OPPORTUNITIES AND LIMITATIONS OF NATURE-BASED STRATEGIES FOR TRANSFORMATIVE ADAPTATION: AN EXAMINATION OF STAKEHOLDER VALUES AND SOCIAL CONTRACTS IN BOSTON

A Dissertation Presented
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JESSICA J. LILLQUIST

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ABSTRACT

OPPORTUNITIES AND LIMITATIONS OF NATURE-BASED STRATEGIES FOR TRANSFORMATIVE ADAPTATION: AN EXAMINATION OF STAKEHOLDER VALUES AND SOCIAL CONTRACTS IN BOSTON

May 2024

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The City of Boston has emerged as a leader in the Northeastern United States for developing and implementing definitive climate action plans for both mitigation and adaptation strategies. Such steps are essential as the city is vulnerable to coastal flooding from storms and exceptionally high tides. These risks will increase in the future due to climate change and associated sea-level-rise (SLR). Among numerous approaches to manage flooding, Nature-Based Strategies (NBS) have emerged as potentially the most reasonable adaptation measures for Boston to the extent that the city has committed to using primarily shore-based NBS as an adaptation approach. There are engineering challenges associated with these adaptation strategies, particularly in the coastal urban context, but equally important are those challenges relating to community dynamics. This research focuses on the influence of human values and interactions in determining adaptation responses, including proposed local climate change adaptation strategies and

policies such as NBS. To this end, I apply a case study research approach and follow a Values-focused Thinking (VFT) framework of analysis. This research explores: 1) How the subjective motivations and priorities among stakeholder groups are influencing their perceived notions of acceptable coastal adaptation approaches, specifically nature-based strategies; 2) What adaptation objectives across various stakeholder groups are informing the selection of coastal adaptation strategies and associated decision actions; and 3) How integrated stakeholder objectives can guide the development of climate change adaptation strategies for transformative adaptation outcomes. The results demonstrate how climate change adaptation strategies designed and informed by diverse stakeholder perspectives and values, placing the human face of climate change at the center of adaptation discourse, can support transformative adaptation. The key contribution of this research is a deeper understanding of the socio-economic and political processes that shape the choice of adaptation strategies and the outcomes for an urban coastal community in fundamental ways.

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ABBREVIATIONS

FGD	Focus Group Discussions
KII	Key Informant Interviews
NBS	Nature-Based Strategies
SLR	Sea-Level Rise
VFT	Values-Focused Thinking

CHAPTER 1

INTRODUCTION

1.1 Background

Climate change will have varying effects globally, but some large-scale impacts present serious implications, particularly for coastal communities. Sea-Level Rise (SLR) poses a serious problem that numerous regions now face and must confront when considering future planning and development (Henson 2019). In some cases, land loss or other uninhabitable conditions, such as frequent flooding, may be a consequence of increasing coastal hazards, which can diminish the infrastructure and ecological resources upon which coastal populations depend. If trends of global warming continue, the Intergovernmental Panel on Climate Change's (IPCC) Special Report on Global Warming of 1.5°C predicts that the impacts will have major effects on human wellbeing (2018). These considerations are of increasing concern for urban areas as coastal cities and settlements are on the frontline of climate change, facing high levels of compounded risk (Glavovic et al 2022). In urban areas environmental change can create disparities between where people live and where they can live safely, as well as affect access to resources that support their survival (Shi 2020). Cities are prone to a higher array of risks as a result of climate change impacts and urbanization occurring simultaneously. The

desirability of coastal areas and increasing development also compounds the complexity of the socio-ecological problems these regions face, creating a tension between the risks and opportunities occurring in urban settings (Yang et al 2018, de Koning & Filatova 2020). Such issues demand adaptation and protection measures that address socio-ecological vulnerabilities residents face on a daily basis.

Urban centers in the Northeastern United States face severe impacts to critical infrastructure, economic activity, and overall community well-being due to projected climate change impacts. In turn, these communities are working to proactively develop and implement adaptation policies to reduce the risks posed by climate change (Dupigny-Giroux et al 2018). The City of Boston has emerged as a leader in the region for developing and implementing definitive climate action plans for both mitigation and adaptation strategies. Such steps are essential as the city is vulnerable to coastal flooding from storms and exceptional high tides and these risks will increase in the future due to climate change and associated SLR (City of Boston 2016). The City of Boston and other municipalities in Boston Harbor are vulnerable to coastal flooding from storms and exceptional high tides. The area is expected to be severely impacted with much of the region's population and businesses at risk due to their proximity to the coast (City of Boston 2016). With mounting vulnerabilities in Boston, the city has committed to using primarily shore-based nature-based strategies (NBS) to address the coastal flooding challenges that climate change presents for city neighborhoods.

NBS are defined as an innovative approach to incorporate or mimic some aspects of the environment with the aim to protect, manage and/or restore coastal landscapes,

providing benefits for biodiversity and human well-being effectively and adaptively (Bridges et al 2014, Cohen-Shacham et al 2016). NBS as an adaptation intervention is intended to work with ecosystems and promote broader societal responses to environmental change (Doswald et al., 2014; Fischer et al., 2015; Seddon, et al., 2016; Woroniecki, 2019). These approaches have been claimed to facilitate and contribute to transformative social change through natural intervention, but it is unclear how such changes can occur as knowledge about the processes underlying their design and implementation continues to develop (Woroniecki et al., 2019). In order to understand the full potential of NBS and benefits for the community, it is important to examine the context in which they will be designed and implemented, including consideration for the challenges that they are intended to address. In particular, it is imperative to investigate how these adaptation strategies and associated policies can be developed to meet various stakeholder needs and values. Preparing for climate change in coastal urban communities is a challenging task, and one that requires thoughtful and thorough planning. In turn, developing coastal flood protection and management strategies must account for the uncertainty of climate outcomes, the array of stakeholders involved in decision-making processes, and the long-term implications for actions taken (Ranger et al 2013, De Brito et al 2016). In light of the demand for proactive policy responses, it is necessary to consider what strategies are appropriate to meet social and environmental needs in a community. For the city of Boston, it is important to investigate how proposed NBS for coastal adaptation and flood protection can be developed to account for various stakeholder needs and values.

Investigating and evaluating stakeholder perspectives can help to determine how adaptation strategies like NBS can meet community needs for climate adaptation. Beyond the general understanding of potential environmental and community-wide benefits that NBS present, the design and implementation of robust climate change adaptation strategies and policies requires a deeper examination of the socio-ecological dynamics affecting adaptation in order to support communities as intended. To this end my research examines human values and perceptions regarding climate risks and the proposed adaptation strategies for the community to determine their influence in designing and implementing strategies that promote transformative adaptation. Transformative adaptation can entail a multitude of possible actions and processes, but as a concept it calls attention to the social, political, and economic factors that contribute to and underly community vulnerability. By definition transformative adaptation calls for addressing the factors underlying vulnerabilities through adaptation strategies, planning, and policy (O'Brien 2012). The concept suggests that shifting power structures to remove or reduce these vulnerabilities can produce equitable outcomes (Pelling 2011). NBS are promoted as approaches that are or could be transformational for communities, but it is unclear exactly how such transformations can come about and what processes are necessary to achieve these outcomes. Because NBS are inherently social (not just engineered measures for flood protection), it is important to understand what stakeholder values and relationships are shaping these strategies (Seddon 2022; Wijsman & Berbés-Blázquez 2022). If NBS are to be avenues for transformative adaptation, then it is necessary to

determine how these strategies can provide coastal flood protection while also addressing factors that are contributing to community vulnerability.

In this case, it is important to understand that vulnerability is not just about the physical risks people face, but the cultural factors that make people more vulnerable than others and ultimately influence adaptive capacity and resilience. Finding ways NBS can act as mechanisms to address these factors is important in order to achieve transformative adaptation. My research explores ways to examine social and political processes that could contribute to the ability of NBS to be transformative, by investigating peoples' values and objectives to identify current opportunities and limitations. Through my research, I engage with various stakeholders in Boston, presenting a participatory analysis to inform the development and implementation of NBS as proposed by the city. The analysis focuses on the role of individual stakeholders and stakeholder groups in determining adaptation responses, as well as strategy design and policy requirements. By analyzing various levels of local stakeholder perspectives through participatory methods this research provides insight regarding the ways in which individual and organizational values can shape adaptation initiatives and their outcomes for communities in fundamental ways.

1.2 Literature Review

This literature review focuses on nature-based strategies for climate change adaptation. There are various terms used for nature-based strategies, which are typically interchangeable, but for the purposes of this study I avoid use of the term nature-based 'solutions.' Primarily, I do not intend to approach this assessment from a preconceived

notion of what ‘solutions’ entail. Rather, I rely on the term nature-based ‘strategies’ to avoid presenting NBS as a predetermined solution for communities and refer to this term only as one of the suggested approaches to climate change adaptation. Understanding the ways in which NBS for climate change adaptation are framed in the literature offers insight into how and why these types of approaches are being prominently considered globally by communities in light of climate impacts and challenges. Additionally, this review explores some of the existing barriers to implementation and gaps in the current knowledge based.

In this literature review I also consider the role of social contracts in adaptation. Social contracts are relevant here as they shed light on the roles and responsibilities of various stakeholders in shaping decision-making efforts in a community. Such relationships are key to understanding the selection, design, and implementation of adaptation strategies, particularly NBS. My review focuses on framings of social contracts to build community resilience, including considerations for environmental and social adaptations over time. This body of knowledge helps to inform my assessment in determining potential pathways for transformative adaptation in considering these types of relationships and their role in shaping adaptation approaches.

1.2.1 Nature-Based Strategies as Climate Change Adaptation Approach

Adaptation initiatives, specifically those tackling climate risks in cities, often promote enhanced resilience and efforts to reduce vulnerability, but it is important to unpack how these adaptation proposals are received and could play out in reality. These issues have become more prevalent for NBS, which are increasingly promoted for urban

systems facing climate challenges, particularly in coastal areas (Frantzeskaki et al 2019, Kabisch et al 2016, Raymond et al 2017). Initially, NBS were of interest for use in ecosystem and habitat restoration, but these strategies are increasingly seen as beneficial for addressing threats of climate-induced impacts on communities, including coastal flood risk reduction under present and future climates (Kabisch et al 2016, Sarabi 2020). Nature-based strategies contribute to different aspects of adaptation with the goal of reducing direct exposures to climate change impacts. In some conditions, NBS can adapt to climate change and rising sea levels, improve performance over time, and provide socio-economic benefits in addition to flood protection. NBS for coastal protection systems can be deployed as a single line of defense or as part of a tiered or hybrid system that extends from the sub-tidal zone through the shoreline and even beyond the shoreline (Sutton-Grier et al 2015). These solutions can also be administered over time as the climate changes; this flexibility makes for a powerful approach to manage the uncertainties associated with scenarios of the future climate and their impact on communities. Additionally, there has been a shift to promoting green infrastructure as a means to address the intersection of environmental, social, and economic problems in order to enhance social cohesion and overall community well-being (Raymond et al 2017).

NBS is an ‘umbrella concept’ as it encompasses a range of actions to enhance nature and address societal challenges, grounded in the principles of healthy natural ecosystems which can produce an array of services that contribute to human wellbeing (Cohen-Shacham et al 2019). As an adaptation concept, NBS go beyond ecosystem-based

approaches and biodiversity and conservation management approaches. Primarily because they tend to integrate other types of strategies and more importantly, by specifically aiming to address broad societal goals such as human wellbeing and socio-economic development (Seddon et al 2019). NBS by definition must be implemented to support people and the natural environment. These approaches reflect the recognition of the interdependency or society-wellbeing and ecosystem health (Seddon 2022). The concept of NBS is widely defined, focusing on multifunctionality or nature-based actions and emphasizing practical applications in community settings, which makes them more easily acceptable and understood by local governments and the public (Fan et al 2023).

Urban areas in particular are a targeted interest for implementation of NBS due to their scope and flexibility as adaptation approaches, and consideration of socio-ecological interactions, built infrastructure, as well as multiple land uses that occur in urban areas (Dorst et al 2019). Urban greening has been found to provide ecosystem services benefits and opportunities for community engagement and social cohesion (Xing et al 2017). Mahmoud et al (2021) argue that NBS go beyond traditional urban development schemes by considering urban regeneration through the enhancement of urban ecosystem services and social inclusivity. Kinol et al (2023) find that the localized application of NBS can help to build social, environmental, and economic adaptive capacity, while addressing development challenges to increase resilience to climate impacts. While NBS cannot solve all community problems, these approaches can be designed and implemented to reduce harm and justice can be promoted through proactive strategies (Kinol et al 2023). In considering NBS for climate change adaptation though, Lafortezza et al (2017)

propose a suite of supporting actions to improve urban wellbeing including identifying obstacles and enabling factors, raising awareness and engagement, integrating policy and research to build the evidence base, and developing models for cost-effectiveness and achieving multiple co-benefits. Cortinovis et al (2022) also contend that even with existing successful demonstrations of NBS contributing to climate change adaptation, it is important to set realistic policy goals that account for different types of NBS in urban spaces, including their associated and expected benefits.

Although interest in NBS is increasing, there is a need to build evidence that supports the rationale for employing these approaches, especially in terms of their efficacy in comparison to alternative strategies. In particular, the co-benefits of NBS can reflect positive outcomes for communities but they are relatively unexplored and can sometimes result in unintended consequences. For instance, increased real estate values as a result of improvements may cause displacement and gentrification of the most at risk and historically marginalized communities, increasing their vulnerability of exposure to harm leading to maladaptation (Anguelovski et al 2019, Magnan et al 2016). There is also uncertainty associated with the evolution of co-benefits over time (Sarabi et al 2020). If NBS are intended to protect residents and the livability of an urban community while promoting equity, they must fit the city's capabilities and needs in the face of climate challenges, while cultivating local identities (Kabisch et al 2016). Research must examine policy and planning processes, working to uncover pathways in which impacts of green infrastructure in cities could worsen vulnerabilities, as well as account for resident perspectives to foster deeper understanding of current and potential risks (Anguelovski et

al 2019). Policy options for these strategies must bring together multiple forms of knowledge stemming from the community's diverse set of stakeholders and across institutional and governance processes (Raymond et al 2017). Additionally, real-world, context-based analyses of the potential impacts of strategies to inform careful design and long-term management to prevent unintended consequences are needed (Frantzeskaki et al 2019).

While NBS can act as proposals for social change, they require critical examinations of traditional forms of planning and management, which further requires increasing knowledge, equity, and access to resources (Cousins 2021). NBS need to account for imbalances in power and knowledge, not solely focus on large-scale impacts for landscapes and livelihoods only, to avoid reinforcing inequalities or unsustainable practices (Woroniecki et al 2020). Storbjörk & Hjerpe (2021) find that many cities are in the process of envisioning and planning for necessary changes, including allowing for the incorporation of NBS, but institutional and governance structures required to support implementation are limited, which slows progress. Nature-based planning for climate governance is a challenge for cities worldwide because they require transdisciplinary efforts that go beyond traditional planning efforts and capacities (Wamsler et al 2020). Complementary strategies are necessary through increased involvement and engagement of internal and external stakeholders. By framing and designing nature-based, green infrastructure strategies in a way that attends to current structural barriers and institutional challenges, these types of approaches can better contribute to justice-oriented goals and progressive reform (Shi 2020). For flood risk management purposes Ferreira et

al (2021) find that planning processes must consider local conditions and multidisciplinary expertise to implement NBS that are economically, environmentally, technologically, and socially sustainable. For NBS in general, Dorst et al (2022) find a common set of barriers to implementation that includes: limited collaborative governance confirms constraints; knowledge, data, and awareness challenges; lack of private sector engagement; competition over urban space; insufficient policy development and public resources; uncertainty about NBS effectiveness; design and construction challenges; and the tendency for decision-making to be based on short-term goals. There are ways to overcome these barriers by contextualizing the adaptation problem/s, enabling knowledge and information transfer, offering multiple approaches to NBS, appropriating funds for existing and future opportunities, and redistributing power and authority in governance structures for project implementation (Rahaman et al 2023).

There is an opportunity to better understand the potential for co-benefits, to ensure that adaptation governance and associated policies reflect societal needs and bring about equitable outcomes. Only then can these approaches better encourage effective adaptation pathways that support traditionally overlooked communities. If NBS continue or exacerbate societal patterns that harm these groups, then they ultimately fail to provide the intended support for a community, jeopardizing the opportunity for transformation and protection against climate impacts. Adaptation strategies and policy approaches can only benefit a community as a whole if they directly confront patterns that contribute to various levels of vulnerability (Anguelovski et al 2019, Pelling 2011, Adger et al 2006). My research builds on the studies described here to better understand the opportunities

and challenges of designing and implementing NBS to address coastal climate change risks in an urban environment, including prospects for transformative adaptation.

1.2.2 Nature-Based Strategies for Transformative Adaptation

Ideas of transformative adaptation have been linked to NBS. Woroniecki et al (2020) find that social transformations are increasingly suggested in describing the processes for designing and implementing NBS with claims that NBS can contribute to transformative social and environmental changes through adaptation. Yet, it is unclear how NBS can bring about such changes. Promoting NBS as transformative adaptation calls attention to consider how social-ecological relationships can be reimagined and redesigned. Cousins (2021) argues that in framing NBS as transformative adaptation there must be considerations for different forms of transformation, including situations in which adaptation burdens are placed on the most vulnerable to reinforce or worsen current circumstances. In this case, NBS are defined in terms of the contexts in which they will be implemented, accounting for environmental and socio-political dynamics, sources of power and authority, and distributions of risks (Pelling et al 2015).

Increasingly, NBS are included in climate adaptation agendas across the globe, which calls for understanding the policy and planning processes that are required to implement these approaches, especially to promote transformative changes (Frantzekaki & Bush 2021). Systematic transformations through NBS entail addressing the practical and political capacities of communities with full recognition of the relationships between decision-makers and citizens that shape modern governance (Wamsler et al 2020). Fostering transformative adaptation with NBS then entails

understanding their social and political context, considering the opportunities for social, economic, and technological changes for increased resilience (Scolobig et al 2022). The design and implementation processes for NBS face multiple barriers, including stakeholders seeking to promote these approaches for development incentives and short-term adaptation goals (Dushkova & Haase 2020). Thus, examination of the various roles and responsibilities of diverse stakeholders in the context in which NBS are being promoted helps to better understand the decision-making processes that hinder or encourage transformative adaptation.

1.2.3 Social Contracts

In considering the importance of context for adaptation initiatives, particularly social and political circumstances in a community to consider the roles and responsibilities of various stakeholders, I introduce social contracts as part of my literature review. The theory of social contracts informs and influences modern concepts of democracy, identifying principles that support political arrangements of government and decision-making processes (Kant 1959, Locke 1965, Rawls 1971, Rousseau 1973, Hobbes 1998). While experts have diverse interpretations of social contacts, each vision includes principles that underlie political arrangements of government that consult the citizens it serves (Weale 2004). Social contracts then can act as means to legitimize or limit levels of government authority which determine the rights and protections of the citizens (Boucher and Kelly 1994, Hampton 1997). Thus, there are forms of mutual benefits, obligations, and constraints on the responsibilities that government and citizens agree to – for example citizens paying taxes in return for the state providing education

and health services (Boucher and Kelly 1994; Hampton 1997; Weale 2004). Reflecting on such arrangements, many scholars argue that social contracts are not typically applied equally to all members of society with some relationships prioritizing power over others, creating avenues for exclusion and domination in modes of governance and decision-making (Nussbaum 2006; Pateman and Mills 2007). Social contracts then highlight limitations to current systems, including those who are excluded or are not legitimately recognized in governance structures (Weale 2011). Beyond the state there are groups that affect modern social contracts but who do not bear the brunt of negative socio-economic and environmental effects that such relationships and governance systems can produce (Bohman 2004). The power and dominance generated by certain social contracts can become more apparent with environmental changes, which impact the fundamental fabrics of communities (Hayward 2008).

Increasing environmental risks in light of climate change draws greater attention to social contracts. The ways in which governance responsibilities evolve over time generate debates about power between communities and the state, particularly as emerging risks pose new challenges and concerns regarding established roles (Adger et al 2012). Barry and Wissenburg (2001) argued that social contracts have acted as a means to exploit nature and the physical environment through development and economic growth, including for accumulation of resources and property for those in power. Climate change is both caused and exacerbated by these patterns, which creates new problems for governments and consensus building efforts for policymaking due to the uncertainty increasing risks present, especially given the uneven distribution of burdens (Adger et al

2012). Consideration of the role of social contracts in environmental changes suggests addressing the social, political, and economic processes that cause damage to ecosystem services and increasing vulnerability (Dryzek 2002; Jackson 2009). The widespread impacts of climate change raise questions of responsibility for present and future generations, which may not be parties to existing social contracts (Adger et al 2006). Additionally, invoking social contracts calls for attention to the social value of understanding and addressing environmental change, including taking action that generates accountability within systems of environmental management and governance (Lubchenco 1998; Demeritt 2000; Zadek, 2006; White 2007; DeFries et al. 2012; Castree et al. 2014; Castree 2016).

New types of political and social arrangements to enable communities to address complex challenges presented by climate change, as well as to enhance human well-being are important to consider. Leichenko and O'Brien (2008) suggest taking into account the way climate change interacts with globalization processes where significant changes to society and the environment can increase inequalities and vulnerabilities. Some of the observed climate trends and exposures are creating a sense of urgency to take action in ways that cannot be fulfilled by current systems of government. In the case of extreme weather events and disasters Pelling (2011) argues that social contracts can help to emphasize gaps between on the ground realities of hazard vulnerability and the formal protections and services that are offered by civil society and governments. O'Brien et al (2009) frames social contracts in the context of resilience thinking to move beyond 'business as usual' governance approaches that are likely to be unsustainable means of

climate change adaptation. Resilience thinking addresses more than local ecosystem and environmental problems by also focusing on the linkages to wider social processes and changes. This viewpoint can be applied to social contracts, considering their role in shaping socio-political responsibilities that also affect environmental systems. In this sense O'Brien et al (2009) argue a resilience thinking perspective can encourage innovation and transformations in societal configurations, helping to identify how and why certain social contracts are desirable to address socio-ecological challenges. Building on these studies, I employ social contracts as analytical lens by which adaptation efforts and strategies can be better understood.

1.3 Research Objectives & Questions

The purpose of this research is to generate a better understanding of how to incorporate human values and community knowledge into adaptation planning, including the design and implementation of NBS. When thinking about successful climate change adaptation, it is important to apply a contextual lens as local stakeholder interactions and decision-making processes often define people's access to resources and thus determine whether outcomes are equitable (See & Wilmsen 2020). Specifically, this research examines the significance of human values in climate change adaptation planning in the coastal urban context by investigating the influence of social contracts through diverse human perceptions on climate change risks associated with SLR and proposed adaptation strategies for flood protection (i.e., NBS). The aim of this assessment is to understand and to recommend policy considerations to achieve transformative adaptation.

The **primary objective** of this research then is to demonstrate how climate change adaptation strategies designed and informed by diverse stakeholder perspectives and values, placing the human face of climate change at the center of adaptation discourse, can support transformative adaptation. Transformational adaptations have been widely accepted as necessary to achieve social, ecological, and economic equity across generations (Eriksen et al. 2011; O'Brien 2012; O'Brien et al. 2015). Transformative adaptation builds resilience in order to support socio-ecological system functions into the future while enabling changes in social organization (Pelling 2011). However, the steps towards achieving transformative adaptation are relatively unclear and it is necessary to better define what types of adaptation futures communities seek and how stakeholders can ensure that these processes can occur (Pelling et al. 2015).

