, coastal flooding, extreme temperature, extreme storms, and others. The succeeding question allowed the participant to describe how these climate conditions may impact or are impacting the condition.

2.1.2 US Census Data

In order to understand how representative the survey respondents were of the MAPC region, census data for the MAPC region was obtained from American FactFinder (factfinder2.census.gov), known as data.census.gov as of April 1, 2020 (U. S. C. Bureau, n.d.). The information about population, age, sex, race, households, and housing were all taken from the 2010 US census. Population estimates were not used since they are not accurate numbers. The other source of information was the American Community Survey (ACS), which collects more in-depth and recent information. Information from 2017 about jobs, occupation, educational attainment, veterans, renters or homeowners, and more can be found through the ACS (U. C. Bureau, n.d.). The ACS randomly selects addresses to survey around the country throughout the year, every year (U. C. Bureau, n.d.). The ACS provides essential information that is utilized for community planning and growth. The 2010 census and the ACS were important information to be able to understand how effective the community engagement was and what groups were not included with the engagement. The data were downloaded from American FactFinder to Excel.

2.2 Analysis Process

2.2.1 Dedoose

The online tool Dedoose© (<https://www.dedoose.com/>) was used for analysis due to its ability to analyze both qualitative and quantitative analysis data. All the MVP reports, survey responses, and community outreach responses were uploaded to the site and linked with descriptors. The descriptors were ID numbers, community engagement method, subregion, city or town name, and coastal or inland. Each document was then read through

by me, and specific words or phrases were tagged with codes. The codes were impacts, climate parameters, and clusivity terms used. Clusivity is a term that includes terms with both inclusive and exclusive tones. One hundred fifty-five codes were used to tag words or phrases in the text from the documents; each of the codes and their definitions can be found in Appendix E.

This content analysis method was used to analyze the 411 documents used in this study. By coding the terms, it turned the responses and reports into quantitative data. The use of content analysis did not lose the importance of what the participants had written but allowed a more absorbable way for the information to be understood.

CHAPTER 3

LITERATURE REVIEW

The following chapter will review the literature overlapping with the goals and objectives of this thesis. The following documents will look into the role of networks in climate change engagement, the role and importance of local government, methods of engagement, and the significance of research's understanding of the needs of all communities. The articles reviewed allows for a better understanding of types of methods and engagement. The importance of understanding what other groups and communities are attempting allows GBRAG to evaluate their work better.

3.1 Importance of Local Government's Role in Climate Change and Establishing Networks for Communities

For decades the IPCC report has been the global leader on informing the world's population of climate change matters. In 2016, a majority of countries around the planet signed the Paris Climate Agreement; the agreement's goal is to help countries respond to extreme global climatic change (*Paris Agreement*, 2015). Each country made its promise to the world to help battle the threat together. In the United States and around the world, media

and citizens are confronting governments about their plans to mitigate and adapt to the climate crisis. At the same time, researchers are asking about the importance of the conversation of mitigation and adaptation at the local and state government level. The BRAG began with Boston's Mayor, Martin J. Walsh, asking for information on climate impacts to prepare the city better. Several cities and states in the United States and around the globe, such as New York, Miami, Los Angeles, London, and Boston, are discussing of roles of cities, states, and federal governments and how they can work together to combat climate change.

When planning for the future, some governments are focusing on either mitigation, adaptation, or both. Saavedra and Budd (2009) discuss the importance of focusing on both practices at the same time; they discuss King County, Washington, and how they are focusing on essential local level work. Although decisions on mitigation and adaptation are often shifted with the political cycle, there is hope that long-term commitments to mitigation and adaptation plans continue no matter to the people in power. Local issues can also tackle local problems; understanding what the risks are at a community level allows for more targeted planning (Saavedra & Budd, 2009). King County understands what their issues are at a smaller, more local level, compared to the federal government. They understand what, who, and where there is more risk and how to work with those communities to better prepare and help them for a changing future. Saavedra and Budd (2009) make the argument that cities, states, and countries must work together to work towards adaptation and mitigation projects.

Before an organization at any level can start working on adaptation and mitigation plans, the organization must understand the risks the community is facing and their needs. The “movement of information and practices through ... networks” is known as social learning (Bidwell et al., 2013, p. 610). Social learning can assist the understanding of interdisciplinary problems that communities are facing, such as economic, environmental, social, health, or political. Each region should have access to training, climate data, and support from experts in organizations like universities, private companies, nonprofits, and federal and state governments (Shi, 2019). Social learning networks allow for communities to be more resilient by working with locally available resources to prepare for the future. Social learning networks are similar to knowledge and other types of networks; they share similar goals of sharing knowledge and practices among a group of people with similar location or needs.

While some networks are specific to regional areas, others are larger like C40 (c40.org), a network of progressive climate attentive cities (C40, n.d.). In the fall of 2019, Boston’s Mayor Marty Walsh attended the C40 World’s Mayors’ Summit with 13 other cities from the United States. At the summit, cities around the world discuss several topics such as business, planning, and health. In a radio interview with WBGH, Mayor Walsh discussed how he joined C40 after President Trump removed the United States from the Paris Climate Accord (Mathieu, 2019). Although the United States federal government was no longer taking a hard stance on climate change, Mayor Walsh found a network of others to learn from and engage on the topic of climate change mitigation, adaptation, and resilience at the city level.

The Federated States of Micronesia, a set of small islands off the east coast of Papua New Guinea, are an example of governments focusing at the local level to inform and educate their citizens on climate change with the use of a knowledge network. Their knowledge network has the goal “to increase information-sharing on climate patterns and effects throughout the community as a management approach that is more precautionary than reactionary” (Bolden et al., 2018, p. 2). With the help of graduate students from the University of Washington, the knowledge network focuses on gathering information for the country’s “science teachers to encourage the dissemination of important climate-related information” (Bolden et al., 2018, p. 2). Their intention of focusing on educators in the country is to funnel information from the government through the local teachers to the parents, students, agricultural specialists, environmental experts, and resources managers and utilities (Bolden et al., 2018). By focusing on educators, they wanted to build a strong educational base for the community and network to work from.

Metropolitan Boston is fortunate to have the MAPC to work with and be a network for city and town planners as a place to share ideas and ask questions. Other local governments, like Los Angeles, are collaborating with universities to create their network while others, like Miami, work with regional counties to create their network (Shi, 2019). Along with having a network like MAPC, Boston is fortunate to have a strong political leader paving a way forward for the city and the region. Mayors across the country have struggled to gather staff to build and implement plans (Shi, 2019). Due to the closeness of New England towns and cities, a single policy and planning decision could potentially significantly affect the neighboring communities. Multiple communities lie on the edges of

Boston Harbor and Massachusetts Bay; individual decisions or actions from one local government could have impacts on others either financially, environmentally, or socially. Collaborating as a region with the specific knowledge of the issues they are facing allows for better planning and more achievable goals. The importance of regional networks, no matter the kind, can help communities work together to become resilient cities.

3.2 Engagement with Citizens and Stakeholders to Inform Government and Researchers on Important Climatic Impacts

The IPCC is the most famous and widely regarded producer of climate change projections, and impact predictions report offering global insight on the future of the planet. They work with scientists around the globe to produce a report every five to ten years with scenario predictions about the physical climate, impacts adaptation and vulnerability, and mitigation of climate change. However, several countries wanted more specific information for their residents and have been producing their own reports. This gives specific regions of their country a better understanding of the future climatic impacts they will be facing. Only a select few have included public engagement in the same style as the GBRA report. In most of the scientific climate reports, the researchers decide, without public opinion, what topics are most important for the world to know. Some cities or states, after the climate parameter report is published, hold public workshops to gain an understanding of what public planning options the public likes. Although it is crucial to have community engagement after the publication of these reports, it is more important to involve the public throughout the entirety of the report's process. Three countries, Switzerland, Scotland, and the United States, actively engaged with their citizens as part of their climate assessments.

3.2.1 National Climate Assessment

The United States' climate report is called the National Climate Assessment (NCA), which is released by the U.S. Global Change Research Program (USGCRP). USGCRP has released four reports since 2000 and is in charge of collaborating with 13 other federal agencies gathering imperative environmental data for the use of the public and private organizations. The goal of the NCA report is to inform the public what the climate conditions will be and what threat they pose to the United States. The second NCA received feedback about “failure to truly connect with the American public” and not producing usable deliverables (Jacobs et al., 2016, p. 3). The USGCRP knew it needed to involve the public throughout the 3rd NCA process. The USGCRP hired a specific staff member to be in charge of the engagement process for the length of the entire project to ensure the goal of engagement was reach. Their goal for NCA3 was to engage with the public early and often, involve diverse stakeholders, have sustained contact with the stakeholders, and enable the engagement with government organizations outside of USGCRP (Cloyd et al., 2016).

The NCA3 broke the United States into eight different regions and conducted workshops and focus groups in each. USGCRP called for relevant climate-related impact materials and technical reports at the beginning of the NCA3 process and received responses from 1000 participants from a variety of backgrounds to help the NCA team build their report. National Ocean and Atmospheric Administration's Regional Integrated Sciences and Assessments program was used to conduct regional workshops and teleconferences to gain insight into the needs of the stakeholders (Cloyd et al., 2016). Other government

organizations, like the US Department of Agriculture, held their own workshops focused on engagement with rural communities (Cloyd et al., 2016).

To ensure the continual feedback, USGCRP created NCAnet; a network that allows for a sustained group of citizens to be contacted and made a part of the NCA process. The NCAnet was publicized by word of mouth and by 2015 had almost 180 participants (Cloyd et al., 2016). The NCAnet allowed for internal conversations about the NCA4 and additional meetings (Cloyd et al., 2016). USGCRP opened the NCA3 for public review and comment and received comments from “644 government, non-profit, and commercial sector employees, educators, students, and the general public” (Cloyd et al., 2016, p. 48). These comments allowed the authors to understand where a particular section was unclear or scientific terminology was not understandable. NCAnet also helped spread the word about the NCA3; several NCAnet members held webinars and meetings discussing the report to inform peers and the public (Cloyd et al., 2016).

3.2.2 Analysis of User Needs for National Climate Scenarios

Switzerland also engaged with stakeholders about climate parameters; Analyse der Nutzerbedürfnisse zu Nationalen Klimaszenarien (Analysis of User Needs for National Climate Scenarios) report discusses the methods used and the outcome of the engagement (Perch-Nielsen et al., 2016). Since the report was mostly written in German; the report was uploaded to Google Translator to translate the text from German to English for the ability to read and analyze for this thesis. The Schweizerische Eidgenossenschaft, Swiss Confederation, and MeteoSchweiz, weather and climate service funded by the Swiss Confederation, worked on the 2011 report about climate change scenarios. Like GBRAg,

there was a need for more specific regional local climate parameters. For the 2016 report, the Swiss government wanted the input of the stakeholders who would need and use the data from the report (Perch-Nielsen et al., 2016). MeteoSchweiz used a variety of methods to engage with the stakeholders in the whole country; methods used were nine group interviews, two workshops, and 115 responses to a survey (Perch-Nielsen et al., 2016).

MeteoSchweiz divided its participants into three different groups: intensive, advanced, and intermediary since not all participants were scientists and researchers. An intensive user is labeled as someone who works closely with the climate parameter data, such as a researcher or scientist. Advanced users process the information from the report for their own purposes, like government employees or private companies. Intermediary uses the data for target audiences, like teachers or media groups. Intensive users represented 28%, advanced represented 50%, and intermediary represented 22% of the total engaged participants (Perch-Nielsen et al., 2016). For the survey, MeteoSchweiz discussed how it had terms and language that several of the survey takers may not have been familiar with, especially those in the advanced and intermediary groups. The survey had questions about the emission scenario, climate indicators, critical thresholds, and asked what past climate documents the participant had used. Since the climate impact report data was to be used in different ways, MeteoSchweiz provided in their final report not only raw climate parameter data but the climate impacts as well for the benefits of all report readers.

3.2.3 Climate Change Public Conversations Series

Scotland is working hard to mitigate greenhouse gases and prepare their communities for climate change impacts as well. The Scottish Parliament passed legislation in 2009 to

involve its citizens in the climate change preparedness, mitigation, and adaptation process (Shaw & Corner, 2016). Their goal was to understand the needs of their people while educating the public about climate change. Like the United States, the Scottish government wanted to ensure long term conversations with communities from the very beginning. In 2016, Scotland decided to host a mixture of rural and urban climate conversations with the help of a private company, Climate Outreach (Shaw et al., 2016). These bottom-up approaches were unique compared to what similar countries were trying to achieve. The Climate Outreach team did not advertise the conversations as climate related when attracting people to participate since they wanted people to join the workshops with an open mind. They also made sure the groups were representative of the region in which they were held, rather than the country as a whole (Shaw & Corner, 2016). The weeknight two-hour conversations were held in six cities and towns. Climate Outreach was able to pay the participants as well. By offering compensation and having the workshops in the evening, it allowed the participants not to have to take time off of work, although, no childcare was provided. By ensuring diversity of the participants and giving compensation it allowed for a more representative group than if they asked for volunteers. Opening engagement methods to the public does not imply that a representative group of the community will participate. Climate Outreach understood which methods and set-up to create to ensure that the workshops would produce representative voices of the community.

Instead of focusing on climate change, Climate Outreach decided to focus on personal values and thoughts surrounding the changes of the nation. There were six workshops with a total of 52 participants; audio recordings, feedback forms, and activity sheets were collected

for data analysis from each workshop (Shaw et al., 2016). Climate Outreach considered several engagement approaches to understand the view of the participants better. Each workshop tried at least one new technique, such as using videos, presentations, voting, discussions, and flip charts. During their research, Climate Outreach found that many other organizations talk more about their outcomes of engagement rather than the activities themselves. They also found that it was not always clear how to extract the data from each activity they had their groups participate in (Shaw & Corner, 2016).

One of their main takeaways was that people wish to learn more and know what role they can play with Climate Change. Climate Outreach found that the participants did not fully understand the “scale of the risks posed by climate change or the challenges involved in reducing the risks” (Shaw et al., 2016, p. 6). Through their variety of workshops throughout the country, they gained a greater understanding of the public’s needs and perspectives.

3.3 Engagement Methods

3.3.1 Community Engagement with Arnstein’s Ladder

The last section summarized each of the three country's stakeholder engagement activities and their methods and outcomes; this section will take a more in-depth look at those methods. Table 5, below, is a matrix that compares the US, Switzerland, Scotland, and UN’s climate reports’ broad methods, like workshops, interviews, and surveys. The table also compares the timing of the engagement practice. Table 5 allows for a quick reminder of the methods as we compare each in this section.

Every engagement project is structured differently and is limited by time and funding. However, the more input from citizens and stakeholders, the more a project will reflect the diverse needs of the community. Arnstein’s ladder is used to understand better how to categorize levels of engagement by assessing who holds power in the project (Arnstein, 1969; Collins & Ison, 2009). According to Arnstein, there are eight levels of participation with citizen engagement and participation (Arnstein, 1969). The eight different levels break into three main categories: citizen power, tokenism, and non-participation. Tokenism is where the group without power has a chance “to [be] hear[d] and have a voice” (Arnstein, 1969, p. 217).

Methods Report Title	Workshops	Interviews	Survey	Interaction at beginning	Interaction throughout	Arnstein’s Ladder
3 rd National Climate Assessment [USA]						Tokenism
Analysis of User Needs for National Climate Scenarios [Switzerland]						Tokenism
Climate Change Public Conversations Series [Scotland]						Tokenism
Greater Boston Research Advisory Group [Boston]						Tokenism
IPCC [UN]						Non-participation

Table 5: Climate Report and Method Matrix
[Shaded means method was used; unshaded means method was not used]

Above in Table 5, each report is labeled with one of Arnstein’s three broad levels of participation. The NCA3 fully involved the public from start to finish, like asking for

comments from the public throughout the process. The Scotland assessment was more critical for the government to understand better the needs of the greater population in terms of planning for interactions in the future. Similar to the GBRAG process, MeteoSchweiz required feedback from a small sample of the stakeholder and scientific community. The GBRAG constructed their goals and objectives for the report based on lessons learned from the previous assessment (BRAG, 2016) and on informal feedback from stakeholders who had used the BRAG (2016) report. As discussed in Chapter 2, GBRAG used three methods to receive community feedback about what climate parameters and impacts the GBRAG assessment should focus on. Community engagement activities occurred at the beginning of the project and lasted about five months. All four of these projects would be categorized as tokenism due to their somewhat limited involvement with the public. It could be argued that the reports are different levels within tokenism. With each of these projects, more time and effort for stakeholder engagement may have reduced the time and resources available for the scientific assessment. Each of these projects could have better involvement the public but might not be accomplished at the same academic level if there was full citizen power. Nor would they accurately mirror the needs of the people if they were non-participation based projects. IPCC is an example of climate parameter reports, for contrast, due to its lack of public engagement. Since the report has no workshops, interviews, or surveys with stakeholders or the public, it falls under Arnstein's category of non-participation. The IPCC does use a peer review process when preparing their reports; however, those peers are scientists and researchers, and although it is the engagement, it would not be considered as tokenism.

3.3.2 White's warning for community engagement

Another way of gauging participation is by ranking the reports by the interests of the participants and the outcome the report provides them. White (1996) discusses how there are different types of engagement and those types produce different results in the participants engagement with the process. The four types are *Nominal*, participants are engaged but more for display than action, *Instrumental*, requires active participants to produce results, *Representative*, gives a meaningful voice to the participants, and *Transformative*, creates participants to feel empowerment when creating change in their communities. White (1996) draws attention to is who is involved in the engagement, how they are involved, and on whose terms. From these three observations, she breaks down difficulties when applying engagement methods.

White (1996) discusses the more the participant receives from participating in the method, then the more involved they will be going forward. In the *nominal* participation, there is low engagement since it is more for display purposes than action. Concerning climate change, stakeholders such as government employees, planners, and engineers are more interested in participating because they need the parameter information to plan for their business or community. This scenario might be labeled *instrumental* participation by White because the stakeholders have to put in the time and energy of participating in making sure they receive the feedback they need to prepare accurately. While citizens may want to know what to expect from climate change, they do not have an immediate use for the information, and the information is not always delivered in an easily digestible manner. To guarantee worthwhile engagement would require work from groups like GBRAG to ensure that

participants understand how participating is important and ensure the engagement method is geared to benefit both the management team and the participants.

White (1996) also examines how ongoing participation is dynamic, which is something for networks and engagement-based reports to keep in mind. NCAnet was a network created for the NCA3 and could but used with future reports. However, it is important that management of the network is continually dynamic if NCAnet is to be used for future reports, which is unknown. The MAPC network is continually helping the subregions through creating helpful reports and documents while also creating a space for the local communities to have a space to exchange ideas.

The group with the power of the engagement process must recognize the power dynamic of the engagement process to ensure that all parties are acknowledged throughout the process. Though it can seem like the group in power is giving a voice to the voiceless with the use of engagement, the use of participation can give a management team power and should not be taken advantage of (White, 1996). Depending on the type of participation and the methods used, it is sometimes a label and not an actual action like *nominal* participation can be. When reports like the ones discussed in this chapter are asking for participation, they should be clear with their goal and objectives, and what the community will receive in return. Although the GBRA survey was only 15 minutes long, the time is taken to complete it might not be worth the participant's time and energy if they do not see an equal outcome for themselves.

White argues that the non-participation of some groups is the fault of the group in power. The group in power should “ensur[e] that they participate in the right ways;” find the

best method of participation for those groups (White, 1996, p. 14). The MeteoSchweiz produced a single survey for everyone; however, they realized that not all groups answered the questions due to their lack of knowledge on the topic and terminology (Perch-Nielsen et al., 2016). This is not the fault of the survey taker but on MeteoSchweiz for not adapting the survey for those participants with less scientific terminology knowledge.

3.3.3 Tools for stakeholder engagement and their effectiveness

The methods of stakeholder engagements used by each report were similar; however, more specific types of engagement used during the focus group events affect the types of data the groups received from the contributors. Scotland's Climate Change Public Conversations Series used a wide variety of tools to engage with their workshop groups. They also described in-depth why they used specific tools and how they were helpful; this was not frequently found in other reports which utilized focus groups. Scotland had discussions about values and climate change, image-based feedback, and language testing. Each activity led to the next and attributed useful data for Climate Outreach to analyze.

NCA trialed the tool World Café Method (theworldcafe.com) to create an opportunity for discussion and learning (Cloyd et al., 2016). The World Café method creates small groups to answer questions for multiple twenty-minute rounds. After each round, one person can stay and debrief the next group while others can "travel" to different tables to learn about other perspectives. In the end, each group can return to their original table to discuss what they learned. The World Café method is supposed to help expand participants' views on a topic. NCA tested this method, and the outcome did not work well for their needs (Cloyd et al., 2016; "World Cafe Method," 2015). Although this method could be useful for specific

groups, this technique might be useful if tested and tweaked to provide the right supports and prompts regarding parameters and their links to climate change.

Similar to the World Café method, a tool used for the GBRAg workshops was *Think Pair Share*, a tool typically used in classroom settings. It is a process that “fosters individual, collaborative, and ... full class input” by asking questions at an individual, small group, and then full class level (Fitzgerald, 2013, p. 88). In classroom settings, educators find that *Think Pair Share* “increase[s] student engagement and create[s] active learning communities” (Fitzgerald, 2013, p. 90). Using *Think Pair Share* during workshops allowed participants to formulate their answers before having outside opinions influence them. This method of engagement allows for groups to communicate their ideas and build on them in small groups similar to World Café. However, *Think Pair Shares* allows for a flexible timeline and ability to ask more specific questions, unlike World Café, which is a more structured engagement program. When deciding on a particular method of engagement, it is essential to know the goal of the engagement, and how much time and money the method requires to be appropriately implemented.

3.4 Importance of Engagement with Communities

Engagement is important, but there is not one specific technique that is necessarily better than another. The communities and their circumstances shift with each project; some project directors are not trained in community engagement and find it challenging to communicate expertise and comprehend the participant’s insight, and ways of connecting with communities outside of their own embrace. Scientists engaging fellow scientists can focus less on technical language since it is in their shared lexicon. However, when scientists

or researchers engage with non-science groups, the scientist and researchers should place more attention onto whom to engage, and what methods to use, as well as, being careful to evaluate and lessen the power balances inherent in the group dynamics. The inclusion of diverse participants from many backgrounds will bridge the span between the scientific community and the citizens (Sarzynski, 2015). If the goal of the engagement is to understand better the needs of the communities' stakeholders then the inclusion of an array of stakeholders is significant and necessary; by involving various groups, the knowledge gained, and feedback received will enhance the results and legitimacy of community engaged research and achieve the goal set out by the project.

3.4.1 Engaging marginalized and under-represented communities

Often community members see Environmental Justice movements as a way for their voices to be heard and a way to advocate and demand change in their community.

Environmental Justice is focused on how toxins and environmental mismanagement are disproportionately injuring lower-income and minority communities in the United States.

Environmental Justice movements often emerge in response to an event—for example, Lovecanel, where buried barrels of toxic waste affected the residence of Lovecanel, New York. Or Majora Carter's work to bring positive physical environmental aspects and improvements to boost the economy of the community in the Bronx, New York City after years of white flight and redlining (Carter, 2006; "Love Canal," n.d.). These events often affect those of marginalized communities or groups who are less represented in society, such as those who are lower-income, minority races/ethnicities, LGBT+, or have disabilities.

In the past, most environmental adaptation and mitigation was reactionary in nature. However, climate change has been made visible, and a response can take place prior to catastrophic events. Climate change does not seem like an urgent everyday event; therefore, the average citizen might not see the same urgency that researchers and government officials can see. Asking for “voluntary participation” does not mean receiving equal representation when it comes to participation (Sarzynski, 2015 p. 54). White’s (1996) theory suggests that depending on what participants think they will gain will determine how much time and energy they will put into the engagement process. Researchers, then need to create room for engagement methods at multiple levels by either inviting broad groups to fill out a survey, arranging workshops with accessible areas and times and using additional techniques, such as body map storytelling or community mapping to involve participants in meaningful participation (Sweet & Escalante, 2017). Broadening how community members can participate increases the diversity of contributors and responses.

Climate Outreach offered a monetary supplement for their participants to ensure a diverse and representational group attended their workshops, which is common in social science research (Shaw et al., 2016). For the NCA, their participants were stakeholders whose sectors would be influenced by the data that was reported, ensuring that they put in the time and energy to respond to a call for information or to comment on the NCA report (Cloyd et al., 2016). The U.S. Department of Agriculture hosted a workshop for NCA with rural communities to better understand what climatic impacts concerned them (Cloyd et al., 2016; Hauser & Jadin, 2012). By specifically reaching out to the rural community, NCA created a space for them to discuss their needs and concerns. MeteoSchweiz’s report

discussed the fact that the survey was not accessible to those without a scientific or technical lexicon, they state how in the future they will need to pay more attention to the language used as to be more attentive to the diverse groups they want to participate in their engagement process. This led to willing contributors whose thoughts were not captured in the survey. Although this made them overlook a target group, it allows them to understand what they need to do for the next time.

3.4.2 Examples of engaging marginalized communities

Looking at the faceted issue and asking questions to those who will be most affected will allow leaders to gain a greater understanding of how to solve a problem. In British Columbia, Canada, the indigenous and aquaculture sector is significantly impacted by the climate change effects on fish health and population. Thinking about the communities' needs from multiple perspectives is essential. Not only will the environment that the fish live in be changed, but the economic security of the fishers will be compromised, and the indigenous community will be impacted by the change in the fish population (Whitney & Ban, 2019). To better understand the best route forward for the Province, they conducted surveys and interviews with those who would be most affected by the changes in the fish population. In British Columbia, both the fishing industry and the indigenous communities were interviewed and surveyed (Whitney & Ban, 2019). Indigenous communities are historically forgotten and are often left out of meaningful conversations, and their needs are not seen as equal to those of the general public. However, in the National Climate Assessment's Alaska Report, they reported not only the climate change effects felt by the economy, the physical environment, and communities but the specific effects on the indigenous communities

(USGCRP, 2018). The report covers changes to their environment, food sources, and culturally significant land.

Durban, South Africa, showed how it is possible to capture all demographics when conducting community engagement. Durban's government wanted to include public participation when creating long term planning. By creating space and time, the City of Durban was able to gain an understanding of what was most important to their citizens. From the feedback, they created a plan to improve the city. Each year the government is required to revisit their plan and have continued community input (Aylett, 2010). Although it was a substantial amount of work, the government divided the city into 100 wards. Each ward held public meetings, and there was an average turn out of 100 people per meeting, with some meetings having upward of 600 people attend (Aylett, 2010). Although the Durban government did not offer monetary amounts for participating in the meetings, there was significant interest from the public to have their voice heard. It seems like the community knew that their time and effort in participating in the public discussions would be a benefit, just like White's theory explains (White, 1996).