I address the primary research objective by investigating **how local government systems can account for formal and informal relationships between stakeholders to incorporate diverse community needs in climate change adaptation strategies to foster transformative outcomes.** I employ an exploratory research design through a case study approach that first unpacks the motivations, priorities, and objectives among different stakeholder groups, and then integrates this knowledge to identify adaptation strategies that best meet community needs. My research objective and approach are rooted in the idea that stakeholders can and should be able to express their concerns and contribute to the decision-making processes involved in developing and implementing climate change adaptation strategies. Participation of diverse stakeholders in these processes helps to uncover the values and perspectives that are shaping adaptation

strategies with a view to identify where improvements are needed in order to foster transformational outcomes. then can reduce and even prevent the potential The overarching research objective will be explored and guided by three research questions and associated methods as follows:

- Research Question 1 – **How do the subjective motivations and priorities among stakeholder groups influence their perceived notions of acceptable coastal adaptation strategies, specifically nature-based approaches?** Addressing this question should demonstrate that the community's definitions of primary climate change adaptation challenges are influenced by their social-cultural relations and perspectives. These perceptions inform their ideas regarding adaptation actions that can meet community needs.
- Research Question 2 – **What are the adaptation objectives across various stakeholder groups informing the selection of coastal adaptation strategies and associated decision actions?** Various stakeholder groups articulate their values and objectives for adaptation differently, with some conflicts between what they hope to see occur versus what is playing out in reality. Climate change adaptation strategies must be developed with a full understanding of the limitations and opportunities of considering diverse perspectives for a community's adaptation decisions.
- Research Question 3 – **How can integrated stakeholder objectives guide the development of climate change adaptation strategies for transformative adaptation outcomes?** Integrating stakeholder objectives helps to connect

diverse stakeholder values to achieve overarching community adaptation goals with the view to foster equitable outcomes. The ways in which different values become embedded in adaptation pathways though has implications for how different stakeholders benefit from selected adaptation strategies.

Each of these research questions are addressed through different forms of qualitative analysis, focusing on how values are subjectively framed and articulated. The assessment supporting each question seeks to understand the multi-dimensional needs and values across stakeholder groups to consider how they are informing adaptation. This type of investigation then informs the design and implementation of adaptation strategies and associated policies to better understand what shifts are needed to create equitable outcomes. These questions are addressed prospectively in Chapters 3-6.

A core assumption of my research is that if the preferences and priorities of diverse stakeholders are considered and applied to act as feedback processes in the formulation of adaptation strategies, then strategies can be developed and implemented in ways that are appropriate and suitable for the community's adaptation needs. In accounting for the adaptation objectives of various stakeholders it is equally important to examine the roles and responsibilities of stakeholders to determine how different types of social contracts are influencing the selection and implementation of adaptation strategies. By considering stakeholder objectives at the beginning of the decision-making process to inform design and implementation of strategies, the strategies can better reflect community objectives and determine what shifts in governance are needed to support the transformative futures they seek. In turn, equitable outcomes can be achieved by

examining and exploring different types of stakeholder knowledge, which are needed to determine where and when climate change adaptation strategies are best suited and what policy mechanisms are appropriate. To demonstrate this, the results of the analyses conducted for each of the research questions will be discussed along with relevant literature to address the primary research objective.

1.4 Overview

This research promotes collaboration to inform climate change policy and planning, particularly where these processes concern promotion of NBS, by providing baseline information from stakeholders. My research addresses the primary research objective to determine how local governance systems can more effectively address diverse community needs by accounting for formal and in formal relationships through climate change adaptation strategies to support and foster transformative adaptation. The results presented through this research can help inform plans for coastal adaptation, facilitating broad input on adaptation interventions and research. Lessons learned from the base of stakeholders participating in this study can strengthen community building in adaptation planning processes by connecting participant ideas, values, and objectives, while generating information to develop and support innovative solutions. For Boston, this research will help to determine what types of adaptation strategies are best suited and what policy mechanisms are appropriate to address underlying vulnerabilities and climate risks in coastal areas. Overall, this research generates insight regarding how adaptation strategies for coastal flood protection in urban areas can support community needs and promote equitable outcomes. The incorporation and examination of human values and

knowledge in adaptation planning processes is necessary, particularly for the design and implementation of NBS promoting transformative adaptation.

CHAPTER 2

RESEARCH DESIGN

2.1 Theoretical Framework

For the purpose of this study, I developed a theoretical framework to guide the research process and analysis. The framework presented here includes evolving social contracts in a changing climate, multiple social contracts, and transformative adaptation. Bringing these frameworks together helps to inform how NBS can promote transformational adaptations in a community. Each framework guides in assessing different perceptions, as well as power and agency across diverse stakeholders to reveal subjective priorities for adaptation, including whose values are more or less likely to drive adaptation pathways. The overall theoretical framework aids in the examination of social and cultural limitations to adaptation while identifying opportunities to improve adaptation decision actions for equitable outcomes. Figure 1 provides a visual to demonstrate how each framework connects and informs one another: social contracts in a changing climate underly the defined rights, obligations between states and citizens that may be altered or affected by changing environments (O'Brien et al 2009, Adger et al 2012); multiple social contracts breaks this down further considering the relationships between individuals, organizations, and institutions within or outside of the state that are

necessary to understand changing societal and environmental conditions, particularly focusing on imagined social contracts and practiced social contracts (Blackburn & Pelling 2018); and the influence of values informing societal relationships and decision-making processes for adaptation (O'Brien & Wolf 2010; Keeney 1992).

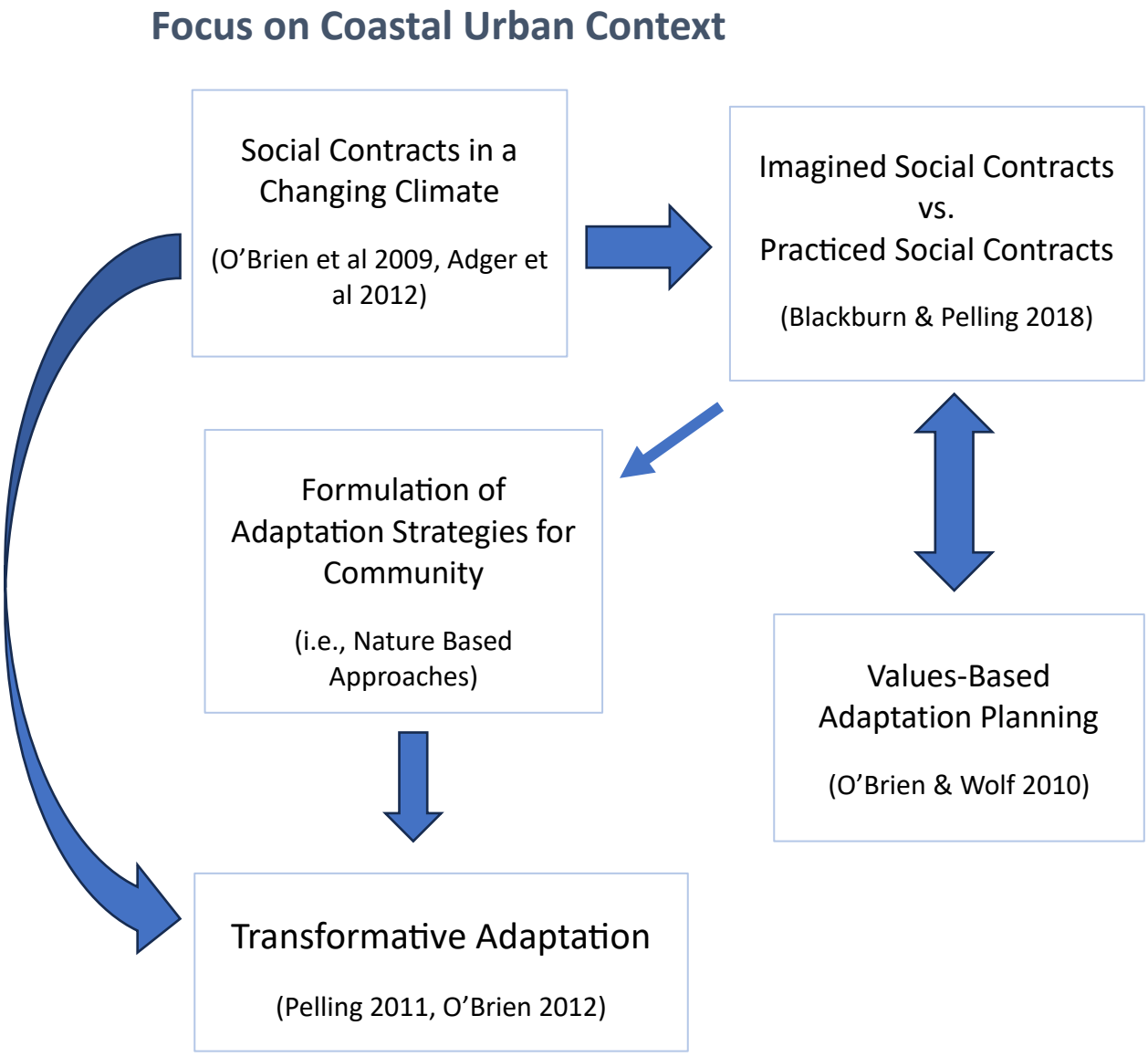


Figure 1 - Theoretical Framework. This framework guides the research process, data collection, and analysis. Understanding stakeholder values and evolving social contracts, how they shape adaptation strategies, and potential pathways for transformation.

Understanding each of these theories helps determine the formulation of adaptation strategies and their potential for promoting and enabling transformative adaptation. Transformative adaptation is the process of building resilience to support socio-ecological system functions in the future while enabling changes in social organization, by addressing the underlying causes of community vulnerabilities, seeking equitable adaptation outcomes (Pelling 2011). In this case, understanding the perspectives of diverse stakeholders with consideration for the social contracts that they are adhering to helps to determine opportunities and limitations of adaptation strategies foster transformation. Together these frameworks contribute to creating better understanding of how social-cultural relations influence the formulation of adaptation strategies for a community, particularly NBS, and under what circumstances transformational adaptation actions can occur.

2.1.2 Evolving Social Contracts in a Changing Climate

Social contracts are the defined rights, obligations, and responsibilities between states and citizens in society. For the purpose of this study, I consider social contracts as a means to examine relationships and the role that they play in climate change adaptation contexts. I am not advocating for social contracts as a way to regulate relationships, but rather consider how they are shaping responses to climate change impacts and how relationships are being affected by these environmental shifts. According to O'Brien et al (2009), social contracts are evolving or likely to evolve in the face of a changing climate. Climate change is creating new challenges for communities requiring them to rethink social and political arrangements for future generations. Such shifts will be needed to

address changes in ecosystems, extreme weather events, and resulting socio-ecological transitions. This research considers the role of social contracts in shaping and informing approaches to climate change adaptation, and what these relationships mean for community-wide outcomes.

Social contract theory informs modern concepts of democracy and governance, as the concept legitimizes collective governance arrangements to be informed by the consent of people (Kant 1959, Locke 1965, Rawls 1971, Rousseau 1973, Hobbes 1998). Often, social contracts are intended to offer mutual benefits, obligations, and constraints for citizens who explicitly or implicitly accept the state's role in providing services. Social contract theory then explains how governments evolve over time as various risks emerge to balance power between civil society and the state (Boucher and Kelly 1994, Hampton 1997). In considering the role of the environment in determining or influencing social contracts, Forsyth (2003) posits that climate presents as problem that requires acknowledging the underlying social, economic, and political factors that influence development pathways that alter relationships between nature and society. Social contracts then bring attention to how the ways in which rights and responsibilities have been legitimized through values, interests, power, politics, as well as socio-economic and technological factors, influence humans and the environment, particularly in the capacity to adapt to impacts associated with climate change (O'Brien et al 2009). Shifts in socio-ecological systems then affect social, cultural, and political relationships, which determine levels of resilience.

In light of the impacts of climate change it is important to consider the role of evolving social contracts as a mechanism for climate change adaptation, as climate change risks suggest that social contracts could be adjusted due to the influences on nature and society (Adger et al 2012). Evolving risks can create new roles in governance as climate change presents issues of uncertainty and uneven distribution of burdens. Social contracts have historically excluded those who are not recognized legitimately by governments, or vice versa, which creates issues in terms of the interconnectedness and consensus needed for addressing climate risks (Adger et al 2012). Thus, adaptation to climate change requires incremental changes to economic and social structures to foster resilient societies that directly consider those who are most vulnerable (Adger et al 2012, O'Brien et al 2012). However, new social contracts will not occur inevitably, as there is risk that such transitions will occur once environmental and social thresholds have occurred, for instance after a major climatic event (Pelling & Dill 2009). O'Brien et al (2009) stress that adaptation to climate change is not a predetermined outcome, as environmental and social considerations must be considered equally among individuals, political leaders, and institutions. A community's collective capacity to deal with risk is dependent on political decisions and social movements that are reflective of social contracts informing adaptation efforts to build community resilience (O'Brien et al 2009). Context is also crucial for adaptation, as Adger et al (2012) find that social contracts develop in response to local circumstances, and that options for addressing climate change challenges entails employing means of political representation to create change that manages climate risks. It is important to prioritize new forms of management that are

responsive to evolving community needs under changing environmental conditions to address resilience and sustainability goals. Climate change adaptation then is about considerations for the interactions and connectivity of people across spatial and temporal scales (O'Brien et al 2009). Accounting for a wider group of stakeholders interacting across different levels can help to better address the array of climate change adaptation challenges. These processes include managing the ability of populations to respond to climate impacts and creating new forms of collaboration to better address complex climate dynamics that account for community needs.

2.1.3 Multiple Social Contracts

Considering how social contracts could be evolving under climate change conditions, there is opportunity to accept and assess the idea of multiple social contracts operating within a socio-ecological system. Blackburn & Pelling (2018) propose moving from the concept of a single social contract to a framework of multiple existing/potential social contracts. As O'Brien et al (2009) establish, climate change adaptation requires rethinking of governance structures, as current roles of responsibility, power and interest will define how adaptation occurs. Rather than solely considering the role between states and citizens, the ideas behind multiple social contracts account for individuals, organizations, collectives, and institutions, inside and outside of state infrastructure (Blackburn & Pelling). Multiple social contracts then help to draw attention to the intersecting and differentiated relationships between stakeholders at multiple scales intending to meaningfully respond to climate risks. In considering multiple social

contracts there are various perspectives and roles needed to determine necessary actions for climate adaptation and how responsibilities can overlap or work collaboratively.

This research focuses on Blackburn & Pelling's (2018) definitions of multiples of social contracts, particularly imagined social contracts and practiced social contracts. Imagined Social Contracts are considered individuals' subjective vision of just social order, which is not always reflected in policy or practice. These types of social contracts are sensitive to social relations, collective history, and culture, as well as shared experiences and beliefs, which can be differentiated between individuals and social groups that evolve over time. According to Blackburn & Pelling (2018) the imagined social contract is independent of legal systems and is dependent on the diversity of societal values within a community. As these social contracts exist in a manner of subjectivity, arrays of perspectives are considered, as unanimous agreement is unlikely (Blackburn & Pelling 2018). On the other hand, there are practiced social contacts which account for the balance of rights and responsibilities in 'real life' that are claimed by and played out in relationships between individuals and state actors. These types of social contracts are most frequently considered in decision-making as they refer to the prevailing rights and responsibilities in society held in place by the rule of operating governance systems (Pelling 2011).

For this study, consideration and examination of imagined social contracts and practiced social contracts provides a lens to help determine how adaptation actions and their outcomes are shaped by stakeholder relationships and objectives. In this sense, examination of imagined social contracts helps to reveal the social and cultural

limitations of adaptation based on stakeholders' definition of climate change adaptation challenges and priorities to the issues. The imagined social contracts lens calls attention to the perspectives of various stakeholders in terms of how they want and hope to see adaptation challenges addressed. On the other hand, an examination of practiced social contracts then pays attention to the relative power and agency various stakeholders have over each other, considering how these relationships can become embedded in adaptation pathways, shaping adaptation strategies and their outcomes. Considering these types of social contracts alongside each other helps to uncover which types of values among stakeholder groups are accounted for in adaptation planning. Examining these types of social contracts also helps to determine whether there are ways to improve outcomes for the community in terms of risk management and equity (Blackburn & Pelling 2018). In order to better understand multiple social contracts and their influence on adaptation processes it is also important to understand the various types of stakeholder values that are informing adaptation.

2.1.4 Values-Based Adaptation

In my theoretical framework, I consider O'Brien & Wolf's (2010) proposal for a values-based research and policy approach to adaptation that has implications for addressing climate change vulnerabilities. This values-based adaptation approach supports the social contracts lens in evaluating the types of knowledge that are considered in planning processes, including what values are favored and prioritized. O'Brien & Wolf (2010) argue that a values-based approach helps to better understand limits to adaptation through stakeholder values and adaptation to determine adaptation practices that can

reflect diverse perspectives and foster more inclusive planning processes. Such an approach places the human face of climate change at the center of adaptation discourse, making diverse perspectives explicit and exposing underlying goals of distinct actors. For the purposes of this framework and my overall assessment, I define values as the broad ideals or principles that serve as the grounds for preference and choice (Helgeson et al 2023). In the context of climate change, I consider values to refer to the individual and collective motivations that are guiding adaptation goals, actions, and framings of priorities (Colloff et al 2016, Schwartz 2012).

Researchers argue that in working to manage climate risks the role of human values should be central to identifying the desirability of potential futures (Helgeson et al 2023). In fact, adaptation options accounting for and aligning with public values are more likely to be socio-culturally acceptable and can facilitate social and behavioral change (Glavovic et al 2022). In promoting transformative adaptation then it is important to explicitly recognize and incorporate peoples' values and beliefs in planning processes. Such efforts to assess and include values can also help to reflect on underlying reasons for policy actions or inactions (Glavovic et al 2022). Determining what is effective and legitimate adaptation is dependent on what people perceive to be worth preserving and achieving, hinging on their perspectives and defined values regarding adaptation (Bennett et al 2016). In community adaptation, risk perceptions often differ with institutional, social and governance barriers hindering adaptive actions (Adger et al 2006, Adger et al 2009). In this sense there are different conceptions of what types of adaptation strategies are desirable, which can be influenced by the ways in which different interests and values

are prioritized. If transformative adaptation is to be pursued and realized, it helps to identify how current systems of decision-making are constrained by preferences of decision-makers and enable new perspectives to be acknowledged in these processes (Colloff et al 2016). Being open to different forms of knowledge and worldviews can allow stakeholders to collectively imagine futures that legitimately navigate change in more inclusive ways (Locatelli et al 2022). A values-based approach recognizes these processes, with consideration of evolving social norms influencing governance systems (O'Brien & Wolf 2010).

2.1.5 Transformative Adaptation

Transformational adaptations have been widely accepted as necessary to achieve social, ecological, and economic equity across generations (Eriksen et al. 2011; O'Brien 2012; O'Brien et al. 2015). Transformative adaptation includes processes with the intent to build resilience in light of climate change by enabling shifts in social organization with the goal to support socio-ecological system functions of a community into the future (Pelling 2011). Transformational adaptations are intended to address underlying community vulnerabilities, seeking equitable adaptation outcomes. Pelling (2011) argues that shifting political and economic relations between states, citizens, and institutions can promote transformations while promoting increased resilience. Transformative adaptation is a concept that is used more frequently in adaptation literature, but it also raises many questions because the steps to achieving transformative adaptation are relatively unclear. Clarity is needed in determining what steps are necessary to achieve transformative adaptation in order to better define what adaptation futures are sought by communities

and how they can occur (Pelling et al. 2015). In this case, adaptation experts believe that by understanding the types of adaptation futures that different community stakeholders seek will help to better establish mechanisms for transformative adaptation outcomes. Questions around transformative adaptation can be understood through the political processes involved in adaptation, including an assessment of conceptual values, goals, and priorities for addressing climate change impacts and challenges (Eriksen et al 2015). O'Brien (2012) argues that transformation can be examined through the socio-political processes that affect how individuals and collectives deal with environmental and social changes. This framing of transformative adaptation builds on Pelling's (2011) argument that adaptation is a social process, not a single decision or measure, where social and political relationships shape the management of climate change.

Adaptation to climate change is considered part of broader societal and environmental processes that are tied to everyday life. Assessments for climate change adaptation need to account for the relationships and negotiations occurring at multiple scales in communities. Assessments for climate change adaptation need to move beyond policy considerations to account for the relationships and negotiations occurring at multiple scales. Accounting for these dynamics then lends to better understanding of the social and political dynamics underlying vulnerabilities to climate change then helps to foster adaptation (Eriksen et al 2015). Eriksen et al (2015) call for adaptation processes where people are not only considered 'recipients of adaptation' but rather treated as active participants in shaping adaptation decisions and outcomes. In that sense it is important to acknowledge how individual and group objectives are prioritized or excluded in decision-

making with different distributions of the negative and positive effects across society and the environment.

Transformation has different meanings for different groups of people and individuals. These are various interests and opportunities that inform adaptation, which influences who benefits from transformative actions (O'Brien 2012). Transformative adaptation and associated actions are likely to be complex and spontaneous with diverse pathways of change, presenting fundamental social and political challenges for communities (Blackburn 2018). O'Brien (2012) argues for deliberate transformation that requires shifting away from 'business as usual' and careful re-negotiation of roles and responsibilities within local systems to benefit the most vulnerable and achieve sustainable outcomes. An improved understanding of how transformative adaptation can occur in just and equitable ways through local actions is needed to address climate change challenges (Blackburn 2018). Transformative adaptation emphasizes the relational aspects of adaptation, seeking to involve stakeholders and consider context specific elements of decision processes (Malloy & Ashcroft 2019; Wamsler 2022). It is important then to examine the ways in which values and priorities of various stakeholder groups are shaping adaptation decisions to account for and determine how transformations could unfold.

2.1.6 Overview

The theoretical framework I developed for this study is intended to guide my assessment of perspectives of various stakeholders in Boston, serving as a critical lens to identify opportunities and limitations for transformative adaptation through NBS. This

theoretical framework is based on my own thinking, informed by the theory to connect these frameworks in a way that help to understand climate adaptation priorities and perceptions of NBS to examine the potential for transformative adaptation in pursuing such approaches. Applying social contracts as an analytical lens helps to understand perspectives that reflect present and potentially shifting social and political relations between diverse stakeholders, which are key to community transformation. The reflexive aspect of the values-based adaptation planning approach then informs multiple social contracts and is influenced by these relationships as well. My theoretical framework indicates that understanding transformative pathways entails assessment and consideration of the individual and stakeholder group perspectives and values that are shaping adaptation strategies. This framework focuses on the coastal urban context, particularly examining the influence and significance of the evolving nature of practiced and implied roles and relationships among stakeholders.

Transformative adaptation is inherently political and requires careful consideration of local systems if interventions and changes are to be sustainable (Blackburn 2018, O'Brien et al 2009). O'Brien (2012) argues that shifts in social contracts to modify governance frameworks are a means of 'deliberate transformation' that benefits the needs of the most vulnerable and focuses on defining how adaptation actions are intended and for whom. However, there are divergent views on how transformative adaptation futures can and should occur. In particular, there are different perspectives on the extent and role of social contracts influencing the effectiveness of adaptation (Christoplos et al 2017). The important question remains in clarifying exactly

what types of adaptation futures are sought, as well as what is required in terms of fair governance to achieve adaptation transitions (Pelling et al 2015; Blackburn & Pelling 2018). Pursuing transformative adaptation through innovative adaptation approaches such as NBS then challenges governance systems and policy initiatives to engage relevant stakeholders to determine and establish visions for a community's future and investigate whether or not these approaches address root causes of vulnerabilities (Boon et al 2021).

2.2 Methodology

In order to determine how climate change adaptation strategies can support and foster transformative adaptation, I apply a case study approach. Here I focus on the case study of Boston and the various stakeholders contributing to and influencing adaptation processes in the city, including the promotion of NBS. I employ key informant interviews (KII) and focus group discussions (FGD) as my primary forms of data collection. I describe an initial assessment of the interviews following cognitive mapping procedures to identify climate change adaptation challenges and priorities amongst participating stakeholders. Then, I introduce Values-Focused Thinking (VFT) originally developed by Keeney (1992) as my primary analytical approach for assessing the interviews and focus group discussions. These methods help to determine stakeholder objectives for coastal climate change adaptation, including the identification of potential decisions actions to minimize coastal flood impacts on the community.

2.2.1 Case Study of Boston

This research follows an exploratory case study design (Yin 2018) to consider the city's diverse stakeholder needs and values in order to ensure adaptation strategies may

be designed and implemented effectively and equitably. The case study focuses on the City of Boston located in the northeastern United States, which faces mounting vulnerabilities to coastal flooding as result of the projected 5-feet of SLR by 2100. As shown in Figure 2, the possible 5-feet of SLR by 2100 will significantly expand Boston's current floodplains, increasing the region's present vulnerability to coastal flooding. In light of these challenges, Boston has committed to pursuing NBS for coastal flood protection. Considering these circumstances, this research will examine the community's various stakeholder perspectives to determine how NBS, can be developed and implemented to meet community needs to address increasing coastal flood risks with underlying vulnerabilities. As a result, the City of Boston's climate adaptation measures can better meet community-wide needs, and the outcomes of this research can inform future adaptation planning.

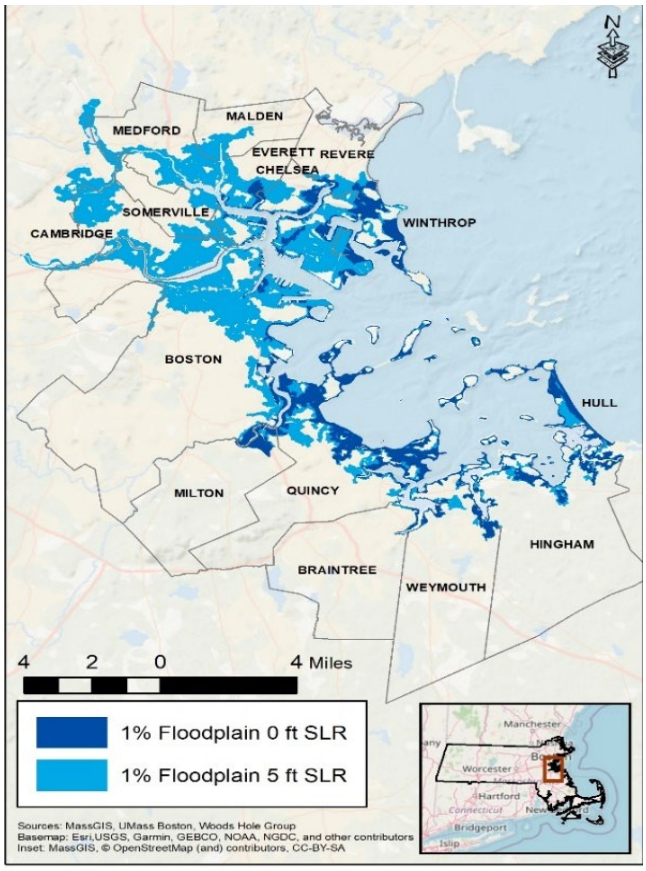


Figure 2 - Map of Boston and Predicted Sea-Level Rise. Present and Future 1 % Floodplains in Boston Harbor. 5 Feet of Sea Level Rise is Possible by 2100

One of the key principles in Boston's Resilience Framework is to incorporate local knowledge into design and decision-making processes (City of Boston 2016). This idea reflects the fact that the planning and design process for the city will involve a

variety of actors who ultimately determine and influence the outcomes of adaptation strategies. Implementation of adaptation strategies in Boston will likely require public and private partnerships, consisting of representatives of the city, nearby public infrastructure and utilities, non-residential building owners, and developers to name a few. Local citizen and business advisory committees are also likely to be established. Each of these actors will play a role in the planning and implementation process, and thus will influence the outcomes that unfold as part adaptation. In order to guide climate change adaptation strategies, these dynamics must be understood and challenges to policy development and implementation must be assessed. Stakeholder engagement will be central to gaining consensus and buy-in for adaptation plans, as their insight and participation can help to establish credibility of various strategies, including how approaches are measured and carried out successfully (De Brito et al 2016, Engle et al 2013). Using the City of Boston as a case study, my research focuses on the development and recommendation of robust adaptation strategies and associated policies, including those for NBS, that explicitly recognize the significance of stakeholder perspectives in shaping climate change adaptation. This research specifically considers diverse stakeholder needs and values in order to ensure that these strategies may be designed and implemented effectively and equitably. As a result, the City of Boston's climate adaptation measures can better meet community-wide needs and goals.

2.2.2 Data Collection

My primary modes of data collection include KII and FGD. These qualitative methods support the primary research objectives, and the information collected is

assessed and guided by the theoretical framework described previously. The interview and focus group transcripts were coded and analyzed using the software, MAXQDA Pro (2022). These methods support establishing a baseline understanding of the different perspectives between public/private organizations, local/regional government officials, and community-based organizations. For the purposes of this study, I use the following definitions to distinguish each stakeholder group:

- **Public/Private Organizations** = institutions consisting of a group of people working together for a shared purpose, including those serving private industry, working not-for-profit, or operating as nongovernmental entities at local, regional, national, and international levels (Cambridge Dictionary 2024).
- **Local/Regional Government Officials** = those working for State and local governments, including as elected officials, municipal employees, and for City and State agencies (The White House 2024).
- **Community-Based Organizations** = a public serving nonprofit organization that is representative of a community or significant segments of a community and provides educational or related services to individuals in the community (Cornell Law School 2024).

An important note regarding public/private organizations – I group these types of institutions together because they are operating at similar levels, particularly as they are associated with larger bodies and groups that conduct work outside of the local community. While there are some larger non-profits included in the group, they are distinguished from community-based organizations, which solely operate at local levels.

A list of the participating organizations and agencies can be found in Appendix A. All identifications of individual stakeholders are kept anonymous throughout the study to protect their confidentiality. The methods and their purpose for this study are described below, followed by a discussion of the analysis approaches.

Key Informant Interviews

Key informant interviews provide understanding of motivation, behavior, and perspectives of participants (Mountain States Group 1999, USAID 1996). The first and second research questions are explored by conducting interviews with key informants in Boston to examine the ways in which stakeholder perceptions are shaping the community's adaptation needs and preferences, particularly as they relate to coastal flood risk due to SLR. The participants and their responses are grouped based on their perspective societal roles, guided by their professional titles and background information. A convenience sample and snowballing procedures were employed to identify and recruit participants to engage in semi-structured interviews. The interview guide and consent forms can be found in Appendix B and Appendix C. Participants were identified starting with the Stone Living Lab Advisory Board and community contacts from the University of Massachusetts Boston School for the Environment. This initial list consisted of an array of field experts and community groups involved in climate change adaptation planning initiatives for Boston. I asked all of the participants for additional suggestions to widen the panel of experts to inform this research. A total of 40 participants were reached, including 16 stakeholders working with private/public organizations, 13 people working with community-based organizations, and 11 local/regional officials.

Demographic information on interview participants was not recorded for the purpose of this research as the aim was to focus on the various societal roles of participants and to gauge overarching themes across groups. Most interviews were one-on-one, though there were two interviews where participants chose to do the interview along with a colleague.

The interviews were semi-structured. Open-ended questions helped to ascertain individual perceptions. Participants were asked about how they understand and experience climate change, how they currently perceive climate risks related to SLR and coastal flooding, and how they are thinking about and/or participating in City-wide adaptation initiatives. The interviews served as discussion spaces for participants to articulate their values regarding climate change adaptation strategies, helping to ascertain individual perceptions, which is a means of defining and setting objectives to address community-defined problems. The individual interviews enabled collection of information on diverse stakeholder viewpoints, building on discussions of climate change adaptation challenges to ask participants to identify possible community objectives and their preferences for adaptation strategies. Each interview was tailored to the subject's particular role and expertise and a common set of questions were given to all subjects. Given the ongoing COVID-19 pandemic at the time of this research, all interviews were conducted remotely through video/audio platform.

As part of the analysis, interview responses were assessed regarding the defined role of various stakeholders, examining how different stakeholders are working together and considering each other, and how their respective priorities connect or disconnect. The interview analysis includes organizing challenges based on thematic similarities and

identifying action-oriented phrases to connect particular issues to potential consequences and challenges for the community as a whole. In order to assess the interview transcripts, I developed an analytic codebook focused on identifying and distinguishing various perspectives, key ideas, and themes from the interview questions and resulting discussions. As I examined the interview data, the interview codebook was expanded to account for emerging ideas and themes, including those related to theoretical framework and social contracts. The analysis focuses on an examination of interview responses to explore the nature of the problems and challenges identified by participants, as well as an exploration of broader community objectives for climate change adaptation strategies.

Focus Groups

The third research question is explored by conducting focus groups where interview participants were invited to engage in discussion spaces in which they could reflect on previously identified adaptation objectives. Focus groups are special types of group settings in which participants engage and listen to one another to better understand how people feel or think about the issues at hand, while the research gathers information emerging from the discussion (Krueger & Casey 2000). These types of discussions are carefully planned and designed to obtain perceptions regarding the topics of interest in an environment that promotes self-disclosure among participants (Krueger & Casey 2000). Focus groups work particularly well to gain understanding about the range of opinions different groups of people can have in addressing decision-making problems.

The purpose of these discussions was to bring together a mix of stakeholders representing community-based organizations, private/public organizations, and

local/regional government officials in order to connect their ideas and perspectives regarding what coastal adaptation strategies should entail and prioritize for Boston. Two focus group discussions with five participants each were conducted with previous interview participants and included representatives from all defined stakeholder groups. The first focus group discussion included two participants representing public/private organizations, two participants representing local/regional government officials, and one participant representing community-based organizations. The second focus group discussion included two participants representing community-based organizations, two participants representing local/regional government officials, and one participant representing public/private organizations. All focus groups were conducted remotely through the ZOOM © video/audio platform to accommodate the participants' schedules and availability. The discussions allowed people to reflect, ponder, and articulate their opinions as well as listen to the experiences of others. The FGD guide and consent forms can be found in Appendix D and E.

The FGD for this study served as spaces in which priorities across stakeholder groups could be compared to determine potential solutions. These objectives were determined from an aggregation of individual stakeholder responses regarding climate change adaptation challenges and priorities identified from the previously described interviews. The discussions concentrated on ranking objectives established from the previous stages of analysis, also considering potential means of implementation and decision actions as identified among the participants. The participants were given a list of primary themes of objectives raised from the interviews, and they were instructed to rank

the objectives in their order of preference from most significant priority to the least significant priority. The aggregated results of a ranking poll completed by all participants then served as the basis of the discussion. Participants were asked questions regarding the ranked results and space was given to unpack the responses, discuss rationale for rankings, and the potential for alternative or combined objectives. The focus group discussions helped to determine priorities across stakeholder groups and how they could be compared to determine potential problem solutions. The conversations further helped to shed light on how different stakeholders were framing their decisions and considering each other in their choices, including offering potential trade-offs for determining decision actions. Ultimately, the focus groups helped to demonstrate how participants could connect their ideas and raise concerns regarding decision processes. Additionally, the findings from these discussions illustrate how objectives for adaptation strategies can be integrated. This integration considered the various roles and responsibilities of each stakeholder group in terms of current modes of decision-making processes, and the potential for shifting relationships to support more collaborative action.

2.2.3 Analysis Approaches

The information gathered from the key informant interviews were first assessed with cognitive mapping techniques, and then by applying the VFT analysis. The information from the focus group discussions was also assessed using the VFT approach. All stages of my analysis were guided by the theoretical framework that I developed for this assessment. The analysis to construct the cognitive maps was guided by the social contracts framework, focusing on characteristics of imagined social contracts.

Considering imagined social contracts in particular, this analysis was sensitive to the social relations and the collective history and culture of various stakeholders. In the case of examining imagined social contracts in climate change adaptation processes, I was concerned with how stakeholders articulated social and cultural limitations to adaptation, boundaries of social acceptance, and tolerable loss and damage (Blackburn & Pelling 2018). The participant responses then informed how individuals and stakeholder groups in Boston working to address climate change adaptation issues are thinking about each other and shaping the problems to be addressed. The cognitive maps constructed in the initial interview analysis help to define the decision context by identifying the challenges described by participants with the aim to better understand broader priorities discussed.

The VFT approach complements the cognitive mapping techniques (Killemsetty & Patel 2022). Working from the decision context described by participants through their articulation of challenges and priorities for coastal climate change adaptation, further interpretation with the VFT framework helps to identify preferences and values amongst stakeholder groups in the form objectives described in interview responses. The application of VFT then helps to facilitate community input into climate change adaptation research and serves as an example of how to address adaptation challenges by focusing on the some of the underlying social dimensions, including individual and collective values. The VFT approach is also supported by the social contracts framework of analysis, as the framework helps to distinguish between expectations across stakeholders groups and acknowledges how individual values among groups are informing potential adaptation actions. I first applied the social contracts lens to the VFT

approach through additional analysis of KII data, focusing on practiced social contracts. This assessment recognizes the pre-defined roles of the stakeholder groups in society and how these perspective roles can influence objectives and the framing of decision actions. The VFT approach does not entail applying a specific theoretical perspective, but in this case VFT as an approach helps to uncover objectives among stakeholders that are shaping adaptation strategies and the associated examination of practiced social contracts frames these objectives in the context of stakeholders' professional roles and community involvement. I then applied the VFT approach and social contracts lens to assess the FGD data, in this case considering how imagined social contracts and practiced social contracts could be considered alongside one another to inform the process of integrating objectives. Applying the VFT approach with the social contracts lens helps uncover strategies for community adaptation based on the understanding of stakeholder preferences and roles regarding certain adaptation pathways.

Cognitive Mapping

Cognitive maps were developed to visualize and aggregate the emerging information regarding stakeholders' motivations and priorities for climate change adaptation in Boston. This initial analysis helps to inform the exploration of broader community objectives for climate change adaptation strategies and associated potential actions. Two cognitive maps were developed as part of the analysis – one map outlining the broad categories and underlying themes shaping climate change adaptation challenges in Boston, and a second map outlining the priorities for climate change adaptation to address these challenges, which were broken down by stakeholder groups.

Cognitive mapping techniques have been used in strategic management, environmental conflict management, and political sciences, applied as a flexible tool that can model people's diverse motivations and relations (Siau & Tan 2005, Vanwindekens et al 2013). Cognitive mapping is a methodology that helps to blend individual perspectives to highlight the diverse subjective views of participants and generate a shared understanding of the problem at hand (Eden & Ackerman 2001, Guarnieri et al 2016). The general approach of cognitive mapping is to extract subjective statements from individuals regarding a particular problem domain to uncover meaningful concepts that can be connected to describe relationships (Siau & Tan 2005). Cognitive maps are developed by creating a general structure to represent the identified concepts with consideration for the most central variables and how they can be linked to each other (Vanwindekens et al 2013).

For this research concepts were determined by assessing KII data gathered from various Boston stakeholders working in climate change adaptation spaces. Cognitive mapping techniques were applied to identify beliefs and values among individual participants and stakeholder groups about climate change adaptation for the City of Boston. Concepts were linked by identifying action-oriented phrases and assertations made by participants, connecting them to overarching goals or themes of the discussion. Linkages were made based upon the content and context of the conversations, including concepts from the interview questions by considering the implications embedded in statements made by participants in their responses. The cognitive maps were then created by evaluating the basis of participant responses, the inferences that can be made based on

those responses, and the underlying explanations behind the statements (Eden & Ackerman 2002). For the purpose of this research, it was important to connect ideas across individual perspectives and among stakeholder groups to identify key themes regarding climate change adaptation challenges and particular priorities for addressing these challenges. This process included developing codes to expand the pre-established code book by defining variables and relations between stakeholders that emerged from the assessment.

The interviews were coded and assessed working from the original codebook that I developed to identify different types of challenges described by interviewees, which were organized based on thematic similarities. Priorities among stakeholders were determined by connecting issues and potential interventions described by the participants, and responses were organized based on their perspective societal roles. In order to build the cognitive maps, coded phrases were aggregated to connect issues and ideas identified and experienced by different individual participants. The pre-defined variables helped me to yield key themes and ideas regarding stakeholder identification of problems and priorities. Then, throughout the analysis I was able to further define new variables to reflect how stakeholders viewed each other and their roles in potential decision-making processes for adaptation to uncover and consider imagined social contracts between participants. The aggregated variables and themes I identified were used to create the two cognitive maps, each formed as causal hierarchy network to link broad ideas to associated issues to create a comprehensive understanding. My coding process helped to create two distinct cognitive maps to represent the challenges described across

stakeholder groups and the priorities that were discussed across and within groups to address such issues. The maps I developed are structured based on participant explanations from interview responses and organized to represent the overarching themes that emerged within and across stakeholder groups. This approach serves as a meaningful way of structuring and organizing the overarching challenge of adaptation to determine how stakeholders are informing adaptation preferences for the community.

Values-Focused Thinking Analysis

The Values-focused Thinking (Keeney 1992) analytical approach is a means to demonstrate how a diverse set of stakeholder perceptions can determine decision-making actions for adaptation, while identifying challenges and opportunities for proposed strategies, particularly to support equitable outcomes. VFT explores how decision-making processes can benefit from early attention to community-wide and individual stakeholder values. Clarity about values is crucial for identifying information needs, creating more attractive alternatives, and serving as the basis for analysis of critical policy questions (Keeney 2001). This research acknowledges that adaptation to changing climate conditions in a coastal urban environment consists of a set of intersecting processes, requiring approaches that can support diverse community needs and values. VFT as a research approach emphasizes finding solutions to complex problems facing high uncertainty through the process of learning more about the problem across stakeholder perspectives, uncovering what policies and alternatives various groups consider worth evaluating (Badami 2004). This is an analytical approach that relies on traditional data production methods, such as interviews and focus groups, while being

intentional about developing distinct forms of knowledge (Reid 2014). In collecting and analyzing this type of information for my research, I developed VFT hierarchy diagrams and network maps to systematically describe objectives, concerns, relationships, and connections among participants to illustrate community-wide motivations and priorities for adaptation and associated strategies. The VFT networks developed as part of this study show implementation challenges and opportunities for NBS in Boston, helping to determine how best to design and implement adaptation strategies that will address climate change risks and have community-wide benefits.

Overall, the approach facilitates an in-depth examination of the complex socio-ecological problem climate change adaptation presents, allowing for mutual learning and extended stakeholder involvement regarding approaches to adaptation. Applied in the context of this research, VFT is a tool for meaningful engagement that highlights the local dimension of climate change adaptation planning and governance, highlighting the importance of local knowledge in constructing effective planning and policy efforts (Arvai et al 2001). By engaging various stakeholders who are going to be affected by the adaptation plans and subsequent actions, this participatory approach helps to outline community priorities and proposed solutions more clearly to inform the strategies and associated policies. The VFT analysis approach then helps to generate potential solutions that reflect stakeholder values, by incorporating various stakeholder concerns, breaking them down and structuring them into a measurable set of variables (Keeney 1994; Keisler 2012). Ultimately, the VFT approach is a tool for meaningful engagement of vulnerable communities in climate change adaptation planning and governance, highlighting the

importance of local knowledge in constructing effective planning and policy efforts. This approach posits community groups and institutional actors as content experts for developing adaptation strategies and policies. Such an approach helps to foster opportunities for participants to inform policy strategies for the City of Boston. The VFT assessment directly involves participants representing diverse actors in the decision-making process by incorporating people's multi-dimensional values and needs (Badami 2004). Part of this analysis includes an examination of the role of institutions and community groups in defining decision-making objectives and fostering equitable adaptation. The results help to determine and demonstrate how the perspectives of various stakeholder groups inform design and implementation of NBS to meet community-wide objectives.

The application of the VFT approach for analysis identifies and sorts fundamental objectives and means-end objectives across stakeholder groups, examining the reasoning behind participant responses. Fundamental objectives focus on reasons of interest for the issue at hand, and means objectives are those that have been defined with implications for addressing the issues (Keeney 1992). The means objectives are useful for analyzing the decision problem of addressing coastal flood risk in ways that meet diverse community needs by considering potential solutions, whereas the fundamental objectives are those that guide the overarching decision-making process. Identifying and distinguishing between these objectives serves to create a fundamental value hierarchy, which outlines values from most general to most specific, connecting fundamental objectives to means objectives, and showing the interrelationships between objectives (Keeney 1996).

Fundamental value hierarchy networks were developed for each of the stakeholder groups based on responses from interviews with participants, and an integrated VFT network was created from the results of the FGD. These networks are the results of the applied VFT approach to analyze interview and focus group transcripts, and they were constructed and assessed according to the three primary stakeholder groups assigned to participants regarding their professional roles. Often VFT networks can be developed with the participants as a one-on-one or group activity, or they can be developed based on an expert assessment of qualitative data (Keeney 1992). For the purpose of this research, I chose to conduct an expert-based assessment of the data I collected from KII and FGD to develop the VFT networks rather than generating the networks with the participants. The networks I developed are an output of the coding of the open-ended qualitative transcription analysis that I conducted. The networks that I developed from the interview data were 'member checked' through the FGD by presenting the objectives identified from the interview analysis and discussing them with focus group participants. This was a decision I made to allow for subsequent analysis of the KII and FGD, building on an initial assessment to further inform the construction of the VFT networks. The open-source software XMind © was used for building the VFT networks.

VFT Interview Analysis – Clarifying Multiple Stakeholder Values

Analysis of interviews applying the VFT approach helps to identify and sort fundamental objectives and means-end objectives across stakeholder groups, examining the reasoning behind participant responses. Connecting the fundamental objectives to the means objectives helps to uncover relevant decision actions for community adaptation

and associated strategies based on the understanding of stakeholder preferences regarding certain adaptation pathways. This assessment includes examining the ways in which equity factors in adaptation considerations across stakeholder groups and explores the role of different groups in defining decision-making objectives and actions for the community. The interview questions I asked participants were structured in a way that elicited responses to define overarching challenges to climate change adaptation in Boston and general priorities for addressing these challenges, and then discuss particular preferences and ideas for meeting priorities, including specific strategies. The interviews then were spaces for individual stakeholders to describe their understanding of the nature of climate change adaptation problems for Boston as well as to identify objectives in addressing the problem, which suits the VFT approach. Values were identified by participant responses to questions about climate change adaptation objectives, including the meaning and reasoning behind objectives. In this case it is important to clarify how decisions will be informed by more than one stakeholder group, and how different stakeholder groups are influencing potential actions. I developed separate value structures of different stakeholder groups to help illuminate distinct decision frames, as well as opportunities to combine or align values (Keeney 1992). The VFT framework of analysis then helps to inform potential adaptation strategies, such as NBS for coastal flood protection, that reflect stakeholder values, by incorporating various stakeholder priorities, breaking them down and structuring them into a measurable set of variables (Keeney 1994, Keisler 2012).

This analysis followed the four basic steps in the VFT approach as established by Keeney (1992):

1. Develop an initial list of objectives, identifying the objectives by discussing the discussion situation.
2. After collecting objectives, structure objectives, distinguishing between fundamental objectives and means objectives.
3. Construct a means-end objective network by displaying objectives in terms of end objective and means objectives and their relation to the fundamental objectives.
4. Build a fundamental value hierarchy network to map the relationships between the means-end objectives and fundamental objectives. The hierarchy network acts as a directed graph to organize objectives into levels that feed into one another.

In order to identify the objectives emerging from interview discussions, analytic codes were developed to assess participants' responses to interview questions regarding adaptation priorities and considerations for potential adaptation strategies, including NBS. This approach followed deductive coding of the interview data, working from variables, themes, and relations that emerged from the initial analysis to identify primary preferences for each group of stakeholders. The analysis included thematic assessment and pattern matching to identify unique values that could be aggregated and converted to create a hierarchy network for each stakeholder group.

VFT Focus Group Analysis – Insights for Decision-Making

Analysis of focus group discussions is also approached by applying VFT. In this assessment, decision actions are identified through the development of a VFT network of integrated stakeholder perspectives. Similar to the VFT networks developed from the interviews for groups of stakeholders, the VFT network developed from the focus groups discussions reflects the array of stakeholders involved, but in this case as a singular

integrated network. The values and objectives identified and ranked by focus group discussion participants informed the development of this integrated network, assessing potential trade-offs and assigning weights to objectives. An integrated VFT network was created by combining objectives defined in the initial VFT hierarchies developed for each stakeholder group, and then updated based on findings from the focus group discussions. In order to combine the objectives hierarchies from the previous stage of analysis, the following steps were followed:

1. List all top-level objectives from each hierarchy.
2. Aggregate objectives that are similar or relatively the same.
3. Group top-level objectives to define set of fundamental objectives for combined hierarchy.
4. Repeat previous steps for all lower-level objectives from each hierarchy.
5. Match lower-level objectives as they associate with top-level objectives.
6. Continue process until all objectives from the individual hierarchies have been accounted for.