The adaptation and mitigation conversations are more manageable and practical at the local scale, as seen in Canada and South Africa. The British Columbian government discovered that working at a local scale was more cost-effective and beneficial than managing the issue from a larger national scale (Whitney & Ban, 2019). Durban understood that by breaking their city into smaller wards, they were able to hear from more concerned residents. As discussed in the first section, adaptation and mitigation measures are making

great strides at the local level due to their greater understanding of local knowledge and community partnerships that can emerge from collaborative engagement.

While some groups use the typical survey, workshop, and interview technique, others have taken on different method approaches when trying to understand the emotional response to a population's environment (Sweet & Escalante, 2017). Body mapping is a technique used to understand how and where participants feel emotionally about an incident. Not all problems cause exclusively physical reactions but often emotional scars as well. By understanding the emotional ties and hurt connected to these events, it allows leaders and the government to be able to prepare residents better and, hopefully, remove stress and anxiety for locations or events in the future. This is another way to comprehend the community and its needs. Although body mapping was not relevant to the stated outcomes of this particular study, it would be interesting to explore it as a possibility in the future. Other techniques used for alternative community engagement are photos walk, mapping, and discussions with smaller populations. The research compiled in *Working Women* (2015), used these methods to understand the needs of the women in the community and their views of their neighborhood (Casanovas et al., 2015). The methods used in this report would need to be modified for the GBRAG process but could be beneficial in understanding diverse and local climate parameter needs.

This chapter has explored the importance for researchers to understand whom they are engaging with and how engagement methods need to change depending on whom they want feedback from. As more local-centric papers are published, the researchers must talk to community members and work toward more tokenism methods. As mitigation and adaptation

become a part of the conversation at a more local level, networks are helping communities learn and support one another. The belief is that if a local community does their part to fight climate change, they are a drop of water in a bucket. However, with each community doing their part, they can fill the bucket and make a significant difference while being conscious of their community's unique needs.

CHAPTER 4

RESULTS AND DISCUSSION

The following chapter will examine the results of the survey, workshops, and MVP reports and will discuss and analyze the results. Firstly, this chapter will look at who participated in community outreach and evaluate their concerns. Then the chapter will report on the findings from the engagement methods. Dedoose was used to conduct a content analysis of the data. The data from the survey, MVP report, and community workshops were uploaded into Dedoose to be able to assess if the needs of the community were captured accurately.

4.1 Results

4.1.1 Participants

There was a total of 396 survey responses (68%), 133 community workshop responses (23%), and 50 MVP reports (9%) for a total of 579 responses. Most responses had a location connected to them. In the survey, participants checked off boxes of individual town names that they either lived and worked in. They were then converted into one of the eight MAPC regions. If they happened to work and live in more than one subregion, they

were listed as Greater Boston. The community workshops were given each in the regions, which made it easy to label the worksheets data as a specific region, but the participants were not required to write down their town name. However, one of the workshops was a joint regional meeting for TRIC and SWAP. There were 19 worksheets collected; six of the participants did not label their sheets with a town. Those that were not labeled were placed into the TRIC region. The MVP reports were from individual towns and were easily divided up into the eight regions.

Each workshop and survey response and each MVP report were labeled as coastal or inland, depending on if the region or city was located on the coast or not. This label was a critical location identifier because some climate impacts are specific to regions that are inland versus coastal. Below, Figure 11 shows the subregions that participated in each method, with the cumulative percentage on the second axis. Overall, ICC made up 33%, and Greater Boston made up 25% of the total responses (N=579), while the other areas each contributed less than 10% of the rest of the responses as seen with the cumulative percentage in Figure 11.

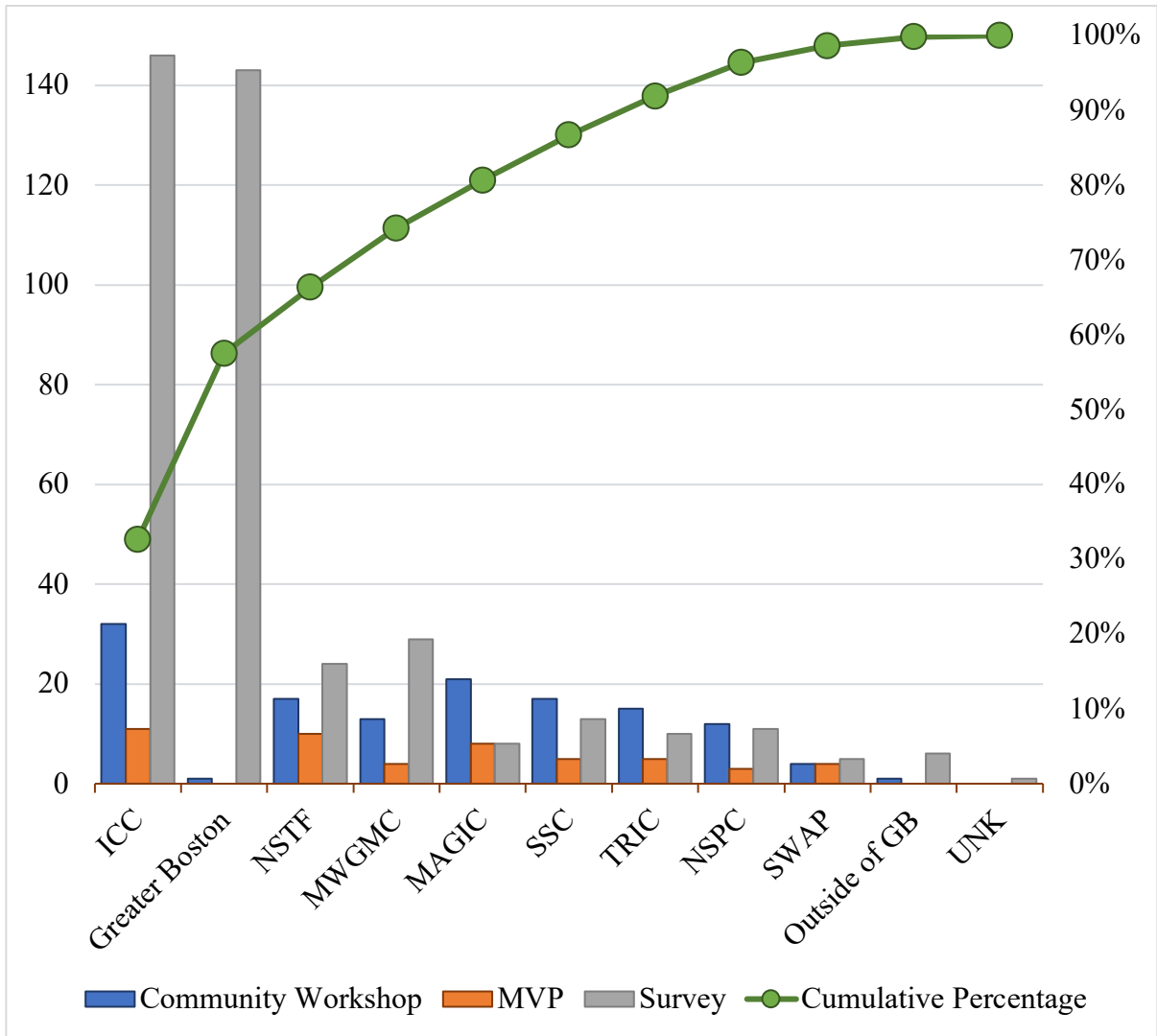


Figure 11: Participation by Region
 Note: GB stands for Greater Boston

From all of the participants, 51% worked or lived in coastal towns or cities, 45% worked or lived in inland towns or cities, and 3% are unknown. This distinction is helpful for scientists building the report to have a sense of how it is essential to focus on coastal problems as well as inland issues. Each region has unique community needs that they are facing due to climate change; understanding those unique aspects will better inform how

each GBRA research team highlight impacts that will cause the most significant damage to their communities.

When comparing the number of participants to the total population from the 2010 US Census, we can better see the uneven participation of the subregions (U. S. C. Bureau, n.d.). For the Community Workshops, MAGIC was best represented compared to the region's population per 100,000, even though ICC had the largest number of participants, as shown in Table 6 below. The best representation for the survey was from MWGMC region, although, again, the ICC region had the most participants. When considering the MVP report, it should be noted that the reports represents climate concerns of whole cities and towns. To represent their participation, the communities' populations, whose MVP reports were reviewed, were compared to the region's population. For the MVP reports, MAGIC had the highest percentage of the population represented for its subregion compared to the other eight regions. Greater Boston, Unknown, and Outside of Greater Boston were not included in the table since the specific populations of those groups are not known, which is why the *Total* is higher than the sum of the eight subregions in Table 6. The gradient shading of the rows is represented by the highest participation in the dark shade to the least participation in light shade.

Subregion	ICC	MAGIC	MWGMC	NSPC	NSTF	SSC	SWAP	TRIC	Total*
Census 2010	1,627,441	167,755	231,967	157,552	280,858	258,305	143,424	280,633	3,147,935
Community Workshop	32	21	13	12	17	17	4	15	133
Participant Representation (per 100,000)	2.0	12.5	5.6	7.6	6.1	6.6	2.8	5.3	4.22
Survey	146	8	29	11	24	13	5	10	396
Participant Representation (per 100,000)	9.0	4.8	12.5	7.0	8.5	5.0	3.5	3.6	12.58
MVP	600,474	129,584	152,817	77,510	176,402	111,224	50,964	110,986	1,409,961
Participant Representation	37%	77%	66%	49%	63%	43%	36%	40%	45%

Table 6: *Weighted Participation by Subregion*
(U. S. C. Bureau, n.d.)

Only the survey required participants to answer a question of their occupation while at the community workshops participants were only asked to write down their occupation if they wanted. Some contributors stated more than one occupation, which explains why the total number of occupations, 543, is higher than the total number of responses. The graph below, Figure 12, gives the breakdown of occupation responses from the two surveys and the community workshops. The percentages are based on the method itself and not the overall total. The x-axis lists the occupations from greatest to least by the number of responses. Planners were the highest total response, with a total of 21% or 113 identifying as planners. Fifty-eight percent of the total responses are composed of the top five occupations: *planners*, *volunteers*, *government employees*, *scientists*, and *non-governmental organizations (NGO)*.

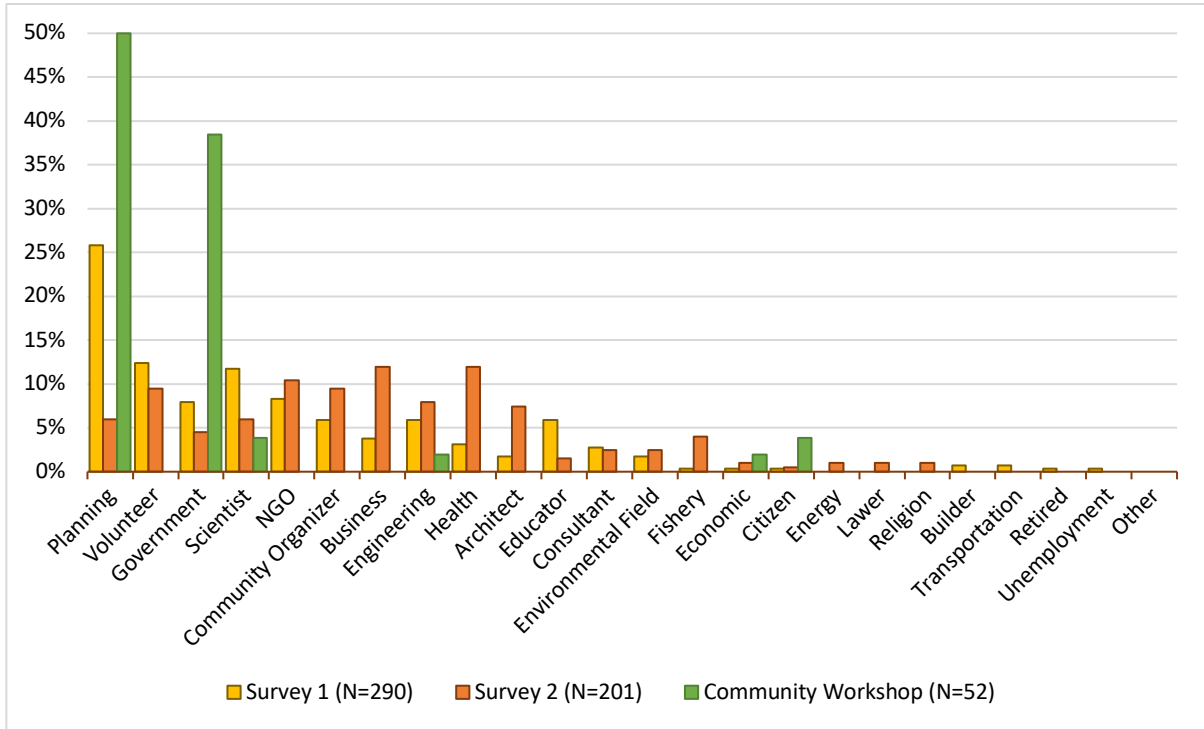


Figure 12: Occupations of Participants by Method

The purpose of opening the survey for the second time was to recruit respondents from a broader range of occupations, as discussed in the Methods section. From Figure 12, it was evident that Survey 1 and Survey 2 were composed of different professions. For the first survey, 50% of the participants were *planners*, *volunteers*, and *scientists*. In comparison, in the second survey, 52% of the participants were from *business*, *health care*, *NGO*, *volunteer*, and *community outreach* occupations. The second survey also saw new sectors not reached in the first survey, like *energy*, *law*, and *religion*. However, there could be an error due to participants not accurately identifying their occupation or not seeing their occupational field as a listed option, which may have caused errors in the data. The second survey did target a more diverse group of professions, which allowed a broader view of parameters and impact concerns related to climate change to be voiced.

4.1.2 Data Collected

From the 579 responses, the code terms were tagged 19,487 times; the content analysis revealed what essential information was important to different regions and what concerned communities. This section will review the importance of *environmental, public health, transportation, infrastructure, governmental, economic, andclusivity* concerns. Raw data can be found in Appendix F.

It is important to note that in the survey, the questions were grouped into nine impact categories: *transportation, housing, public health and safety, economy and business, governance, environmental resources, social justice and equality, and other*. The survey asked if the participants found the topics of concern; if the answer was yes, it was tagged and counted as a code term use. This could have led to the nine topic areas being focused on and appearing more during the survey since they were the focused topic areas compared to other code terms that did not focus areas.

4.1.2.1 Environmental

Parameters and impacts related to the environment had the highest number of coded words that were studied from the three methods. Figure 13 shows the code count of the environmental theme codes from lowest to highest. There are 55 codes in the environmental section, with the terms used a total of 4,462 times for environmental parameters and impacts. The survey accounted for 60% of code use, the MVP made up 22%, and the community workshops reports were 18% of the responses. Some of the parameters were grouped and are shown with the label '(total)' in its name. Those parameters had sub-codes; for example, *flooding* could have been classified as *flooding, inland flooding, or coastal flooding*.

Definitions of each code can be referenced in Appendix E. In Figure 13, the parameters, measurable elements used to predict climate impacts, are identified with the blue rows and boxes around the code term. While climate impacts, due to the interactions of one or more climate parameters, are identified with orange rows and no boxes around the code terms.

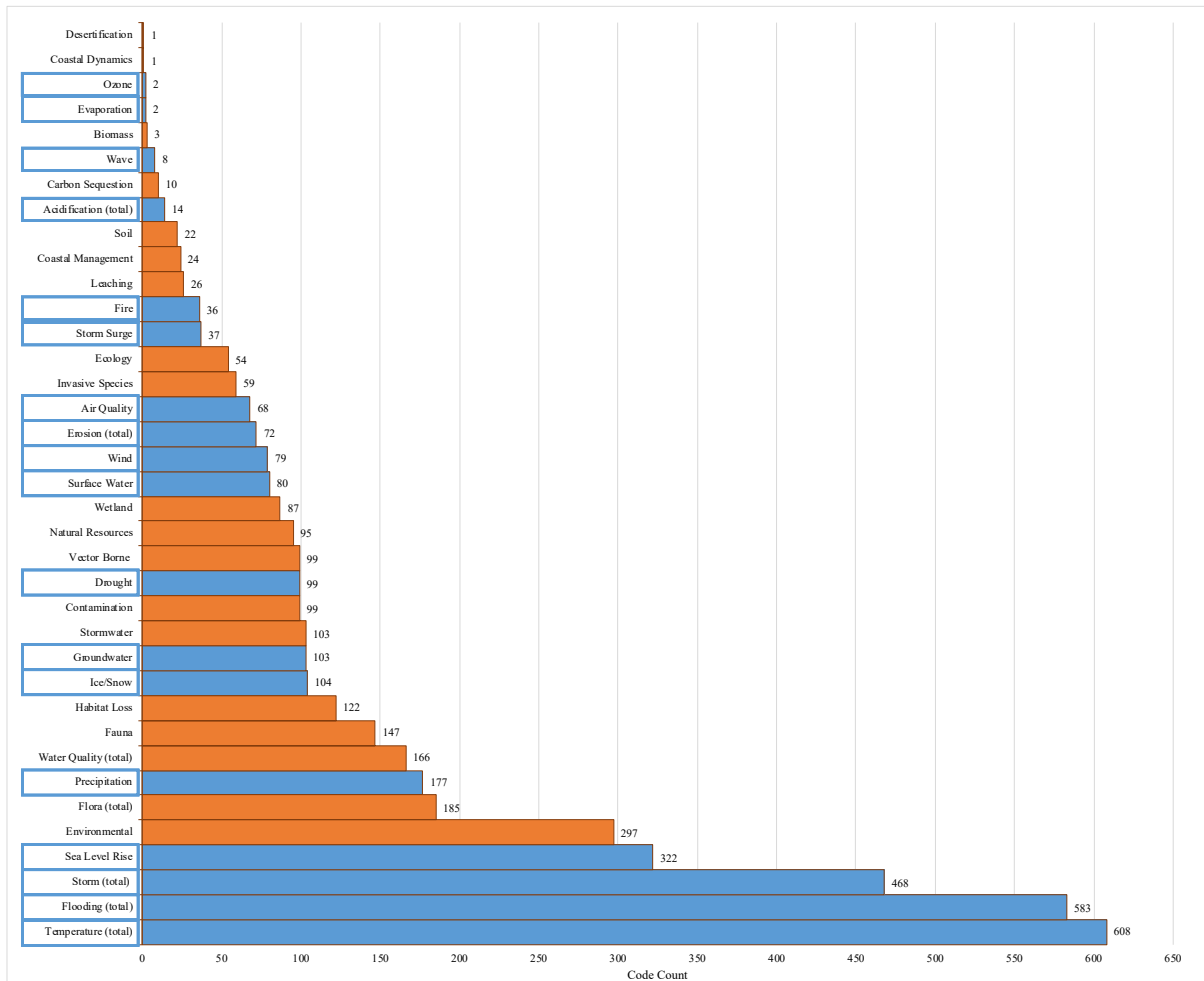


Figure 13: Environmental Parameter Concerns
The blue boxed codes represent Climate Parameters, and the Orange codes are Climate Impacts

In Figure 13, the temperature, flooding, storm, sea-level rise, and environmental made up 51% of the total codes for the environmental focused parameter and impacts of concern. However, there was a difference in answers when it came to what impacts were

significant to coastal participants compared to inland participants. Table 7 shows the impacts that made up about 50% of the total responses for coastal versus inland. Coastal responses were much more focused on their top six responses, while Inland responses were more varied across more codes. Their parameter and impact concerns were not as consistent and were spread out. The amount of total code use counted was close between coastal and inland participants; coastal communities accounted for 51% of the code count while inland communities accounted for 47% (2% was from unknown locations); these code ratios are well aligned with the ratios of coastal and inland participation overall.

Coastal Impacts	Code Count	Inland Impact	Code Count
Sea Level Rise	10.1%	Temperature	8.4%
Storm	9.9%	Storm	8.0%
Flooding Coastal	9.6%	Environmental	5.6%
Temperature	8.5%	Flooding	5.3%
Environmental	7.7%	Precipitation	4.6%
Habitat Loss	3.5%	Sea Level Rise	4.1%
		Water Quality	4.0%
		Fauna	3.8%
		Flooding-Coastal	3.5%
		Temperature – High Air	3.4%
Total Coastal	2267	Total Inland	2090

Table 7: Coastal vs. Inland Impacts

4.1.2.2 Public Health and Safety

The public health and safety section had a total of 652 code terms counted. Figure 14 shows the distribution of code counts between the four codes in this section. Coastal and inland communities responded similarly to concerns about health and safety. The survey accounted for 74% of responses; the MVP report and the community workshops accounted for 13% each.

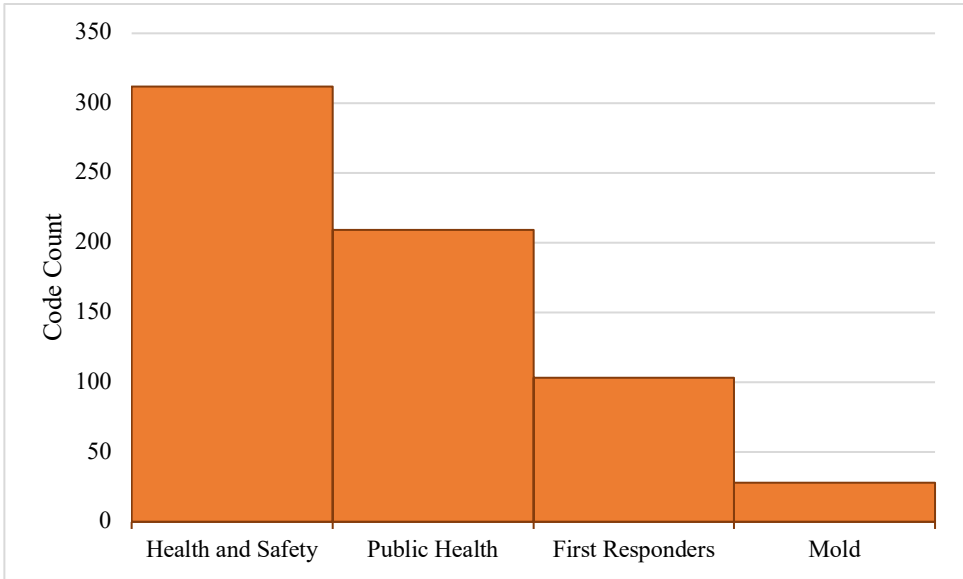


Figure 14: Public Health and Safety Code Count

4.1.2.3 Transportation

The transportation section had a total of 574 code terms counted. Figure 15 shows the distribution of code used count between the three codes in this section. The survey accounted for 75% of the responses, the community workshops were 13% of the total, and the MVP report made up 12%. Coastal and inland communities responded differently. Coastal communities had 333 total code uses counted (60%) while inland communities had 232 total code uses counted (40%), suggesting that coastal communities see transportation impacts as more concerning than inland communities. The coastal communities seem to have a greater concern for the *transportation* and *mass transit* codes than the inland participants.

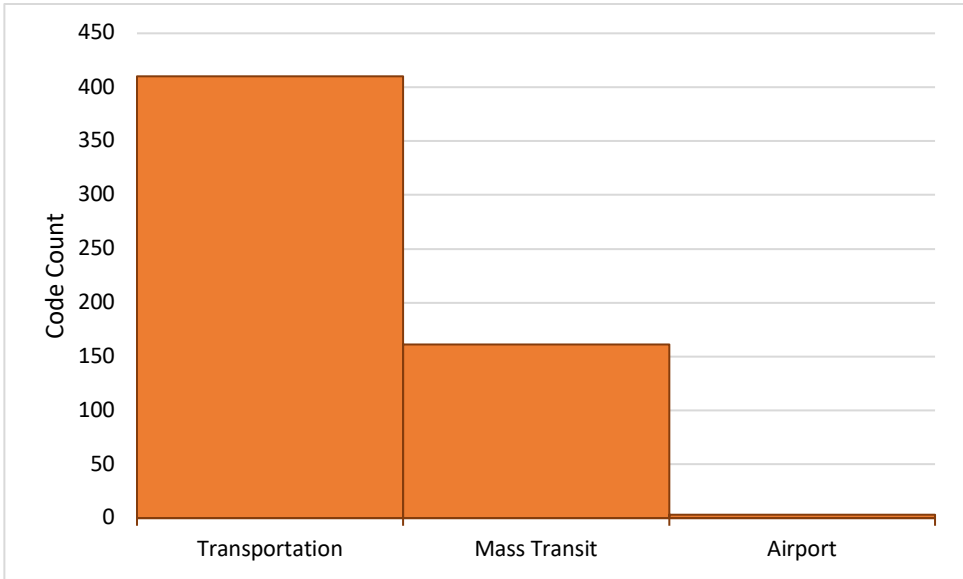


Figure 15: Transportation Code Count

4.1.2.4 Infrastructure

The infrastructure section had a total of 719 code terms counted. Figure 16 shows the distribution of code counts between the nine codes in this section; the specific types of infrastructure *energy, water, and wastewater* made up 75% of those responses. Coastal and Inland communities responded similarly to concerns about infrastructure.