The resulting draft of combined fundamental objectives hierarchy network was then reviewed and revised in order to ensure that the network was a comprehensive reflection of the perspectives of the various stakeholder groups. Additionally, any omissions from the original VFT networks were rectified by assessing how each of the objectives is addressed by the combined hierarchy network. The combined network was further adjusted to reflect the objectives and alternatives raised by participants during the focus group discussions. The network was finalized then by applying the results of the ranking exercise from each focus group discussion.

From the newly established combined network, weights could be allotted to objectives and alternatives that were identified in the discussions based on the rankings made by participants. Weighting is not always applied in VFT assessments, but in some

cases the values identified by participants can be assessed by their relative importance based on the preferences articulated, which can indicate desirability for possible outcomes (Keeney 1996). In the case of this assessment, I apply a simple ranking method by examining the results of the ranking exercises from each focus group discussion. The results of these exercises indicated preferences for fundamental objectives and the discussions further defined characteristics of these objectives, as well as the means achieving the stated goals. Weights could be assigned to each of the objectives using a rank-based weighting method (Barron & Barret 1996). This ranking method helped me define the primary fundamental objectives based on the ranks given by each group, from which calculated weights could be applied to develop the hierarchy network. These fundamental objectives were also considered in terms of how they support the overall strategic objective to minimize coastal flood impacts on the Boston community.

Applying a simple weighting exercise to determine the fundamental objectives for the hierarchy network helped me to determine the most and least preferred priority objectives. Using the results from the ranking exercise further informed how objectives could be grouped into policy relevant themes. The weights were not distributed across the VFT network as stakeholder responses from the focus group discussions emphasized the need for all objectives to be addressed. The stakeholders participating stressed that the ways in which objectives are addressed are dependent on considerations for the timelines and responsibilities for executing the objectives. The resulting themes reflect the characteristics of objectives highlighted by the different stakeholders participating in the focus group discussions. The themes were determined by the characteristics of objectives

highlighted by different stakeholder groups in the focus group discussions. Particular decision actions were identified across policy themes to reflect critical actions to be undertaken for the community. Associated with these decision actions are the roles and responsibilities for implementation, as identified by participants. From the discussions means objectives were identified based on language and descriptions participants used describing how fundamental objectives could be achieved. Additionally, potential decision actions were also identified across themes to reflect critical actions to be undertaken for the community. At this stage of the assessment, the weights were used primarily to establish the fundamental objectives and to connect them with means objectives and potential decision actions.

2.3 Overview

I develop a novel theoretical framework connecting the ideas of evolving, multiple social contracts in a changing climate, values-based adaptation planning, and transformative adaptation to better understand how stakeholder perspectives, roles and responsibilities are shaping adaptation approaches and potential decision actions for the community. I apply this framework in three stages: 1) assess the subjective motivations priorities across stakeholder groups through an imagined social contracts lens to understand the ways in which they perceive climate change adaptation challenges and how they hope to see these challenges addressed and prioritized; 2) assess the objectives across stakeholder groups through a practiced social contracts lens to determine how the selection of adaptation strategies is enabled or constrained based on current governance systems; and 3) assess how these different types of social contracts and associated ideas

can be considered together to shape adaptation strategies with the potential to improve community-wide outcomes.

The analysis approach covered in this chapter follows the theoretical framework as a guide for this assessment. By considering the relationships between stakeholder groups and their societal responsibilities, the differences between individuals' subjective visions of just climate change adaptation and the reality of defined roles shaping adaptation actions can be distinguished. This analysis maintains the concept of multiple social contracts to account for the varying roles of state and non-state actors in climate change adaptation planning (Blackburn & Pelling 2018). The initial analysis to produce the cognitive maps focuses on **imagined social contracts**, or those that reflect stakeholders' subjective ideas of adaptation challenges and how they can be addressed. The second stage of the analysis focuses on **practiced social contracts,** developing VFT networks for different stakeholder groups to understand how current roles and responsibilities among stakeholders are shaping decision actions in reality (Blackburn & Pelling 2018). The third stage of analysis seeks to consider **imagined social contracts and practiced social contracts simultaneously** by developing an integrated VFT network.

The design and implementation of adaptation strategies requires input from numerous actors, but the ways in which different groups inform the adaptation process will vary. Examining the underlying and predefined roles and relationships among the stakeholders throughout this assessment helps to uncover the gaps that exist between imagined social contracts and practiced social contracts. A deeper investigation of the

values and interests among stakeholders then helps to generate a better understanding of the current nature of societal relationships and responsibilities shaping adaptation decisions as well as opportunities for how these arrangements can evolve to address existing and future challenges (Adger et al 2012). This type of assessment uncovers adaptation considerations across stakeholder groups, exploring the role different groups play in defining decision-making objectives and actions for the community, highlighting where priorities conflict as well as opportunities for change that could create more beneficial outcomes. There are also potential benefits for participants and their community through involvement and increased awareness, acknowledging their roles in climate adaptation processes.

CHAPTER 3

MOTIVATIONS SHAPING ADAPTATION STRATEGIES FOR COASTAL FLOOD PROTECTION IN BOSTON

3.1 Introduction

This chapter examines the primary climate change adaptation challenges and concerns identified among various stakeholders in Boston. The chapter contributes to the dissertation's primary objective to demonstrate how climate change adaptation strategies can be designed and informed by diverse stakeholder perspectives and values to support transformative adaptation. An understanding of the challenges stakeholders operating at various levels in Boston helps to define the scope of potential climate change adaptation strategies for coastal flood protection in the city, including the potential for NBS. Understanding these perspectives can also help to define overarching community objectives for climate change adaptation. When considering adaptation strategies for a community, it is important to apply a contextual lens. Context is important, as local community dynamics, particularly stakeholder relations and decision-making processes, often define people's access to resources and determine whether outcomes are equitable (See & Wilmsen 2020). Without attention to and consideration of the drivers causing societal vulnerability, and those exacerbated by climate change, policies are likely to

maintain the status quo and result in further exclusionary patterns of development, as well as potentially reinforce inequality in the long term (Anguelovski et al 2016, Georgeson et al 2016, Shi et al 2016, Shi 2020). This chapter sheds light on stakeholder perceptions of Boston's climate change challenges in tackling increased coastal flood risks.

In examining the case of Boston, it is important to understand the community's various stakeholder perspectives on the challenges climate change presents for the city. Understanding these challenges will help to determine how NBS, in comparison to other strategies, can be developed and implemented to meet community needs to address underlying vulnerabilities with increasing coastal flood risk. Even as cities like Boston work to develop and support innovative solutions such as NBS, there remains contextual challenges of urban governance and limited scientifically validated knowledge on emerging adaptation options (Kabisch et al 2016). Conceptually, NBS has the potential to be transformative for communities by creating opportunities to reimagine social-ecological relationships, enhancing nature to address societal challenges (Chausson et al 2020). However, in practice there are varying motivations and interests among local community groups, public officials, and private institutions that must be considered, as they affect the overarching process of adaptation and the selection of certain strategies (Cousins 2021). Stakeholders have different ways of framing adaptation and the range of subjective ideas and priorities across groups are important to understand in order to determine potential adaptation strategies and their outcomes for the community.

In this chapter, I examine the climate change adaptation challenges identified by various Boston stakeholders through KII. The chapter focuses on initial findings from

the interviews, using cognitive mapping techniques to examine and discuss the defining adaptation challenges among stakeholders, indicating the overarching motivations for adaptation, and the implications of these for NBS. The interview analysis helps to uncover some of the opportunities and limitations for adaptation to increasing coastal flood risk for the city. This analysis serves to generate a better understanding of Boston's climate change adaptation challenges affecting adaptation efforts that are already underway or envisioned for the future.

3.2 Results

The results are presented as a cognitive map, outlining the broad climate change adaptation challenges identified amongst all an array of stakeholders engaged in climate change adaptation efforts for Boston participating in this study. I discuss these results in terms of the ways the various stakeholders described adaptation challenges, including how they consider other stakeholders and their influence on adaptation processes and potential outcomes. Finally, the implications for NBS are discussed relative to the imagined social contracts between stakeholder groups.

3.2.1 Cognitive Map of Challenges

The challenges identified by various stakeholders in Boston are structured and connected with each other as causal pathways to create the cognitive map as seen in Figure 3. Interview responses were categorized into three distinct themes based on participants' descriptions of adaptation challenges raised in discussions. The primary challenges were organized by those associated with funding and investment, community consensus and engagement, and governance and management. Each of these broad

challenges account for themes generally discussed and agreed upon across stakeholders, and they include various sub-sets of challenges and underlying conditions that participants identified in the interview discussions, which could be aggregated into the broader categories. The challenges identified through this analysis each have implications for how stakeholders view the opportunities and limitations of adaptation approaches to address increasing coastal flood risks for the city of Boston. This includes implications for how these challenges could be addressed through NBS or affected by such strategies.

Funding and Investment

One of the most significant challenges described by stakeholders is the matter of funding climate change adaptation projects and initiatives and the types of investments available. In fact, funding and investment challenges were mentioned in all but two of the interviews conducted. Across stakeholder groups participants described concerns regarding the availability of funding to meet climate adaptation goals, as well as how funds that are available will be distributed in the community. As one stakeholder encapsulated the issue, "I think something that is still always a question mark is the funding around the work, so how much is it really going to cost, who is funding it, how, when? All of it." (Interview 34, Community-based Organization). There are concerns around the availability of funding and the relatively high costs for adaptation planning and subsequent implementation, reflecting the challenge of finding adaptation strategies that are affordable and cost-effective in the present as well as in the future. Costs are particularly a concern when thinking about coastal flood management and how it is going to be funded.

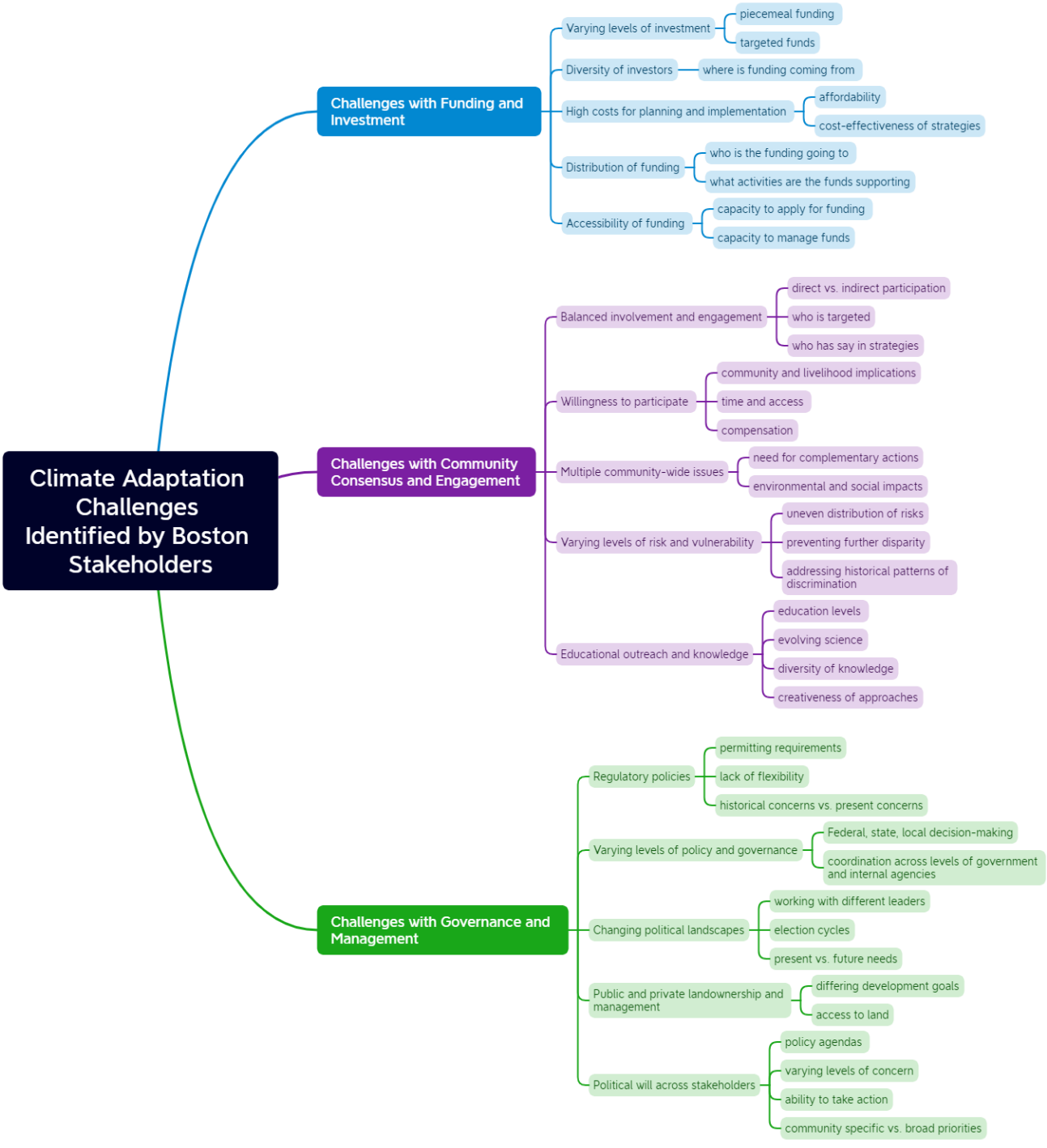


Figure 3 – Cognitive Map of Climate Change Adaptation Challenges. This Cognitive Map shows the climate change adaptation challenges identified by Boston stakeholders based on responses from key informant interviews.

One stakeholder stated, “Coastal flooding is for sure something we're thinking a lot about regionally, but it's so expensive. The real challenge is how do we mobilize either state resources and/or federal resources to get enough funding in hand to make a difference?” (Interview 32, Community-based Organization). In this case, the high cost for planning and implementing coastal adaptation strategies seems top of mind amongst local organizations, who are particularly concerned about where the funds will be coming from and when they will become available.

Funding availability also concerns the accessibility of funding to meet these needs, which includes determining reliable sources of funding, clarity on where the funds are sourced, and diversity of funding providers. Answering these questions remains an obstacle to work moving forward. As one participant stated, “There's so many different players and so many voices that need to come to the table, not just to talk about the regulations, but to talk about who gets what first and where do we get these funds and what makes the most sense. That seems, to me, the biggest hurdle in just even getting to a next step” (Interview 5, Public/Private Organization). The accessibility of funding is a concern across stakeholder groups, as there is lack of clarity on exactly where the funding will come from and who will receive these funds. Accessibility of funding further relates to the challenge of finding and maintaining the needed capacity to apply for and manage the funds required to design and implement adaptation projects. This challenge is particular of concern for community-based organizations who have limited capacity but rely on external funding. One of the participants described,

> It's been very hard to get the funding into local hands. It's very hard to access the funding. In general, right now, we

> are flush with funds, we're not flush with staff. The funding is difficult to access and it's difficult to use. It can be very narrow. The biggest thing is that we just need dedicated funding for climate resilience. (Interview 32, Community-based Organization).

This issue calls into question who currently has the capacity to access and manage necessary funding, who requires assistance in this endeavor, and whether that assistance is available to groups in need. Not only did participants discuss access to funding in terms of availability, but they also considered the challenges of distributing resources effectively. Distribution of funding requires more streamlining of funding sources to those actively involved in the community. As one participant noted,

> Instead of just being like how can we help you get grants, speaking as higher levels of government, maybe it's more just like can the upper levels of government just better resource the communities that need the access to these funds to just do the work without having to go through the complexity of potentially year-long application processes for a grant. If the money that's available for this work was just more readily available for the people that are doing the work, whether that's local government or maybe even non-profits and private institutions, I think that would be a huge benefit to just advancing this work faster. (Interview 19, Local/Regional Government).

The issue of how funding is distributed also touches on the questions of who the funding is going to, as well as what activities the funds are supporting. If all groups are concerned with funding and financing, clarity is needed on what funding is available to who, as well as the type of work for which funds are available. Funding distribution then also concerns whether and how adaptation strategies can be equitable and reach communities most vulnerable. As one participant aptly put it, "Doing it more equitably and doing it more holistically takes more time, that takes more money, and we need to make sure that our

funding supports that." (Interview 40, Public/Private Organization). In order for vulnerable groups to benefit from the adaptation strategies, they also require financial support and stability.

Community Consensus and Engagement

Another important challenge described by stakeholders is reaching community consensus on adaptation approaches to address coastal flood risk, as well as ensuring community groups and residents are directly engaged in adaptation processes for the city. These issues were mentioned in all 40 interview discussions, but individuals had different ways of describing the challenges of community engagement. In this sense, community consensus and engagement challenges are shaped by various sub-sets of challenges for stakeholder groups. One of the primary aspects of this challenge across groups though includes the need for balanced involvement and engagement in the adaptation processes for Boston. This challenge concerns those who are targeted by adaptation engagement efforts and reflects on how engagement strategies can affect who has a say in strategy development and implementation. One participant stated,

> The one thing I want to see us do is really not lose sight of the public engagement as we have all of these technical arguments over what we should or can do because it's very easy to say, "Well, we've got to get all the experts in the room decide for the city, how do we protect it," and not have a good sense of what it would mean for people to build a wall here, build a salt marsh here and how that would impact their lives on a daily basis. (Interview 14, Public/Private Organization).

It is not enough for those actors who are regularly involved in planning processes to dominate decisions for adaptation, rather planning needs to be more considerate of

community needs. Engagement challenges also consider ideas of participation, particularly distinguishing between the levels of involvement required and whether direct or indirect participation among residents and community groups is necessary. People's willingness to participate in adaptation efforts is also a challenge, reflecting the ability of various community members to engage in community-wide adaptation efforts. This means meeting people where they are at, as one participant explains,

> I think anything around community engagement, but really if you want to talk to residents in this neighborhood about climate change, you can't talk about sea level rise. You need to talk about, oh, does your neighbor have an AC or like have you called your grandma about not locking her windows at night or something. I don't know all the specifics, but you have to make it very relevant to people. (Interview 28, Community-based Organization).

Community engagement is top of mind for local organizations, who are thinking about how to get more people involved in initiatives. This type of engagement requires time for and access to participation spaces, and in some cases compensation for community participation. Getting around traditional forms of community engagement is part of this problem, as one participant noted,

> Meetings are extremely helpful and really valuable, you're just going to miss a lot of people…I feel like figuring out what are the opportunities to be in places where the community is already at, is already gathering and having that be a really big component of the approach rather than saying, "Okay, well, the community has to come to us." I think that's one piece of it. (Interview 6, Public/Private Organization).

Another participant further emphasized the point,

> If your community's not used to that kind of advocacy and that kind of engagement, then that's not going to be a good way to get people involved in the conversation. For those

> communities, I think it's important to acknowledge that they don't engage in the typical way than a more wealthy neighborhood would. Two, they're not really going to be at a place, where in a perfect world, they have all the time and space to be able to think about climate in a meaningful way. (Interview 5, Public/Private Organization).

The willingness to participate in adaptation efforts then has implications for people's livelihoods and the community as a whole. Part of this challenge is encouraging people to participate and understanding the opportunities of engaging with adaptation issues. Community-based organizations tended to highlight this, as one participant described efforts to engage more people in the planning process:

> We need your perspective at the table because we're all going to be living with these decisions that we're making, both in terms of our climate risk, but also in terms of something that has nothing to do with the climate, which is how the neighborhood is transformed as a result of these questions, of these resilience planning decisions. I think that's important. There has to be an authentic and clear invitation made that explicitly recognizes the inherent responsibility and agency that we have in making these resilience planning decisions…The real problem, I think, is that at least with respect to the large-scale infrastructure, the public engagement comes at the end after they've got a plan. It can't go that way. (Interview 12, Community-based Organization).

Further, the ability to address multiple community-wide issues simultaneously through adaptation strategies is both a concern and a challenge across stakeholders. Addressing this challenge calls for complementary actions and addressing social and environmental issues at once, which can only be determined by the community. One participant noted:

> You are worried about being able to access this space. You are worried about the connectivity between this space and another space. You are worried about the safety that you may not feel exists here because of the proximity to public transit where it's not safe to get here. There are things like

> that where we can be like, ‘We can make these improvements’ as part of this project that's focused on resilience that also just improves these day-to-day conditions so that even if you're not concerned with flooding. (Interview 20, Local/Regional Official).

In this case, local/regional officials tended to agree that resilience initiatives that address multiple issues in the community simultaneously are imperative, but there is still a gap in directly involving residents in the process of shaping these projects. Then there is the challenge of managing and addressing varying levels of climate risks and vulnerabilities, as climate change highlights how risks are distributed unevenly across the community. This challenge requires addressing historical patterns of discrimination and preventing further disparities. The role of trust in engagement and mending past grievances was captured by one of the participants as they noted:

> The challenge of relationship building speaks also to the challenge of a lack of trust in government, in municipal government, in state government, and particularly when it comes to environmental justice populations or priority populations. They don't traditionally have a good relationship because traditionally, whether it's direct government decisions that negatively impacted environmental justice communities or indirectly negatively impacted environmental justice communities, just our inequitable systems have not fostered a trusting relationship. That's definitely a big challenge to overcome when it comes to trying to encourage this model of capacity building and community engagement. (Interview 22, Local/Regional Government).

Providing educational opportunities and outreach that considers current community knowledge is another part of this challenge. Community engagement initiatives sometimes struggle to actively consider and account for various education levels in communities, diversity of knowledge, as well as the evolving science of climate change,

which calls for more creative engagement approaches. One participant noted that finding new ways to communicate is a difficult, but important challenge to address:

> I think storytelling is, I guess, an effective way to educate the greater population, because I don't think people want to get a bunch of numbers thrown at them…they want creative and thoughtful community engagement and addressing climate resilience, but other issues in the community as well through this public asset that we're working on. (Interview 9, Public/Private Organization).

In order to address the challenges of community consensus and engagement then relies on new means of communication for the involvement of a wider audience.

Governance and Management

Finally, stakeholders interviewed described the overarching challenges of governance and management regarding adaptation to climate change and increasing coastal risks. This category of challenges is defined by existing regulations, varying levels of policy and governance, changing political landscapes, management dynamics for public and private lands, and political will across stakeholders. While public/private organizations and community-based organizations tended to focus their concerns on local governance challenges, local/regional officials tended to be concerned about overarching governance processes and regional coordination. One participant from a community-based organization stated,

> I think there's going to be a tremendous governance challenge that's further exacerbated by the fractured nature of the way Massachusetts does land use planning. If you look at the Neponset Watershed, if you're trying to protect Hyde Park from flooding in Boston, most of what has to happen is well, upstream and not under the direct control of the city of Boston. (Interview 38, Community-based Organization).

Even as Boston is working towards addressing climate change adaptation issues within its communities, the city is ultimately affected by challenges occurring in surrounding areas too. While localized approaches are important, the city also needs to consider how people in the community are affected by current systems of government. On the other hand, a local/regional official considered the need for leadership in the region to address governance issues:

> I think getting the political system in a place where it's prioritizing people on the shoreline and prioritizing and really emphasizing either nature-based solutions or coastal-resilient developments or retreat, having truly leaders and politicians be on the same page seems critical. I'm not sure if that's happening right now, but kind of. There's leaders that do really care, but there are so many issues to care about, and there's always going to have budgetary constraints and whatnot, but yes, something about having the political system have the right fertile ground for the right solutions, that seems really important. (Interview 25, Local/Regional Official)

Strong leadership and better alignment within current governance systems is needed in order to address any of the challenges coastal communities face in light of climate change. Current political systems then need to work towards improving policy coordination to tackle present and future challenges.

In terms of regulatory challenges, existing policies were described by participants as being rooted in historical environmental concerns. These types of policies are difficult to apply under present and future changing conditions, as they are not flexible enough to allow for streamlined implementation of adaptive environmental strategies. A participant aptly captured this challenge:

> There is definitely a conversation that needs to happen around regulations that are currently in place and whether or not those allow for the type of climate-ready plans that we've got ready to go. You would think that they would have thought of that before coming up with the plans, but Boston is notorious for working backwards on things. It is really tricky to balance the need to update these regulations in order to allow for climate-resilient efforts to move forward, but continuing to hold on to the core of why those regulations are really important, which is to protect public access and engagement and, honestly, to prevent development from happening right on the coast in a way that's going to be harmful or in a way that's disjointed from things we've done in the past. (Interview 5, Public/Private Organization).

The challenges of working with various levels of policy also touch on the challenges of coordination and communication at multiple levels. Climate adaptation governance requires decision-making that needs to occur at federal, state, and local levels. Coordination then is required across different levels of government, across different government agencies, as well as between different organizations working within the community. Particularly as more people become involved in the decision-making process, lack of organized management creates a bigger challenge. As one participant noted,

> Currently, there are lots and lots of people and agencies, and organizations, and property owners, and departments, and whatever else. There's just tons of people who understand that this is a problem who are committed to trying to do what they can. It is not centrally organized. It's not prioritized across a broader spectrum of concerns. This ends up being kind of there's too much good intent, and not enough management to organize that. That's what we need. (Interview 15, Public/Private Organization).

Changing political landscapes also affects the ability to conduct consistent coordinated adaptation efforts affecting leadership, and the overall process of addressing various

present and future needs. Even those working within government agencies emphasized the challenges of coordination under these conditions, as one participant described:

> Are we building regional coalitions because a lot of these measures are going to be regional scale and I think that's the biggest priority for everyone from us at the local level to the federal level. They want to see more regional coalitions built. Just acting at all these different levels simultaneously, that's when it gets really, really difficult because you just struggle to do your own homework, but then at the same time, you have so many other levels that you have to be engaging on. (Interview 17, Local/Regional Official)

The structures and connections needed among various levels of government and across stakeholder groups are not currently in place to engage with each other effectively and consistently. Given current systems of management, if coordination does not improve, further challenges could develop.

The political will to take climate action is also reflected in governance challenges, as there are varying levels of concern across stakeholders to account for, which influences policy agendas, potentially hindering the ability to act in a timely manner. One participant stated,

> I think what a lot of people have said is it's going to take a really devastating storm event for us to get the political will and to find the funding to implement a lot of these plans, and that was true in New York for Hurricane Sandy and it's been true in a lot of other places. I would hope that that's not the case here, but we just need the political will to do it quickly. (Interview 10, Public/Private Organization).

The ability to take adaptation actions is also affected by the challenge of land management in Boston's urban environment, as well as surrounding areas, which is influenced by land ownership and varying development goals. As one participant noted,

“Most of Boston's coastline is controlled by state agencies and is not their own. The rest of it is pretty much controlled by private property owners. While Boston can influence its coastal protection systems, it can be a challenge for them to unilaterally do that” (Interview 4, Public/Private Organization). Part of this challenge also ties back to the issues raised by limited communication. One participant stated: “I think if anything, the opportunity is there, is improving communications because if you don't, then you have a piecemeal approach, and that's definitely not going to lead to a good solution that's going to help an entire area that is going to be affected by climate” (Interview 24, Community-based Organization). Currently, governance operations and communications are siloed, which could act as a major impediment to community adaptation efforts. Overall, the challenges that climate change adaptation presents highlight gaps and barriers in governance, which need to be addressed. As one participant noted, “We're running up against a governance structure that was focused on keeping traditions, making it hard to change traditions, and it makes it really hard to adapt to something this fast moving and unpredictable” (Interview 34, Community-based Organization). Shifts and improvements to enhance aspects of the current governance systems are necessary to tackle climate adaptation challenges and reduce the risk of further exacerbating the issues.

3.2.2 Implications for NBS

The ways in which the various stakeholders described climate change adaptation challenges for Boston reflect the shared experiences and subjective beliefs within the community. Although the challenges were described and identified by different individuals, these key informants described distinctly related ideas. Each of the

overarching challenges, including challenges with funding and investment, challenges with community consensus and engagement, and challenges with governance and management, were mentioned and discussed across almost all interviews. Even where these challenges were not mentioned directly by individuals, various underlying themes they discussed could be related back to these broader issues. Additionally, these challenges reflect how stakeholders across Boston are thinking about climate change adaptation for the city. The broader challenges identified will influence adaptation strategies selected for the community and determine their effectiveness.

Considering Boston's selection of NBS as a primary approach to address coastal flooding impacts that are anticipated as a result of climate change, it is important to assess how the broader challenges identified by the stakeholders could influence and be informed by these approaches. First, the challenges identified by the interview participants reveal the subjective visions of these stakeholders when it comes to climate change adaptation and adaptation processes for Boston. As an adaptation approach NBS are intended to work with nature, including urban nature, to address societal challenges and sustainability challenges, emphasizing the need for problem-driven and solution-oriented actions (Fan et al 2023). The barriers to NBS though tend to reflect societal challenges faced by a community, which calls for new forms of adaptation governance to take these types of actions into account. For instance, Seddon et al (2019) find that key barriers to NBS include mobilizing investment and overcoming governance challenges. These challenges demonstrate for a need for systemic change and holistic design that can fully account for the benefits of NBS. In Boston, even when climate change adaptation

challenges are becoming more apparent for the city, they tend to be viewed as separate from everyday community challenges and broader societal issues. As one participant noted,

> I think lots of people who are doing this work in agencies believe in climate change, I think that they are fundamentally aware of the problem, but their day-to-day is to execute on the business of their agency and the rules that they've been given. I think fundamentally, we probably need some people who break a few eggs along the way, to try to help to mobilize the day-to-day doing business through bigger objectives, again it's not easy. (Interview 4, Public/Private Organization).

While there is a relevant amount of awareness and concern within governing bodies regarding climate change and adaptation issues, more work is needed to connect these challenges to daily life in Boston. These circumstances are also reflective of imagined social contracts among stakeholders involved in climate change adaptation work. The various stakeholder groups can envision how climate change adaptation challenges can be connected to broader resilience initiatives, but this is not reflected in current policy and practice. In the case described above, some stakeholders expect government agencies to ensure that their day-to-day work incorporates addressing broader adaptation challenges. Currently though, such responsibilities are not fully recognized across the city's governing structure.

Making changes within current governance structures is often hindered by financing and investment strategies. Typically, regulatory structures are focused on economic growth and short-term gains, particularly when it comes to urban development, which affects the ability to incorporate the long-term investments that climate change

adaptation requires (Dorst et al 2022). This issue also affects how adaptation strategies are developed and implemented, including NBS approaches that are intended to generate benefits over time. Without adequate consideration of the types of investments needed for these approaches there are risks of promoting uneven adaptation benefits to the community. However, there is an opportunity in rethinking these types of funding models, particularly by considering the role local groups can play in mainstreaming climate adaptation initiatives. As one participant suggested,

> I think really changing, encouraging partnerships, and making it so community-based organizations can access funding directly, providing more technical support for grants, especially like the state grants that are a pain in the neck to apply for and manage once you have them. Making it easier for people to get planning and community engagement grants that are on meaningful timescales that you can really move at the pace of community leadership and partnership. (Interview 40, Public/Private Organization).

Here, stakeholders are envisioning new social contracts, considering how support for community-based organizations help to foster meaningful partnerships and further resilience efforts. In this sense, funding and investment strategies that prioritize community groups and organizations can help to foster partnerships and create new models of local governance. This type of restructuring also supports innovative adaptation approaches like NBS and can help to ensure the intended benefits are generated.

NBS present opportunities to connect climate change issues and societal issues, tackling these challenges simultaneously to promote community transformation. NBS as adaptation approaches call for consideration of the multiple dimensions of adaptation,

going beyond solely treating the exposure to immediate climate change impacts (Seddon 2022). By their definition, NBS are explicitly intended to address social goals, recognizing how greening cities can also advance community goals like environmental justice (Wijsman & Berbés-Blázquez 2022). There is a need though for enhanced understanding of how, when and where NBS can support a community's adaptation needs. This challenge is reflective of the need to enhance community engagement and rethink governance and management systems. Part of this process is connecting adaptation to how people feel about their community. One participant noted,

> I believe really deeply in the power of place. I think people know the places that they live. They know what's great about them, and they know what needs to be fixed. The hard part is, as I was saying before, to get people to not just think about what it means for their yard and their property values. How can we use this opportunity of refreshing and thinking about our infrastructure as a way to make our community more equitable and inviting and more resilient? (Interview 12, Community-based Organization).

The context of a place shapes the challenges a community faces as well as how interventions will perform and affect that community. In pursuing NBS, Boston must acknowledge how these approaches not only provide coastal flood protection but can also help reshape the city to address broader day-to-day issues. The ways in which NBS function are dependent on the local environmental, physical, and social contexts. In order to function effectively to protect people and places, while also providing social benefits, more knowledge is needed regarding the context in which they will be developed and implemented.

3.2.3 Summary

In assessing the responses from key informant interviews, numerous challenges were discussed, but three overarching categories emerged. The main challenges and concerns that emerged from interview responses could be broadly grouped into issues of funding and investment, community consensus and engagement, and governance and management challenges. The cognitive map helps to visualize these issues and some of the underlying causes and concerns. The participants could agree that adaptation to climate change is necessary, and they are concerned with the questions of how, when, and what it will take to meet community needs, demonstrating Adger et al's (2007) argument that adaptation is no longer a matter of choice. These challenges also have implications for NBS, which Boston has selected as a primary coastal adaptation approach to address flooding risks. The challenges identified here reflect some of the barriers to implementing NBS that will need to be addressed to ensure their effectiveness. Yet, pursuing NBS can also create opportunities for addressing these challenges as they promote social and environmental change. The collective identification of challenges surrounding funding, governance, and community engagement for adaptation indicate the need for solutions that involve stakeholders interacting at different levels, local and regional, which may impose new responsibilities to better address climate change risks (O'Brien et al 2009, Cash et al 2006). In order for NBS to be effective, changes to current governance and funding strategies will be necessary to overcome these broad challenges and to ensure community-wide benefits are achieved. The ways in which the stakeholders participating in this assessment frame these challenges also indicate that social and cultural shifts are

necessary in order to better connect the community and address longstanding issues. This assessment further informs the overarching ideas that may be shaping the adaptation priorities of various stakeholders.

3.3 Discussion

The findings of this chapter help to provide a baseline understanding of how stakeholders in Boston are defining climate change adaptation challenges, particularly those related to addressing increasing coastal flood risks. Based upon the challenges, adaptation priorities across stakeholder groups could also be identified. Ultimately, the results help to generate a more comprehensive picture of how climate change adaptation is thought about by individuals working in these spaces. The cognitive map produced establishes key concepts and emerging themes found in conversations among various stakeholders, highlighting the predominant challenges identified across groups, and then how each group is prioritizing certain adaptation actions. The initial analysis uses the subjective viewpoints and perceptions of stakeholders to structure the adaptation problem (Guarinieri et al 2016, Eden & Ackermann 2004, Keeney 1992). In this case, Boston's problem of addressing increasing coastal flood risks, with consideration for underlying issues and the associated challenges that will affect adaptation and how NBS can meet community goals.

Applying the social contracts framework of analysis illuminates how certain ideas may be shaping potential adaptation strategies for the city. The analysis for this chapter particularly focuses on the role of imagined social contracts. Applying this lens helps to identify some of the social and cultural opportunities and limits to adaptation for Boston,

including how they inform NBS as coastal adaptation approaches. Boston stakeholders have various concerns regarding climate change adaptation, and they mostly align in defining the types of challenges the community faces, even when they may have different motivations. In Boston, current policy structures and funding procedures combined with limited engagement and siloed management will significantly curtail efforts to implement innovative approaches like NBS. Such challenges also constrict the ability of producing holistic benefits for the community.

By understanding the role of imagined social contracts in shaping climate change adaptation challenges, the ways forward for NBS become clearer. The stakeholders engaged in this study identify the types of structural and social changes challenges that need to be addressed in their vision for promoting the transformational adaptation pathways NBS promise. Cross-sectoral partnerships, collaboration and coordination of multiple actors, strong political commitment and institutional frameworks for long-term planning and management are essential for NBS approaches to climate adaptation and mitigation (Ferreira et al., 2020, Frantzeskaki et al., 2020, Moosavi et al., 2021, Oke et al., 2021, Tzoulas et al., 2021). In order to promote transformational adaptation through NBS in Boston, the ways in which various stakeholders envision adaptation challenges must be considered and connected with one another. Sustainable transitions require engaging and activating multiple actors to guide the path towards desirable outcomes. NBS informed by local knowledge and context, as well as implemented through equitable distributions of power between local communities and government can facilitate adaptive management to ensure interventions enable necessary environmental and socio-economic

changes and positive outcomes for the community (Seddon et al 2020). The approaches applied in this assessment help to understand stakeholders' risk perception and ideas of community resilience that are informing climate change adaptation capacity in the community plans. The interviews and cognitive mapping then help to review and gain insights into the challenges and incentives for climate change adaptation that need to be addressed for implementing NBS in Boston.

3.3.1 Theoretical Framework Reflections

In assessing the initial findings from the KII, I focused on uncovering the climate change adaptation challenges among various stakeholder groups to better understand how they are thinking about current and future climate risks. I applied my theoretical framework as an approach with the intent to structure the problem of climate change adaptation for Boston through the perspective of diverse stakeholders in order to establish what factors are informing the adaptation process and selection of coastal protection strategies. This analysis was sensitive to the social relations and the collective history and culture of various stakeholders, considering imagined social contracts in particular. In this case, I was concerned with how stakeholders articulated social and cultural limitations to climate change adaptation (Blackburn & Pelling 2018). I focused on investigating different stakeholders' subjective conceptions of climate change challenges across stakeholder groups to reveal how this shapes adaptation processes for the community. The participant responses then informed how individuals and stakeholder groups in Boston working to address climate change adaptation issues are thinking about each other and the problems to be addressed.

From my assessment, it is clear that the decision-context is influenced and shaped by the stakeholders' subjective visions of just social order in their community. In this sense, accounting for imagined social contracts in my interpretations of stakeholder responses illuminates how certain perspectives are shaping broader community motivations for coastal climate change. The ways in which participants are framing adaptation challenges are reflective of their personal and professional roles in the community, which has implications for addressing broader issues that the city is facing. The collective identification of challenges signifies that stakeholders have similar ideas regarding current limitations Boston faces in addressing climate change risks, particularly if the city is seeking to generate transformative outcomes for the community. In considering NBS for coastal flood protection, the city and its stakeholders acknowledge current governance challenges, which indicates the need for restructuring and innovative engagement to achieve adaptation goals.

Employing cognitive mapping techniques worked to develop a visual understanding of the overarching climate change adaptation challenges for Boston, as defined by various stakeholders. The resulting cognitive map helped me to define the decision-context in which various stakeholders are operating to determine how best to tackle increasing coastal flood risks now and into the future. While the cognitive map I produced serves as a means to clearly outline the challenges described by the participants, it is not necessarily reflective of some of the underlying drivers of the issues raised by stakeholders. My assessment and application of the theoretical framework uncovers how stakeholders are connecting climate change adaptation challenges to broader societal

issues. However, the results are limited to my interpretation and translation of the responses and could be further expanded through additional analysis.

3.4 Conclusions

In this chapter I examined the climate change adaptation challenges identified by various Boston stakeholders. Using initial findings from the interviews, I generated a cognitive map to assess and discuss the defining adaptation challenges among stakeholders to determine the motivations and subjective priorities for adaptation across stakeholder groups. The analysis helps to shed light on how Boston stakeholders generally align in defining the primary climate change adaptation challenges for the city. The application of the social contracts framework of analysis uncovers the subjective conceptions of climate change adaptation for Boston among stakeholders, reflective of ideas that are sensitive to their collective culture and history, as well as their social relations and boundaries. The framework provides insights that reveal how these relationships and broadly defined challenges may shape adaptation processes for the community. The next stage of this investigation focuses on identifying baseline adaptation priorities across stakeholder groups though. The following chapter will explore the stakeholder priorities emerging from the key informant interviews to determine the subjective priorities identified through imagined social contracts may inform decision-making procedures. Building on this initial analysis, I assess perspectives across stakeholder groups to better understand how priorities among different groups are influencing adaptation strategies.

CHAPTER 4

PRIORITIES SHAPING ADAPTATION STRATEGIES FOR COASTAL FLOOD PROTECTION IN BOSTON

4.1 Introduction

In this chapter I explore the ways that the different stakeholder groups hope to see the previously identified challenges addressed. In particular, my examination considers the strategies that stakeholders deem socially and environmentally acceptable to shape the adaptation futures they envision for the city. I explore how dominating perspectives among stakeholder groups are shaping preferences for adaptation strategies for coastal flood protection in Boston. Researchers and policymakers have an incomplete understanding of how coastal populations may react or evolve under increasing climate stress, making it imperative that climate change adaptation efforts recognize and consider societal processes that shape communities. These processes are influenced by the perspectives and actions of diverse stakeholders. Thus, in order to effectively design and implement innovative adaptation strategies like NBS, it is important understand how stakeholders are prioritizing adaptation initiatives, considering what challenges they seek to address first.

Poorly designed and implemented adaptation projects can lead to maladaptive outcomes if the social impacts of interventions are not fully considered. Acknowledging how community stakeholders both influence and are affected by adaptation decisions is necessary (Macintosh 2012, Malloy & Ashcraft 2020). Cities have the ability to capitalize on this as an opportunity to design and implement localized climate solutions, as urban communities are in a position to promote innovation and collaboration (Frantzeskaki et al 2019). Research then must examine policy and planning processes, working to uncover pathways in which impacts of NBS and green infrastructure in cities could worsen vulnerabilities, as well as account for resident perspectives to foster deeper understanding of current and potential risks (Anguelovski et al 2019).

In this chapter, I examine the climate change adaptation priorities identified by various Boston stakeholders through analysis of key informant interviews. The chapter expands the initial findings from the interviews, again employing cognitive mapping techniques to examine and discuss the defining adaptation priorities across stakeholder groups, indicating the potential directions for adaptation, and the implications of these for NBS. This interview analysis helps to uncover the array of hopes and expectations stakeholders have for the city's adaptation processes to address increasing coastal flood risk for the city. This analysis serves to generate a better understanding of Boston's coastal adaptation goals and how they are influencing the selection and implementation of coastal adaptation strategies. Priorities among stakeholders were determined by connecting issues to potential interventions described by the participants and organized based on their perspective societal roles. The cognitive map developed at this stage of the

study helps to present a comprehensive snapshot of the interconnections between the priorities discussed by different stakeholders in Boston regarding climate change adaptation and increasing coastal risks.

4.2 Results

The results examined in this chapter reflect the findings of the initial analysis of key informant interviews conducted with an array of stakeholders engaged in climate change adaptation efforts for Boston. The results again are presented as a cognitive map, this one outlining the subjective priorities for addressing the previously identified challenges with issues organized by stakeholder groups. I discuss these results in terms of the ways the various stakeholders described priorities, including how they consider other stakeholders and their influence on adaptation processes and potential outcomes. Finally, the implications for NBS are discussed relative to the imagined social contracts between stakeholder groups.

4.2.1 Cognitive Map of Priorities

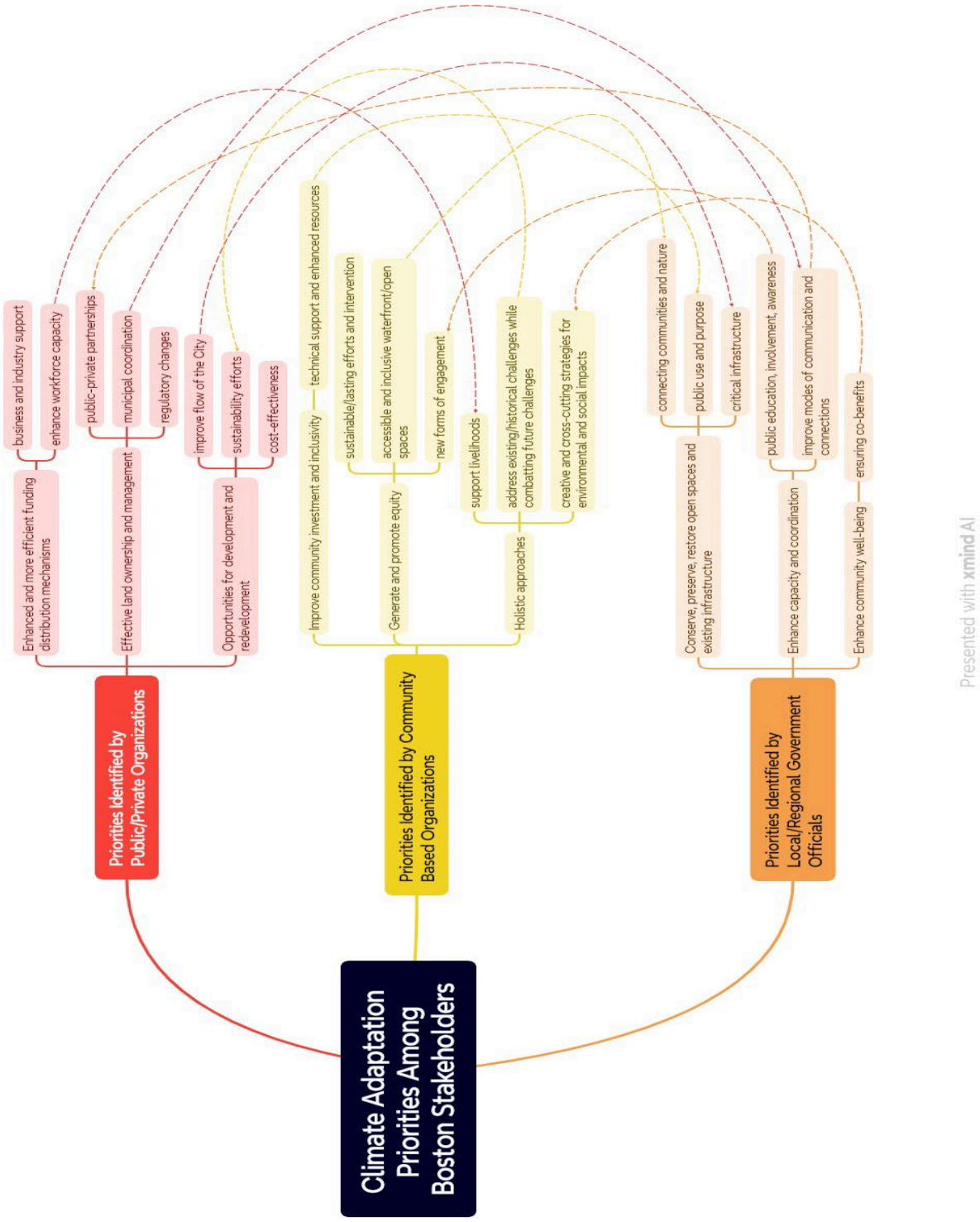
The second cognitive map produced as part of this initial analysis identifies the adaptation priorities that emerged from the interviews with key informants, as shown in Figure 4. Building on the assessment of the primary challenges that were identified across stakeholders, the adaptation priorities were broken down into those most commonly identified by particular stakeholder groups. The results include priorities that were primarily discussed by individuals that fall within the stakeholder groups, which include those working for public/private organizations, community-based organizations, and local/regional government. Although the main priorities were expressed and characterized

by these groups in different ways, ultimately there are various connected themes in the way each group broke down the priorities for adaptation.