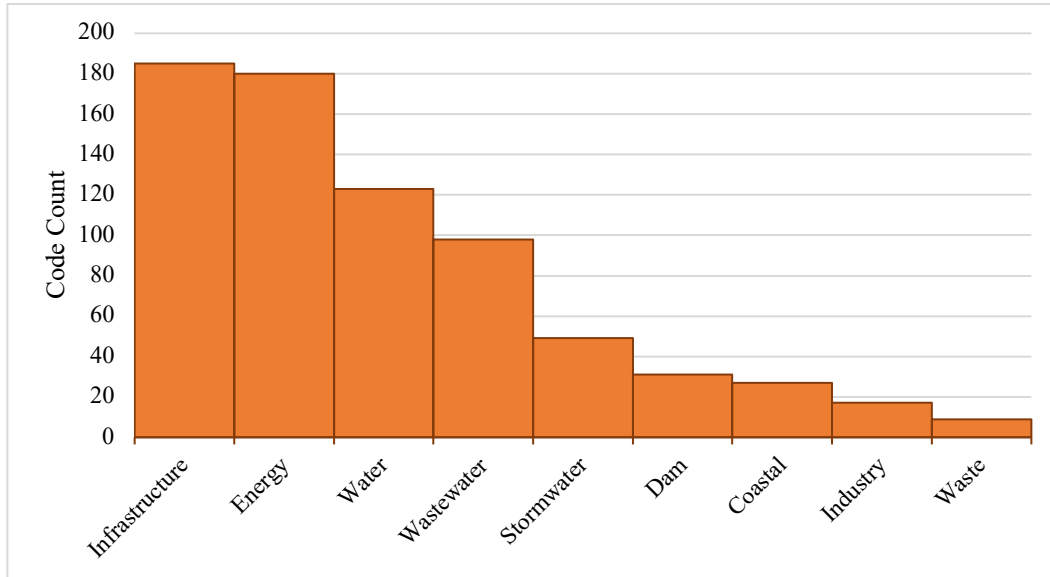


Figure 16: Infrastructure Code Count

The survey accounted for 45% of the responses, the MVP report was 35%, and the community workshops made up 19% of the total responses. The MVP report responses show *stormwater infrastructure* as a high code count while it was a low code use for both Community Workshops and Survey responses. This difference can be seen in Table 8, which shows the code count for each method and code. The color gradient goes from dark, higher code use count, to light, lower code use count. The total code count are ordered from the highest code count to lowest; this shows the total having the color gradient from dark to light. The table shows how certain types of infrastructure concerns were exposed through different methods.

Name	Community Outreach	MVP	Survey	Total
Infrastructure	40	41	104	185
Energy	31	43	106	180
Water	34	39	50	123
Wastewater	25	38	35	98
Stormwater	2	45	2	49
Dam	1	27	3	31
Coastal	0	16	11	27
Industry	5	4	8	17
Waste	0	2	7	9
Total	138	255	326	719

Table 8: Infrastructure Code Use Count by Method

The MWRA supplies water and wastewater facilities to many of the subregion’s communities. The comparison of *infrastructure*, *wastewater*, and *water* codes by the population of subregions will allow for more straightforward observation of MWRA communities and infrastructure impact concern. Table 9 is data only of the subregion’s responses to those three infrastructure concerns. ICC and NSTF have the highest code counts for these terms. However, MAGIC has the highest concern for population representation. The concern in some regions could be in regard to the future of drinking water and wastewater infrastructure. Greater Boston, Unknown, and Outside of Greater Boston were not included in the table since the specific populations are not known, which is why the *Total* is higher than the sum of the eight subregions in Table 9. The gradient shading of the rows is represented by the highest participation in the dark shade to the least participation in light shade.

Subregion	ICC	MAGIC	MWGMC	NSPC	NSTF	SSC	SWAP	TRIC	Total*
Census 2010	1,627,441	167,755	231,967	157,552	280,858	258,305	143,424	280,633	3,147,935
Code Count	95	43	36	19	53	37	20	28	331
Population Representation (code count per 100,000)	5.84	25.63	15.52	12.06	18.87	14.32	13.94	9.98	10.51

Table 9: Infrastructure, Wastewater, and Water Code Count

4.1.2.5 Governance

The governance section had a total of 1,612 code terms counted. Figure 17 shows the distribution of code counts between the 14 codes in this section. Coastal and Inland communities responded similarly to governmental concerns. The survey accounted for 61% of responses, the MVP report was 20%, and the community workshops made up 19% of the total responses. The impact on housing was a significant concern for all the methods and coastal and inland communities.

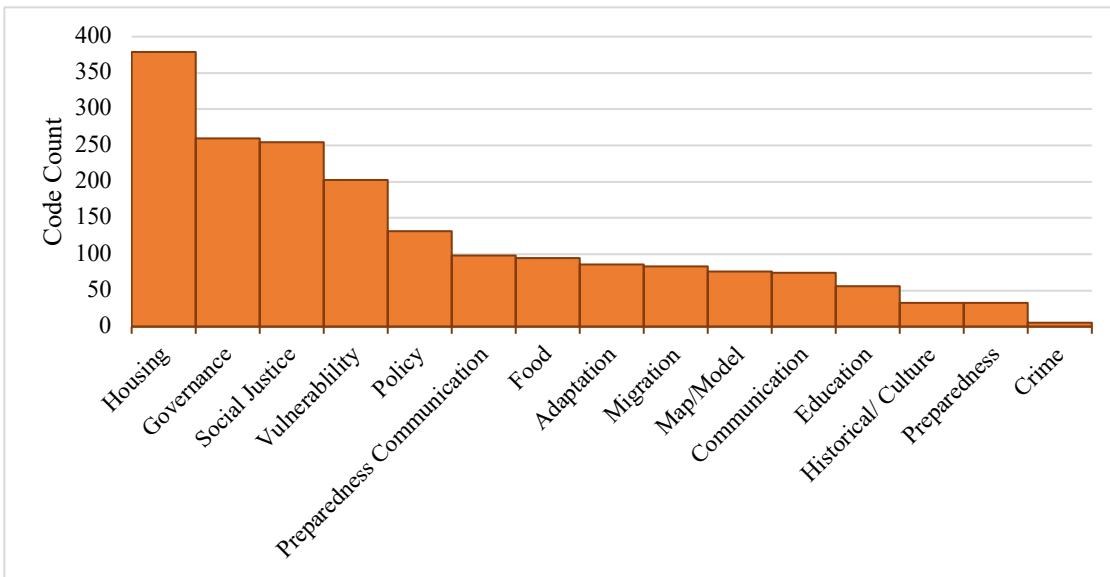


Figure 17: Governmental Code Count

4.1.2.6 Economic

The economic section had a total of 576 code terms counted. Figure 18 shows the distribution of code used counts between the five codes in this section. The survey accounted

for 75% of responses, the community workshops were 15%, and the MVP reports made up 10% of the total responses.

Overall *economic*, economic impacts to a variety of sectors due to climate change, were the highest code to all communities except for the MAGIC subregion. Figure 18 shows the difference in economic concerns between Coastal and Inland communities. *Agriculture* is higher for Inland communities, while Coastal communities had discernible higher code counts for the codes *fishing* and *tourism*.

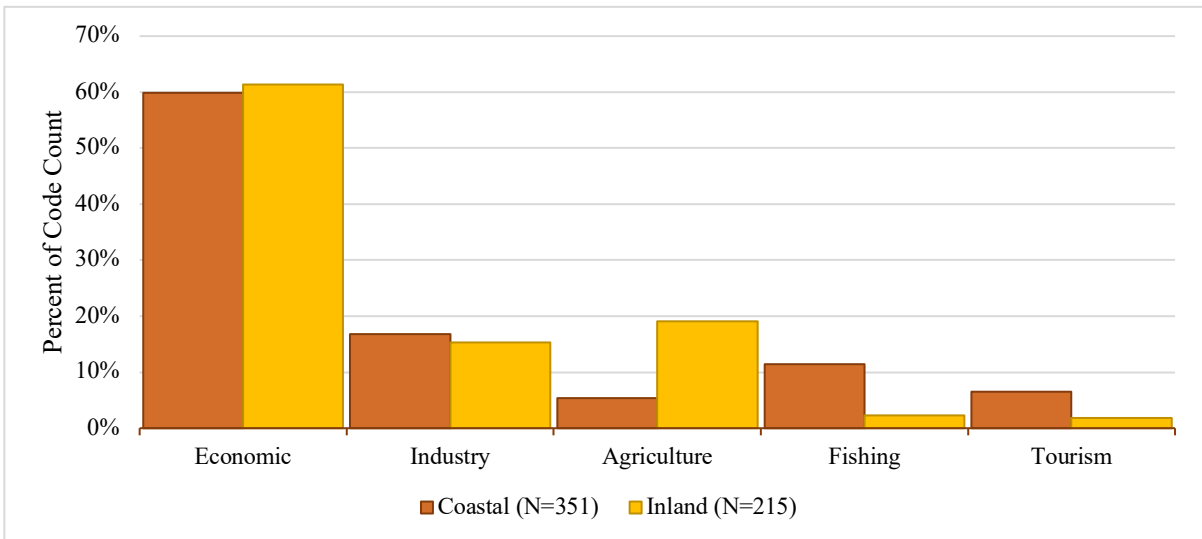


Figure 18: Coastal versus Inland Economic Code Count

4.1.3 Clusivity

The term clusivity in this thesis includes both inclusive and exclusive terms. Such terms are not the climate parameters or impacts themselves, but the words used around the climate parameters and impacts. These terms illuminate how the participants of the community engagement feel and see themselves, their profession, or community as a part of those who will be impacted by climate change. This section also looked at the concerns of

the communities' participants beyond themselves or their profession, labeled as vulnerable communities. The clusivity section code terms counted 748 times. Figure 19 shows the distribution of code counts between the five codes used to describe the parameter and impact concern in this section. Figure 20 shows the distribution of code terms counted between the 14 codes used to describe vulnerable communities. The survey accounted for 51% of responses, the community workshops were 34%, and the MVP reports made up 15% of the total responses.

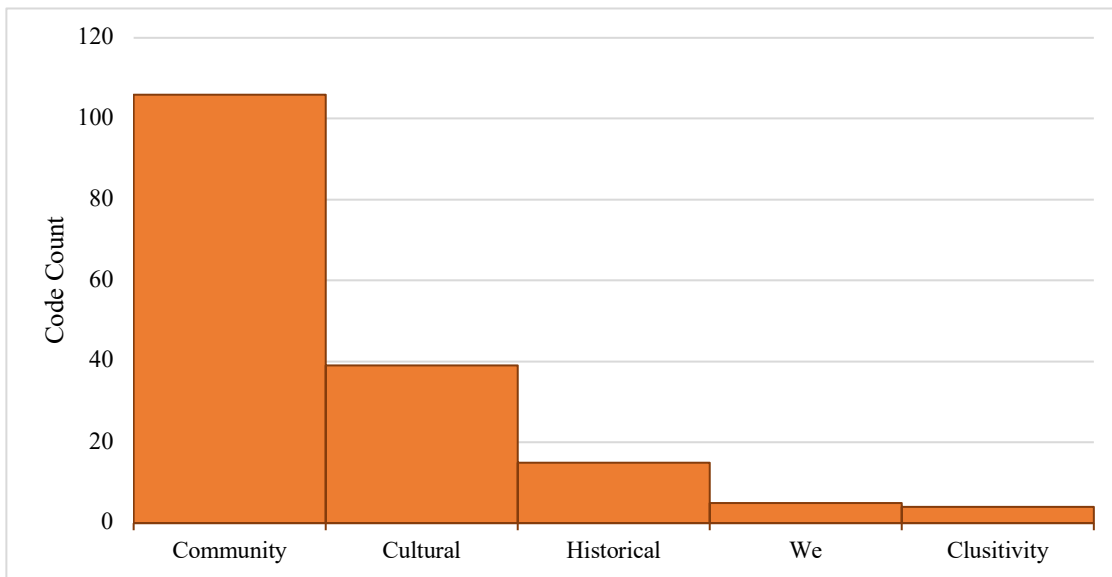


Figure 19: Clusivity Code Count

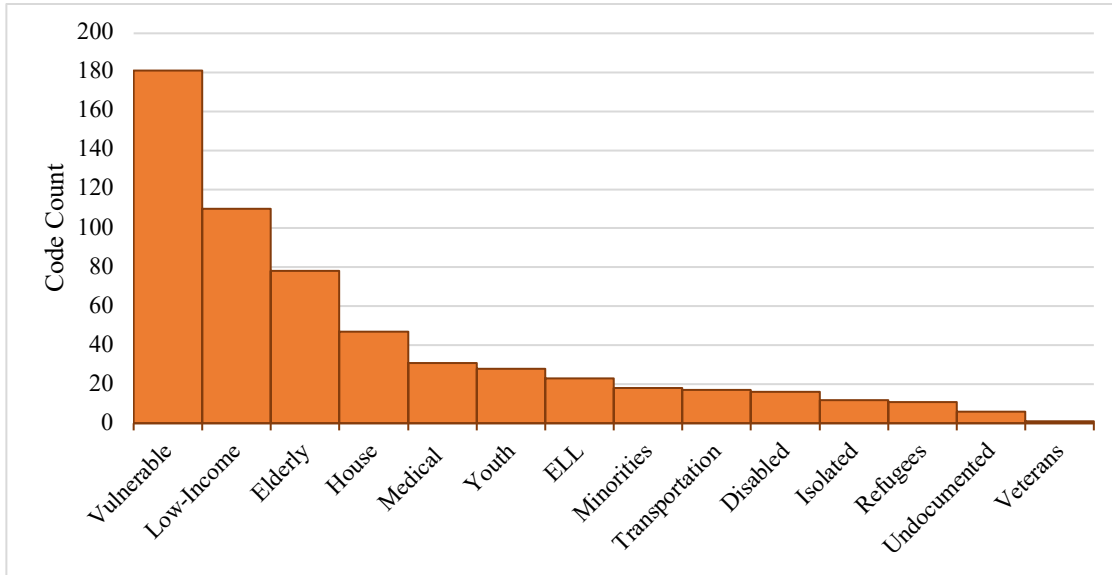


Figure 20: Vulnerable Communities Code Count

4.2 Discussion

4.2.1 Discussion of Themes

In this section, the themes of environment, infrastructure, and clusivity will be further examined. These three themes were identified as valuable because of their importance to Greater Boston participants and ability to identify how well the methods captured those needs.

4.2.1.1 Environment

The environmental findings from the engagement reveal what climate change parameters and data needs are essential to the Greater Boston communities. These findings will help guide the scientist groups who will be gathering climate data scenarios for the GBRAG Report. The top five topics of concern were *sea level rise, precipitation, temperature, extreme storms and flooding*, and how these will impact the other code themes like *transportation, infrastructure, and vulnerable communities*.

When relaying these findings found to the scientist, it is necessary to distinguish between the needs of inland and coastal communities. Weather events affect both coastal and inland communities, but the effects could be felt differently. A survey response captured under the topic of environmental resources was “Habitat loss, restricted water resources, further inland housing being developed = inland habitat loss” (Survey, ID#1.164). This participant seems to be worried about what future disturbances of coastal impacts could mean to the inland communities. This worry was not singular and was stated by many participants, which could explain why inland communities were concerned with *sea level rise* and *coastal flooding*, as seen in Table 7. It was a surprise that coastal participants did not share the same level of concerns as inland participants since coastal communities have similar impacts to worry about with the addition of coastal impacts. However, it seems like coastal communities are more heavily focused on just impacts such as *sea level rise* and *coastal flooding*.

The high use of code terms by inland communities (*temperature, storm, environmental, flooding, precipitation, sea level rise, water quality, fauna, coastal flooding, and high air temperature*), as seen in Table 7, could alternatively be due to how the survey was conducted. The survey asked the participants to think about nine key areas: *transportation, housing, public health and safety, economy and business, governance, environmental resources, social justice and equality, and others*. For each of the areas, it asked, “What climate conditions may impact or are impacting [topic area]?” and listed *sea level rise, coastal flooding, extreme temperatures, extreme storms, and other* as multiple-choice options. The way this question was written could mean that even though inland participants could write-in an alternative effect under *other*, they were more likely to choose

one of the given options. Some participants wrote in *inland flooding* in the *other* category, but not many. The survey questions can be found in Appendix C.

A further finding is that codes in other sections, like infrastructure and transportation, along with the environmental section, could be linked to the top climate parameter code terms. The lead terms are *sea level rise, precipitation, flooding, storm, temperature, and ocean*. These main concern areas are topics that the scientist groups can be divided into for the GBRA report. The scientist should investigate each theme by which region was concerned with code terms to ensure that the communities receive the data they need. Table 10 shows codes that could be related to the main term.

Sea level rise had the most code terms linked with it, while *ocean* had the least code term linked with it out of the six terms. When aspects of the ocean change, they will have extensive impacts on the communities that interact with it. For example, understanding what ocean temperatures could be in 50 or 100 years could influence the fishing community in terms of what they could catch and how much of a specific species they could catch. This parameter could influence the entire economy of Massachusetts’ fishing community.

Climate Parameter (Sum Total of Codes)	Linked Code Effects (Coastal Code Count, Inland Code Count, Unknown Location Code Count)		
Sea Level Rise 6407	Transportation 230, 172, 8	Flora 5, 72, 1	Economic –
	Storm 225, 168, 2	Infrastructure –	Tourism 23, 4, 0
	Housing 213, 156, 10	Water 44, 73, 6	Infrastructure –
	Economic 210, 132, 8	Habitat Loss 80, 42, 0	Coastal 25, 2, 0
	Sea Level Rise 230, 86, 6	Groundwater 29, 70, 4	Leaching 17, 9, 0
	Health and Safety 188, 124, 0	First Responders 63, 39, 1	Coastal
	Environmental 174, 117, 6	Infrastructure –	Management 22, 2, 0
	Flooding – Coastal 218, 73, 1	Wastewater 49, 44, 5	Erosion – Coastal 20, 1, 1
	Government 144, 113, 3	Natural Resources 50, 42, 3	Storm- Frequency 9, 9, 0
	Social Justice 152, 100, 2	Wetland 47, 36, 4	Storm – Coastal 14, 3, 0
	Public Health 84, 117, 8	Adaptation 42, 40, 4	Acidification –
	Mitigation –	Migration 51, 27, 5	Ocean 12, 1, 0
	Vulnerable 100, 96, 6	Map/Model 30, 41, 5	Water Quality –
	Flooding 68, 111, 11	Ecosystem 24, 29, 1	Beach 6, 2, 0

	<p>Infrastructure 94, 85, 6 Infrastructure – Energy 89, 90, 1 Mass Transit 101, 59, 1 Water Quality 67, 84, 7 Fauna 63, 79, 5 Policy 63, 66, 3</p>	<p>Economic – Fishing 40, 5, 1 Erosion 25, 11, 2 Storm Surge 29, 7, 1 Storm – Winter 11, 25, 0 Historical/Culture 18, 13, 2 Mold 17, 11, 0</p>	<p>Wave 7, 1, 0 Airport 2, 1, 0 Acidification - Fresh Water 1, 0, 0 Acidification 0, 0, 0</p>
<p>Precipitation 5698</p>	<p>Transportation 230, 172, 8 Housing 213, 156, 10 Health and Safety 188, 124, 0 Environmental 174, 117, 6 Precipitation 51, 97, 9 Social Justice 152, 100, 2 Public Health 84, 117, 8 Mitigation – Vulnerable 100, 96, 6 Flooding 68, 111, 11 Infrastructure 94, 85, 6 Infrastructure – Energy 89, 90, 1 Mass Transit 101, 59, 1 Water Quality 67, 84, 7 Fauna 63, 79, 5 Temp - Air High 63, 72, 2 Policy 63, 66, 3 Flora 57, 72, 1 Infrastructure – Water 44, 73, 6</p>	<p>Habitat Loss 80, 42, 0 Ice/Snow 40, 63, 1 Groundwater 29, 70, 4 Stormwater 38, 62, 3 First Responders 63, 39, 1 Contamination 45, 52, 2 Drought 28, 65, 6 Vector Borne 37, 58, 4 Infrastructure - Wastewater 49, 44, 5 Natural Resources 50, 42, 3 Food 48, 46, 1 Flooding – Inland 34, 50, 2 Adaptation 42, 40, 4 Surface Water 22, 57, 1 Map/Model 30, 41, 5 Economic – Agriculture 19, 41, 1 Flora – Trees 19, 36, 0 Ecosystem 24, 29, 1</p>	<p>Infrastructure – Stormwater 18, 31, 0 Erosion 25, 11, 2 Fire 25, 32, 0 Infrastructure – Dam 6, 25, 0 Mold 17, 11, 0 Infrastructure – Coastal 25, 2, 0 Leaching 17, 9, 0 Precipitation – Frequency 6, 11, 3 Storm- Frequency 9, 9, 0 Storm – Coastal 14, 3, 0 Flooding – Frequency 9, 5, 1 Water Quality – Beach 6, 2, 0 Biomass 2, 1, 0 Desertification 1, 0, 0</p>
<p>Flooding 5480</p>	<p>Transportation 230, 172, 8 Storm 225, 168, 2 Housing 213, 156, 10 Economic 210, 132, 8 Flooding 68, 111, 11 Health and Safety 188, 124, 0 Environmental 174, 117, 6 Flooding – Coastal 218, 73, 1 Government 144, 113, 3 Social Justice 152, 100, 2 Public Health 84, 117, 8 Mitigation – Vulnerable 100, 96, 6 Infrastructure 94, 85, 6 Infrastructure – Energy 89, 90, 1 Mass Transit 101, 59, 1</p>	<p>Infrastructure – Water 44, 73, 6 Groundwater 29, 70, 4 Stormwater 38, 62, 3 Precipitation 51, 97, 9 Infrastructure – Wastewater 49, 44, 5 Natural Resources 50, 42, 3 Flooding – Inland 86 Adaptation 42, 40, 4 Surface Water 22, 57, 1 Flora – Trees 19, 36, 0 Ecosystem 24, 29, 1 Infrastructure – Stormwater 18, 13, 2 Erosion 25, 11, 2</p>	<p>Historical/Culture 18, 13, 2 Preparedness 17, 16, 0 Infrastructure – Dam 6, 25, 0 Mold 17, 11, 0 Leaching 17, 9, 0 Erosion – Coastal 20, 1, 1 Precipitation – Frequency 6, 11, 3 Storm- Frequency 9, 9, 0 Storm – Coastal 14, 3, 0 Infrastructure – Industry 59, 33, 0 Flooding – Frequency 9, 5, 1 Erosion – Inland 4, 8, 0 Airport 2, 1, 0 Storm – Inland 1, 1, 0</p>
<p>Storm 4698</p>	<p>Storm 225, 168, 2 Transportation 230, 172, 8 Housing 213, 156, 10 Economic 210, 132, 8 Health and Safety 188, 124, 0 Environmental 174, 117, 6 Flooding – Coastal 218, 73, 1 Public Health 84, 117, 8 Mitigation – Vulnerable 100, 96, 6 Flooding 68, 111, 11 Infrastructure 94, 85, 6 Infrastructure – Energy 89, 90, 1</p>	<p>First Responders 63, 39, 1 Infrastructure – Wastewater 49, 44, 5 Preparedness Comm- unication 49, 48, 1 Wind 34, 45, 0 Map/Model 30, 41, 5 Flora – Trees 19, 36, 0 Ecosystem 24, 29, 1 Infrastructure – Stormwater 18, 31, 0 Erosion 25, 11, 2 Storm Surge 29, 7, 1 Storm – Winter 11, 25, 0</p>	<p>Coastal Management 22, 2, 0 Erosion – Coastal 20, 1, 1 Precipitation – Frequency 6, 11, 3 Storm- Frequency 9, 9, 0 Storm – Coastal 14, 3, 0 Flooding – Frequency 9, 5, 1 Erosion – Inland 4, 8, 0 Wave 7, 1, 0 Temp – Humidity 3, 2, 2 Storm – Inland 1, 1, 0 Coastal Dynamics 1, 0, 0</p>

	Mass Transit 101, 59, 1 Ice/Snow 40, 63,1 Stormwater 29, 70, 4	Preparedness 17, 16, 0 Infrastructure – Coastal 25, 2, 0	
Temperature 4483	Temperature 192, 175, 6 Transportation 230, 172, 8 Government 144, 113, 3 Social Justice 152, 100, 2 Public Health 84, 117, 8 Mitigation – Vulnerable 100, 96, 6 Infrastructure 94, 85, 6 Infrastructure – Energy 89, 90, 1 Mass Transit 101, 59, 1 Water Quality 67, 84, 7 Fauna 63, 79, 5 Temp - Air High 63, 72, 2 Flora 57, 72, 1 Infrastructure – Water 44, 73, 6 Habitat Loss 80, 42, 0	Ice/Snow 40, 63, 1 Stormwater 38, 62, 3 Contamination 45, 52, 2 Drought 28, 65, 6 Vector Borne 99 Natural Resources 50, 42, 3 Food 48, 46, 1 Economic – Industry 59, 33, 0 Surface Water 22, 57, 1 Map/Model 30, 41, 5 Economic – Agriculture 19, 41, 1 Invasive Species 23, 36, 0 Flora – Trees 19, 36, 0 Ecosystem 24, 29, 1 Fire 15, 21, 0	Storm – Winter 11, 25, 0 Mold 17, 11, 0 Economic – Tourism 23, 4, 0 Temp - Air Low 8, 15, 2 Temp – Surface 10, 14, 1 Soil 7, 15, 0 Storm- Frequency 9, 9, 0 Storm – Coastal 14, 3, 0 Water Quality – Beach 6, 2, 0 Temp – Humidity 3, 2, 2 Crime 2, 3, 0 Biomass 2, 1, 0 Evaporation 1, 0, 1 Storm – Inland 1, 1, 0
Ocean 2017	Storm 225, 168, 2 Sea Level Rise 230, 86, 6 Flooding – Coastal 218, 73, 1 Water Quality 67, 84, 7 Habitat Loss 80, 42, 0 Natural Resources 50, 42, 3 Wetland 47, 36, 4 Flooding – Inland 34, 50, 2	Adaptation 42, 40, 4 Migration 51, 27, 5 Ecosystem 24, 29, 1 Economic – Fishing 40, 5, 1 Temp – Ocean 31, 9, 1 Erosion 25, 11, 2 Storm Surge 29, 7, 1	Storm- Frequency 9, 9, 0 Storm – Coastal 14, 3, 0 Ocean Acidification 12, 1, 0 Carbon Sequestration 4, 4, 2 Water Quality – Beach 6, 2, 0 Wave 7, 1, 0 Coastal Dynamics 1, 0, 0

Table 10: Climate Parameter and Impacts

Sea level rise, ocean temperatures, air temperatures, and precipitation are being studied worldwide and will be available to gather regional climate scenarios for the report. However, some topics like groundwater, while it is studied, take further research to better understand the future of groundwater specific to the Greater Boston region. Although this is a challenge for building this report, it allows the researchers to understand the data needs of the Greater Boston communities and possible research opportunities for the future. Hopefully, before future GBRAG reports are prepared, more data will be available to report to the communities.

The environmental impacts found from the three methods suggest what parameters are essential to focus on for the GBRAG report. By having data that predict changes in environmental conditions, professionals and communities can understand where they need to

focus their resiliency plans. The federal, state, and local governments will be spending a lot of money and time on their adaptation plans; World Bank reported that developing countries could spend \$500 billion per year by 2050 on adaptations (Martin, 2016). The review of studies that will be presented by the GBRAG report will allow those communities to focus on the most crucial problems.

4.2.1.2 Infrastructure

The effect of climate on Greater Boston's infrastructure is a significant concern to the participants of the engagement process. The environmental parameters like *temperature*, *storms*, and *precipitation* discussed in the earlier section will directly influence the availability of utilities for citizens. Concerns over damaged coastal infrastructure, contamination of drinking water, overwhelmed stormwater systems, and damaged electrical lines were repeated as impacts of climate change related effects.

Access to *energy*, electricity or gas, was the greatest specific concern in the infrastructure section, as seen in Figure 16. This concern is from past events and increased possibility of future extreme events in the Greater Boston region. Homes, vulnerable communities, and businesses are at risk of losing power, and the effects could reverberate in the community. Towns and cities understand the greater need to prepare for possibilities of losing power for multiple days and the need to minimize the effects. Boston's Seaport district, the most recently developed district in Boston, is dealing with sea level rise currently, storm surges and king high tides increase the high probability of the Seaport district experiencing flooding. General Electric reported that they are prepared for flooding by placing emergency generators "on the roof of [their] 12-story building" (Marcelo, 2018).

Other companies and government buildings might start placing their generators and electrical systems on higher floors due to the increased flooding risk. By preparing ahead, companies and city governments could decrease the risk of prolonged power outages.

The MVP reports revealed that their highest infrastructure concern was *stormwater*, as seen in Table 8, which was not the primary concern gleaned from the other engagement methods. However, the impact of increased precipitation and flooding was a repeated concern. For example, Wenham’s MVP report listed flooding due to “stream-crossings and barriers due to bridges/ culverts/drainage/beavers” as one of their vulnerabilities (*Town Of Wenham, Hazard Mitigation Plan and Municipal Vulnerability Preparedness Plan*, 2019, p. 3-6). They also listed key areas and roadways that were known problem areas. In the Newton MVP report, they listed that “75% of identified flood claims” were “outside of FEMA flood zones,” a common issue that was brought up by inland communities (*City of Newton, Community Resilience Building Workshop, Summary of Findings*, 2018, p. 3). Stormwater has been an increasingly important topic of concern at the city level due to the updated Federal Environmental Protection Agency’s (EPA) Municipal Separate Storm Sewer System (MS4) permit. The MS4 permit is a nationwide initiative to decrease stormwater and sewage outfall contamination. Under the MS4 permit, the community must also develop and implement the Storm Water Management Program. The permit’s goal is to increase treatment and monitoring techniques to improve water quality (US EPA, 2016). The conversation around this permit could have influenced the awareness and concern about the cities’ and towns’ stormwater, drinking water, and wastewater infrastructure and is the reason why stormwater is a noticeably higher concern for the MVP reports than the other methods.

In the MAPC region, 54 of the 101 communities are a part of the MWRA, which supplies drinking water and wastewater infrastructure for towns and cities in the Greater Boston Area. Table 11 is a breakdown of how the subregions use MWRA facilities and what those facilities are. By comparing Table 11 to the concern of the subregions to the codes *infrastructure*, *water*, and *wastewater* in Table 9, there is a higher concern with communities not in the MWRA region. MAGIC, NSTF, and SSC each have fewer than five communities that are a part of the MWRA, and the weighted response against the population is higher in those three regions than the others. However, SWAP does not have any cities or towns that are a part of the MWRA but does not show a high level of concern for those three terms. The reason for this low level of concern is unknown and could be from the professions who participated in the engagement methods. MWGMC has 78% of its communities using MWRA facilities but expressed a high concern for the topics of *infrastructure*, *water*, and *wastewater*. While the subregions of ICC, NSPC, and TRIC have a majority if not all of their communities using MWRA facilities and revealed low concern as seen in Table 9.

Subregion	MWRA Facility Options					
	% of Communities a Part of MWRA (n=Total)	Water Only	Sewer Only	Water and Sewer	Partial and Emergency Water	Full Sewer and Partial Water
ICC	100% (n=21)			20		1
NSTF	20% (n=15)	2			1	
MAGIC	15% (n=13)			1		1
MWGMC	78% (n=9)	2	2	1	1	1
SSC	33% (n=12)		4			
TRIC	96% (n=13)		2	2		5
SWAP	0% (n=10)					
NSPC	89% (n=9)		1	5		2

Table 11: MWRA Communities

Communities which have experienced increased flooding and rely on groundwater for their primary drinking water source, instead of the MWRA facilities, have a specific interest on groundwater levels. The quantity and quality of the groundwater sources are important for the town to be prepared for the future. However, the topic of groundwater was specifically not brought up frequently, but it intersects with multiple other terms like *water infrastructure, inland flooding, drought, and precipitation*. Groundwater levels appear to be an important topic for cities and require additional research so cities can develop appropriate mitigation strategies.

Other code terms that are not directly infrastructure but could be linked with infrastructure concerns are *policy, map/model, housing, and vulnerable communities*; the term *policy*, as defined for this project as encompassing laws, policies, and permits. As new laws and permits are implemented, they could influence communities and their response rate. With the MS4 permit, cities and towns are better understanding their stormwater and wastewater infrastructure needs. Although the other terms are not as highly referenced, they reveal the story of how the concerns are linked together and influence one another.

Due to the concern about infrastructure, cities and towns will have to work with their local departments and utility companies to understand how to adapt their communities for future climatic impacts. The future climate predictions that will be summarized in the GBRA report will help these entities when assessing the current capacity of their current infrastructure and what will have to be adapted to create a resilient community.

4.2.1.3 Clusivity

Clusivity is the use of inclusive or exclusive terms that were used in the participant's responses from the community engagement. Evaluating the language used regarding environmental parameters can offer insight into how inclusive or exclusive the participants of the study were relative to the demographics of their respective subregions. Even though the engagement was targeted at the professional level, the hope was that those professionals understood the diverse needs of the different groups within the communities they serve. The concern was that lower-income, minority, elderly, and lower educational achievement communities were not represented or considered equally in the engagement process. For this reason, the terms used concerning the parameter data were analyzed as well.

The definition of the inclusive term 'we' is "to represent a collective viewpoint" (*Definition of We*, n.d.). The term *we* only appeared five times in the documents. Since the MVP reports are professionally made, some by planning or engineering firms, it is understandable why "we" did not appear in those reports. In this study, the term "we" was used from a place of responsibility or position of power. This is illustrated by a quote from the survey by a healthcare professional talking about how climate change may impact governance: "We are going to have differential [e]ffect on different areas. This will involve making decision[s] for some areas that will use resources from other parts of the Commonwealth. It will test our solidarity as a community" (Survey, ID#2.004). Another example is from the survey as well, which is by an architect who used the other section to say, "WE will be vulnerable to all of these changes impacting our built environment." (Survey, ID#2.024) This comment is from an inclusive view of how everyone will

experience the impacts of climate change. It could be viewed as exclusive, though, in minimizing the fact that vulnerable communities will feel the impact of climate change greater than more affluent and whiter communities.

When the use of the phrase “*vulnerable communities*” was evaluated by method, it became clear that each method represented the vulnerable groups differently. Figure 21 shows the distribution of the vulnerable communities’ codes used. The percentages are from each method’s total and not the overall total for the section. The terms are organized from least to greatest. The MVP had a greater variety of vulnerable communities discussed than the other methods, as seen by the greater amount and distribution of colored bars in its column. The term *vulnerable* was used more often in survey and community outreach results instead of a specific vulnerable community being identified.

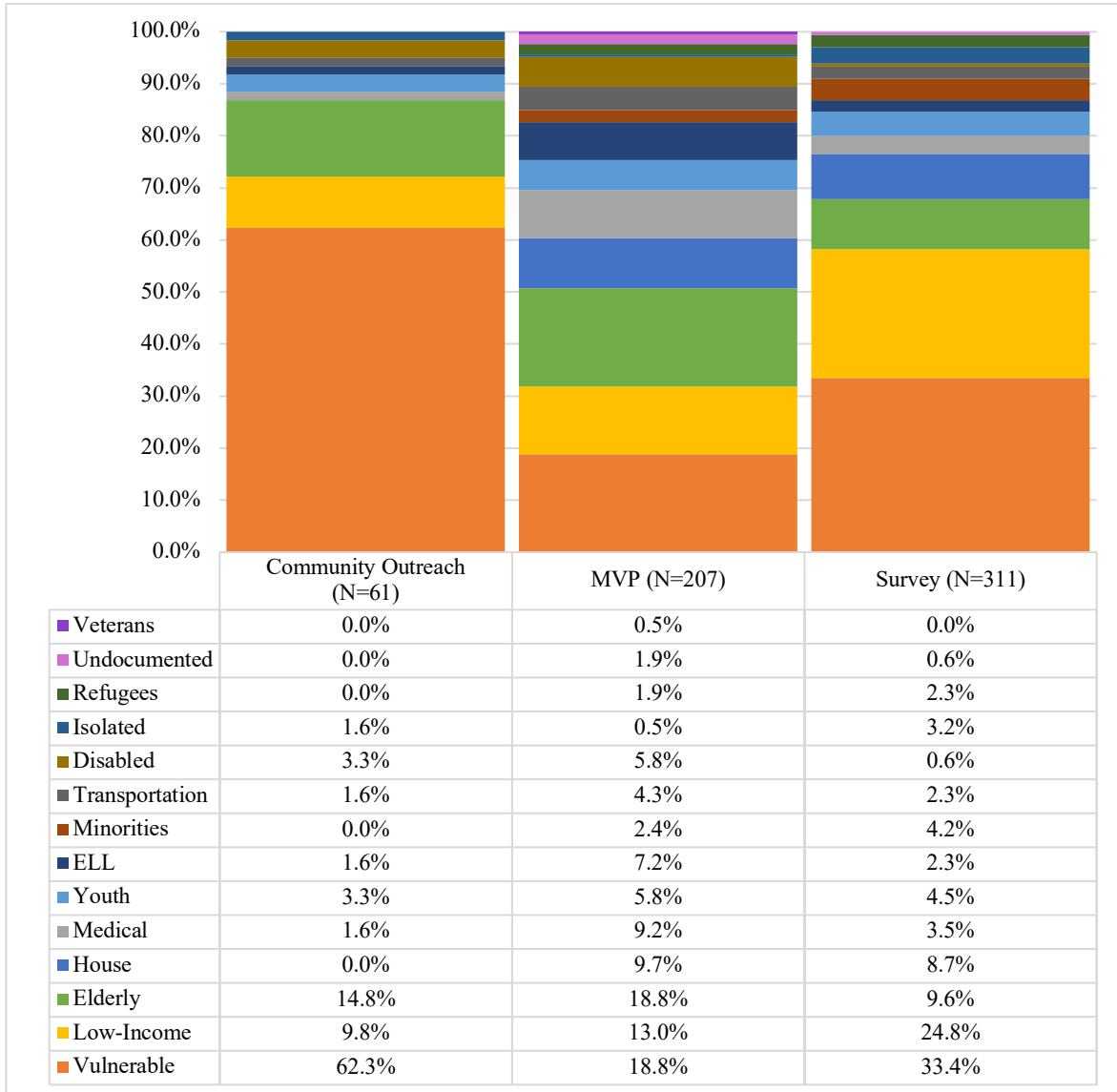


Figure 21: Vulnerable Communities Code Count by Method

The community workshops used the phase more broadly, with only nine out of 14 vulnerable groups identified in the text; 62% of the workshop participants used *vulnerable* compared to a more specific term. The survey had a better distribution of terms, with 13 of 14 groups identified. However, the code *vulnerability* was used 33.4% of the time in place of a more specific term. The MVP Report did the best job of identifying a broad distribution of terms by using specific names of the vulnerable groups rather than using the term

vulnerability to identify a broad range of communities. Fourteen codes were used, and the term *vulnerable* made up only 18.8% of the count in this section. For the MVP reports, there was a greater distribution of vulnerable communities' terms used compared to the other methods. From this data, it is concluded that the MVP reports likely have a better understanding of what vulnerable groups live in their towns and cities. It would have been nice if all three methods delivering similar results. However, if the engagement were done again in the future, it would be important to see if a wider range of vulnerable communities can be identified during the workshops and surveys. It is unknown if this is due to how the MVP reports were produced, or the engagement methods or terminology used during the survey or workshops.

Some exclusive language was identified in community engagement. Inland communities identified the worry of an increase in population as a direct result of coastal communities losing land due to sea level rise. For example, in the Medfield MVP report it was stated that “though not a coastal community, sea level rise could have important implications on the future community of Medfield if significant loss of coastal land promotes migration to more inland suburban Boston communities such as Medfield” (*Medfield Municipal Vulnerability Preparedness Community Resilience Building*, 2019, p. 6). A similar concern appeared in the SWAP community workshops; one participant wrote how there would be an increase in “gentrification of inland areas/‘safe’ area,” and “areas least vulnerable to climate change impact[s]” will see the largest changes (Community Workshop, ID#D-5). Another example is from the survey, where a community health professional was concerned with “less housing overall, those who can afford to move inland will” (Survey, ID#1.034). A community organizer from the survey wrote, “we're especially likely to see inland and high-ground areas

rapidly gentrified as the rich from flooding coastal areas push poor and working-class people out of their more-climate-safe neighborhoods further from the coast” (Survey, ID#2.089). These comments from the three different methods are all pointing to how the vulnerable coastal towns and cities will feel the most impact and how lower-income communities will have less ability to adapt to the impacts than those with higher incomes. The divisions between these communities may become greater and should be prioritized as communities create their resiliency plans. Policy and plans should pay attention to the fate of communities and groups who may be priced out of areas as people migrate away from impacted areas.

The Medfield MVP report showed how some communities might have a negative feeling towards an increase of population as coastal communities have to relocate. However, later in the report, there were examples made of inclusive measures for new residents. A study of how coastal residents feel about leaving their homes due to climate change and how inland residents feel about an increase of population due to climate change would allow towns to understand better if and how they need to prepare communities for this migration.

Overall, there was an understanding that vulnerable communities will feel the impacts of climate change worse than the rest of the Greater Boston Area. Although we saw evidence of participants noting a diversity of vulnerable groups, it was not equal among the multiple groups. There could have been more effort from the GBRAG team to ensure the vulnerable communities were represented in the data. To receive more data on vulnerable communities, the GBRAG team could have involved local groups that work with those communities or held workshops that were focused on those groups to ensure their voices were heard. The MVP report did the best job of identifying a wide range of vulnerable communities. If the GBRAG decides to conduct

community outreach again for their next report, there would need to be more effort in getting a broad view of the needs, concerns, and safety of these communities.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Comparison and Discussion of Methods

Each of the three methods contributed to understanding the needs of the 101 communities in Greater Boston. The methods were chosen to ensure that a well-rounded view of Greater Boston was achieved. Reviewing the engagement processes of the National Climate Assessment, MeteoSchweiz, and the Scottish Climate Outreach in the Literature Review chapter allowed us to understand similar processes of engagement.

Due to the short time frame to plan and conduct the engagement process, there was not much time spent on reviewing the best method for engaging the GBRAG's target professional sectors. The methods selected were standard methods used in community outreach and engagement, but each method had unique strengths and weaknesses. Each method resulted in different levels of engagement and contributed a variety of information which was beneficial to the GBRAG report. Table 12 is a matrix of how each method contributed to outreach and its ability to retrieve a variety of data. *Vulnerable communities,*

infrastructure, and *environment* are theme areas and are represented in the matrix by the number of times terms appeared.

Outcome		Community Workshops	Survey	MVP Reports
Participants Information	Participation	133	396	50
	Professions	53	493	0
Term Count	Vulnerable communities	67	371	332
	Infrastructure	179	489	590
	Environment	1,100	7,739	1,997

Table 12: Attributes of Methods

The MVP reports were an easy addition to the GBRAG engagement since reports were available to the public online. However, not every city and town within the GBRAG region had completed an MVP report. In the future, even more cities and towns will likely have produced an MVP report, which will increase the number of voices heard in the MAPC regions. The MVP reports identified several parameter needs and impacts on their communities; this can be seen in Table 12, where the number of times *vulnerable communities*, *infrastructure*, and *environment* were mentioned were relatively high in comparison to the surveys.

The MVP report engaged the public during its process, which allowed for community comment along with the concerns of city officials. By using the Community Resilience Builder as the community engagement effort for the MVP reports, it allowed the voices of the public to be evident, even though outside consultants produced the reports. For example, the Chelsea MVP report brought in the concerns and assets noted during the community engagement process. The participants noted infrastructure, societal, and environmental

concerns in their community. They also stated positive assets in the community, such as “trees and parks,” “la comunidad diversa” (community diversity), and “community services and groups” (*City of Chelsea Community Resilience Building*, 2018, p. 12-13).

The reports offered perspectives on the key features of the towns and what aspects of the community needed adapting in the future. Due to the clear layout of needs and concerns of the specific cities, the report gave the GBRAG clear and defined information of the needs of those communities. This method also gave clear reasons for the concern and the origins of the concern, something not always available with the other methods.

The survey offered individual perspectives across a wide range of occupations and locations. The information from the survey helped researchers hear concerns from the professional community of Greater Boston. It was evident that planners and engineers were targeted more during the first part of the survey compared to other occupations. Professions like fishers were harder to reach with the survey, and fewer responses were collected even though this group was specifically targeted during the second release of the survey.

When comparing GBRAG’s survey to MeteoSchwez’s survey, there are possible overlaps. The MeteoSchwez targeted groups that would use the data from the report; similarly, GBRAG’s survey targeted professionals who require regional climate parameters. MeteoSchwez was able to divide their participants into user groups, such as scientists and researchers, businesses, and educational and informative groups; it would be enlightening if GBRAG added a question next time that would allow GBRAG to similarly group the report’s users (Perch-Nielsen et al., 2016). This grouping would allow GBRAG to understand how to better phrase the engagement processes and to release the data in styles that are useful for

those groups. The MeteoSchweiz also stated that there was a lack of understanding due to the terminology they used in their survey (Perch-Nielsen et al., 2016). This was not a stated concern among survey participants but could be a reason why individuals from some occupations did not participate in the survey. Some participants in the survey only marked that they were worried about a topic without explaining why they were concerned. It could be that some groups did not feel that they had enough understanding about the specifics of climate change to answer parts of the survey or feel confident enough to know what data was important for their sector to prepare for the future.

It is also feasible that some professions are prioritizing climate change more than others. With permits like MS4, there is likely an increase in conversation around flooding due to climate change in planning and engineering professions about what information and data they need. White (1996) hypothesized the theory that if a participant thinks something is worth their time and energy, they will engage in the process. Using a different method of engagement for the participants whose numbers were lower could help increase the relevance of the findings to their group.

The other community engagement method used for GBRAG was the community workshops, which were conducted during the MAPC regional meeting and not heavily advertised since they were set up quickly; there was also not much participation compared to the survey. Also, time constraints meant that the workshops were limited to 30-60 minutes. Scotland's Climate Outreach's and the US's National Climate Assessment's workshops were sometimes multiple days long, which allowed for a more comprehensive workshop. By creating workshops outside of the MAPC regional meeting, the team might have been able to

attract a larger group of more diverse backgrounds to the meetings. Live streaming and video recording could also increase participation.

Scotland's Climate Outreach created programs to learn the needs of the diverse regions and participants. They gave the participants money in exchange for their time, which could be a tactic that GBRAG could use if they were to replicate the workshops to increase the diversity of the participants. Climate Outreach was also during after work hours, which allowed a wider variety of people to be involved. The MAPC meetings were during the middle of the workday and were not always accessible by public transportation. Mostly governmental employees and planners attended the workshop by making the stated changes above; it could increase the types of professionals who would attend the workshops.

The National Climate Assessment hosted regional meetings but also hosted meetings about specific topics. For example, the US Department of Agriculture hosted a meeting on impacts on rural communities (Cloyd et al., 2016). The GBRAG team could hold targeted meetings to ensure the voices of specific professions are heard. Those workshops could also be developed and planned for those participants to ensure their climate data and information needs are noted. A few of those specific communities could be aquaculture, farm, low income, and health care. Those groups were heard from least during this engagement process but will be significantly impacted by climate change.

The MAPC is a wonderful network for GBRAG to work with; they were ideal for creating a Greater Boston geographical limit for the GBRAG. MAPC has an expansive network of sub-regional leaders and ties with local professionals in an array of occupations. Regions like Los Angeles and Miami are creating or using networks to build resiliency and

climate knowledge. These networks help learn and listen to community needs and disperse important information. The networks can also be used at a larger level, the C40 or IPCC, which connect international cities and countries who discuss resilience and adaptation plans. Sharing information and working together as communities allow more increased success than working alone. Continuing to work with the MAPC and utilizing their network will increase the ability for the GBRAG to hear from the Greater Boston communities.

5.2 Inclusion of Marginalized Communities' Needs

Marginalized communities are more vulnerable to climate change impacts because of racism, sexism, discrimination, xenophobia, and more as a consequence, they have fewer resources to adapt and protect themselves. When analyzing the data from the different methods, GBRAG needs to know if the findings took into account the marginalized and vulnerable communities in Greater Boston.

Agyeman, Bullard, and Evans explain “that environmental problems bear down disproportionately upon the poor” compared to the rich (Agyeman et al., 2002, p. 78). As discussed in the 4.3.1.3 Clusivity section, the participants did understand that vulnerable communities are at higher risk and that there is a broad definition of the term *vulnerable communities*. As communities prepare for a future of increasingly intense weather events, the leaders must keep the whole of the community in mind. The three methods GBRAG used to listen to the professional communities about their parameter data needs are important to create resilient communities. However, the GBRAG separated the data needs from the impacts; most participants were concerned with the impact of climate change. The impacts and effects of extreme weather events will be more harmful to marginalized communities. It

is important not to entirely disregard the impacts so that those communities are adequately represented.

Not surprisingly, the MVP report had the most detailed descriptions of what type of communities were at risk from climate change impacts. For example, the Marlborough MVP report noted that some of their dams “are classified as high hazard dams” by the state; if an extreme precipitation event were to occur, then it could cause the failure of the dams (*City of Marlborough, Community Resilience Building Workshop, 2019, p. 3*). Those dam failures could lead to negative impacts “to homes(s), industrial or commercial facilities, important public utilities, main highways or railroad(s)” in their community (*City of Marlborough, Community Resilience Building Workshop, 2019, p. 3*). However, it is worrisome that the possible failure of infrastructure could cause significant impacts on a city or town if not fixed. In some areas, those infrastructure concerns are managed better or fixed faster in non-marginalized communities.

This concern is highlighted by recent events in Flint, Michigan, a post-industrial city that is now mostly low-income, African-American, and suffering long-term health impacts related to water supply infrastructure (Butler et al., 2016). A large proportion of the Flint population, especially children, was exposed to excessive lead concentrations in drinking water due to ill-considered source changes and improper government oversight. Without proper planning and oversight, disenfranchised neighborhoods in the MAPC region could suffer from an increased risk of climate change impacts. The downstream communities of hazardous dams, like the ones discussed in the Marlborough MVP report, are at a higher risk in the case of extreme precipitation or storm events due to climate change. Without correct

oversight, infrastructure failures could pose a significant risk to marginalized neighborhoods, while more white and higher-income neighborhoods could receive better protection from climate change impacts. Flint is one of the hundreds of cities across the US and the world where the marginalized and vulnerable are at higher risk for environmental, climate change impacts, and other related dangers. Government leaders and citizens must ensure that the entire community is included fairly in climate resiliency and adaptation plans.

Sea level rise was a concern for not just coastal but also inland towns and cities. Hurricane Sandy was a wakeup call for many Northern Atlantic coastal cities about how much preparation they lacked. The New Jersey and New York coastline experienced high storm surges, flooding, and impacts to transportation and power due to Hurricane Sandy. Only afterward did they realize that not only did they need to increase resiliency measures but also to understand the social needs of their communities (Burger & Gochfeld, 2017). The low income and minority communities lacked transportation and first aid kits. Those groups were not prepared, and the cities and towns were not ready to help them either. The physical infrastructure was not adapted for a storm as strong as Hurricane Sandy, but the preparation at the city level was not planned either. By understanding the future climate scenarios, cities and towns in Greater Boston can create resiliency and adaptation plans for worse case scenarios. The plans should focus on the physical conditions of the town like small stormwater pipes, coastal infrastructure, or hazardous dams. At the same time, cities and towns should prepare for reverse 9-1-1 contact in multiple languages, cooling centers for extreme heat days, and evacuation routes for those without access to vehicles. By preparing

in advance for all community members, that town will experience better resiliency to extreme climate events.

Schlosberg's and Collins' article discusses the link between the Environmental Justice and Climate Justice movements and how the adaptation of communities is a time for the movements to be involved to ensure the Earth and its residents are protected (Schlosberg & Collins, 2014). The environmental justice movement is focused on how toxins and environmental mismanagement are disproportionately injuring lower income and minority communities in the United States. Climate justice is an offshoot of the Environmental Justice movement; the climate justice movement has many similarities but differs in that it is focused on ethical climate change dilemmas. The Climate Justice movement wants to protect lower income and minority communities who will be unequally impacted. Schlosberg and Collins state how there should be a balance of policies and grassroots movements. When the GBRAG report is released to the public, it will be important for community leaders and Climate Justice leaders to be involved with the adaptation planning. They should work together to ensure that their whole community is represented and protected when resiliency and adaptation plans are created and developed.

Since the engagement process was not focused on the impacts that the communities would face due to climate change but instead focused on the data parameters, the engagement process did not capture all the concerns that Environmental and Climate Justice groups are concerned with. Although, by modifying the targeted community or methods of engagement, there could be an increase in the inclusion of marginalized communities' needs. If the engagement methods were modified to work with marginalized communities, those

community members might not know what parameter data they are concerned with, but they will know what climate impacts they are worried about. The inclusion of diverse communities will allow GBRAG to have a better understanding of the needs of the Greater Boston communities.

5.3 Recommendations for Future Community Engagement Activities

Four primary recommendations that could help improve the GBRAG's ability to listen to Greater Boston can be extrapolated from this thesis. Increased time and funding, modification to methods, an increase of engagement of diverse community members, and inclusion of social scientists to the GBRAG team would increase the ability to hear the needs for Greater Boston's climate change concerns.

5.3.1 Time and Funding

The engagement process was rushed with limited time to prepare for the engagement process and implement them. If the team had more time to plan and execute workshops and surveys, there might be an increase in the diversity of participants with GBRAG. The engagement planning process started in early February 2019; the first workshop meeting was on March 13th. The final workshop and the end of the survey was the end of April. The survey reopened from May 3rd to July 8th. The planning process was less than a month long. With a more extended period of planning, the participants could be better targeted to engage a larger variety of professions.