Public/Private Organizations

Among the key informants interviewed, those working for public/private organizations discussed adaptation priorities in mostly pragmatic terms, considering challenges within current systems of operations and how they could be mended. For instance, addressing the funding challenges of climate adaptation efforts emerged as a top priority, as one participant noted, “I still think the question around financing is still a strategy or approach that needs to be prioritized and that I think folks are working on, but it's going to require a lot of attention” (Interview 6). Participants within this stakeholder group discussed organizing funding as a primary first step in the adaptation process, particularly as one that needs to show commitment to addressing climate change in the community. One participant suggested, “If there was some type of state revolving fund that invested in the adaptation after these things were built, then that would be wonderful, and that would say, ‘That's a priority of ours. You don't have to do everything today because there is more money.’” (Interview 4). In this case, if funds are more readily available to begin work, and remain available to continue work, adaptation projects could become more streamlined. Additionally, public/private organizations generally emphasized the need for more effective land ownership and management, which requires coordination across municipalities and agencies, as well as in partnerships between public and private landowners.

Figure 4 - Cognitive Map of Climate Change Adaptation Priorities. This Cognitive Map shows the climate change adaptation priorities identified by Boston stakeholders based on responses from key informant interviews.



This priority also emerged as part of addressing regulatory constraints, considering how they apply to land management today, but also conversations that are needed to determine what actions can be taken to address increasing future risks. As one of the participants stated,

> I think part of, and I go back to the unsexy conversation of updating regs, but that, to me, is really the key to unlocking a lot of the deadlock that we've got in conversations around how do we implement our very good plans. People kind of stop because they know permitting is very expensive, and so why would you start a permitting process on a project if you know that the regulations are not really well settled and it really is up to the will of whoever's sitting in the chair of that department in that particular time? I think removing the uncertainty of the regs don't allow or do allow for this particular thing is really going to be beneficial in moving projects forward. (Interview 5)

Essentially in order for any adaptation projects to move forward there must be clarity in how the community can work on existing landscapes. Without clearcut knowledge of how land can be managed and what interventions are possible, it will be difficult to implement adaptation plans that effectively address increasing coastal flood risks and meet community needs.

Another priority that was primarily discussed across stakeholders working with public and private organizations was identifying opportunities for new development in Boston, as well as opportunities for redevelopment of existing infrastructure. Coastal development projects were discussed as a virtually inevitable part of adaptation for the city, considered a means of improving the flow and livability of Boston. One participant described this as an opportunity for ‘near-term solutions’:

> We really need to prioritize the livability of the city of Boston and the day-to-day life of the city of Boston. A lot

> of those day-to-day title impacts are still a solid 30 to 50 years in the future…Thinking about how we can come up with some near-term solutions that improve the quality of life in the city of Boston by allowing for greater access to all of the city's residents to the water, that is adaptable, that does think about flooding on a daily basis in the medium to long term future, but then also starts to, from a materiality perspective, address what inundation looks like in the event of a storm and a storm surge to help protect some of the people in, to a smaller extent, the infrastructure behind it. (Interview 14).

Working with existing infrastructure and creating new spaces in the community could serve as measures that are consistent with current sustainability efforts in the city and also a cost-effective way of protecting against present-day flood risks, while raising awareness for future risks.

Community-based Organizations

The priorities identified by the key informants working with community-based organizations tended to be geared towards addressing broader societal concerns. In particular, this group of stakeholders suggested climate change adaptation efforts should focus on improving community investment and inclusivity. Part of this priority includes becoming more transparent about adaptation goals and how resources are going to be used. As one participant stated,

> I think just being a little bit more honest about the situation, and really thinking realistically about the investments that we make. I might have priorities for my investments, but I think it should be a priority of each community to say, okay, realistically, what are we going to accept as far as flooding is concerned because we're just going to have to live with more flooding? That's part of it. (Interview 30).

Not only do communities throughout Boston need to be clearer about the risks they are willing to accept, but they must also consider what investments and support is available to them to engage in adaptation initiatives. In this sense, enhancing resources and making them accessible to communities will be important to ensure adaptation goals can be reached.

Further, stakeholders with community-based organizations emphasized the need to prioritize holistic approaches to adaptation. Part of this priority entails connecting environmental challenges with the day-to-day challenges community members are facing. One participant explained, “If we improve the environment, we improve everybody's social, like social economic status…I guess, well, this will all be different kind of solutions because y'all want to care about climate change and I want to care about feeding my community. It's like, these are the same issue” (Interview 28). It is essential then that climate change adaptation strategies for Boston work towards protecting people’s livelihoods and addressing existing socio-environmental issues to combat exacerbating these challenges in the future.

Overall, community-based organizations are focused on prioritizing climate change adaptation initiatives that generate and promote equity. These stakeholders discussed how the environmental challenges of climate change and increasing coastal risk need to be connected to addressing community issues, particularly to ensure the strategies benefit all residents. The priority of adaptation should be developing and enacting plans that are inclusive of the needs of the most vulnerable, while ensuring efforts are lasting interventions, not a quick fix. One of the participants stated,

> I'd like to see a climate action plan that's focused on the most vulnerable in a very, very concrete, and clear way. I'd like to see plans that help people become capable of dealing with the problems, as opposed to just continuing to treat them as some people that need other people's help all the time. Those are some things I'd like to see. (Interview 31).

Rather than adaptation strategies being something that are done to and for people in Boston's vulnerable communities, the approaches need to foster the community's sense of agency. This type of adaptation then requires new forms of engagement and interventions that lend to community ownership of the spaces they are protecting.

Local/Regional Officials

The priorities described by the local and regional officials who participated in the interviews focused on enhancing current systems of operation, as well and improving connections with the community. Overall, in thinking about climate change adaptation for Boston's coastline, these officials are concerned with preserving and restoring open spaces as well as protecting existing infrastructure. One participant explained,

> I think we want to prioritize the measures that obviously enhance public space, preserve, and improve the harbor work, create multi-hazard benefits, address existing societal needs and issues that we're seeing in this or that neighborhood. I guess it's like approaching every measure we want to think about in a very holistic way whether how many boxes it ticks. (Interview 17).

As part of this it is important to officials that climate change adaptation initiatives are helping to connect communities to their environment, ensuring that spaces are developed and maintained for public use. Another official described,

> Active public spaces, learning, and ability to learn through waterfront classrooms, bringing down access to the waterfronts, being able to touch the water, and all of that.

> Basically, creating community and educating them on why it's so important to maintain and foster the treasured environmental assets would be key. (Interview 21).

Connecting communities with existing natural spaces and resources in Boston would then serve to promote awareness of how these spaces support residents and the critical infrastructure that they rely on. Underlying this priority is also ensuring that adaptation initiatives have multiple benefits to support community wellbeing.

Enhancing capacity and coordination among stakeholder groups and within agencies will be imperative to developing and implementing adaptation strategies that meet these goals. Getting specific about community priorities and coordinating efforts would be an important first step. As one official noted, “I think priority has to be let's get it all on the same page. A lot of cases, that can be a very big challenge. If you're on the same page, then the word gets out and people are resilient, they're going to fix their own problems” (Interview 25). In this sense coordination would help to improve communication and foster agency across communities in Boston. Another aspect of this priority though is ensuring the systems are in place to support coordination, or at least become better developed and established. As one official put it,

> I think getting the political system in a place where it's prioritizing people on the shoreline and prioritizing and really emphasizing either nature-based solutions or coastal-resilient developments or retreat, having truly leaders and politicians be on the same page seems critical. I'm not sure if that's happening right now, but kind of. There's leaders that do really care, but there are so many issues to care about, and there's always going to have budgetary constraints and whatnot, but yes, something about having the political system have the right fertile ground for the right solutions, that seems really important. (Interview 23).

Although there is currently leadership that is supportive of climate adaptation efforts, there is a need for more coordinated efforts, which will take improvements to communication among leaders as well as creating more connected means of management and planning. Without a more cohesive political landscape the capacity of communities to address adaptation challenges becomes limited.

4.2.2 Implications for NBS

The adaptation priorities described by interview participants shed light on the ways in which different stakeholder groups are considering how adaptation challenges could and should be addressed. Priorities identified among groups also are insights into the motivations and interests among groups for addressing adaptation. Interestingly, many of the themes discussed by stakeholders regarding climate change adaptation priorities also reflect the characteristics often described alongside NBS – cost-effective, means to manage and restore coastal landscapes, and improved community wellbeing (Kabisch et al 2016, Raymond et al 2017, Sarabi 2020). Perhaps this is because of Boston's fairly recent commitment to pursuing shore-based NBS for coastal adaptation and flood protection. These themes also reflect how community stakeholders envision adaptation, particularly what they hope the city can achieve, what they would like to see addressed in the process, and what they deem as acceptable approaches. However, depending on the ability of NBS to equitably distribute social and ecological benefits, community groups will accept or reject NBS as an approach accordingly (Anguelovski et al., 2018).

There are ways that stakeholder priorities can align to support overarching objectives associated with NBS, but this will come down to the underlying mechanisms

applied to meet these objectives. There remains limited knowledge regarding the processes that underly the design and implementation of NBS even as they are increasingly discussed as means of adaptation that meet community needs in changing climate conditions (Woroniecki et al 2020). Stakeholders in Boston recognize the need to connect and work with one another, especially to effectively design and implement NBS in the community, but they are operating under familiar patterns of governance. One stakeholder described how these processes stagnate progress:

> I don't think we're doing enough and I don't think that's necessarily any one person's problem. I think collectively, we're not doing enough. I think I would say that for the whole coast, not even just Boston. If we're looking at Boston, yes, I think there needs to be more urgency around it…I think we just need that urgency around actually taking action and creating a plan for how we're going to accomplish it. (Interview 36, Community-based Organization).

In considering imagined social contracts among the stakeholders, the various stakeholder groups in Boston collectively recognize that adaptation challenges need to be addressed, and they are making strides in identifying adaptation priorities, but they are not yet connected in terms of how action should be taken. The stakeholder groups each have subjective visions of how climate change adaptation challenges should be addressed, and there is need for consideration of each other and how they define priorities in the planning and implementation processes. If Boston continues to pursue NBS as adaptation approaches, the ways in which stakeholders consider each other and define their priorities will have implications for the potential of NBS to reshape, prepare, and protect communities. Major barriers to implementation of NBS are driven by processes that are

based on past forms of decision making that do not support innovative approaches to adaptation (Seddon et al 2019). Even as Boston promotes NBS, the roles and responsibilities among stakeholders are unclear in terms of how objectives should be prioritized. One participant described,

> There's this vision, but then who owns it? Who owns the responsibility of it? Who's going to pay for it? Who's going to maintain it? Those are the types of things that we can design really quick if we have enough money and talent to bring people in. It's having that aspect of both who does it and then also making sure that we're giving enough time for the communities to really inform the process and not just be informed by the process. (Interview 16, Public/Private Organization).

NBS are approaches that require commitment and willingness from local leaders and various stakeholders, as well as reflexivity in the design and implementation process (Storbjörk & Hjerpe 2021). If current standards of decision-making are upheld though, then the opportunity for community input will be reduced. Although stakeholders can see paths forward to address climate change adaptation, current policy and practice does not yet reflect the ways that they envision challenges being addressed.

Making connections between stakeholder priorities can help to illuminate what different decision-making processes could entail to be more reflective of adaptation goals for the community. In considering how various stakeholder groups defined priorities for addressing climate change adaptation challenges, it is important to acknowledge how these priorities can be connected to one another to address overarching challenges. In Figure 4, the various dotted lines between priorities defined by different stakeholder groups demonstrate how ideas can be connected. The line colorings also indicate how

connections can be made between stakeholder groups as each line designates which group the priority is coming from and where it can be connected. For instance, the priorities defined by community-based organizations can be connected to and supported by priorities defined by public/private organizations and local/regional government officials. The priority 'address existing/historical challenges while combatting future challenges' can be connected to the 'sustainability efforts' priority defined by public/private organizations. In this case, the community-based organization priority informs the public/private organization priority, by setting standards for what sustainability should entail, ensuring that both goals can be achieved. Additionally, the public/private organizations' priority 'enhance workforce capacity' connects to the community-based organization priority of 'support livelihoods' as the workforce can be supported by creating new localized job opportunities. The community-based organization priority 'accessible and inclusive waterfront/open spaces' connects to local/regional officials' priority of 'connecting communities and nature' in terms of linking these goals to improve the urban environment. The priorities of local/regional officials can also be linked to community-based organizations in various ways. The priority of 'ensuring co-benefits' and 'public education, involvement, awareness' can be connected to the priority of 'new forms of engagement', and the priority 'public educations, involvement, awareness' can be connected to 'creative and cross-cutting strategies for environmental and social impacts'. These connections are examples of how priorities can be supported by one another, particularly to improve coordination and involvement of the community in decision-making processes. Moreover, the priority

‘improve flow of the city’ defined by public/private organizations aligns with the priority ‘critical infrastructure’ defined by local/regional officials. This connection demonstrates the different ways of defining how to enhance the organization of the city. The goals of local/regional officials then can be achieved through supporting the goals of community-based organizations and public/private organizations.

Connecting these priorities also encourages new forms of collaboration, which may fall outside of current ways of governing. Interestingly local officials are aware and considerate of the need to coordinate and connect for successful adaptation, as well as to enable new types of approaches like NBS. As one stakeholder noted, “If we want those to really be coming from a community-oriented place, I think it's having those conversations and creating those partnerships both for capacity building and in the name of creating just and equitable adaptation solutions. I think that's where we need to start” (Interview 23, Local/Regional Government). Another stakeholder further emphasized the need for working together in prioritizing objectives, “We have to work together, we have to come together and figure out what our priorities are to address all of this because ultimately, it is a problem that we're all facing. I think that that's something that we are starting to do; knowledge sharing and just speaking up more about what we need to push the needle forward” (Interview 19, Local/Regional Government). The current governing agencies recognize the challenges of climate change adaptation and how it will affect many people and various aspects of the community. Although the current governing structure is encouraging partnerships and collaborations in the process of addressing these challenges, pursuing NBS requires effectively making systematic changes. Further

encouragement of changing societal organization to address underlying vulnerabilities for equitable outcomes is needed.

4.2.3 Summary

There were various ways in which stakeholder groups described adaptation priorities for Boston. While public/private organizations and local officials tended to describe priorities as action-items to address within the current system, community-based organizations focused on different paths forward to meet adaptation goals that encourage rethinking current systems of management and organization. The ways in which stakeholders identified climate change adaptation priorities are more reflective of how ideas of approaching these challenges differentiate between social groups. The responses of participants shaped a breakdown of priorities that are more appropriately situated within the respective societal roles of the stakeholders, as they are concerned with the policies, partnerships, and responsibilities for decision-making processes regarding adaptation (Guarinieri et al 2016, Eden & Ackermann 2004). While the adaptation priorities help to show the hopes and expectations participants hold for Boston's approach to climate change adaptation, they are influenced by the current social and political landscapes that the stakeholders operate within. The Public/private organizations are primarily seeking ways to effectively operationalize funding and land management for adaptation strategies that are legally and physically practical. Community-based organizations are focused on ways that adaptation efforts can coincide with social reforms to address past harms, emphasizing priorities that are creative enough to consider social and environmental challenges together. Local officials are concerned with

enhancing community connectivity and improving the urban environment. Although stakeholders generally agree on the overarching challenges for climate change adaptation in Boston, the priorities that they identified are more reflective of how they differ in thinking about the mechanisms by which adaptation will occur. This analysis helps to show how the different framings of priorities among stakeholders, where they are diverging and where they can be connected. Whether and how these priorities can be addressed simultaneously and cohesively will be dependent on the ways stakeholders work with each other moving forward.

4.3 Discussion

Based upon the challenges, adaptation priorities across stakeholder groups could also be identified. The findings of this chapter help to provide a baseline understanding of how stakeholders in Boston are thinking about the ways in which climate change adaptation challenges, particularly those related to addressing increasing coastal flood risks, should be addressed. The cognitive map produced establishes key concepts and emerging themes found in conversations among various stakeholders, and how each group is prioritizing certain adaptation actions. The initial analysis uses the subjective viewpoints and perceptions of stakeholders to structure to establish objectives and criteria they are considering in order to determine the best plan of action (Guarinieri et al 2016, Eden & Ackermann 2004, Keeney 1992). In this case, Boston's problem of addressing increasing coastal flood risks, ensuring strategies meet diverse community needs and values, and considering how NBS can meet community goals.

It is important to acknowledge where stakeholders converge and conflict in their ideas for adaptation because they are all shaping strategies and their outcomes in some way. The difference though is in how they will influence adaptation, as the various interests and motivations of community groups, organizations, and public officials tend to play out unevenly across spatial and temporal scales (Cousins 2021). Applying the social contracts framework of analysis then lends to an evaluation of how stakeholders are considering adaptation options, and what they see their roles to be influencing adaptation processes and outcomes. The analysis for this chapter continues to focus on the role of imagined social contracts. Considering the subjective visions of various stakeholders in Boston and how they are (or are not) reflected in current policy and practice illustrates the disconnect between plans for innovative and equitable adaptation and what the processes to achieve those goals actually entail.

Boston stakeholders have various concerns regarding climate change adaptation and what types of initiatives should be prioritized, but there is a disconnect between goals for adaptation and what current governance structures allow in terms of acting on these goals. To a certain extent, stakeholders seem to recognize a need for new innovative approaches to address climate change adaptation challenges by selecting NBS as primary means of addressing increased coastal flood risk. NBS are typically considered alternative approaches to urban development, as socio-ecological solutions that require collaboration and coordination among diverse community actors (Kabisch et al., 2017; Lafortezza & Sanesi, 2019, Tzoulas et al 2021). However, NBS struggle to become mainstream adaptation approaches due to existing rules, norms, and governance

practices, which are difficult to reconfigure as they are resistant to change (Dorst et al 2022). As evolving environmental interventions, NBS require different approaches to management and consideration of social and cultural conditions.

Interorganizational and cross-organizational dynamics and in cities can create hurdles for the uptake of NBS (Frantzeskaki & Bush (2021), or they can shift to create new mechanisms for socio-ecological resilience. The connections that can be made between stakeholder priorities in Boston reveal how these groups can better work together or take on roles that will help the community to achieve positive adaptation outcomes. Coastal adaptation developments create opportunities for protection of populous cities, but current distributions of public and private responsibilities in coastal development, as well as current funding mechanisms, can contribute to uncertainty regarding whether implementation can occur evenly and equitably (Storbjörk & Hjerpe 2021). The growing emphasis on NBS as a significant contributor to urban resilience calls for a more thorough understanding of the institutional frameworks and social infrastructure needed for effective governance (Ferreira et al 2021). Sustainable transitions require understanding how the dynamics and roles between actors can shift through the process of adaptation, including the design and implementation of NBS (Frantzeskaki & Bush 2021). The approaches applied in this assessment help to understand ideas for building community resilience across stakeholder groups to determine what level of climate change adaptation capacity the community plans to achieve (Ruangpan et al 2020). The interviews and cognitive mapping then help to

review and gain insights into the obstacles and motivations to climate change adaptation, including those for implementing NBS in Boston.

4.3.1 Theoretical Framework Reflections

This stage of my assessment further considers and builds on my assessment in Chapter 3, applying an imagined social contracts lens to my analysis of KII responses. In this case, I take into account the climate change adaptation challenges described by stakeholders to further investigate how their subjective visions are influencing how they define adaptation priorities. My application of the theoretical framework to interpret the results focused on how participants were describing boundaries of social acceptance for adaptation, including what they considered tolerable loss and damage in light of coastal climate risks (Blackburn & Pelling 2018). At this stage I examined subjective conceptions of climate change adaptation priorities across stakeholder groups to uncover how these perspectives are potentially shaping and informing community adaptation objectives. Again, my analysis aimed to be sensitive to the collective history and culture among the various stakeholders participating in this study, considering how individually and collectively working to address climate change adaptation issues in Boston.

Similar to how I structured a cognitive map to visualize primary adaptation challenges described my stakeholders, I used cognitive mapping techniques to develop a visual understanding of stakeholder priorities for coastal climate change adaptation in Boston. This approach, applied to the KII data with the critical theoretical framework lens helps to better understand how various stakeholder groups are thinking about the means of addressing climate change risks and community challenges. From my assessment of

the interview findings, I was able to distinguish between the subjective visions of each stakeholder group in terms of how they defined adaptation priorities. Responses from participants within each stakeholder group demonstrated how they were considerate of the various actors in Boston and the region, as well as the social and environmental conditions of the area. However, in defining priorities they were concerned with their own roles in shaping and effecting adaptation responses for the community. Each stakeholder group participating underpinned their ideal objectives for adaptation futures with the limitations of current systems affecting these goals. While community-based organizations and local officials emphasized necessary changes to enable innovative adaptation like NBS, public/private organizations were thinking about how to work within current systems of governance to operationalize these approaches. Such findings highlight how some stakeholders are more considerate of pursuing adaptation by following their defined and accepted societal roles and responsibilities. Whereas there are other groups thinking about how to work outside of current structures to establish new relationships that foster community changes.

In developing the cognitive map of climate change adaptation priorities, I offer a baseline understanding of how different stakeholder groups are thinking about how to address climate change adaptation challenges. My application of the theoretical framework focusing on imagined social contracts and their role in shaping adaptation strategies helps to illuminate the types of ideas and perspectives that underlying the defined priorities. My assessment helps to connect stakeholder perspectives and garner knowledge on how conceptions of the roles and responsibilities across stakeholders could

influence adaptation processes. There is room for further analysis though to investigate formal and informal relationships between stakeholder groups to determine what types of dynamics are relevant to community adaptation.

4.4 Conclusions

In this chapter I examined the climate change adaptation priorities identified by various Boston stakeholders. Using initial findings from the interviews, I generated a cognitive map to assess and discuss the defining motivations and subjective priorities for adaptation across stakeholder groups. The analysis helps to shed light on how Boston stakeholders generally align and diverge in priorities for addressing previously identified challenges. The application of the social contracts framework of analysis uncovers the subjective conceptions of climate change adaptation for Boston among stakeholders, reflective of ideas that are sensitive to their collective culture and history, as well as their social relations and boundaries. In identifying baseline adaptation priorities across stakeholder groups though, the framework provides insights that reveal how these may shape adaptation processes for the community. The next stage of this investigation then calls for further examination of the adaptation priorities among stakeholders to more concretely determine where they can connect to address broader climate change adaptation challenges for the community. Chapter 5 further explores the stakeholder objectives emerging from the key informant interviews to determine how the subjective priorities identified through imagined social contracts here may play out in reality based on existing relationships and decision-making procedures.

CHAPTER 5

STAKEHOLDER VALUES AND OBJECTIVES INFORMING ADAPTATION DECISIONS

5.1 Introduction

This chapter further explores the adaptation priorities identified in the initial analysis of key informant interviews with various stakeholders in Boston. Working from the preliminary findings in the previous chapter, this next stage of analysis focuses on breaking down broader priorities, identifying stakeholder values and objectives that are informing potential adaptation decision-actions. The identification of climate change adaptation challenges and priorities across the stakeholders in the previous chapter serves as the basis for formulating solutions to meet their needs. While this understanding of challenges and preferences at various levels in Boston helps to define the scope of adaptation strategies for coastal flood protection in the city, taking this analysis a step further helps to define the decision context with the ways in which stakeholders are seeking to address their adaptation objectives. Distinguishing hopes and expectations for adaptation from specific objectives that are informing decisions sheds light on what stakeholder preferences are currently defining adaptation actions and determining potential outcomes for the community. Such an analysis supports the primary aim of this

dissertation to demonstrate how climate change adaptation strategies designed and informed by diverse stakeholder perspectives and values can support transformative adaptation by uncovering new decision opportunities.

Preparing for climate change in coastal urban communities is a challenging task, and one that requires thoughtful and thorough planning. Developing coastal flood protection and management strategies must account for the uncertainty of climate outcomes, the array of stakeholders involved in decision-making processes, and the long-term implications for actions taken (Ranger et al 2013, De Brito et al 2016). As cities like Boston face increasing coastal flood risks, the planning and design process for the city will involve a variety of actors who ultimately determine and influence the outcomes of adaptation strategies. Each of these actors will play a role in the planning and implementation process, and thus will influence the outcomes that unfold as part adaptation. One of the key principles in Boston's Climate Resilience Framework is to incorporate local knowledge into design and decision-making processes (City of Boston 2016). However, it is relatively unclear how different forms of local knowledge shape the adaptation related decision actions.