Along with time, GBRAG would need more funding for accessible workshops or meetings. The workshops had low accessibility for groups that use public transportation,

work full time, or have children. By hosting the workshops at a more available time, like at night or on the weekends, it could be more accessible to the targeted groups. Also, giving monetary payments to those who are participating could increase the attendance of groups whose numbers were low during this engagement process.

Finally, more time could give the option to hold targeted meetings. In the discussion section, there was the recommendation of holding a targeted meeting for peoples whose occupations will be significantly impacted by climate change. Groups like fishers, farmers, and healthcare workers, could have separate targeted events to ensure that their concerns are heard. Since fishers do not have a typical 9 to 5 schedule, their community could be more responsive to in-person surveys, or late afternoon or weekend workshops.

By spending more time and funding at the beginning planning phase and with the engagement processes, there could be an increased in engagement with the community. By investing more time and funding on the methods, GBRAG could have a more well-rounded understanding of the needs of Greater Boston's communities.

5.3.2 Methods Modifications

With additional time to research methods, it would be essential to ensure that the methods used are specific for the targeted participants. During this engagement period, GBRAG focused on professional groups. It was unknown who would be captured with the surveys and workshops. GBRAG understood that certain groups were not captured with the first survey, and it had to be re-released. If GBRAG wishes to engage with professionals, it would be important to modify the methods to ensure that a variety of professionals participate.

Before selecting methods, the GBRAG team should have a clear goal of the professional groups they are hoping to hear from. By reviewing the data from the 2019 engagement process, they will have an understanding of what groups they need to find specific methods for. For example, working with professional health care organizations as a network to reach out to health care workers may be easier than trying to send surveys to health care workers individually. The organization might be able to help GBRAG send out survey links or set up a specific workshop.

Accessibility to the engagement processes should be modified. The MAPC meetings were typically at a town hall building and during the day. It was a challenge to have people who were not allowed by their jobs to come to the meeting. Also, if participants relied on transportation, it was challenging for them to make it to the meeting location. Some participants might have children and need daycare. Others who may not speak English may feel excluded from meetings or taking the survey, or the terminology used during the survey or workshops might have been unfamiliar for some potential participants. Increasing accessibility of the survey, workshops, or other types of engagement may lead to increased engagement levels. Targeting the key demographic and understanding their limitations will allow the methods to be modified around their needs. Workshops may need to take place after work hours with childcare and monetary payments. Others may need online attendance options if they want to participate but cannot leave their homes. There might need to be several types of surveys depending on who is being targeted, like one for scientific communities, another for non-scientific participants, and another for Spanish or other Non-English speakers.

By reviewing and modifying the methods, it would allow GBRAG to receive feedback from a variety of participants accurately. It will also ensure that GBRAG hears from groups that are harder to receive feedback from. Although setting up more meetings and building multiple surveys will require more time and energy, it will increase the occupation diversity and allow GBRAG to deliver climate parameters that are needed to create resilient and adaptive communities.

5.3.3 Participation Diversity

To receive a broader representational outcome of the Greater Boston area, GBRAG would need to increase the participant's diversity, both diversity of occupations and demographics. The engagement did not have a significant range of participation by subregion or occupation. To have a more accurate understanding of the needs of Greater Boston, GBRAG has to increase the target participant group or ensure the methods reach out to their goal demographics. As stated above, there are specific changes that can be made to include more participants so that the report GBRAG releases can better support communities.

There is an opportunity for further research in this area as well as future engagement. By increasing background questions, the team would be able to report what climate data needs are important to specific regions, demographics, and occupations. These additional questions would be a new insight that is not widely available and would be interesting to climate researchers.

In addition, if the team decides to increase the engagement, an introduction and background of terminology could be helpful for participants to understand. By ensuring a primary understanding of climate change for the Greater Boston area of the participants, it

could result in richer engagement. The educational introduction could change from method to method or according to which groups are being targeted. By establishing a base understanding of climate change and connecting the climate change concerns to the participants' lives and occupation, the participants should have the increased ability to articulate their climate change data needs and concerns. The understanding of the levels of educational information needed will give the GBRAG team a new understanding of how to produce the final report. The final report might need to have multiple variations, one that is for scientists with raw data and another that is more graphics-based and is understandable by non-climate science groups. These differing reports would allow the more diverse groups, who were engaged, to be able to have useable information to work with.

The greater and more diverse the participation, the better and the more useful the GBRAG report will be to the Greater Boston area since it would more accurately depict the diverse needs of the metropolitan area. The more participation and the clearer the GBRAG is about whom they are targeting, the more accurately represented the Greater Boston population will be in the report (White, 1996). Although the GBRAG was able to interact with several hundred participants, it would be interesting to understand if there are changes in the concerns and data needs if more diverse populations are reached out to and engaged in the process.

5.3.4 Social Scientist

Finally, the last recommendation is to include social scientists in the team. The GBRAG team has multiple scientists who are experts in the field of climate change; adding

social scientists to the team might accomplish transdisciplinary approach that GBRAG hopes to achieve.

Social scientists could contribute to the team by helping to link social, historical, economic, racial, gendered, and other issues related to climate change. They can help with human subject research, develop more specific methods linked to specific communities. Those methods should be able to encompass a vast array of occupations that will be impacted by climate change. They could also conduct more profound research on the implementation and outcome of the engagement process of GBRAG. A more well-rounded team would positively contribute to the GBRAG report and the information provided to the public.

5.4 Conclusion

Even though there are things, GBRAG could have done better at engaging more diverse communities, significant progress was made towards linking community needs to climate change parameters. The ability to utilize and work with the MAPC network allowed for the possibility of a long-term connection and networks to gain and distribute information. The GBRAG built a survey and workshop protocol which received knowledge from professionals and allowed the GBRAG researchers to understand, not only what parameter data communities were interested in, but what regions were concerned with and how those climate projections would affect them.

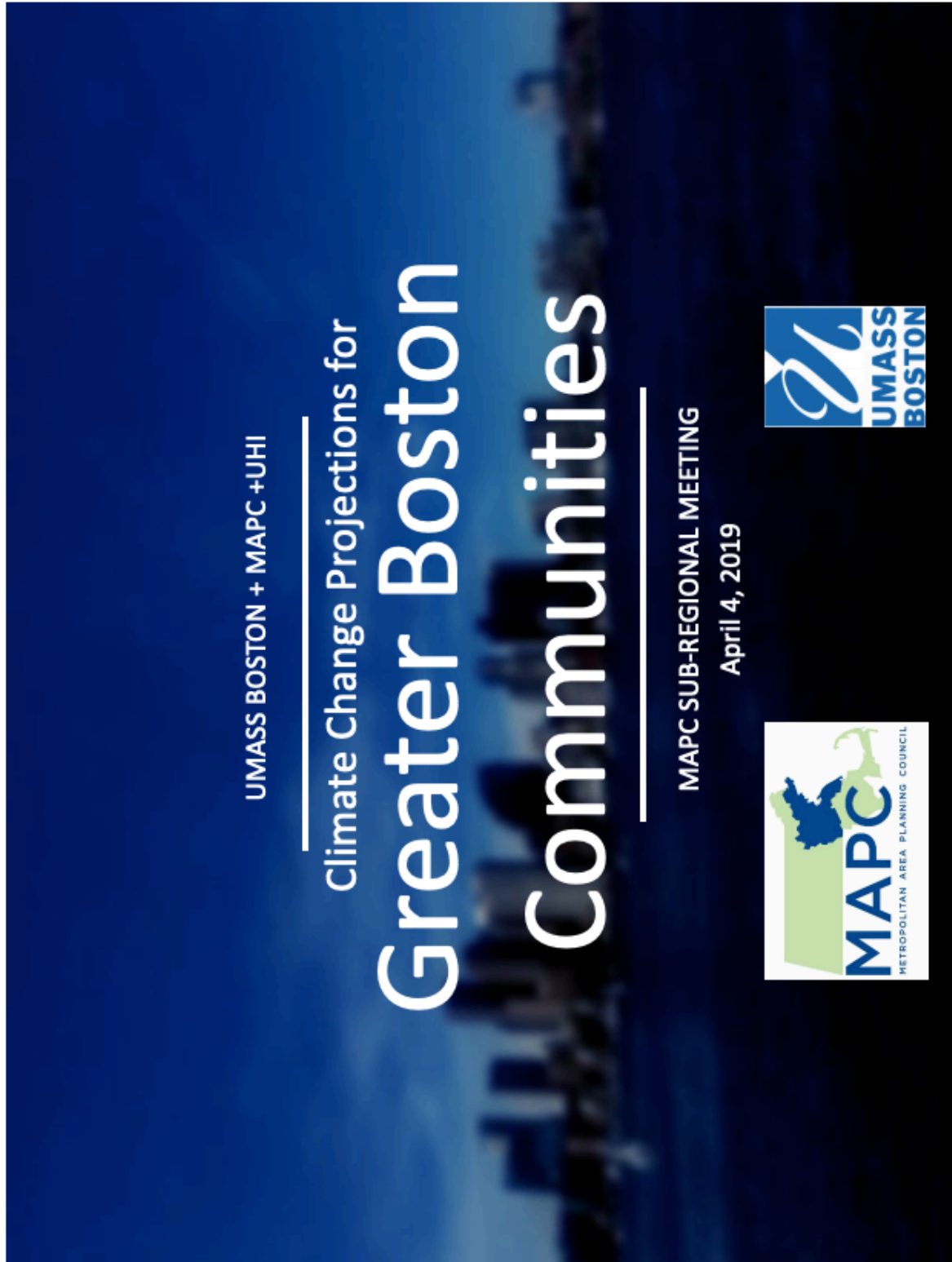
The engagement processes used for the GBRAG report will be the building blocks for future GBRAG reports. Hopefully, similar groups from around the world will learn from the process trialed in this paper to learn about the climate change knowledge need of their communities. No town, state, or country is alone in creating resiliency plans for our

communities. The more information that can be shared, the better the world can help and support each other as we face uncertain times. There is an urgency in reducing greenhouse gases; the planet has reached a point when changes to the Earth's climate are inevitable, and adaptation and mitigation planning must take place. Wendell Berry stated, "a man [should know] that the world is not given by his fathers [and mothers], but borrowed from his children" (Berry, 1971, p. 26). As citizens of the Earth, it is our job to protect our home for future generations. Every step toward a safer and better tomorrow counts, and every decision matters as we walk hand in hand into our future.

APPENDIX

A. MVP REPORTS

1. Acton
2. Arlington
3. Beverly
4. Burlington
5. Canton
6. Chelsea
7. Cohasset
8. Concord
9. Dedham
10. Essex
11. Everett
12. Framingham
13. Gloucester
14. Hingham
15. Hudson
16. Hull
17. Ipswich
18. Lexington
19. Lincoln
20. Littleton
21. Lynn
22. Manchester
23. Marblehead
24. Marlborough
25. Medfield
26. Medford
27. Melrose
28. Milford
29. Millis
30. Nahant
31. Natick
32. Newton
33. North Reading
34. Norwood
35. Peabody
36. Quincy
37. Revere
38. Rockland
39. Rockport
40. Sherborn
41. Stow
42. Sudbury
43. Walpole
44. Waltham
45. Wayland
46. Wenham
47. Weymouth
48. Winthrop
49. Woburn
50. Wrentham





UMASS BOSTON + MAPC +UHI

Climate Change Projections for

Greater Boston Communities

MAPC SUB-REGIONAL MEETING
April 4, 2019



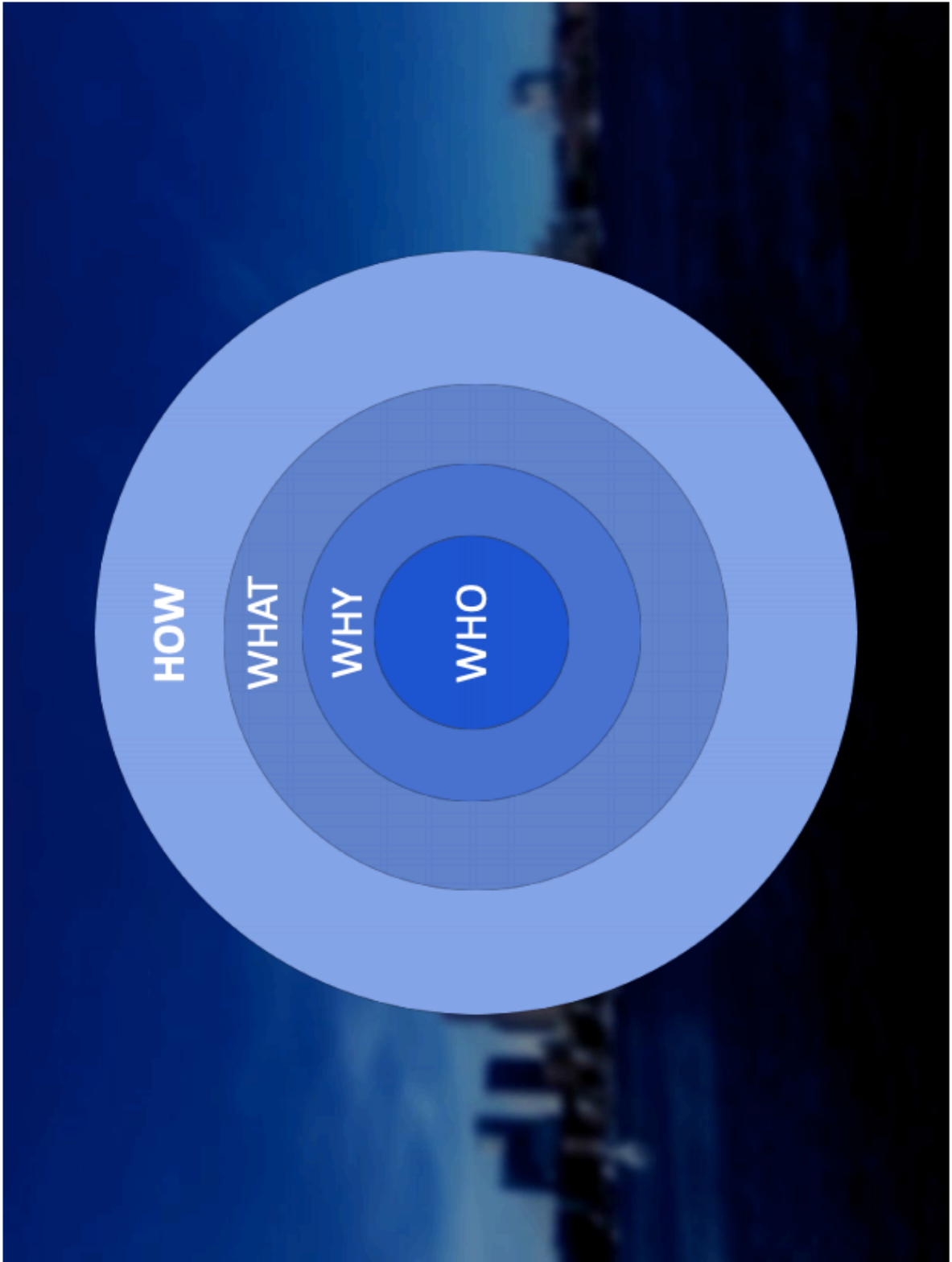
Agenda

Introduction

Brainstorm Session

Next Steps

**Be sure to sign the sign-in
sheet!**





Greater Boston Research Advisory Group (G-BRAG)

Managed by the School for the Environment at UMass Boston (E. Douglas and P. Kirshen, Joint Principal Investigators), with collaboration from the Urban Harbors Institute and the MAPC, and oversight by a Steering Committee made of a variety of local stakeholders. The project is funded by the Barr Foundation.

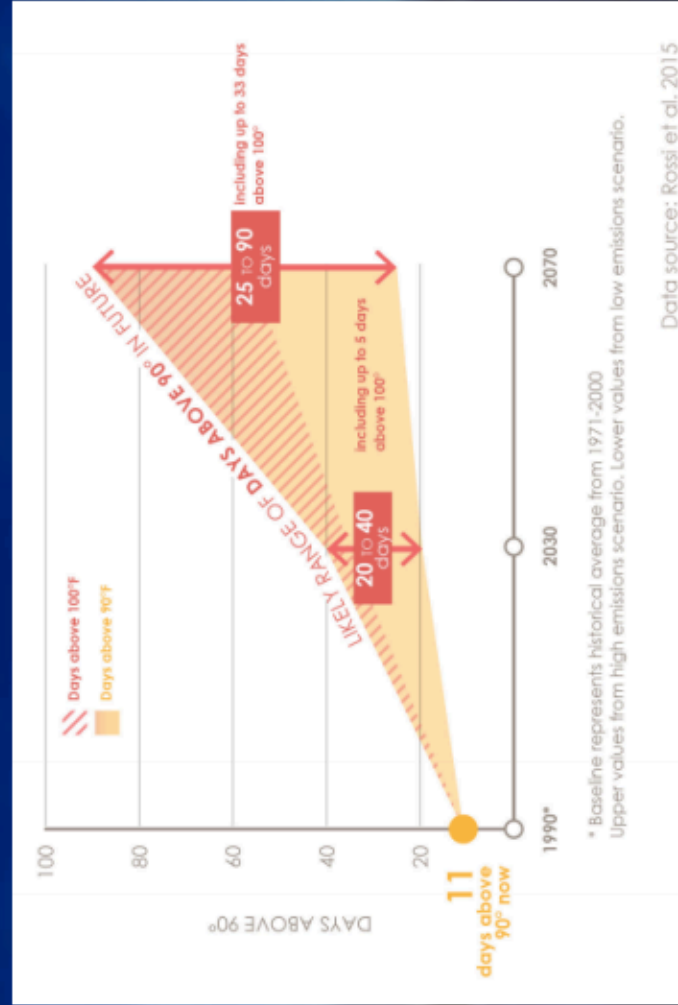


**Provide Greater Boston
Area stakeholders with
projections to protect and
prepare for climate
change-related impacts.**

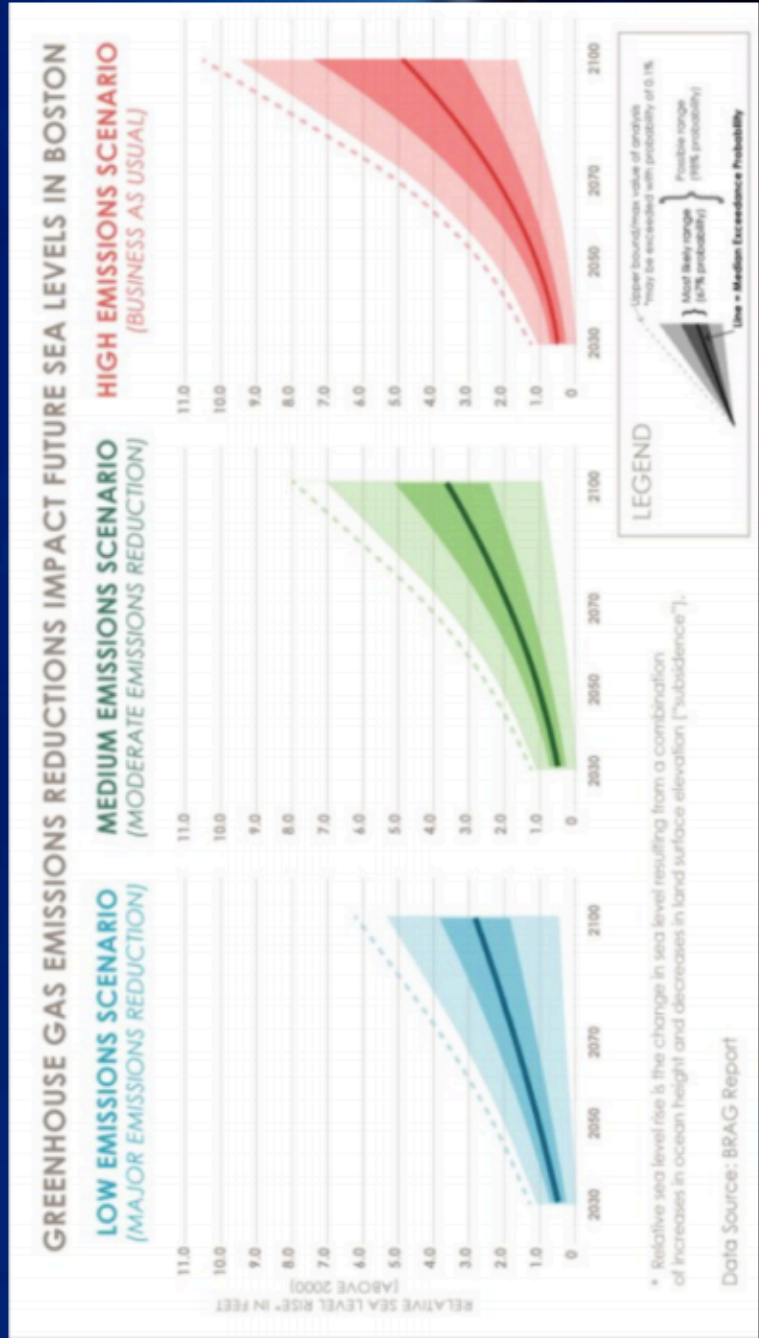
Boston Climate Ready 2016 Report



2016 Boston Climate Ready Report



Boston Climate Ready 2016 Report



Listen

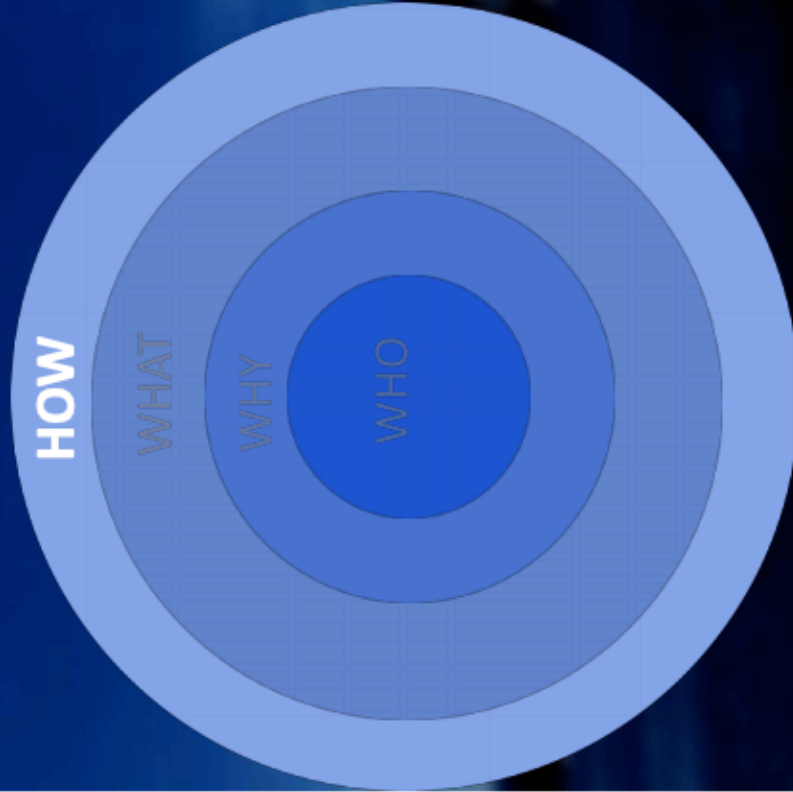
to communities about what worries them and what information they need to build resilient communities. This will be accomplished by meetings and a survey.

Collaborate

with scientists to examine peer-reviewed pertinent information to update climate change projections.

Publish

the final project report and special interest reports.



Project Schedule

January, 2019: Project Begins

February – April, 2019: Community Outreach

May, 2019: Engage Scientists

Summer, 2019 – 2020: Develop Special Report 1

**Mid-2020: Complete Assessment of Updated
Climate Change Parameters**

Summer, 2020 – 2021: Develop Special Report 2

December, 2021 - 2022: Complete Final Report

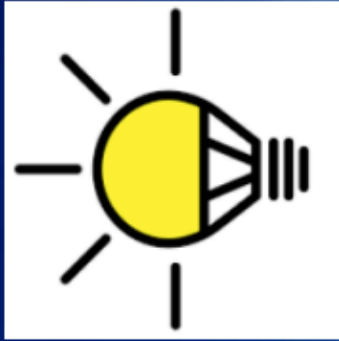


Agenda

Introduction

Brainstorm Session

Next Steps



1

Think

You will have 4 minutes to write down your answers to the questions! All papers will be collected at the end.



2

Pair

You have 12 minutes to share your thoughts with a small group (no more than 5). Prepare to share topics with the rest of the room!



3

Share

Each group will share ideas!

GBRAG Worksheet

Name (Not Required): _____ Email Address (Not Required): _____

TOPICS	Climate Change Impact 1	Needed Information	Climate Change Impact 2	Needed Information
EX: Transportation	Flooded Streets	Extreme Precipitation	Road Rutting	Groundwater and Sea Level Elevations

Currently work as:

Engineer

Planner

Researcher/Scientist

Community Organizer

Volunteer

Business Person/Entrepreneur

Health Care Professional

Emergency Service Provider

Builder

NGO Employee

Other

1

Think

You will have 4 minutes to write down your answers to the questions! All papers will be collected at the end. We appreciate if you write your name on the paper but it is not required.

2

Pair

You have 12 minutes to share your thoughts with a small group (no more than 5). Prepare to share topics with the rest of the room!

3

Share

Each group will share ideas!

Questions:

What concerns you about how climate change may impact

- Transportation
- Housing
- Public health
- The economy/business
- Governance
- Environmental resources
- Social justice and equity
- Other

in the Massachusetts communities where you work and live?

What climate change information and projections would help you address these impacts?

1

Think

You will have 4 minutes to write down your answers to the questions! All papers will be collected at the end. We appreciate if you write your name on the paper but it is not required.

2

Pair

You have 12 minutes to share your thoughts with a small group (no more than 5). Prepare to share topics with the rest of the room!

3

Share

Each group will share ideas!

Questions:

What concerns you about how climate change may impact

- Transportation
- Housing
- Public health
- The economy/business
- Governance
- Environmental resources
- Social justice and equity
- Other

in the Massachusetts communities where you work and live?

What climate change information and projections would help you address these impacts?

1

Think

You will have 4 minutes to write down your answers to the questions! All papers will be collected at the end. We appreciate if you write your name on the paper but it is not required.

2

Pair

You have 12 minutes to share your thoughts with a small group (no more than 5). Prepare to share one topic with the rest of the room!

3

Share

Each group will share ideas!

Questions:

What concerns you about how climate change may impact

- Transportation
- Housing
- Public health
- The economy/business
- Governance
- Environmental resources
- Social justice and equity
- Other

in the Massachusetts communities where you work and live?

What climate change information and projections would help you address these impacts?



UPCOMING EVENTS

North Shore Task Force April
18th (Danvers)

MetroWest April 25th
(Ashland)



CONTACT US

Website

www.umb.edu/gbrag

Follow and Like us on Facebook
Greater-Boston Research Advisory
Board

Email

Kimberly.Starbuck@umb.edu and
visit our website to take the
survey

C. GROUPS CONTACTED

A Better City	Association to Preserve Cape Cod	Boston Harbor Now
90 Meat Outlet	Atlantic Banks Fisheries LLC	Boston Health Care Preparedness Coalition
A And D Cold Storage Inc	Atlantic Capes Fisheries Inc	Boston Lobster Co
A B Seafood Inc.	DbA IQF Custom Packing LLC	Boston Preservation Alliance
A Taste of Nantucket Inc	Atlantic Coast Seafood, Inc	Boston Properties
Acushnet Fish Corp	Atlantic Lobster International Inc	Boston Seafood Express Inc
Adams Fish Mkt, Inc	Atlantic Red Crab Co	Boston Society for Architecture
AFC Trading Corp	Atlantic Red Crab Co LLC	Boston Society of Architects
Alianca Import & Export Co	B And B Trading Corp	Boston Society of Civil Engineers
All Island Seafood Inc	Boston Architectural College	Boston Sword and Tuna
Alternatives For Community And Environment (Ace)	Barnstable Seafarms	Boston University Initiative on Cities
Age Lab	Barr Foundation	Boston W/S Lobster Corp
America Food Systems Inc	Bay Breeze Inc	Boudreau's Shellfish
American Council of Engineering Companies/ Massachusetts	Bay State Seafood Express Corp	Bridge Terminal
American Institute of Architects Massachusetts	Beau's SFD Co Inc	C & C Lobster Co
Americold	Bens Seafood Inc DbA Bens Seafood	C & P Bait Inc
AML Fish International Inc	Bergie's Seafood, Inc	C & S W/S Grocers, Inc
Andy's Seafood Co., Inc	Beyond The Sea Imports, Inc	C & U Connection Inc
Ap Fish Co, Inc	Big G Seafood, Inc	C S Storage Iv Inc
Appalachian Mountain Club	Big Y Distribution Center	Climate Action Business Association
Aqua World Seafood Inc	Billingsgate Shellfish	Calamari Fisheries Inc
Aquacultural Research Corp	Black Pearl Seafood, LLC	Cambridge Packing Co, Inc
Aquaculture - Ma	Blackfish Creek Shellfish Co	Canal Seafood DbA
Aquaculture Association	Blount Fine Foods Corp	Fishermen's View
Aquanor Marketing, Inc.	Blue Harvest Foods LLC	Cape & Islands Self Reliance Corporation
Araho Transfer Co.	Blue Moon Oyster Co LLC	Cape Ann Fresh Catch
Arctic Cold Storage	Boston American Association of Retired Persons	Cape Ann Seafood Exchange Inc
Arctic Fresh Seafood	Boston Fish Mkt	Cape Cod Clam Co
Arnold's & Eddie's Foods, Inc DbA Arnold's Meats		

Cape Cod Commercial Fishermen's Alliance	Chatham Seafood Enterprises Db a Georges Fish	Crocker & Winsor SFDS, Inc
Cape Cod Commission	Chatham Shellfish Co	Cuttyhunk Shellfish Farms, Inc
Cape Cod Oyster Company	Checkmark Packing, Inc	D And N Provisions, Inc
Cape Cod Shellfish & Seafood	Cherry Street Fish Mkt	D'andrea Foods, Inc.
Cape Cod Stuffed Quahog Co, Inc	Chinese Progressive Association	David's Fish Mkt
Cape Fish & Lobster Co, Inc	Chinese American Citizens Alliance	Dawson Seafood
Cape Seafoods, Inc	Church	Db a Cape Ann Lobstermen
Cape Tip Seafood	City of Boston	Demello's Produce Mkt, Inc
Capt. Joe & Sons, Inc	The Clam Man	Demoulas SMKT, Inc
Capt. Marden's Seafoods, Inc.	Clean Water Action	Department Of Conservation And Recreation
Capt. Vince, Inc.	Climate Action Business Association	Dinatale Seafood Co Ii Inc
Captain Hutchins Fryers LLC	Codman Square Neighborhood Development Corporation	Massachusetts Division of Marine Fisheries
Captain Marden's Seafoods Inc	Cohasset Lobster Pound, Inc	Dockside Fisheries, Inc
Cargo Service Center Inc	Cold Storage Solutions I Inc	Dole & Bailey, Inc
Carlos Seafood	Collaborative Institute for Oceans, Climate And Security At UMASS Boston	Duxbury Mussels & Seafood Corp
Castle Hill Lobster Co	Commercial Brokers Association	Duxbury Oyster Company LLC
Center for Climate Change - Massachusetts General Hospital	Commercial Lobster Co, Inc	E & T Farms Inc
Center for Coastal Studies	Commodity Forwarders Inc.	East Bay Seafood Co Inc
Ceres	Consensus Building Institute	East Coast Seafood, Inc Db a Worldwide Perishables
Chambers of Commerce	Conservation Law Foundation	East Dennis Oyster Farm
Channel Fish Co, Inc	Constitution Seafoods Inc	Eastern Fisheries
Channel Fish Processing Co Inc	Continental Cold Storage, LLC	Eastern Fisheries / South Terminal
Charles River Conservancy	Coonamesett Farm Inc	Eastern Fisheries Inc
Charles River Watershed Association	Costa Fisheries Db a Outer Cape Lobster Co	Eastern Fisheries, Inc
Chatham Fish & Lobster Co	Cotuit Oyster Co, Inc	Edgartown Seafood, Inc
Chatham Light Seafood		Eastern Economic Association
Chatham Pier Fish Market Inc		Environmental Business Council

Environmental League of Massachusetts	Grassground Corp/ Cataumet Fish	Humarock Seafood
Environmental Protection Agency	Great Eastern Seafood Inc	Ice Cube, LLC
Essex Shellfish	Great Falls Aquaculture, LLC	Ideal Seafood, Inc
Everett Community Growers	Great Marsh Coalition	Interbay Seafoods Inc
Eversource	Greater Boston Interfaith Organization	Interfaith Power & Light
F.J. O'Hara & Sons, Inc	Greater Boston Physicians for Social Responsibility	International Association of Bridge, Structural, Ornamental And Reinforcing Iron Workers
F.W. Bryce, Inc	Greater Boston Real Estate Board	International Association of Heat And Frost Insulators And Asbestos Workers
Falmouth Fish Mkt, Inc	Green Justice Coalition	International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers Local 29
Federal Shell and Fish	Green Newton	International Brotherhood of Electrical Workers
Ferrullo's Wholesale SFD	Green Pond Fish'n Gear, Inc	International Brotherhood of Teamsters
Fisherman's Fleet, Inc	Green Ribbon Commission	International C Food, Inc
Fisherman's Wharf Gloucester	Greenroots	International Facility Management Association
Fishermen's Dock Co-Op, Inc	H And M Bay Inc	International Union of Bricklayers And Allied Craftworkers
Fosters SMKT	Harbormasters - Ma Harbormaster Association	International Union of Elevator Constructors
Four Seas	Harvard	International Union of Operating Engineers
Fraser Fish Ltd	Harvard Business School	International Union of Painters And Allied Trades
Fresh Catch, Inc, The	Harvester Seafood & Shellfish	Intershell International Corp
Fresh Direct, LLC Db	Hatch's Fish Market, Inc	Ipswich Maritime Products
Svenfish	Health Care Without Harm	Ipswich Shellfish Co, Inc
Fresh Line LLC Db	Henry Gonsalves Co.	Island Creek Oyster Inc
Sakanaya Boston	High Quality Seafood Corp	Island Food Products Corp
Galletta	Historic New England	J And B Freight Services
Harbard	Holbrook Oyster Ranch Inc	
Girls, Inc.	Home Harbor Seafood	
Global Heath - Harvard	Honeysuckle Oyster Farm LLC	
Gloucester House Waterfront	Hong Lung Seafood Co. Inc	
Gloucester Seafood Processing Inc	Huali Fish House Inc	
Gloucester Seafood Wholesalers LLC	Humarock Fish Co Db	
Goldwell Trading Corp	Nautical Mile Market	
Gorton's		

J Moniz Company Inc	Lou Joe's Fresh Seafood	Martinez Seafood Inc
J. Turner Seafoods Inc	Louie's Seafood, Inc Of Boston	Martino's Seafood LLC
J.T. Sea Products, Inc	Lynch Lobster Co., Inc	Mass Association of Conservation Commissions
J&A Whaling Seafood/ Dbawhaler Seafood	M & B Sea Products, Inc.	Mass Association of Planning Directors
James Hook & Company LLC	M And M Seafood	Mass Association of Regional Planning Agencies
JFC International Inc	M.F. Foley, Inc - Boston	Mass Audubon
JJ Bartlett (Ma Fishing Partnership)	M.F. Foley, Inc - New Bedford	Mass Bays Nep
Joe Seafood Trading Co Dbadennisport Lobster Co	MA Association of Realtors	Mass Land Trust Coalition
John Mantia & Sons Co, Inc	Ma Department of Public Health	Mass Rivers Alliance
John Nagle Co	MA Division of Ecological Restoration	Massachusetts Ambulance Association
Jolin Lobster	MA Harbor Safety Committee	Massachusetts Climate Action Network
Jordan Brothers Seafood, Inc	Ma Hospital Association	Massachusetts Coastal Coalition
Kapa Food Supply	Ma Lobsterman's Association	Massachusetts Emergency Management Agency
Kleinfelder	MA Medical Society	Massachusetts Fishing Partnership
Kneeland Brothers, Inc	MA Nurses Association	Massachusetts General Hospital And Partners
Kyler SFD, Inc DbakTyler's Catch	Magalhaes Inc Dbamarals	Massachusetts Office Of Coastal Zone Management
Laborers International Union Of North America	Mkt An State Fruit Food Service	Massachusetts Organization of Scientists and Engineers
Larsen's Fish Mkt	Massachusetts Affordable Housing Alliance	Massachusetts Rivers Alliance
Latino Food Distributors, Inc	Maine Coast Shellfish LLC	Massachusetts Department of Transportation
Leading Seafoods	Maloney Seafood Corp	Massachusetts Port Authority
Lee Matsueda	MAPC Contacts with Business Community	Maurice's Groceries
Legal Sea Foods LLC	MAPC Newsletter	Merry Shellfish Farm LLC
Liberty Lobster Company	Marder Trawling Inc	Dbamerry Oysters
Lisbon Seafood Inc	Mariner Seafood LLC	Metro Mayors Climate Preparedness Task Force
Little Harbor Lobster Company	Maritime Terminal	
Liveable Street Alliance	Maritime Terminal/West Terminal	
Lobster Pot	Martha's Vineyard Smokehouse	
Lobster Trap Co, Inc		
Lotzzos Inc		

Metropolitan Area Planning Council	New England Market LLC	Pacific American Fish Co Inc
Mike Carver's Fresh Seafood	New Ocean Dragon Lobster LLC	Pacific Seafood Co
Mit Ceepr	Newton Conservators	Panapesca Usa LLC
Massachusetts Marine Trades Association	North Atlantic Traders Ltd	Pangea Shellfish & Seafood Co, Inc
Monomoy Seafood Inc	North Coast Seafoods	Pangea Shellfish Company
Mortillaro Lobster Inc	North East Refrigerated Terminals Inc	Parker River Marine Farm Prod
Mullaney's Fish Market Corp	Northeast Refrigerated Distributing Co Inc	Partners Healthcare
Museums of Boston Collaborative	Northeastern University	Patriot Seafood
Mv Spear Point Oysters	Northern Edge Seafood	Perkins Paper LLC
Mystic River Watershed Association	Northern Pelagic Group, LLC	PFG Springfield
N.W.D., Inc	Northern Wind, Inc	Pier 7, Inc
Nantucket Lobster Trap Db	Nova Coldstore Corp	Pier Fish Co, Inc
Nantucket Bay Scallop Trading	NSD Seafood Inc. Db	Pigeon Cove Fishermans Co-Op
Nantucket Seafoods	Atlantic Fish & Seafood	Plymouth Rock Oyster Growers LLC
Nantucket Sound Seafood LLC	O.W. & B.S. Look Co., Inc.	Pocomo Meadow Oysters
Nantucket Specialty SFD Co	Ocean C Star LLC	Pog Group (Port Operators Group)
National Fish & Seafood, Inc	Ocean Choice International	Portugalia Imports Inc
National Grid	Ocean Crest Seafood, Inc	Powder Point Shellfish Farm
National Oceanic and Atmospheric Administration	Ocean Express LLC	Preferred Freezer Services
National Wildlife Federation	Ocean Gatherer's Transportation Inc	Preferred Freezer Services of Avon
Native Cape Cod Shellfish	Ocean Mac Inc	Preferred Freezer Services of Boston Harbor LLC
Nebula Foods, Inc.	Ocean River Institute	Preferred Freezer Services of Westfield, LLC
Neighborhood of Affordable Housing	Ocean State Lobster Co LLC	Prime Foodservice Inc Db
Net Result, The	Oceanair Inc Db	Sm Sneider Co
New Bedford Crab Company, Inc.	Oceanair Inc Db Perishables by Oceanair	Puritan Fish Co., Inc.
New England Aquarium	Oceans Dock Seafood (A Division of Oceans Fleet)	Quality Custom Packing Inc
New England Forestry Foundation	Oceans Fleet Fisheries, Inc	Quality Custom Packing, Inc
	Operative Plasterers and Cement Masons International Association Of The United States And Canada	Raw Art Works
	Orleans Seafood	Raw Seafoods, Inc.

Ray/Col Inc DbA: Masse's Fish Mkt	Shaws Supermarket #6652	The MA Hospital Association
Rd Mass Inc	Sheet Metal Workers International Association	The Matt Wright Co
Rd Mass Inc DbA Restaurant Depot	Sierra Club Mass Chapter	The Nature Conservancy Massachusetts
Red's Best	Signature Oysters	The Oyster Company
Red's Best DbA Menemsha Fish House	Silva Cameron	The Trustees of Reservations
Red's Best New Bedford	Slade Gorton & Co, Inc	This Old House
Reinhart Foodservice LLC	Smith	Thousand Chef Trading Corp
Richs Transportation Services Inc	Southeast Shellfish Inc	Tichon SFD Corp
Rockport Lobster	Souza Seafood Co	Tirrell Seafood and Shellfish DbA Portside Seafood
Rockport Specialty Seafood Inc	Specialty Foods Boston	Tom's Bait Tackle
Rocky Neck Fish Co LLC	Spence & Co Ltd	Transportation for Massachusetts
Rose Shellfish	SSL List	Trico Usa LLC
S & W Trading Co	St. Ours & Co	Trio Algarvio Seafood, Inc
S.S. Lobster Ltd.	Stanley Seafood Co.	Triunfo Foods Import & Export Corp
Salty Balls Seafood, LLC	State Street	True World Foods, Inc
Santoro Seafood Inc DbA the Net Result	Stavis Seafoods LLC	Trust for Public Land
Savage Seafoods, Inc	Steering Committee Newsletters	Turk's Seafood
Sayles Seafood	Steve Connolly Seafood Co, Inc	Urban Land Institute
Schermerhorn's Seafood	Stony Island Sea Farm	UMass Boston
Schucks Inc	Stop & Shop Smkt Co, Inc #7042	Union of Concerned Scientists
Sea Cap, Inc	Storm Surge	United Association of Journeymen and Apprentices of The Plumbing and Pipefitting Industry of the United States and Canada
Sea Fresh Usa Inc	Sunny's Sfd.	United Brotherhood of Carpenters & Joiners of America
Sea Holly Inc	Superior Lobster, LLC	United States Geological Survey
Sea Watch International	Sweet Neck Farm	
Seaport Catering Company	Sysco Boston LLC	
Seatrade International Co Inc	Taiyo Seafood Boston Inc	
Seatrade International LLC	Taurus Packing Co Inc	
Seaway Co	Taylor Cultured Seafood	
Seawitch Inc	Tempest Fisheries Ltd	
Shaheeen Bros Inc	The Big Rock Oyster Company	
	The Butchery Inc	

United Union of Roofers,
Waterproofers, And Allied
Workers
Urban Harbors Institute
US Green Building Council -
Ma Chapter
Waterfront Cold Store LLC
Waterways Transportation
Group
Wayne Hayes Seafood
Wellfleet Oyster
Wellfleet Shellfish Co
West Boylston Seafood
Whaling City Sfd Display
Auction
Whole Foods Market
WHSC, Inc Dba Mac's
Seafood
Wildfish LLC DBA
Menemsha Fish House
Wilmington Cold Storage
Wohrle's Foods, Inc
Wong Trading, Inc
Woodman's, Inc
Woods Seafood
Wulf Fish Wholesale
Wulf Fish Wholesale LLC
Yarmouth Oyster Farms Inc
Yell-O-Glow Corp
Youngs Trading Dba
Metropolitan Meat

D. SURVEY QUESTIONS



Survey on Climate Change Concerns for the Greater Boston Area

SURVEY INTRODUCTION

This survey will gather information about interests and concerns related to possible climate changes and their impacts in the Greater Boston Area, as defined by the service area of the Metropolitan Area Planning Council (MAPC) (see colored regions in map below). The target audience for the survey is people who, in a professional or volunteer capacity, help make decisions for organizations that could be influenced by climate change (e.g., a city planner, facilities manager, health care professional).

This survey is very important, as it will help guide scientific research to assist with planning for and addressing climate change issues. This project will expand the [2016 Boston Research Advisory Group \(BRAG\) project](#) to investigate climate changes and threats to the entire MAPC region, including the 101 cities and towns within the Greater Boston Area.

This survey will support a project being conducted by the School for the Environment (SFE) and the Urban Harbors Institute (UHI) at the University of Massachusetts Boston with the assistance of the MAPC. The Barr Foundation is providing funding for this project. For more details on this project, including a list of Steering Committee organizations, please visit: <https://www.umb.edu/gbrag>

It should take approximately 10-15 minutes to complete this survey. The survey will close on May 3rd.

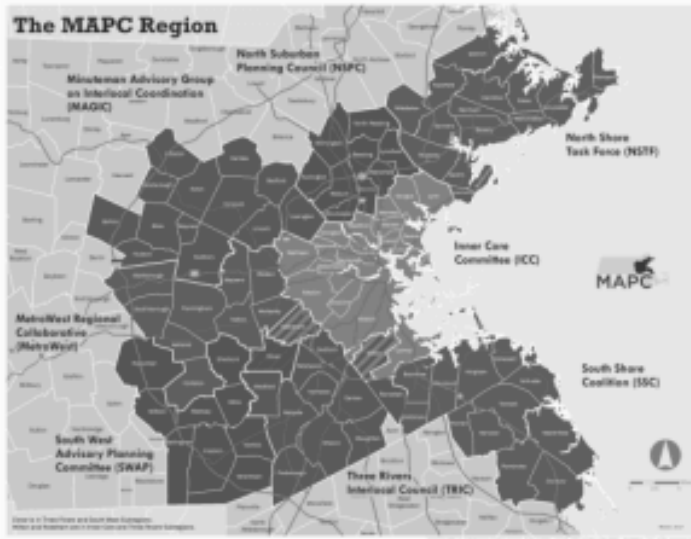
This survey is for research purposes, and your participation is anonymous and voluntary. You must be 18 years or older to participate. The data will be securely stored via [surveymonkey](#).

For questions, please contact:

Anna Valdez at UMass Boston at Anna.Valdez001@umb.edu or

Kim Starbuck at UHI at Kimberly.Starbuck@umb.edu

Map of MAPC Service Areas





Survey on Climate Change Concerns for the Greater Boston Area

PARTICIPANT INFORMATION

1. I currently work as a/an:

Check all that apply.

- Engineer
- Business Person/Entrepreneur
- Planner
- Health Care Professional
- Researcher/Scientist
- Emergency Service Provider
- Community Organizer
- Builder
- Volunteer
- NGO Employee
- Other (please specify)

* 2. What primary towns/cities do you work in or with in the Greater Boston Area?

Check all that apply.

- The entire Greater Boston Area (e.g., all of the communities listed below)
- Foxborough
- Newton-Waban
- Acton
- Framingham (all)
- Newton-West Newton
- Arlington-North
- Framingham-Saxonville
- Norfolk
- Arlington-South
- Framingham-Coburnville
- North Reading
- Ashland
- Framingham-Framingham Center
- Norwell
- Bedford
- Franklin
- Norwood
- Bellingham
- Gloucester
- Peabody
- Hamilton
- Pembroke

<input type="checkbox"/> Belmont	<input type="checkbox"/> Hanover	<input type="checkbox"/> Quincy
<input type="checkbox"/> Beverly	<input type="checkbox"/> Hingham	<input type="checkbox"/> Randolph
<input type="checkbox"/> Bolton	<input type="checkbox"/> Holbrook	<input type="checkbox"/> Reading
<input type="checkbox"/> Boston (all)	<input type="checkbox"/> Holliston	<input type="checkbox"/> Revere
<input type="checkbox"/> Boston -Allston	<input type="checkbox"/> Hopkinton	<input type="checkbox"/> Rockland
<input type="checkbox"/> Boston-Back Bay	<input type="checkbox"/> Hudson	<input type="checkbox"/> Rockport
<input type="checkbox"/> Boston-Beacon Hill	<input type="checkbox"/> Hull	<input type="checkbox"/> Salem
<input type="checkbox"/> Boston-Brighton	<input type="checkbox"/> Ipswich	<input type="checkbox"/> Saugus
<input type="checkbox"/> Boston-Chinatown	<input type="checkbox"/> Lexington	<input type="checkbox"/> Scituate
<input type="checkbox"/> Boston-Dorchester	<input type="checkbox"/> Lincoln	<input type="checkbox"/> Sharon
<input type="checkbox"/> Boston-Downtown	<input type="checkbox"/> Lynn	<input type="checkbox"/> Sherborn
<input type="checkbox"/> Boston-East Boston	<input type="checkbox"/> Lynnfield	<input type="checkbox"/> Somerville
<input type="checkbox"/> Boston-Ferway/Kenmore	<input type="checkbox"/> Malden	<input type="checkbox"/> Southborough
<input type="checkbox"/> Boston-Hyde Park	<input type="checkbox"/> Manchester	<input type="checkbox"/> Stoneham
<input type="checkbox"/> Boston-Jamaica Plain	<input type="checkbox"/> Manchester-By-The-Sea	<input type="checkbox"/> Stoughton
<input type="checkbox"/> Boston-Mattapan	<input type="checkbox"/> Marblehead	<input type="checkbox"/> Stow
<input type="checkbox"/> Boston-Mission Hill	<input type="checkbox"/> Marlborough	<input type="checkbox"/> Sudbury
<input type="checkbox"/> Boston-North End	<input type="checkbox"/> Marshfield	<input type="checkbox"/> Swampscott
<input type="checkbox"/> Boston-Roslindale	<input type="checkbox"/> Marshfield-Humarock	<input type="checkbox"/> Topsfield
<input type="checkbox"/> Boston-Roxbury	<input type="checkbox"/> Maynard	<input type="checkbox"/> Wakefield
<input type="checkbox"/> Boston-Seaport	<input type="checkbox"/> Medfield	<input type="checkbox"/> Walpole (all)
<input type="checkbox"/> Boston-South Boston	<input type="checkbox"/> Medford	<input type="checkbox"/> Walpole-East
<input type="checkbox"/> Boston-South End	<input type="checkbox"/> Medway	<input type="checkbox"/> Walpole-South
<input type="checkbox"/> Boston-West End	<input type="checkbox"/> Melrose	<input type="checkbox"/> Waltham (all)
<input type="checkbox"/> Boston-West Roxbury	<input type="checkbox"/> Middleton	<input type="checkbox"/> Waltham-North
<input type="checkbox"/> Boxborough	<input type="checkbox"/> Milford	<input type="checkbox"/> Waltham-South
<input type="checkbox"/> Braintree	<input type="checkbox"/> Millis	<input type="checkbox"/> Waltham-West
<input type="checkbox"/> Brookline	<input type="checkbox"/> Milton	<input type="checkbox"/> Wayland
<input type="checkbox"/> Burlington	<input type="checkbox"/> Natick	<input type="checkbox"/> Wellesley
<input type="checkbox"/> Cambridge	<input type="checkbox"/> Needham	<input type="checkbox"/> Wenham
<input type="checkbox"/> Canton	<input type="checkbox"/> Needham-Needham Heights	<input type="checkbox"/> Weston

- | | | |
|---|--|---|
| <input type="checkbox"/> Carlisle | <input type="checkbox"/> Newton (all) | <input type="checkbox"/> Westwood |
| <input type="checkbox"/> Chelsea | <input type="checkbox"/> Newton-Auburndale | <input type="checkbox"/> Weymouth |
| <input type="checkbox"/> Cohasset | <input type="checkbox"/> Newton-Chesnut Hill | <input type="checkbox"/> Weymouth-North |
| <input type="checkbox"/> Concord | <input type="checkbox"/> Newton-Newton Center | <input type="checkbox"/> Weymouth-South |
| <input type="checkbox"/> Danvers | <input type="checkbox"/> Newton-Newton Highlands | <input type="checkbox"/> Wilmington |
| <input type="checkbox"/> Dedham | <input type="checkbox"/> Newton-Lower Falls | <input type="checkbox"/> Winchester |
| <input type="checkbox"/> Dover | <input type="checkbox"/> Newton-Upper Falls | <input type="checkbox"/> Winthrop |
| <input type="checkbox"/> Duxbury | <input type="checkbox"/> Newton-Newtonville | <input type="checkbox"/> Woburn |
| <input type="checkbox"/> Essex | <input type="checkbox"/> Newton-Nonantum | <input type="checkbox"/> Wrentham |
| <input type="checkbox"/> Everett | | |
| <input type="checkbox"/> Other (please specify) | | |



Survey on Climate Change Concerns for the Greater Boston Area

Climate Change Impacts

* 3. Do you think climate change is currently impacting, or will impact in the future, the Massachusetts city(ies)/town(s) where you work?

- Yes
- No



Survey on Climate Change Concerns for the Greater Boston Area

Climate Change Impacts

The following questions will ask how you think climate change is impacting, or will impact, the following topics in the city(ies)/town(s) where you work.