In order to meet adaptation needs the planning process requires new methods, beyond those that currently dominant policy-making processes. If diverse perspectives are to effectively come together to address adaptation challenges, then it is important to understand the underlying goals of actors involved in decision making. O'Brien & Wolf (2010) have argued that research on adaptation must take full account of human values, especially to understand how adaptation actions can be made equitable and legitimate for

a community. Focusing on values in the planning process makes explicit the types of adaptations that are deemed effective and acceptable by individuals, groups, institutions, and government. In order to create opportunities for more inclusive processes and make decision-making pathways transparent, it is important to understand diverse perspectives (O'Brien & Wolf 2010). Additionally, when adaptation options account for and align with public values, they are typically more socio-culturally acceptable and can facilitate changing behaviors in a community (IPCC 2022).

When shaping adaptation strategies for communities, it is important to recognize and account for diverse values. These ideas are applicable to Boston as the city continues to consider NBS as adaptation approaches for coastal flood protection. There are range of public and private actors that will design and implement NBS. Many of these actors differ in their values and could either reinforce current systems and biases or generate alternative pathways to support new partnerships and ideals. While NBS can be mechanisms that create proposals for social change, this can only occur if different sets of values are accounted for and incorporated in the planning process (Cousins 2021). Rather than relying on and being situated in traditional forms of planning and management, successful NBS for a community will be dependent on new types of policies and practices that respond to and address current underlying challenges. Current knowledge of how governance process can support the type of adaptation NBS proposes is limited (Wamsler et al 2020), but there is opportunity to uncover pathways to meet this potential through the involvement and consultation of various stakeholders involved in adaptation processes.

In this chapter, I continue to assess adaptation priorities identified by various Boston stakeholders through key informant interviews. The chapter focuses on stakeholder objectives as they relate to Boston's overall adaptation processes, and how they are informing and shaping selected strategies for the city, particularly NBS. This stage of the interview analysis builds on findings from the initial assessment by applying a Values-Focused Thinking (VFT) approach (Keeney 1992). As a method, VFT helps to generate potential solutions that reflect stakeholder values, by incorporating various stakeholder concerns, breaking them down and structuring them into a measurable set of variables (Keeney 1994, Keisler 2012). This additional analysis identifies fundamental objectives and means-end objectives across stakeholder groups, examining the reasoning behind participant responses to determine their role in shaping adaptation strategies and potential mechanisms for implementation that influence outcomes for the community. In turn, this investigation explores what stakeholder values are emerging in adaptation priorities and the roles of various stakeholders in executing adaptation approaches like NBS. The findings will help to determine how coastal adaptation and NBS implementation could be playing out in Boston. The assessment also identifies opportunities to improve outcomes through consideration of emerging policy themes and new decision-actions.

5.2 Results

The results examined in this chapter reflect the findings from the VFT approach to assess key informant interviews conducted with an array of stakeholders living and working in Boston. The results presented here are based on the information found

regarding themes and ideas broadly shaping adaptation challenges and priorities for the city. Throughout my analysis I was able to further define new variables that reflect stakeholder roles in decision-making processes for adaptation (i.e. practiced social contracts), and I identified different types of adaptation objectives that inform the VFT approach. The VFT approach and social contracts framework helps to distinguish stakeholder expectations for adaptation and the potential objectives shaping adaptation decisions based on current societal roles. I identify relevant themes which consist of my interpretations of interview responses following the VFT approach to determine the objectives and their linkages, guided by supporting literature and theory. I also discuss the implications for NBS relative to the practiced social contracts between stakeholder groups.

5.2.1 VFT Hierarchy Networks

Fundamental value hierarchy networks were developed for each of the stakeholder groups based on responses from interviews with participants. These networks are the results of the applied VFT approach to analyze interview transcripts, and they were constructed and assessed according to the three primary stakeholder groups assigned to participants regarding their professional roles. Each network represents the fundamental objectives and means objectives identified by participants in these groups. The strategic fundamental objective for all groups is to **minimize coastal flood impacts for the Boston community**, as the basis for the discussions about adaptation objectives with the participants focused on coastal flood risks related to climate change.

Public/Private Organizations Objectives Hierarchy

Stakeholders from public and private organizations have identified adaptation objectives to minimize coastal flood impacts in Boston, as shown in the VFT network in Figure 5. The three critical fundamental objectives shaping this group's adaptation preferences include: maximizing protection of people, maximizing management of existing landscapes, and maximizing community connectivity. For each of these fundamental objectives stakeholders in this group identified means objectives, or those objectives that would have implications for meeting the fundamental objectives.

Stakeholders from public/private organizations generally focus discussions on **maximizing protection of people**, especially for those residents and groups considered most vulnerable. Respondents in this group describe protection of people as minimizing impacts on most vulnerable populations, maximizing resources available to the community, and maximizing human safety. The stakeholders from public/private organizations discussed enhancing community amenities, protecting people's livelihoods, and streamlining financial support as means to enable communities to maximize their resources more effectively. This stakeholder group also views increasing community engagement and awareness as means of co-creating adaptation strategies with residents. These objectives are considered crucial to minimizing impacts on the most vulnerable populations in the community, particularly to foster a sense of agency among residents. In order to maximize human safety, stakeholders from these organizations consider maximizing preparation and recovery tactics for the community.

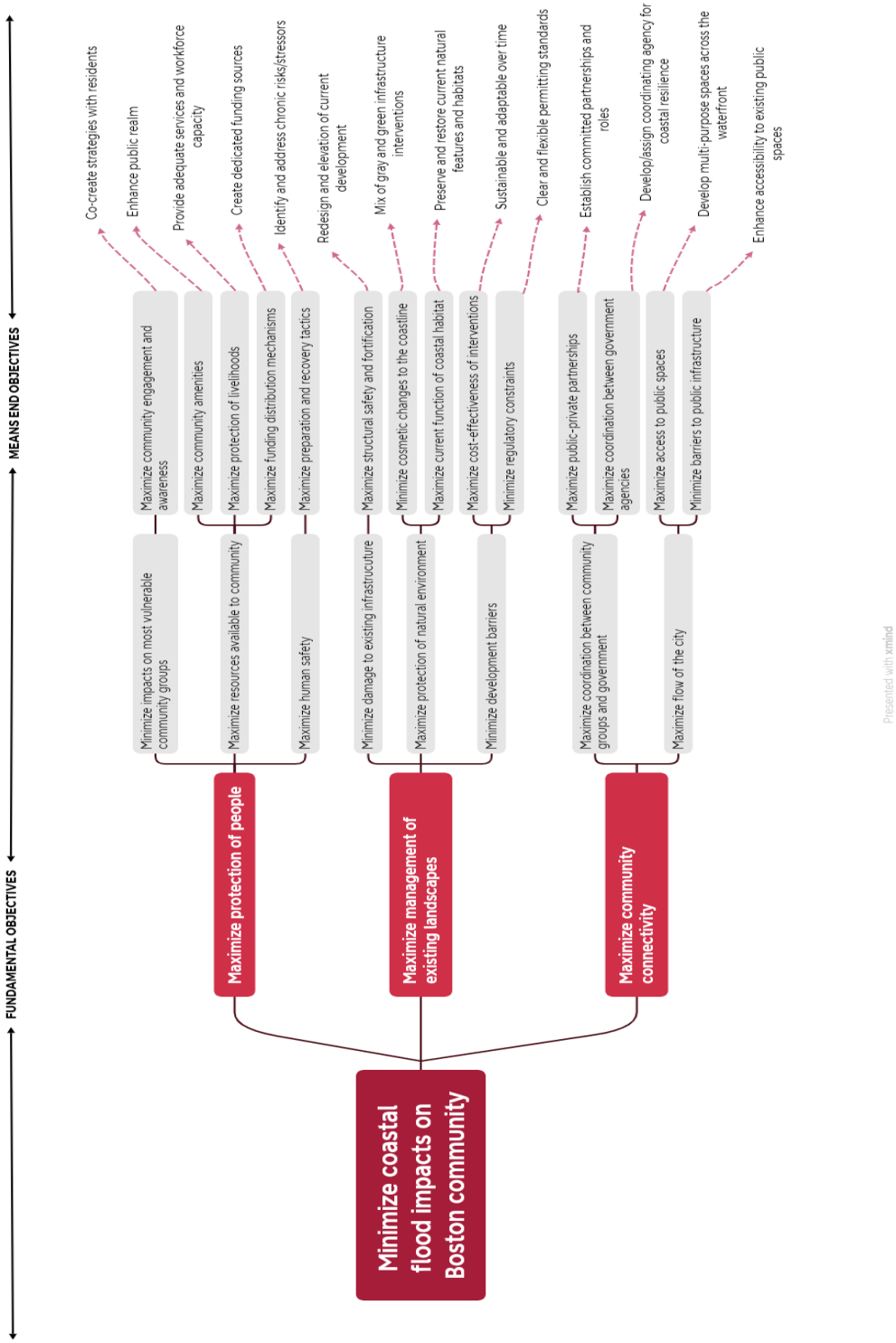


Figure 5 - Values-Focused Thinking Network Public/Private Organizations. This VFT Network shows the objectives of stakeholders from public/private organizations to minimize coastal flood impacts.

While some of the more specific means of protecting people from coastal flood risks and impacts were not discussed, ultimately stakeholders from public/private organizations frame protection measures as mechanisms to reshape the Boston community as a whole. As one participant describes,

> What an opportunity to fortify our communities and to create new amenities and to make our city more livable and more vibrant…I hope that we can inject a little bit of excitement in terms of the opportunity for city building and for improving the fabric of our region. It's not easy and there are a lot of priorities, and these projects are very expensive. My hope is that we can try and inject some of that opportunity into the broader conversation. (Interview 7, Public/Private Organization).

By describing adaptation interventions as opportunities to enhance Boston's structure and culture, these stakeholders acknowledge the potential for transformation, which can be interpreted as using climate change adaptation measures as means to address other underlying goals to change the city landscape. Further, stakeholders from this group focus on how adaptation interventions should connect more people to the waterfront, linking them to the resources that the coast provides. One participant described,

> Thinking about how we can come up with some near-term solutions that improve the quality of life in the city of Boston by allowing for greater access to all of the city's residents to the water, that is adaptable, that does think about flooding on a daily basis in the medium to long term future, but then also starts to, from a materiality perspective, address what inundation looks like in the event of a storm and a storm surge to help protect some of the people in, to a smaller extent, the infrastructure behind it. (Interview 14, Public/Private Organization).

Among this group of stakeholders, improving the quality of life of residents through connections to the waterfront is often discussed as a means of protecting them from

future impacts, as well as improving the people's chance of recovery should they be inundated by a flooding event. Ultimately, this group believes that minimizing coastal flood impacts to maximize people's protection hinges on how people in the community are connected to Boston's coastal landscape.

Stakeholders from public/private organizations also describe **maximizing the management of existing landscapes** in Boston as fundamental to minimizing coastal flood impacts for the community. In order to effectively manage the city's current landscape, respondents in this group discuss minimizing any damage to existing infrastructure, maximizing protection of the natural environment, and minimizing development barriers. As a means to minimize damage to current infrastructure, stakeholders from this group are focused on maximizing the structural safety and fortification of existing buildings and public spaces. They specifically suggest that redesigning and elevating existing developments can prevent damage and reduce flood impacts on the community. To protect the natural environment, respondents emphasize preserving and restoring the area's coastal habitat to maintain its current function, while also minimizing significant alterations to the coastline's appearance. One participant noted,

> I'm a big fan of really exploring the less invasive, less cosmetic changes to the coast as we can, especially in a city like Boston which, for better or worse, is essentially a heavily manufactured coast. If you look at a map of Boston neighborhoods today, most of them were underwater. The Back Bay's called the Back Bay because it was a bay. To me, continuing to really manufacture and change our coast from a man-made perspective can only be problematic. (Interview 5, Public/Private Organization).

Interestingly, respondents in this group are primarily concerned with existing infrastructure and public spaces, which would entail pursuing a mix of gray-green infrastructure interventions. These participants also describe the need to minimize development barriers for adaptation interventions addressing flood impacts. Participants note that this would require ensuring that interventions are cost effective, as there is typically a high upfront cost for many coastal interventions. In this sense, this group generally believes that if interventions are thought to be sustainable and adaptable over time this could save the community additional costs in the long run. One of the participants explained the difficulty development partners face in getting on board with coastal interventions for adaptation,

> It's hard for them to overinvest, which is often what we're asking of people in coastal protection systems that are much broader than them to create large areas of undeveloped land. Do I think that it's a wonderful benefit of nature-based solutions to be able to build and create habitat? Yes. Do I think the private sector can fund that fundamentally? Probably not. Again, if those are our goals and values as a state, then how do we use the state to give tax incentives to acquire property, to go through the other ways to be supportive of those types of goals? (Interview 4, Public/Private Organization).

In this case, stakeholders describe addressing the financial aspects of coastal adaptation as central to selecting and developing any solutions. According to one participant, “We don't really know who's going to pay for it or how to pay for it. Making sure that we're balancing appropriate concern for an ecological approach, a human-centered approach with a financial reality approach is balanced should be considered” (Interview 11, Public/Private Organization). While nature-based adaptation interventions for coastal flood protection may be championed by various stakeholders, including those from

public/private organizations, these groups are looking to the State to provide leadership in making this possible. These stakeholders feel that support and direct intervention from the State is essential to meet community goals in adaptation. Additionally, stakeholders recognize the State's role in determining existing regulations, which can create constraints to working with and even making small alterations to the existing landscape. In this case, this group explains that more flexible permitting standards would be a means to address this development barrier for any interventions, and clarity on the permitting requirements of projects would also be needed. This is particularly relevant for NBS, as one respondent described,

> I think we really have to get on the same page about what we mean when we say nature-based solution and what projects specifically we're interested in doing that for, before we can really have a solution, because they should ultimately have some level of performance standard…We have to figure out what that floor is, and then as long as you can meet those minimum standards, we fast track you but that's a complicated process. You've got to do that for a certain set of projects, and each of those projects likely has to have their own set of performance standards. (Interview 10, Public/Private Organization).

These stakeholders then believe that better coordination and communication is needed if current systems of operation are going to work to meet adaptation objectives.

Participants working for public/private organizations concerned with coastal climate impacts for Boston further describe **maximizing community connectivity** as a fundamental aspect of minimizing potential flood impacts on the community. Underlying this fundamental objective are the objectives of maximizing coordination between community groups and maximizing the flow of the city. In order to enhance coordination, participants describe maximizing public-private partnerships and maximizing

coordination between government agencies as the means to achieve this objective. One participant explained, “We're currently in the silos. I think that we're in silos in terms of project types. This is a coastal project, or this is a heat project. I understand that we've had to do it to be able to define it. I think that the next step is really understanding how we can take all of the incredible work and data that have been developed and find a way to activate it” (Interview 16, Public/Private Organization). Committed partnerships between public and private institutions and stakeholders can then help to better connect adaptation efforts across groups, avoiding one-off projects or even unnecessary duplication of work. In line with stronger and directed partnerships, stakeholders from these organizations also suggest developing or assigning a coordinating agency for government agencies and officials dedicated to coastal resilience would be necessary. As one participant stated, “I think short-term, having a better connection between all of these different groups that are working on this to have at least the bare minimum connection to one another, the shortest term is we need all the same people in the room talking about this” (Interview 8, Public/Private Organization). Additionally, these stakeholders acknowledge that maximizing the flow and connectivity of the city requires broader adjustments such as maximizing access to public spaces and minimizing barriers to public infrastructure. These participants consider encouraging and creating multi-use spaces across Boston’s waterfront as a means of enhancing public access, improving the accessibility of public spaces to reduce barriers to public infrastructure. As one participant describes,

> I think having, again, areas that are accessible is probably of paramount value. What that looks like, whether it's

> natural, I think anyone would be able to argue that a natural green lush place is far more inviting than cement and riff-raff and hard infrastructure. That said, I think there's plenty of creative infrastructure that could be implemented as long as it's welcoming and accessible and gives people the opportunity to get down by the waterfront, then it's a net positive. (Interview 14, Public/Private Organization).

Interventions to create more welcoming and aesthetically pleasing places, while also addressing flood risks are then thought to be necessary aspects of enabling adaptation strategies that minimize impacts on the community, as described by public/private organizations interviewed for this assessment.

Community-Based Organizations Objectives Hierarchy

Figure 6 outlines the adaptation objectives to minimize coastal flood impacts in Boston as identified by stakeholders from community-based organizations. The three fundamental objectives include: maximize equity-centered adaptation approaches, minimize damage to critical infrastructure, and maximize healthy landscapes. For each of these fundamental objectives there are means objectives, or those preferences for meeting the fundamental objectives, which are identified based on stakeholder responses. These are objectives that would have implications shaping this group's adaptation priorities.

When discussing the goal of equity-centered adaptation to reduce coastal flood impacts in Boston, participants from community-based organizations mainly worry about including residents in planning and how these plans will affect them.

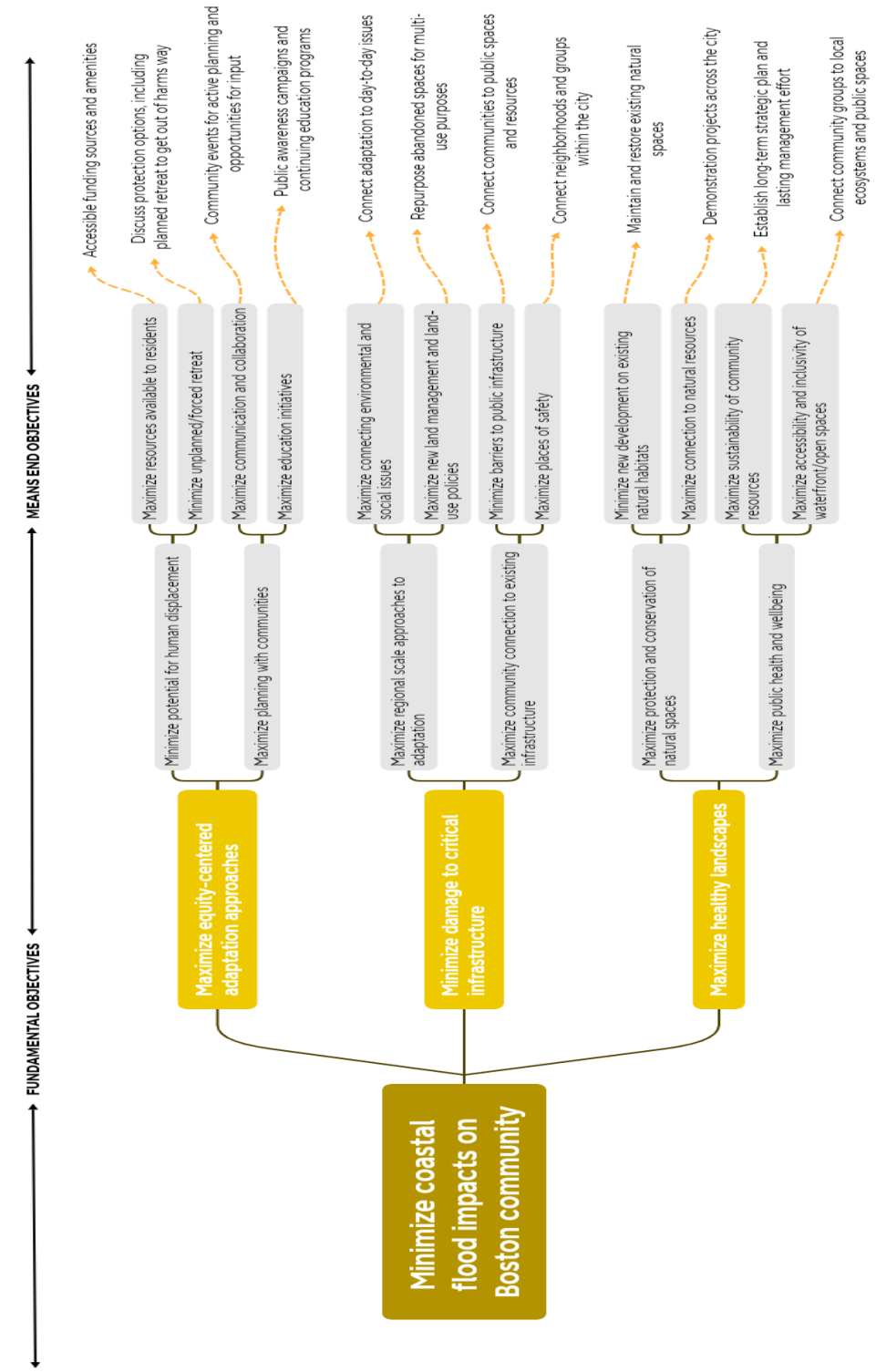


Figure 6 - Values-Focused Thinking Network Community-Based Organizations. This VFT Network shows the objectives of stakeholders from community-based organizations to minimize coastal flood impacts.

As one participant described,

> I will say that I think all of this work around equity is kind of like something you have to do before you can even get people to really care, because they're not going to care what the adaptation strategy on, I don't know, like Tenean Beach is if they never even go there. I think that we try and kind of play both sides. Yes, I'm just on the community side of building sense of agency and feeling a belonging, but I'm also going to the Tenean Beach redevelopment meetings to say like, okay, well, what can I imagine my community would want in this space if they felt comfortable enough to be in this meeting? (Interview 28, Community-Based Organization).

An essential part of adaptation to coastal climate risks in Boston is to connect with the people living in the affected communities, ensuring their wants and needs are central to any planning and interventions. Many participants in this group also discuss the potential for human displacement and the need to minimize this risk by providing and making available important resources to residents, including accessible funding and daily amenities. Additionally, working to minimize unplanned/forced retreat is emphasized both in terms of ensuring residents and their community leaders have open conversations about protection options, and to begin discussing future plans to retreat fully out of harm's way over time. One participant explained,

> I think getting ahead of not waiting for a disaster that just displaces people that have no other option I think would really just behoove us. Would just really benefit us as a region really…Let's just really be realistic about how much time we have and plan. That's what I would like to see more regional planning around just getting people out of harm's way. That the state should be stepping up more, taking more leadership on, and really making it, again, just so it's not like every man for themselves basically. If you get hit, some people rebuild, some people won't but it's devastating. People don't want to go through floods more than once. It just wipes everything out and then there's

> long-term consequences with the mold and stuff. I think that regionally I would really like to see that just be more of an actual conversation. (Interview 32, Community-Based Organization).

Community-based organizations are working with residents and other groups to better prepare and respond to storm events, knowing that they have a role in planning efforts and that people do not want to wait for flood impacts. Participants from community-based organizations emphasize the need for planning adaptation with the communities and residents, rather than selecting a strategy for them. However, these stakeholders are seeking more direct leadership from local and regional government to act, as they need state authority and resources to provide communities continued support and to meet protection needs. Additionally, clarity is needed on what types of strategies are going to be supported by the state and local governments in order for community-based groups to act accordingly. As one participant explained,

> I think people are becoming more familiar on the concept of green infrastructure in terms of stormwater management, or it can also obviously be for coastal flooding. Like Moakley Park being a park that's floodable, I think is where the city should be prioritizing if they're not going to consider retreat or migration. I think integrating those kinds of adaptation should be in projects and developments and buildings that we still need, I think is what the city should prioritize. (Interview 31, Community-Based Organization).

Communication and collaboration with surrounding communities and with state leaders needs to be enhanced if adaptation is going to occur effectively and equitably. One participant further stated,

> In order for us to know that we're doing our part, we have to work with others who have to be doing their part as well. It has to be regional and statewide ventures and support that cities get. It can't be put on some cities to handle

> everything. We have to have a sense of how other towns, other municipalities are participating in this and playing their role. We have to have state-level cooperation for this and regional-level cooperation, national one, international cooperation. (Interview 33, Community-Based Organization).

Some responses suggest using community events as opportunities for active planning and input rather than solely relying on meetings could help in these efforts. Further maximizing education initiatives through public awareness campaigns, as well as continuing education programs are also thought to be necessary and impactful.