- Transportation
- Housing
- Public health & safety
- The economy/business
- Governance
- Environmental resources (*e.g.*, wetlands, trees)
- Social justice and equality

You will also have the opportunity to identify other topics that could be impacted by climate change.



Survey on Climate Change Concerns for the Greater Boston Area

Climate Change Impacts - Transportation

* 4. In the Massachusetts communities where you work, are you concerned about how climate change impacts are affecting, or may affect in the future, TRANSPORTATION?

- Yes
- No

If you answered YES, please ANSWER the following questions on this page.

If you answered NO, please SKIP the following questions and scroll to the bottom of this page and click NEXT.

5. What climate conditions may impact or are impacting TRANSPORTATION?

- Sea level rise
- Coastal flooding
- Extreme temperatures
- Extreme storms
- OTHER.

Please list other climate conditions that may impact TRANSPORTATION (now or in future).

6. Please describe how these climate conditions may impact or are impacting TRANSPORTATION.

For example, station flooding.





Survey on Climate Change Concerns for the Greater Boston Area

Climate Change Impacts - Housing

* 7. In the Massachusetts communities where you work, are you concerned about how climate change impacts are affecting, or may affect in the future, HOUSING?

- Yes
- No

If you answered YES, please ANSWER the following questions on this page.

If you answered NO, please SKIP the following questions and scroll to the bottom of this page and click NEXT.

8. What climate conditions may impact or are impacting HOUSING?

- Sea level rise
- Coastal flooding
- Extreme temperatures
- Extreme storms
- OTHER.

Please list other climate conditions that may impact HOUSING (now or in future).

9. Please describe how these climate conditions may impact or are impacting HOUSING.

For example, house damage.





Survey on Climate Change Concerns for the Greater Boston Area

Climate Change Impacts - Public Health & Safety

* 10. In the Massachusetts communities where you work, are you concerned about how climate change impacts are affecting, or may affect in the future, PUBLIC HEALTH & SAFETY?

- Yes
- No

If you answered YES, please ANSWER the following questions on this page.

If you answered NO, please SKIP the following questions and scroll to the bottom of this page and click NEXT.

11. What climate conditions may impact or are impacting PUBLIC HEALTH & SAFETY?

- Sea level rise
- Coastal flooding
- Extreme temperatures
- Extreme storms
- OTHER.

Please list other climate conditions that may impact PUBLIC HEALTH & SAFETY (now or in future).

12. Please describe how these climate conditions may impact or are impacting PUBLIC HEALTH & SAFETY.

For example, restricted access to hospitals.





Survey on Climate Change Concerns for the Greater Boston Area

Climate Change Impacts - THE ECONOMY/BUSINESS

* 13. In the Massachusetts communities where you work, are you concerned about how climate change impacts are affecting, or may affect in the future, THE ECONOMY/BUSINESS?

- Yes
- No

If you answered YES, please ANSWER the following questions on this page.

If you answered NO, please SKIP the following questions and scroll to the bottom of this page and click NEXT.

14. What climate conditions may impact or are impacting THE ECONOMY/BUSINESS?

- Sea level rise
- Coastal flooding
- Extreme temperatures
- Extreme storms
- OTHER.

Please list other climate conditions that may impact THE ECONOMY/BUSINESS (now or in future).

15. Please describe how these climate conditions may impact or are impacting THE ECONOMY/BUSINESS.

For example, loss of labor productivity.





Survey on Climate Change Concerns for the Greater Boston Area

Climate Change Impacts - GOVERNANCE

* 16. In the Massachusetts communities where you work, are you concerned about how climate change impacts are affecting, or may affect in the future, GOVERNANCE?

- Yes
- No

If you answered YES, please ANSWER the following questions on this page.

If you answered NO, please SKIP the following questions and scroll to the bottom of this page and click NEXT.

17. What climate conditions may impact or are impacting GOVERNANCE?

- Sea level rise
- Coastal flooding
- Extreme temperatures
- Extreme storms
- OTHER.

Please list other climate conditions that may impact GOVERNANCE (now or in future).

18. Please describe how these climate conditions may impact or are impacting GOVERNANCE.

For example, changes in zoning.





Survey on Climate Change Concerns for the Greater Boston Area

Climate Change Impacts - ENVIRONMENTAL RESOURCES

* 19. In the Massachusetts communities where you work, are you concerned about how climate change impacts are affecting, or may affect in the future, ENVIRONMENTAL RESOURCES?

- Yes
- No

If you answered YES, please ANSWER the following questions on this page.

If you answered NO, please SKIP the following questions and scroll to the bottom of this page and click NEXT.

20. What climate conditions may impact or are impacting ENVIRONMENTAL RESOURCES?

- Sea level rise
- Coastal flooding
- Extreme temperatures
- Extreme storms
- OTHER.

Please list other climate conditions that may impact ENVIRONMENTAL RESOURCES (now or in future).

21. Please describe how these climate conditions may impact or are impacting ENVIRONMENTAL RESOURCES.

For example, loss of fish habitat.





Survey on Climate Change Concerns for the Greater Boston Area

Climate Change Impacts - SOCIAL JUSTICE & EQUALITY

* 22. In the Massachusetts communities where you work, are you concerned about how climate change impacts are affecting, or may affect in the future, SOCIAL JUSTICE & EQUALITY?

- Yes
 No

If you answered YES, please ANSWER the following questions on this page.

If you answered NO, please SKIP the following questions and scroll to the bottom of this page and click NEXT.

23. What climate conditions may impact or are impacting SOCIAL JUSTICE & EQUALITY?

- Sea level rise
 Coastal flooding
 Extreme temperatures
 Extreme storms
 OTHER.

Please list other climate conditions that may impact SOCIAL JUSTICE & EQUALITY (now or in future).

24. Please describe how these climate conditions may impact or are impacting **SOCIAL JUSTICE & EQUALITY**.

For example, lack of food security for vulnerable populations.





Survey on Climate Change Concerns for the Greater Boston Area

Climate Change Impacts - OTHER

* 25. In the Massachusetts communities where you work, are you concerned about how climate change impacts are affecting, or may affect in the future, OTHER TOPICS not previously mentioned?

- Yes
 No

If yes, please list other topics.

If you answered YES, please ANSWER the following questions on this page.

If you answered NO, please SKIP the following questions and scroll to the bottom of this page and click NEXT.

26. What climate conditions may impact or are impacting the topics you listed for OTHER?

- Sea level rise
- Coastal flooding
- Extreme temperatures
- Extreme storms
- OTHER.

Please list other climate conditions that may impact the topics you listed for OTHER (now or in future).

27. Please describe how these climate conditions may impact or are impacting the topics you listed for OTHER.

For example, damage to infrastructure.

26. What climate conditions may impact or are impacting the topics you listed for OTHER?

- Sea level rise
- Coastal flooding
- Extreme temperatures
- Extreme storms
- OTHER.

Please list other climate conditions that may impact the topics you listed for OTHER (now or in future).

27. Please describe how these climate conditions may impact or are impacting the topics you listed for OTHER.

For example, damage to infrastructure.



Survey on Climate Change Concerns for the Greater Boston Area

Climate Change Data & Special Reports

28. Are you aware of any climate change projections and/or data that could be shared with others?

Yes

No

If applicable, please describe data.

29. We plan to produce 1-2 Special Reports on topics of interest to the region. For example, the wide uncertainty in the contributions of glacier and ice melt to sea level rise, the relative roles of urbanization and climate change on stormwater flows, retreat as an adaptation option, possible increase in forest fires in metro Boston, changing groundwater levels, etc.

Do you have any suggestions for Special Reports?

If yes, please describe below.

Yes

No

If yes, please describe.



Survey on Climate Change Concerns for the Greater Boston Area

30. If you are willing, we would appreciate if you provided your name and contact information to give us a better sense of who participated in the survey. Your responses will not be linked to your contact information.

If you would like to remain anonymous, please leave these lines blank.

Name

Company

31. Would you like to receive e-mail updates about this project?

Yes

No

If yes, please provide your email address.

Thank you for participating in this survey. We greatly appreciate your time. If you have any questions or additional comments, please contact Anna Valdez with UMass Boston at Anna.Valdez001@umb.edu or Kim Starbuck with the Urban Harbors Institute at Kimberly.Starbuck@umb.edu.

Please click **DONE** below to complete the survey.

E. CODE DEFINITIONS

- a) Impacts: *climate change Impacts*
- a. Environmental: *To do with physical and chemical aspects of the environment.*
 - i. Acidification: *Decrease of pH of water causing it to be more acidic.*
 - 1. Fresh Water: *Acidification of freshwater sources.*
 - 2. Ocean: *Acidification of saltwater sources.*
 - ii. Air Quality: *The measurement of how many particles are in the air.*
 - iii. Biomass: *Organic matter.*
 - iv. Carbon Sequestration: *Removal of Carbon Dioxide from the air and transformed into solid or liquid form.*
 - v. Coastal Dynamics: *The movement and changes of the coastline and its features.*
 - vi. Coastal Management: *The process of placing infrastructure to protect and maintain coastlines.*
 - vii. Contamination: *The quality of a substance becoming impure.*
 - viii. Desertification: *The process of land becoming dry and arid.*
 - ix. Drought: *Shortage of precipitation for long periods of time.*
 - x. Ecology: *Habitat of organisms and its physical environment.*
 - xi. Erosion: *The removal process of rocks, soil, and sand due to wind or water.*
 - 1. Inland: *The erosion process not on a saltwater coastline.*
 - 2. Coastal: *The erosion process on a saltwater coastline.*
 - xii. Evaporation: *The process of water transforming from a liquid to a gas.*
 - xiii. Fauna: *All wild living life forms.*
 - xiv. Fire: *Combustion of fuel and oxygen.*
 - xv. Flooding: *The process of excess water in a normally dry area.*
 - 1. Coastal: *The process of excess saltwater in a normally dry area.*
 - 2. Frequency: *How often excess water is found in a normally dry area.*
 - 3. Inland: *The process of excess freshwater in a normally dry area.*
 - xvi. Flora: *All living organic plant matter.*
 - 1. Trees: *A perennial plant that has leaves, trunk, branches, and fruit.*
 - xvii. Groundwater: *Water found underground in pores of rocks and soil.*
 - xviii. Habitat Loss: *The loss of natural for plants and animals.*
 - xix. Ice/Snow: *Frozen and solid water precipitation.*
 - xx. Invasive Species: *Non-native species that typically multiply quickly and overtake native habitats.*
 - xxi. Leaching: *The process of toxics or unwanted water-soluble matter contaminating fresh water sources.*
 - xxii. Natural Resources: *Material that occurs in a natural habitat.*

- xxiii. Ozone: *Trioxxygen that is made up of three oxygen particles.*
- xxiv. Precipitation: *The process of water vapor transforming into liquid water and falling from the sky onto the earth. Often referred to as rain.*
 - 1. Frequency: *How much and how often precipitation happens.*
- xxv. Sea Level Rise: *The increase of height sea level compared to historical averages.*
- xxvi. Soil: *Mixture of organic matter, sand, and minerals. Also known as dirt.*
- xxvii. Storm: *Increase intensity of wind, precipitation, and/or lighting storm caused by a disturbance in the atmosphere.*
 - 1. Coastal: *Storm that forms over the ocean.*
 - 2. Inland: *Storm that forms over land.*
 - 3. Winter: *Storm that happens during the winter season with the addition of ice and snow.*
 - 4. Frequency: *How often storms occur.*
- xxviii. Storm Surge: *The increase of sea or ocean height during a storm due to wind or atmospheric pressures.*
- xxix. Stormwater: *Water from a precipitation event.*
- xxx. Surface Water: *Fresh water on earth's surface like rivers, lakes, and ponds.*
- xxxi. Temperature: *The measurement of something as hot or cold.*
 - 1. Air High: *The high range of air temperature.*
 - 2. Air Low: *The low range of air temperature.*
 - 3. Humidity: *The measurement of water vapor present in the air.*
 - 4. Ocean: *The temperature of saltwater.*
 - 5. Surface: *The temperature of surface water.*
- xxxii. Vector Borne: *Human disease caring organism.*
- xxxiii. Water Quality: *The measurement of physical, chemical, and biological characteristics of water to determine if it is clean or not.*
 - 1. Beach: *The measurement of saltwater quality.*
- xxxiv. Wave: *A body of water breaking on a shore.*
- xxxv. Wetland: *A habitat that consists of saturated land.*
- xxxvi. Wind: *The movement of air over the earth's surface.*
- b. Economic: *Pertaining to the movement of money for goods and services.*
 - i. Agriculture: *Economics of farming of crops or production of livestock.*
 - ii. Fishing: *Economics of capturing aquatic organisms.*
 - iii. Industry: *Economics of production of goods.*
 - iv. Tourism: *Economics of people who travel for pleasure.*
- c. Health and Safety: *Protecting the overall health and safety of human lives.*
 - i. First Responders: *Fireman, policemen, and ambulance workers who respond to emergency calls first.*
 - ii. Mold: *The growth of fungus that can be harmful to humans and animals.*
 - iii. Public Health: *The health of a human community and the study of*

- diseases.*
- d. Infrastructure: *Man-made structures that supply or remove goods and services for communities.*
 - i. Coastal: *Infrastructure is structures that are built on a saltwater coastline.*
 - ii. Dam: *Infrastructure that holds water or restricts water flow.*
 - iii. Energy: *Infrastructure that supplies energy to homes and businesses.*
 - iv. Industry: *Infrastructure for industries and businesses.*
 - v. Stormwater: *Infrastructure for stormwater like pipes and culverts.*
 - vi. Waste: *Facilities that remove waste.*
 - vii. Wastewater: *Infrastructure that removes and cleans human wastewater.*
 - viii. Water: *Infrastructure that supplies and cleans drinkable water.*
 - e. Governance: *Societal needs and impacts relating to climate change.*
 - i. Adaptation: *The process of changing something to better suit its environment.*
 - ii. Communication: *The process of exchanging information.*
 - iii. Crime: *The breaking of laws.*
 - iv. Education: *Teaching information to someone to become knowledgeable.*
 - v. Food: *Edible organic matter to is grown or made.*
 - vi. Historical/Culture: *Structures or locations that hold historical significance. Structure or location that hold cultural significance.*
 - vii. Housing: *A structure that is lived in.*
 - viii. Map/Model: *Computerized model of a physical event. A map of physical features to show information. Like FEMA flood maps or wave action model.*
 - ix. Migration: *The movement of humans from one location to another.*
 - 1. Vulnerable: *Population who have physical or emotional characteristics that increase their level of risk.*
 - x. Policy: *Laws, permits, guidelines made by a governing body.*
 - xi. Preparedness: *The act of being prepared.*
 - xii. Preparedness Communication: *The act of discussing and exchanging preparedness information.*
 - xiii. Social Justice: *Societal rights among different demographics in communities.*
 - f. Transportation: *The movement of a person or people typically by cars.*
 - i. Airport: *Air transportation or airport location.*
 - ii. Mass Transit: *Transportation of people by mass transit like trains, trolleys, or buses.*
- b) Clusivity
- a. Community: *A group of people who live or work in a physical location.*
 - b. Cultural: *Structure or location that hold cultural significance.*
 - c. Historical: *Structures or locations that hold historical significance.*

- d. Vulnerable:
 - i. Disabled: *A person or people who is disabled.*
 - ii. ELL (English Language Learner): *A person or people who speak a language(s) other than English.*
 - iii. Elderly: *A person or people who are over the age of 60 years old.*
 - iv. House: *A person or people who lack stable and safe housing.*
 - v. Low-Income: *A person or people who make less than the majority of their community or region.*
 - vi. Medical: *A person or people who have medical and/or health issues.*
 - vii. Minorities: *A person or people who are a part of a minority demographic.*
 - viii. Refugees: *A person or people who comes to the United States as a refugee.*
 - ix. Transportation: *A person or people who do not have access to transportation.*
 - x. Undocumented: *A person or people who do not hold citizenship in the United States.*
 - xi. Veterans: *A person or people who have served the United States in the military.*
 - xii. Youth: *A person or people under the age of 18.*
 - xiii. Isolated: *A person or people who are alone with limited mobility.*
- e. We: *Inclusive term used to inclusive the writing with the group being described.*
- c) Occupation: *A profession that a person or people hold.*
 - a. Architect: *A person who designs buildings.*
 - b. Builder: *A person who builds structures.*
 - c. Business: *A person who works for or owns a business.*
 - d. Citizen: *A member of a community.*
 - e. Community Organizer: *A person who works with a larger organization to improve an aspect of a community.*
 - f. Consultant: *A person who gives professional advice.*
 - g. Economic: *A person who works with money in exchange with goods and services.*
 - i. Government: *A person who works for the government in the field of economics.*
 - h. Educator: *A person who teaches others so they can be knowledgeable in a subject from elementary school to college.*
 - i. Energy: *A person who works in the energy sector.*
 - j. Engineering: *A person who designs, builds, or maintains structures or services.*
 - k. Environmental Field: *A person who works in the field of environmental science.*
 - l. Fishery: *A person who works in the field of capturing aquaculture for consumption.*

- m. Government: *A person who works for local, state, or federal government.*
- n. Health: *A person who works in the health care field.*
- o. Lawyer: *A person who works in the law field.*
- p. NGO (Non-governmental Organization): *A person who works for a nonprofit organization.*
- q. Other: *A person whose position did not fit in one of the other categories.*
- r. Retired: *A person who has retired from their occupation.*
- s. Unemployment: *A person who is not currently employed.*
- t. Planning: *A person who plans out physical features of urban areas for best land use.*
 - i. Government: *A person who works for the government in the field of planning.*
- u. Religion: *A person who works for a religious organization as a priest, pastor, rabbi, or other.*
- v. Scientist: *A person who works in the field of science.*
- w. Transportation: *A person who works in the transportation sector.*
- x. Volunteer: *A person who volunteers their time for an organization.*

F. RAW DATA

	Community Workshops	MVP	Survey	2.0 Survey
Impacts	0	0	1	0
Environmental	54	11	107	163
Acidification	0	0	0	0
Acidification - Fresh Water	0	0	1	0
Acidification - Ocean	0	0	0	0
Air Quality	14	15	27	37
Biomass	0	3	0	1
Carbon Sequestration	6	2	0	3
Coastal Dynamics	0	1	0	0
Coastal Management	1	18	6	12
Contamination	20	69	15	46
Desertification	0	0	0	1
Drought	38	102	11	42
Ecology	11	11	11	28
Erosion	10	23	5	17
Erosion - Inland	1	6	2	3
Erosion - Coastal	2	26	4	8
Evaporation	1	0	0	1
Fauna	51	31	24	90
Fire	1	36	2	12
Flooding	124	152	37	76
Flooding - Coastal	6	33	584	797
Flooding - Frequency	4	1	1	9
Flooding - Inland	15	54	32	39
Flora	51	29	16	82
Flora - Trees	4	84	20	0
Groundwater	74	59	4	23
Habitat Loss	0	12	32	89
Ice/Snow	22	97	14	38
Invasive Species	14	31	9	23
Leaching	2	12	6	11
Natural Resources	34	66	15	25

	Community Workshops	MVP	Survey	2.0 Survey
Ocean Acidification	0	1	2	12
Ozone	1	0	0	1
Precipitation	116	123	23	40
Precipitation - Frequency	7	11	0	8
Sea Level Rise	38	58	573	786
Soil	13	8	4	3
Storm	46	111	671	990
Storm - Coastal	2	16	1	7
Storm - Inland	0	1	2	0
Storm - Winter	5	40	1	6
Storm-Frequency	0	12	0	8
Storm Surge	9	33	7	9
Stormwater	38	84	11	45
Surface Water	20	68	8	26
Temperature	83	64	608	816
Temp - Air High	29	91	43	43
Temp - Air Low	5	18	6	4
Temp - Humidity	3	1	2	1
Temp - Ocean	2	3	11	30
Temp - Surface	6	12	4	4
Vector Borne	31	23	28	38
Water Quality	49	80	21	84
Water Quality - Beach	2	1	0	6
Wave	0	9	3	0
Wetland	22	56	11	31
Wind	13	89	18	22

	Community Workshops	MVP	Survey	2.0 Survey
Clusitivity	3	2	1	0
Community	42	51	4	50
Cultural	12	18	0	13
Historical	3	12	1	5
Refugees	0	4	0	7
Vulnerable	42	95	31	103
Disabled	2	14	1	2
ELL	1	23	3	5
Elderly	9	63	24	15
House	0	32	18	11
Low-Income	8	36	49	44
Medical	1	24	8	5
Minorities	0	5	7	7
Transportation	1	11	0	7
Undocumented	0	6	3	0
Veterans	0	3	0	0
Youth	2	18	10	6
Isolated	1	2	8	4
We	0	0	1	4
Economic	82	42	157	264
Economic - Agriculture	15	19	14	34
Economic - Fishing	6	8	19	26
Economic - Industry	9	19	29	47
Economic - Tourism	3	0	6	19
Health and Safety	13	50	122	184
First Responders	7	49	18	64
Mold	1	2	14	14
Public Health	109	49	79	82

	Community Workshops	MVP	Survey	2.0 Survey
Infrastructure	56	108	46	127
Infrastructure - Coastal	0	25	18	4
Infrastructure - Dam	1	53	1	2
Infrastructure - Energy	40	126	73	99
Infrastructure - Industry	5	4	3	5
Infrastructure - Stormwater	3	103	2	0
Infrastructure - Waste	0	2	3	4
Infrastructure - Wastewater	27	64	15	26
Infrastructure - Water	47	105	28	33
Governance	42	39	80	170
Adaptation	28	34	9	44
Communication	5	83	13	15
Crime	0	2	1	2
Education	22	32	5	12
Food	6	23	43	50
Historical/ Culture	10	13	1	13
Housing	114	102	139	222
Map/Model	40	12	1	39
Migration	25	3	19	54
Mitigation - Vulnerable	53	116	30	139
Policy	32	26	29	79
Preparedness	0	37	7	0
Preparedness Communication	30	57	3	48
Social Justice	33	19	87	146
Transportation	95	143	165	242
Airport	0	2	1	0
Mass Transit	12	32	55	90

	Community Workshops	MVP	Survey	2.0 Survey
Location	4	1	1	0
Boston	0	0	0	1
Greater Boston	0	0	34	43
ICC	22	11	104	113
MAGIC	23	7	12	17
MWGMC	12	4	11	33
NSPC	0	3	11	18
NSTF	17	10	13	50
Outside of Greater Boston	0	0	5	4
SSC	17	5	15	28
SWAP	10	4	3	11
TRIC	17	5	9	18
Occupation	1	0	1	1
Architect	0	0	15	5
Builder	0	0	0	2
Business	0	0	24	11
Citizen	2	0	1	1
Community Organizer	0	0	19	17
Consultant	0	0	5	8
Economic	0	0	2	1
Government	1	0	0	0
Educator	0	0	3	17
Energy	0	0	2	0
Engineering	1	0	16	17
Environmental Field	0	0	5	5
Fishery	0	0	8	1
Government	20	0	9	23
Health	0	0	24	9
Lawyer	0	0	2	0
NGO	0	0	21	24
Other	0	0	0	0
Retired	0	0	0	1
Unemployment	0	0	0	1
Planning	13	0	12	74
Government	13	0	0	1
Religion	0	0	2	0
Scientist	2	0	12	34
Transportation	0	0	0	2
Volunteer	0	0	19	36

	Coastal	Inland	N/A
Impacts	1	0	0
Environmental	193	133	9
Acidification	0	0	0
Acidification - Fresh Water	1	0	0
Acidification - Ocean	0	0	0
Air Quality	50	42	1
Biomass	2	2	0
Carbon Sequestration	4	5	2
Coastal Dynamics	1	0	0
Coastal Management	35	2	0
Contamination	70	78	2
Desertification	1	0	0
Drought	55	131	7
Ecology	28	32	1
Erosion	41	12	2
Erosion - Inland	4	8	0
Erosion - Coastal	38	1	1
Evaporation	1	0	1
Fauna	82	108	6
Fire	21	30	0
Flooding	123	247	19
Flooding - Coastal	1124	295	1
Flooding - Frequency	9	5	1
Flooding - Inland	51	87	2
Flora	68	109	1
Flora - Trees	29	79	0
Groundwater	37	116	7
Habitat Loss	86	47	0
Ice/Snow	49	121	1
Invasive Species	27	50	0
Leaching	20	11	0
Natural Resources	63	70	7

	Coastal	Inland	N/A
Ocean Acidification	14	1	0
Ozone	0	2	0
Precipitation	80	207	15
Precipitation - Frequency	12	11	3
Sea Level Rise	1124	322	9
Soil	7	21	0
Storm	1143	673	2
Storm - Coastal	23	3	0
Storm - Inland	2	1	0
Storm - Winter	17	35	0
Storm- Frequency	11	9	0
Storm Surge	44	13	1
Stormwater	64	110	4
Surface Water	34	87	1
Temperature	931	630	10
Temp - Air High	84	118	4
Temp - Air Low	12	19	2
Temp - Humidity	3	2	2
Temp - Ocean	36	9	1
Temp - Surface	10	15	1
Vector Borne	47	69	4
Water Quality	92	133	9
Water Quality - Beach	7	2	0
Wave	11	1	0
Wetland	61	54	5
Wind	51	91	0

	Coastal	Inland	N/A
Clusitivity	4	2	0
Community	77	65	5
Cultural	24	17	2
Historical	11	10	0
Refugees	6	5	0
Vulnerable	130	134	7
Disabled	4	14	1
ELL	14	17	1
Elderly	39	70	2
House	27	34	0
Low-Income	76	60	1
Medical	15	23	0
Minorities	12	7	0
Transportation	11	8	0
Undocumented	5	4	0
Veterans	0	3	0
Youth	15	19	2
Isolated	8	7	0
We	3	2	0
Economic	322	210	13
Economic - Agriculture	27	54	1
Economic - Fishing	53	5	1
Economic - Industry	65	39	0
Economic - Tourism	24	4	0
Health and Safety	216	153	0
First Responders	78	58	2
Mold	19	12	0
Public Health	127	177	15
Infrastructure	171	159	7
Infrastructure - Coastal	45	2	0
Infrastructure - Dam	8	49	0
Infrastructure - Energy	151	186	1
Infrastructure - Industry	5	11	1
Infrastructure - Stormwater	38	70	0
Infrastructure - Waste	5	4	0
Infrastructure - Wastewater	66	61	5
Infrastructure - Water	63	141	9

	Coastal	Inland	N/A
Governance	180	145	6
Adaptation	58	53	4
Communication	44	72	0
Crime	2	3	0
Education	38	31	2
Food	60	61	1
Historical/ Culture	20	15	2
Housing	305	256	16
Map/Model	37	48	7
Migration	65	31	5
Mitigation - Vulnerable	165	166	7
Policy	83	80	3
Preparedness	22	22	0
Preparedness Communication	69	67	2
Social Justice	168	113	4
Transportation	355	278	12
Airport	2	1	0
Mass Transit	119	69	1
Location	1	4	1
Boston	1	0	0
Greater Boston	73	4	0
ICC	157	87	6
MAGIC	16	43	0
MWGMC	8	52	0
NSPC	16	16	0
NSTF	80	8	2
Outside of Greater Boston	7	1	1
SSC	54	6	5
SWAP	5	23	0
TRIC	13	36	0

	Coastal	Inland	N/A
Occupation	2	1	0
Architect	15	5	0
Builder	2	0	0
Business	19	15	1
Citizen	3	1	0
Community Organizer	27	9	0
Consultant	8	5	0
Economic	2	1	0
Government	1	0	0
Educator	6	14	0
Energy	2	0	0
Engineering	19	15	0
Environmental Field	9	1	0
Fishery	9	0	0
Government	24	25	3
Health	18	15	0
Lawyer	2	0	0
NGO	32	13	0
Other	0	0	0
Retired	0	1	0
Unemployment	0	0	1
Planning	60	37	2
Government	5	7	2
Religion	0	2	0
Scientist	40	8	0
Transportation	1	1	0
Volunteer	23	32	0

	NSTF	MAGIC	MWGMC	NSPC	ICC	Greater Boston	UNK	Outside of Greater Boston	SSC	SWAP	TRIC
Impacts	0	0	0	0	0	0	0	0	1	0	0
Environmental	29	16	23	15	105	105	0	2	12	10	18
Acidification	0	0	0	0	0	0	0	0	0	0	0
Acidification - Fresh Water	0	0	0	0	1	0	0	0	0	0	0
Acidification - Ocean	0	0	0	0	0	0	0	0	0	0	0
Air Quality	3	11	9	2	37	27	0	0	0	2	2
Biomass	1	0	0	0	0	1	0	0	0	0	2
Carbon Sequestration	3	0	0	0	0	3	0	0	1	3	1
Coastal Dynamics	1	0	0	0	0	0	0	0	0	0	0
Coastal Management	15	0	1	0	6	9	0	0	6	0	0
Contamination	16	15	14	4	31	28	0	0	12	10	20
Desertification	0	0	0	0	1	0	0	0	0	0	0
Drought	27	42	15	10	17	27	0	0	23	14	18
Ecology	7	7	8	3	17	14	0	0	1	0	4
Erosion	16	2	0	2	16	13	0	0	6	0	0
Erosion - Inland	1	3	3	0	3	0	0	0	1	1	0
Erosion - Coastal	21	0	0	0	4	9	0	1	5	0	0
Evaporation	0	0	0	0	1	1	0	0	0	0	0
Fauna	22	29	18	21	38	46	0	0	7	3	12
Fire	15	8	6	0	11	1	0	0	1	3	6
Flooding	56	41	59	30	93	25	0	1	28	24	32
Flooding - Coastal	137	11	28	21	532	613	0	6	60	4	8
Flooding - Frequency	3	1	1	1	4	5	0	0	0	0	0
Flooding - Inland	15	5	14	14	31	30	0	1	9	12	9
Flora	22	29	17	12	37	30	0	0	4	4	23
Flora - Trees	9	16	14	6	29	4	0	0	11	6	13
Groundwater	13	35	14	13	19	13	0	1	15	16	21
Habitat Loss	12	7	8	3	36	56	0	0	4	2	5
Ice/Snow	12	23	14	12	48	18	0	1	10	9	24
Invasive Species	7	14	6	7	12	14	0	0	1	5	11
Leaching	7	0	2	0	6	9	0	0	3	0	4
Natural Resources	29	25	9	4	29	22	0	0	10	7	5

	NSTF	MAGIC	MWGMGMC	NSPC	ICC	Greater Boston	UNK	Outside of Greater Boston	SSC	SWAP	TRIC
Ocean Acidification	4	0	0	0	2	8	0	0	1	0	0
Ozone	0	0	0	1	1	0	0	0	0	0	0
Precipitation	45	50	19	30	43	39	0	1	23	21	31
Precipitation - Frequency	4	4	1	1	12	0	0	0	3	0	1
Sea Level Rise	155	17	34	23	535	599	0	5	72	4	11
Soil	0	11	2	5	3	3	0	0	3	0	1
Storm	144	72	164	45	627	620	0	11	66	27	42
Storm - Coastal	17	0	0	0	1	5	0	0	2	0	1
Storm - Inland	0	0	0	0	0	2	0	0	1	0	0
Storm - Winter	11	5	1	6	15	0	0	0	1	5	8
Storm - Frequency	3	3	2	0	1	6	0	0	3	0	2
Storm Surge	28	0	0	1	18	8	0	0	2	0	1
Stormwater	25	13	18	9	33	33	0	2	16	12	17
Surface Water	15	16	9	15	19	11	0	0	12	12	13
Temperature	86	75	134	51	575	527	0	11	37	25	50
Temp - Air High	20	24	15	6	76	28	0	1	10	6	20
Temp - Air Low	7	7	1	0	7	4	0	0	0	5	2
Temp - Humidity	1	0	0	0	3	3	0	0	0	0	0
Temp - Ocean	8	2	0	1	7	22	0	0	4	0	2
Temp - Surface	2	1	0	3	9	4	0	0	2	1	4
Vector Borne	16	16	11	9	32	21	0	0	3	5	7
Water Quality	22	30	22	15	43	47	0	0	15	15	25
Water Quality - Beach	3	0	0	1	1	4	0	0	0	0	0
Wave	6	0	0	0	2	0	0	0	4	0	0
Wetland	29	12	11	6	17	20	0	0	11	9	5
Wind	24	19	13	8	36	10	0	0	12	6	14

	NSTF	MAGIC	MWGMGMC	NSPC	ICC	Greater Boston	UNK	Outside of Greater Boston	SSC	SWAP	TRIC
Clusitivity	4	0	0	1	1	0	0	0	0	0	0
Community	28	12	10	6	45	24	0	0	5	5	12
Cultural	12	3	1	2	15	6	0	0	1	0	3
Historical	8	4	0	0	4	3	0	0	1	0	1
Refugees	0	0	1	1	4	5	0	0	0	0	0
Vulnerable	33	19	23	13	86	50	0	0	14	10	23
Disabled	2	0	3	0	8	0	0	0	2	3	1
ELL	2	4	3	2	16	3	0	0	1	0	1
Elderly	10	10	11	7	33	8	0	0	10	9	13
House	8	3	7	4	21	10	0	0	1	4	3
Low-Income	15	8	14	3	60	22	0	0	6	3	6
Medical	5	4	3	3	13	3	0	0	1	2	4
Minorities	1	0	2	0	13	2	0	0	0	0	1
Transportation	3	2	0	0	7	4	0	0	0	2	1
Undocumented	0	1	0	2	6	0	0	0	0	0	0
Veterans	0	0	0	0	0	0	0	0	0	3	0
Youth	2	1	0	3	17	5	0	0	0	3	5
Isolated	1	1	2	0	8	2	0	0	1	0	0
We	1	0	0	0	0	4	0	0	0	0	0
Economic	58	14	41	18	183	160	0	3	28	7	33
Economic - Agriculture	4	20	7	6	27	15	0	0	0	3	0
Economic - Fishing	19	0	0	0	11	23	0	0	6	0	0
Economic - Industry	13	7	7	4	40	26	0	0	4	0	3
Economic - Tourism	9	2	1	0	6	9	0	0	1	0	0
Health and Safety	37	18	29	11	119	120	0	5	7	7	16
First Responders	17	11	15	6	38	35	0	0	9	2	5
Mold	1	1	2	1	13	13	0	0	0	0	0
Public Health	30	40	23	17	112	55	0	0	7	10	25

	NSTF	MAGIC	MWGMCM	NSPC	ICC	Greater Boston	UNK	Outside of Greater Boston	SSC	SWAP	TRIC
Infrastructure	52	33	31	11	92	70	0	0	16	6	26
Infrastructure - Coastal	17	0	0	0	6	12	0	0	12	0	0
Infrastructure - Dam	7	14	6	0	12	1	0	0	4	7	6
Infrastructure - Energy	37	37	27	19	96	66	0	1	21	8	26
Infrastructure - Industry	2	0	3	0	9	1	0	0	1	0	1
Infrastructure - Stormwater	19	15	9	8	28	0	0	0	9	9	11
Infrastructure - Waste	0	0	0	0	6	3	0	0	0	0	0
Infrastructure - Wastewater	23	9	10	8	26	18	0	0	18	10	10
Infrastructure - Water	28	41	12	10	37	21	0	0	19	30	15
Governance	29	19	28	10	104	98	0	3	15	5	20
Adaptation	17	12	7	8	27	23	0	0	10	3	8
Communication	19	18	5	8	28	14	0	1	8	4	11
Crime	0	1	1	0	0	1	0	1	0	1	0
Education	19	6	3	3	22	8	0	0	4	2	4
Food	9	9	18	1	43	29	0	0	2	7	4
Historical/ Culture	9	3	0	2	10	6	0	0	2	0	5
Housing	55	36	42	31	193	139	0	2	33	14	32
Map/Model	7	4	7	9	32	20	0	0	4	0	9
Migration	10	3	5	4	29	41	0	0	8	0	1
Mitigation - Vulnerable	36	26	34	13	104	67	0	0	18	14	26
Policy	30	11	7	11	46	40	0	0	9	8	4
Preparedness	9	6	1	0	18	1	0	0	5	1	3
Preparedness Communication	27	10	8	6	38	22	0	0	10	5	12
Social Justice	17	12	23	16	109	90	0	1	7	2	8
Transportation	91	38	54	27	196	152	0	3	37	16	31
Airport	0	0	0	0	2	0	0	0	0	0	1
Mass Transit	20	3	14	2	78	55	0	0	7	3	7

	NSTF	MAGIC	MWGMC	NSPC	ICC	Greater Boston	UNK	Outside of Greater Boston	SSC	SWAP	TRIC
Location	1	2	0	1	1	0	0	0	1	0	0
Boston	0	0	0	0	1	0	0	0	0	0	0
Greater Boston	0	0	0	0	0	77	0	0	0	0	0
ICC	0	0	0	0	179	71	0	0	0	0	0
MAGIC	0	35	0	2	1	20	0	1	0	0	0
MWGMC	0	0	45	0	0	15	0	0	0	0	0
NSPC	0	0	0	14	2	16	0	0	0	0	0
NSTF	51	0	0	0	1	38	0	0	0	0	0
Outside of Greater Boston	0	0	0	0	1	2	0	6	0	0	0
SSC	0	0	0	0	1	30	0	0	34	0	0
SWAP	0	0	0	10	0	9	0	0	0	9	0
TRIC	0	0	0	0	1	16	0	0	0	3	29
Occupation	1	0	1	0	0	1	0	0	0	0	0
Architect	0	0	1	0	9	10	0	0	0	0	0
Builder	0	0	0	0	0	2	0	0	0	0	0
Business	0	0	4	0	15	8	0	4	2	0	2
Citizen	1	0	0	0	1	1	0	0	0	0	1
Community Organizer	2	0	0	1	17	15	0	0	0	0	1
Consultant	1	1	0	1	4	6	0	0	0	0	0
Economic	0	0	0	0	2	1	0	0	0	0	0
Government	1	0	0	0	0	0	0	0	0	0	0
Educator	1	0	0	0	15	3	0	0	1	0	0
Energy	0	0	0	0	1	1	0	0	0	0	0
Engineering	0	1	1	4	10	16	0	0	1	1	0
Environmental Field	0	0	0	0	3	7	0	0	0	0	0
Fishery	0	0	0	0	1	5	0	2	1	0	0
Government	4	4	5	6	15	12	0	0	4	2	0
Health	2	0	2	0	22	4	0	1	1	1	0
Lawyer	0	0	0	0	1	1	0	0	0	0	0
NGO	1	1	2	1	21	17	0	0	2	0	0
Other	0	0	0	0	0	0	0	0	0	0	0
Retired	0	0	0	0	1	0	0	0	0	0	0
Unemployment	0	0	0	0	0	0	1	0	0	0	0
Planning	18	8	4	3	28	28	0	2	4	0	4
Government	4	1	0	0	8	0	0	1	0	0	0
Religion	0	0	2	0	0	0	0	0	0	0	0
Scientist	5	1	0	0	11	31	0	0	0	0	0
Transportation	0	0	0	0	1	1	0	0	0	0	0
Volunteer	2	3	8	3	16	13	0	1	4	1	4

REFERENCES

- 2018 Hazard Mitigation and Climate Adaptation Plan (p. 554). (2018).
<https://www.mass.gov/files/documents/2018/10/26/SHMCAP-September2018-Full-Plan-web.pdf>
- Agyeman, J., Bullard, R. D., & Evans, B. (2002). Exploring the Nexus: Bringing Together Sustainability, Environmental Justice and Equity. *Space and Polity*, 6(1), 77–90.
<https://doi.org/10.1080/13562570220137907>
- Arnstein, S. R. (1969). A Ladder Of Citizen Participation. *Journal of the American Institute of Planners*, 35(4), 216–224. <https://doi.org/10.1080/01944366908977225>
- Aylett, A. (2010). Participatory Planning, Justice, and Climate Change in Durban, South Africa. *Environment and Planning A: Economy and Space*, 42(1), 99–115.
<https://doi.org/10.1068/a4274>
- Berry, W. (1971). *The Unforeseen Wilderness: An Essay on Kentucky's Red River Gorge*. University Press of Kentucky.
- Bidwell, D., Dietz, T., & Scavia, D. (2013). Fostering knowledge networks for climate adaptation. *Nature Climate Change*, 3(7), 610–611.
<https://doi.org/10.1038/nclimate1931>
- Bolden, I. W., Seroy, S. K., Roberts, E. A., Schmeisser, L., Koehn, J. Z., Rilometo, C. H., Odango, E. L., Barros, C., Sachs, J. P., & Klinger, T. (2018). Climate-related community knowledge networks as a tool to increase learning in the context of environmental change. *Climate Risk Management*, 21, 1–6.
<https://doi.org/10.1016/j.crm.2018.04.004>
- B.R.A.G. (2016). *Climate Ready Boston—Climate Change and Sea Level Rise Projections for Boston*. https://liveumb-my.sharepoint.com/personal/anna_valdez001_umb_edu/Documents/G- BRAG%20Doc/GBRAG- STEERING%20COMMITTEE/BRAG%202016%20Report/CRB_BRAG_report_060116.pdf
- Bureau, U. C. (n.d.). *About the Survey*. The United States Census Bureau. Retrieved February 3, 2020, from <https://www.census.gov/programs-surveys/acs/about.html>
- Bureau, U. S. C. (n.d.). *American FactFinder*. Retrieved January 27, 2020, from <https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml#none>
- Burger, J., & Gochfeld, M. (2017). Perceptions of severe storms, climate change, ecological structures and resiliency three years post-hurricane Sandy in New Jersey. *Urban Ecosystems*, 20(6), 1261–1275. <https://doi.org/10.1007/s11252-017-0678-x>
- Butler, L. J., Scammell, M. K., & Benson, E. B. (2016). The Flint, Michigan, Water Crisis: A Case Study in Regulatory Failure and Environmental Injustice. *Environmental Justice*, 9(4), 93–97. <https://doi.org/10.1089/env.2016.0014>
- C40. (n.d.). Retrieved June 16, 2020, from <https://www.c40.org/>
- Carter, M. (2006). *Greening the Ghetto*.
https://www.ted.com/talks/majora_carter_greening_the_ghetto

- Casanovas, R., Ciocoletto, A., Salinas, M. F., Valdivia, B. G., Martinez, Z. M., & Escalante, S. O. (2015). *Women Working. Urban assessment guide from a gender perspective* (pp. 1–124). https://issuu.com/punt6/docs/ww_issuu_simple
- City of Chelsea Community Resilience Building*. (2018). [Municipal Vulnerability Preparedness Report].
- City of Marlborough, Community Resilience Building Workshop*. (2019). [Municipal Vulnerability Preparedness Report].
- City of Newton, Community Resilience Building Workshop, Summary of Findings* (p. 34). (2018). [Municipal Vulnerability Preparedness Report].
- Climate Ready Boston—Final Report*. (2016). [Climate Ready Boston - Final Report]. https://liveumb-my.sharepoint.com/personal/anna_valdez001_umb_edu/Documents/G-BRAG/20161207_climate_ready_boston_digital2.pdf
- Cloyd, E., Moser, S. C., Maibach, E., Maldonado, J., & Chen, T. (2016). Engagement in the Third U.S. National Climate Assessment: Commitment, capacity, and communication for impact. *Climatic Change*, *135*(1), 39–54. <https://doi.org/10.1007/s10584-015-1568-y>
- Collins, K., & Ison, R. (2009). Jumping off Arnstein’s ladder: Social learning as a new policy paradigm for climate change adaptation. *Environmental Policy and Governance*, *19*(6), 358–373. <https://doi.org/10.1002/eet.523>
- Community Resilience Building*. (n.d.). Communityresilience. Retrieved June 15, 2020, from <https://www.communityresiliencebuilding.com>
- Definition of we*. (n.d.). [Dictionary.com]. www.Dictionary.Com. Retrieved April 25, 2020, from <https://www.dictionary.com/browse/we>
- Electricity Data*. (n.d.). U.S. Energy Information Administration. Retrieved January 27, 2020, from https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_1_17_b
- Environmental Justice*. (2014, November 3). [Collections and Lists]. US EPA. <https://www.epa.gov/environmentaljustice>
- Fitzgerald, D. (2013). Employing think–pair–share in associate degree nursing curriculum. *Teaching and Learning in Nursing*, *8*(3), 88–90. <https://doi.org/10.1016/j.teln.2013.01.006>
- Hauser, R., & Jadin, J. (2012). *Rural Communities Workshop Technical Report* (p. 38) [Technical Report]. USDA.
- Iacono, M. (2018, January 3). 2017-2018 Snowfall. *Blue Hill Observatory and Science Center*. <http://bluehill.org/observatory/2018/01/2017-2018-snowfall/>
- Iacono, M. (2019, August 12). *July 2019 Summary – Third Warmest on Record* [Blue Hill Observatory and Science Center]. <https://bluehill.org/observatory/2019/08/july-2019-summary-third-warmest-on-record/>
- Iacono, M. (2020, January 20). 2019 Was Warmer and Wetter Than Average. *Blue Hill Observatory and Science Center*. <http://bluehill.org/observatory/2020/01/2019-was-warmer-and-wetter-than-average/>

- IPCC. (2014). *Climate Change 2014 Synthesis Report Summary for Policymakers* (No. AR5; p. 32). United Nations.
https://www.ipcc.ch/site/assets/uploads/2018/02/AR5_SYR_FINAL_SPM.pdf
- Jacobs, K. L., Buizer, J. L., & Moser, S. C. (2016). The third US national climate assessment: Innovations in science and engagement. *Climatic Change*, 135(1), 1–7.
<https://doi.org/10.1007/s10584-016-1621-5>
- Keenan, J. M., Hill, T., & Gumber, A. (2018). Climate gentrification: From theory to empiricism in Miami-Dade County, Florida. *Environmental Research Letters*, 13(5), 054001. <https://doi.org/10.1088/1748-9326/aabb32>
- Love Canal. (n.d.). *Center for Health, Environment & Justice*. Retrieved March 9, 2020, from <http://chej.org/about-us/story/love-canal/>
- Marcelo, P. (2018, June 6). In Boston’s booming Seaport, the namesake is also the threat. *Boston.Com*. <https://www.boston.com/news/local-news/2018/06/06/boston-seaport-flood-threat>
- Martin. (2016, May 10). UNEP report: Cost of adapting to climate change could hit \$500B per year by 2050. *United Nations Sustainable Development*.
<https://www.un.org/sustainabledevelopment/blog/2016/05/unep-report-cost-of-adapting-to-climate-change-could-hit-500b-per-year-by-2050/>
- Mass Rivers & Watersheds Map*. (2009). [Map]. Commonwealth of Massachusetts - Division of Ecological Restoration. <http://massriversalliance.org/wp-content/uploads/2016/12/MassRiversAndWatersheds2.pdf>
- Massachusetts Document Repository*. (n.d.). Retrieved January 27, 2020, from <https://docs.digital.mass.gov/dataset/massgis-data-public-utility-service-providers>
- Massachusetts—State Energy Profile Analysis*. (n.d.). U.S. Energy Information Administration. Retrieved January 27, 2020, from <https://www.eia.gov/state/analysis.php?sid=MA#16>
- Massachusetts—State Energy Profile Overview*. (n.d.). U.S. Energy Information Administration. Retrieved January 27, 2020, from <https://www.eia.gov/state/?sid=MA#tabs-1>
- MassDOT. (2015). *MassDOT Transportation Facts*.
https://www.mass.gov/files/documents/2017/12/06/MassDOT_TransportationFacts2015.pdf
- Mathieu, J. (2019, October 11). *Mayor Walsh In Denmark For World Mayors Summit*. News.
<https://www.wgbh.org/news/local-news/2019/10/11/mayor-walsh-in-denmark-for-world-mayors-summit>
- MBTA Performance Dashboard*. (n.d.). Retrieved January 29, 2020, from <https://mbtabackontrack.com/performance/#/detail/ridership/2019-12-01/Commuter%20Rail///>
- Medfield Municipal Vulnerability Preparedness Community Resilience Building*. (2019). [MVP].
- MWRA - Water Supply and Demand*. (n.d.). Retrieved January 28, 2020, from <http://www.mwra.com/04water/html/wsupdate.htm>
- MWRA: About MWRA*. (n.d.). Retrieved January 28, 2020, from <http://www.mwra.com/02org/html/whatis.htm>

- MWRA Sewer System Mainpage*. (n.d.). Retrieved January 28, 2020, from <http://www.mwra.com/03sewer/html/sew.htm>
- OLIVER*. (n.d.). Retrieved January 29, 2020, from http://maps.massgis.state.ma.us/map_ol/oliver.php
- Paris Agreement*. (2015). United Nations. <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>
- Perch-Nielsen, S., Oberpriller, Q., Holthausen, N., Locher, P., & Schöni, S. (2016). *Analyse der Nutzerbedürfnisse zu nationalen Klimaszenarien—MeteoSwiss* (Technical Report No. 258). MeteoSchweiz. <https://www.meteoswiss.admin.ch/home/services-and-publications/publications.subpage.html/en/data/publications/2016/3/analyse-der-nutzerbeduerfnisse-zu-nationalen-klimaszenarien.html?query=analyse+der+nutzerbedufnisse+zu+nationalen&topic=0&publicationYear=&pageIndex=0>
- Place in Massachusetts History*. (n.d.). Retrieved January 27, 2020, from <http://www.msp.umb.edu/placereadings.html>
- Saavedra, C., & Budd, W. W. (2009). Climate change and environmental planning: Working to build community resilience and adaptive capacity in Washington State, USA. *Habitat International*, 33(3), 246–252. <https://doi.org/10.1016/j.habitatint.2008.10.004>
- Sarzynski, A. (2015). Public participation, civic capacity, and climate change adaptation in cities. *Urban Climate*, 14, 52–67. <https://doi.org/10.1016/j.uclim.2015.08.002>
- Schlosberg, D., & Collins, L. B. (2014). From environmental to climate justice: Climate change and the discourse of environmental justice. *WIREs Climate Change*, 5(3), 359–374. <https://doi.org/10.1002/wcc.275>
- Shaw, C., & Corner, A. (2016). *Climate Change Public Conversations Series—Desk Review*.
- Shaw, C., Corner, A., & Messling, L. (2016). *Scotland’s Climate Change Public Conversations Series—Findings from the Workshop*. <https://climateoutreach.org/resources/scotlands-climate-change-public-conversations-series/>
- Shi, L. (2019). Promise and paradox of metropolitan regional climate adaptation. *Environmental Science & Policy*, 92, 262–274. <https://doi.org/10.1016/j.envsci.2018.11.002>
- Stout, M. (2018, April 30). Baker asks feds for disaster relief from March Nor’easter. *The Boston Globe*. <https://www.bostonglobe.com/metro/2018/04/30/baker-asks-feds-for-disaster-relief-from-march-nor-easter/8o0tNBDhY79A1hATOV2l8K/story.html?event=event12>
- Subregions*. (n.d.). MAPC. Retrieved May 13, 2020, from <https://www.mapc.org/get-involved/subregions/>
- Sweet, E. L., & Escalante, S. O. (2017). *Engaging territorio cuerpo-tierra through body and community mapping: A methodology for making communities safer*. <https://doi.org/10.1080/0966369X.2016.1219325>
- Town Of Wenham, Hazard Mitigation Plan and Municipal Vulnerability Preparedness Plan*. (2019). [Municipal Vulnerability Preparedness Report].

- United States—Rankings*. (n.d.). U.S. Energy Information Administration. Retrieved January 27, 2020, from <https://www.eia.gov/state/rankings/?sid=US>
- U.S. Census Bureau *QuickFacts: Massachusetts*. (n.d.). Retrieved January 27, 2020, from <https://www.census.gov/quickfacts/MA>
- US EPA, R. 06. (2016, July 8). *Municipal Separate Storm Sewer System (MS4) Storm Water Management Program (SWMP)* (Texas) [Policies and Guidance]. US EPA. <https://www.epa.gov/tx/municipal-separate-storm-sewer-system-ms4-storm-water-management-program-swmp>
- USGCRP. (2018). *Fourth National Climate Assessment*. <https://nca2018.globalchange.gov>
- Vineyard Wind 1*. (n.d.). Vineyard Wind. Retrieved January 27, 2020, from <https://www.vineyardwind.com/vineyard-wind-1>
- White, S. C. (1996). Depoliticising development: The uses and abuses of participation. *Development in Practice*, 6(1), 6–15. <https://doi.org/10.1080/0961452961000157564>
- Whitney, C. K., & Ban, N. C. (2019). Barriers and opportunities for social-ecological adaptation to climate change in coastal British Columbia. *Ocean & Coastal Management*, 179, 104808. <https://doi.org/10.1016/j.ocecoaman.2019.05.010>
- World Cafe Method. (2015, July 4). *The World Cafe*. <http://www.theworldcafe.com/key-concepts-resources/world-cafe-method/>