In line with ensuring adaptation approaches for coastal flood protection are centered on equity, community-based organizations are additionally concerned with **minimizing damage to critical infrastructure**. Participants in this group of stakeholders discuss maximizing regional-scale approaches to adaptation and maximizing community connection to existing infrastructure as part of this objective. As one participant described,

> I think historically, it's been a lot of parcel by parcel, project by project, to the end. Water knows no boundaries. One building might be protected, but the water is just going to find its way around that one building, for example. That's something really important of making sure we're looking at, not even just the entire city of Boston, but our entire state's coastline and getting everybody at the same table. (Interview 36, Community-Based Organization).

To enhance regional adaptation strategies, stakeholders from community-based organizations emphasize the importance of linking environmental and social issues in the city. They particularly advocate for connecting adaptation efforts to the everyday challenges faced by community members. Additionally, maximizing new land management and land-use policies would be necessary to support regional scale

approaches to adaptation. This means objective is different from how public and private organization stakeholders described land management, as participants with community-based organizations primarily discuss how abandoned and open spaces could be repurposed for multi-uses. Ensuring there is minimal damage to critical infrastructure, as defined by this stakeholder group, then also entails improving community connection to existing infrastructure. One participant described discussions with residents saying,

> A standout response was people wanted a real priority for flood protection to be critical infrastructure. We need to dig in a little bit more to what people think of that, but I think it is your place, your fire department, your schools. Essentially, really places you would rely on, your hospitals, places you really would rely on in an emergency for shelter, basic human safety. That rose to the top as like, "Okay, this is what we want to be protecting." (Interview 32, Community-Based Organization).

Improvements would specifically mean minimizing current barriers to public infrastructure that residents face by better connecting communities to public spaces and resources. Ensuring safe places is crucial for connecting communities to existing infrastructure. Stakeholders from community-based organizations describe connecting neighborhoods and groups within the city as part of this objective, as residents in the neighborhoods that they work with do not always feel welcome in spaces deemed as public and open to the community. One participant stated, “The system is built to support a certain set of people, and if that can be redesigned to support others as well, I think that'll be helpful. Major impediments, otherwise” (Interview 33, Community-Based Organization). Adaptation strategies to minimize coastal flood impacts on the community’s neighborhoods, particularly those most vulnerable, then must contribute to

shaping an environment that supports all people in the community rather than benefiting some groups over others.

Maximizing healthy landscapes is the third fundamental objective identified by community-based organizations to minimize coastal flood impacts in the city of Boston. This objective concerns maximizing protection and conservation of current natural spaces in the area, as well as maximizing public health and well-being in the community. In terms of protecting and conserving natural spaces, stakeholders from community-based organizations discuss minimizing development on existing natural habitats, which includes maintaining and restoring existing natural spaces. As one participant explained people's perceptions of nature-based adaptation strategies,

> I guess the public standpoint for nature-based strategies, I guess what I'm seeing from Boston residents and community members is they fundamentally understand the concept of nature-based strategies, and their concept is less on the technical side and more on understanding the preservation and conservation of nature. (Interview 31, Community-Based Organization).

As a result, residents are focused on how the environment can act as natural protection measures while also benefiting people in the community. Stakeholders believe that demonstration projects throughout the city, aimed at strengthening people's connection to natural resources, will benefit the community. In order to maximize public health and well-being as part of supporting healthy landscapes in Boston, stakeholders describe maximizing the accessibility and inclusivity of the city's waterfront and open spaces. By connecting communities to ecosystems and public spaces this could also serve to enhance relationships among community-members. One participant stated,

> A commitment from all of the landowners that front the waterfront-- a recognition first that everybody has to play a part because it's just like links in a chain. If we all aren't linked together, the water's going to find its way wherever it can, and everyone has to be working together in developing their pieces of land appropriately to create this more effective barrier. (Interview 29, Community-Based Organization).

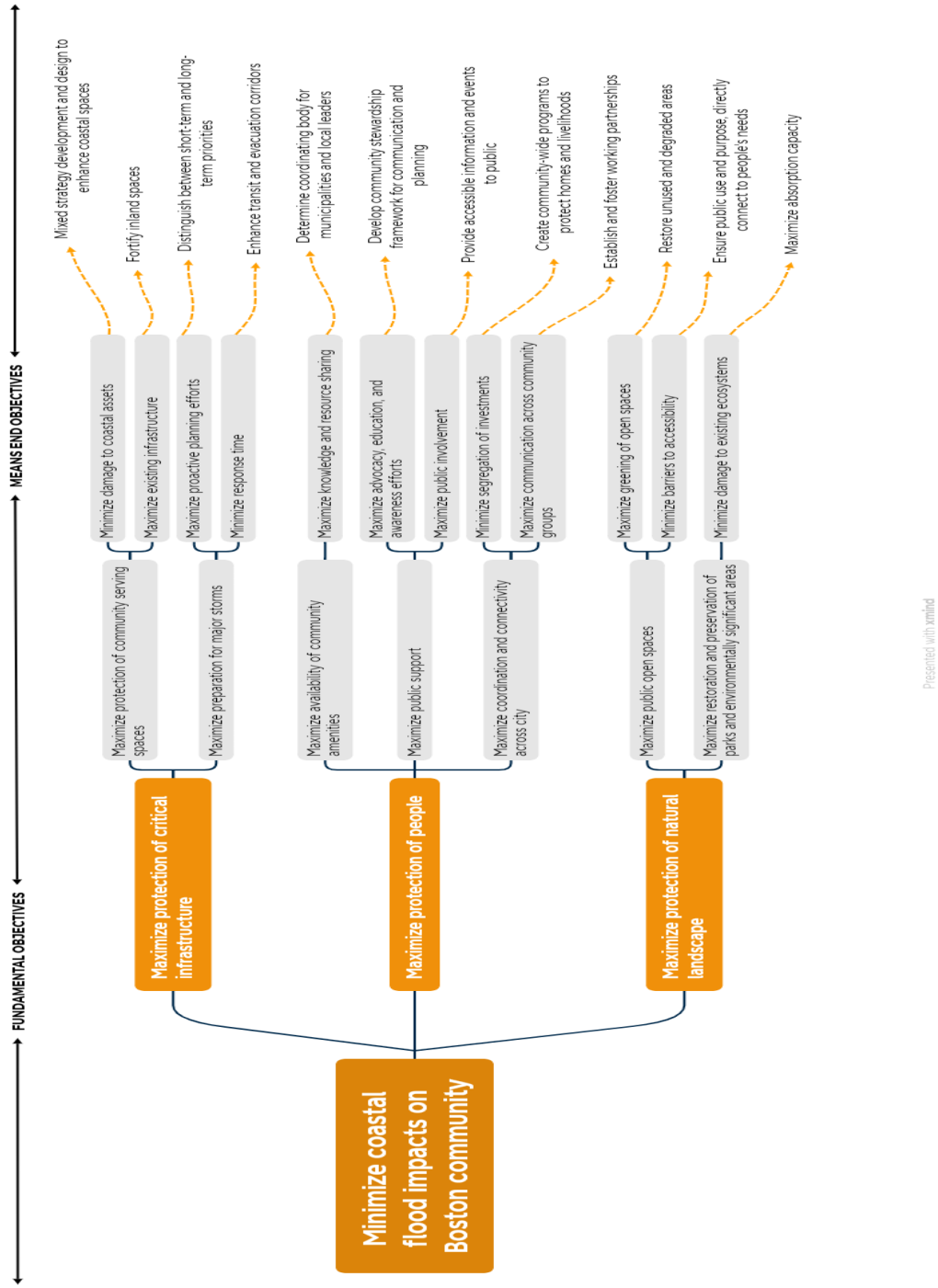
The stakeholders in this group further stated that community resources need to be made sustainable and available over time, which can be supported by establishing a long-term strategic plan and lasting management efforts across the city.

Local/Regional Government Officials Objectives Hierarchy

The VFT network in Figure 7 shows the adaptation objectives to minimize coastal flood impacts in Boston identified by stakeholders from local and regional government. The three critical fundamental objectives shaping this group's adaptation preferences include: maximize protection of critical infrastructure, maximize protection of people, and maximize protection of natural landscapes. Stakeholders in this group identified various means objectives with implications for addressing each of the fundamental objectives to minimize coastal flood impacts in the Boston community.

Local and regional officials tended to describe their fundamental objectives in terms of their obligations and goals for adaptation efforts that provide coastal flood protection for the city of Boston. The fundamental objective to **maximize protection of critical infrastructure** entails maximizing protection of community serving spaces and maximizing preparedness for major storms in the future.

Figure 7 - Values-Focused Thinking Network Local/Regional Government Officials. This VFT Network shows the objectives of stakeholders from local/regional government officials to minimize coastal flood impacts.



In order to ensure community serving spaces are maximally protected, stakeholders working for local and regional government agencies describe minimizing damage to coastal assets while maximizing existing infrastructure. These stakeholders describe mixed strategies for the development of and redesign of current coastal spaces in the city. As one participant stated,

> I think especially in a city that already has a lot of great infrastructure, that puts really Massachusetts as a whole and Boston specifically as well in a good footing to really start ramping up on the nature-based solution part of the equation. There's also opportunities, even with gray to do green-gray where it makes sense, where you can bolster existing grade infrastructure with nature-based solutions, like a part of it, and especially to help create a sense of space and community so that it's not just this infrastructure that's there to keep water away or to keep us dry, but there's also opportunities to increase tree canopy and just green space in general. (Interview 26, Local/Regional Government).

Additionally, existing infrastructure can be fortified as protective measures, particularly inland spaces, should floods significantly breach the coastline, as well as to deal with more frequent flooding events. Then in terms of maximizing preparation for major storms, local officials seek to maximize proactive planning efforts and to minimize the response time required to address impacts from a storm event. Proactive planning efforts require distinguishing between short-term and long-term priorities for adaptation efforts which affect overall preparedness. Response time is also dependent on current transit and evacuation corridors in the city, which must be enhanced to meet future challenges. As one participant explained, “I think it starts to break down into the question of critical infrastructure, environmental justice populations, affordable housing, and those kinds of considerations where it's thinking about, ‘What is it that we need to protect first and

foremost and who is what we're protecting going to serve?'" (Interview 19, Local/Regional Government). Another participant also emphasized, "I think getting the political system in a place where it's prioritizing people on the shoreline and prioritizing and really emphasizing either nature-based solutions or coastal-resilient developments or retreat, having leaders and politicians be on the same page seems critical" (Interview 25, Local/Regional Government). Local officials then are still in the stages of coordinating, breaking down priorities, and determining the leadership responsibilities required to meet community needs.

In terms of the fundamental objective to **maximize protection of people,** local and regional government stakeholders consider the involvement of residents and community groups in minimizing risks and potential future climate impacts. Essential to protecting people are efforts to maximize the availability of community amenities, maximizing public support for adaptation, and maximizing coordination and connectivity across Boston. The provision of community amenities entails maximizing knowledge and resource sharing among stakeholders and residents, which includes coordination efforts and enhanced communication. One participant noted, "We have to work together, we have to come together and figure out what our priorities are to address all of this because ultimately, it is a problem that we're all facing. I think that that's something that we are starting to do; knowledge sharing and just speaking up more about what we need to push the needle forward" (Interview 20, Local/Regional Government). As part of this objective local and regional agencies agree that it would help to determine a coordinating body to better connect municipalities and local leaders on adaptation planning initiatives.

Enhanced public support for adaptation planning by means of maximizing public involvement, as well as advocacy and awareness efforts are also necessary. As one participant stated,

> Not just municipal staff, but folks from nonprofits, residents, folks who are connected socially to environmental justice, or other priority populations. Bring those folks to the table, and then do a lot of iterative community engagements to say, 'Here's what's happening in terms of climate change, and here's our original priorities. How should they be different?' (Interview 23, Local/Regional Government).

Participants in this stakeholder group also describe developing a community stewardship framework for adaptation efforts and providing accessible information and public events to be ways of achieving this objective. Further, maximizing coordination and connectivity across the city would require minimizing any segregation of investments, meaning there should be a focus on creating community-wide programs rather than working in silos. Establishing and nurturing working partnerships for adaptation planning and implementation is crucial for improving communication among community groups, enhancing coordination, and ultimately protecting people throughout the city.

Finally, local and regional officials describe **maximizing the protection of the city's natural landscape** as a fundamental objective for minimizing coastal flood impacts on the Boston community. In particular these stakeholders describe maximizing public open spaces and maximizing the restoration and preservation of parks and environmentally significant areas. One respondent noted, "I think there are some elements or opportunities for us to think about how we reorient people to the wetlands that exist, the marshes of the world, the natural landscape we have, the harbor islands,

and think about how you protect those coastal assets at a time of rapidly increasing sea level rise and consequently erosion" (Interview 21, Local/Regional Government). To restore and preserve existing environmentally significant areas local officials suggest minimizing damage to existing ecosystems, which could entail maximizing the absorption capacity of these spaces should severe flooding or a coastal storm occur. In terms of maximizing public open spaces these officials discuss efforts to maximize greening of open spaces and minimizing barriers to accessibility of open spaces. As one participant described,

> I think at least that for me is what got me interested in this work was how can we solve these two issues of just needing to increase the natural spaces in cities for all of the reasons that are unrelated to climate change, but then also increasing them for the reasons that are related to climate change. I think that there's a lot that can be done just to make the city cleaner and more beautiful and healthier and more enjoyable for people, while at the same time, acting as flood prevention. (Interview 19, Local/Regional Government).

Then, to enhance greening participants suggest restoring unused and degraded areas. In order to reduce barriers to these spaces there must be an ensured use and purpose for the public, and tangible features to meet people's needs.

5.2.2 Implications for NBS

The results outlined above articulate values as climate change adaptation objectives, showcasing the diverse perspectives of Boston stakeholders from public/private organizations, community-based organizations, and local/regional government. These objectives articulate what is necessary to effectively tackle the city's challenges in reducing coastal flood risks and impacts on the community according to

these groups. The VFT hierarchy networks developed for each stakeholder group show that Boston stakeholders are aligned in terms of their underlying fundamental objectives, but the mechanisms by which they view these objectives being addressed are different. If the fundamental objectives of these stakeholders are to align to inform and shape adaptation strategies like NBS, current systems of policy and practice will need to adjust to ensure processes for adaptation are inclusive.

In the case of Boston, there are various groups that are promoting NBS for coastal adaptation, but the question arises about whether stakeholders are the enforcing current systems of decision-making to enable these strategies or are they supporting new types of policies and practices. Certain articulations of values and emerging objectives described by particular stakeholder groups will shape adaptation strategies with a range of effects on the community as a whole. Due to existing practiced social contracts the reality of established relationships and responsibilities come to light in decision-making processes, even when stakeholder groups support similar adaptation strategies. For instance, community knowledge is often underrepresented in the design of specific adaptation strategies, such as NBS; rather the design of these strategies tend to be dominated by embedded political systems and power relations (Woroniecki et al 2020). A participant from the group of public/private organizations illuminates this point:

> Who owns this property? It becomes this giant puzzle of how do you fit all of these big action items that we have to do into the bounds of a state grant or into the bounds of a federal grant. How do we work with a project that has 20 homeowners living in this area that all have different ideas, different levels of financing themselves to get something done? Or how do we work on a project that is owned by the state that we want to advance because it is a critical flood

> pathway moving forward? Those are just some of the things that I think rattled through our brains as we try to determine the best pathway forward both from that social, political, economic sphere. (Interview 19, Local/Regional Government)

In selecting and implementing adaptation strategies across the city of Boston, property ownership and funding mechanisms are primary considerations, particularly as these are central aspects of projects being coordinated with higher levels of government in the region. If adaptation projects involving NBS are to be externally imposed though, there is a greater chance that the work will benefit some people at the expense of others (Seddon 2022). This is a significant challenge for Boston, as much of coastal development in the area is based on alignment of government and private developers. One participant described their point of view in this situation,

> Its leadership in the city and the State, it's finding a way to navigate all the different agencies that is-- I'm a developer, developer-friendly because we're the ones who are doing it, so unless it's a public project with ironclad requirements that everyone has to comply with. We're left to our own devices. Sometimes you'll get someone who wants to go the extra mile and thinks it's worth it, and there will be payback, but mostly it's so hard that the nature-based solutions are just not even on the table. (Interview 3, Public/Private Organization)

The people who are responsible for designing and implementing coastal development are looking to local government to impose stringent requirements to account for NBS. Because of historical and present governance mechanisms, the implementation of NBS is reliant on prioritization from the government to require groups to apply these approaches. However, relying solely on directives from the government can take away from the holistic ideas essential to NBS, including those needed to achieve sustainable and

equitable climate adaptation outcomes. If initiatives claim to implement NBS but fail to achieve these goals they risk undermining public support, which can divert additional resources away from legitimate climate solutions (Ellis et al 2024). Another participant described,

> Again, it's all going to be situational-dependent…It's just totally different situations even within a quarter mile of where you are. I think, yes, a collaborative effort where the city leaders, state leaders, and federal leaders are all working together directly engaging with the public to get feedback and understand opportunity, is the work that is going on and is going to need to continue to happen. (Interview 14, Public/Private Organization).

The coordination needed for adaptation work is viewed to be dependent primarily on how government agencies connect with one another to promote adaptation work. Engaging with the public is part of the processes, but there remains the question of whether this engagement is defined by seeking input, or if these agencies are willing to directly partner with community-based groups. Local/Regional government officials acknowledge that they need to work better with one another to achieve the adaptation outcomes that they envision for the community. One participant explained,

> In partnership with other agencies, in partnership with other communities, we could try to find that and what does that look like? That's something that I am thinking about constantly because some of these nature-based solutions, at a larger scale, pose a lot of questions. We may need to think about where it makes sense to do a pilot project to test that out. That's one. Then the second is really just, well, we need to talk even more. We need to make sure that we're in constant communication so that there are no miscommunication, no misunderstandings, because at the end of the day, we don't want piecemeal approaches…It's hard, but just having even groups of communities that are working together, I think is going to be a much better effort

> than just piecemeal, for sure. (Interview 26, Local/Regional Government).

Most respondents within and across groups suggest that if they were better connected and coordinated that they could align their ideas to shape and implement the adaptation strategies and outcomes that they seek. The various stakeholders engaged in this assessment understand that to pursue climate change adaptation actions, multidisciplinary input is required (Unsworth et al 2016). Yet, these groups are struggling to find ways to fully align under current systems of operation and decision-making. The structures that stakeholders have relied on to make decisions and act on adaptation may no longer suffice to enable the type of adaptation outcomes that they seek for the community in pursuing NBS. In some ways the stakeholder groups seek to support one another in adaptation objectives, but considering the city as a whole, there remains the reality that some stakeholders have more power over others and their objectives will dominate the discourse and decision-making processes.

On the other hand, there is an opportunity for local governments to engage effectively with community groups in pursuing NBS rather than relying on other agencies and private developers to carry out their objectives. In Boston, some community groups are actually looking to work with the city government to promote NBS that are reflective of the interconnected challenges that climate change presents. As one participant stated,

> We can't wait. We know that we're already flooding on a regular basis. We already know what the-- the trajectory keeps changing and it's not good news, each time it changes. That's why I feel as though doing as many things now that can begin to knit pieces together, address things in different ways, because it raises the public's awareness. The city is in a better position to try to direct how all of this can be done for the collective good than individual projects like

> ourselves. We can be a part of the solution, but we can't tell the whole story the way the city could…every single neighborhood in Boston, no matter where it is, people in Chinatown, the South End, Roxbury, places like that, may not think that they're vulnerable, but they are. They are already experiencing vulnerabilities that many times they don't even recognize how this is all connected together. (Interview 29, Community-based Organization).

Local groups are working on initiatives that aim to improve community wellbeing by addressing environmental and social challenges simultaneously. In this sense they recognize the potential of NBS and are looking to the city to support them in promoting solutions to address collective challenges, moving beyond current forms of community engagement. The local outcomes of NBS are dependent on community cohesion and empowerment to ensure that they can be maintained over time and continue to produce social and environmental benefits (Seddon 2022). In pursuing NBS it is important to foster a sense of community ownership of strategies and their implementation. Frantzeskaki & Bush (2021) have found that if strategies are visible to and supported by community members, local official are more likely to continue to support these projects, but lack of visibility weakens support and allows local governments to avoid committing a stronger number of resources. There is a need for local governments to become more engaged with community groups and initiatives to ensure NBS can be fully considered and pursued as adaptation approaches. Instead of seeking input, this effort will come down to fostering partnerships and working with the community groups. Some organizations have begun to recognize this need in their work, as one participant explains,

> You find those trusted intermediaries, you figure out who will help you hear the voice of the community, and not just finding one partner, but trying to find a couple of different partners. That may not always be possible. That has not

> always been possible for me in projects I've worked on. Sometimes you just have a timeline and you have a partner and they're doing the work and it's great. You know that you're not getting the full component of perspectives, but you're still getting some. You find out by building trust. (Interview 40, Public/Private Organization).

As stakeholders work towards more collaborative efforts for adaptation, it will be important to find connections across stakeholder groups. Adaptation processes that promote NBS and transformational changes entail working outside of current structures of government and establishing new relationships. In the local context, adaptation processes are shaped by the situational and relational knowledge of people in the community (Woroniecki et al 2020). If NBS are to achieve just outcomes for the city and its stakeholders then it will be important to integrate diverse articulations of values, addressing any contestations and avoiding exclusion of perspectives (Anguelovski et al 2018). There are multiple dimensions of how the city can adapt and transition, particularly in pursuing NBS, but equitable outcomes will be dependent on how new policies and practices prioritize different sets of objectives (Cousins 2021).

5.2.3 Summary

The application of the VFT analysis to assess key informant interviews with Boston stakeholders working in the realm of climate change adaptation helps to distinguish the overarching goals and mechanisms different groups see as meaningful to minimize coastal flood impacts on the community. Each of the different stakeholder groups have different ways of describing fundamental objectives, but they mostly align in terms of prioritizing protection of people, as well as protecting and enhancing existing landscapes and infrastructure. All stakeholder groups seem to be looking for some sense

of leadership. Whether it is looking towards city leaders, state agencies or even the federal government for their support, guidance is sought to create a sense of direction on adaptation actions. Although these objectives are similar across groups, the means of achieving these objectives are defined differently, particularly in how each group assesses their associated roles and responsibilities to address adaptation challenges. Public/Private organizations are looking for directives from local/regional government officials in order to pursue adaptation initiatives, whereas community-based organizations are looking for various agencies and organizations to better connect local initiatives and support community groups. Framing is important here in terms of how the means objectives are being prioritized and by who, as this will affect adaptation outcomes and the distribution of impacts. In considering the implications of this assessment for NBS, stakeholders are restricted by current structures of governance. The current relationships between groups will need to shift and responsibilities will need to be redefined if the holistic and equitable outcomes that NBS promise are to be fulfilled. Otherwise, there is a great chance for uneven outcomes, where some stakeholder groups will continue to benefit over others.

5.3 Discussion

The values-focused approach presented through this assessment can establish a foundation that highlights the diverse perspectives among stakeholders seeking to address climate change adaptation challenges in their community. Adaptation practices must then adjust to recognize these values to respond effectively to the changing environment. There are limits to adaptation as current systems tend to promote some strategies over

others, subordinating some groups in the process (O'Brien & Wolf 2010). Often, community-based organizations and actors who typically have limited resources and power tend to be underrepresented in the design and implementation of adaptation strategies (Woroniecki et al 2020). The involvement of local people in decision-making is often reduced to programmatic formalities and training for capacity building, rather than creating a space for space for direct participation, negotiation, and influence in these processes (Newell et al 2020). Adaptation efforts need to be more inclusive and supportive of local knowledge and participation to establish equitable involvement and promote positive adaptation outcomes for the community as a whole. New types of socio-political relations are likely to better serve resilience goals and meet sustainability needs under conditions of global climate change (O'Brien et al 2009). Additionally, in urban climate adaptation work governments and funders have tended to focus on reinforcing infrastructure with retrofits as practical means of protected cities from climate impacts, but the focus on physical infrastructural solutions is often at the expense of social, political, and economic reforms (Shi et al 2016). Such adaptation frameworks act as significant barriers to NBS, which is intended to enable changes in socio-political organization through environmental interventions. If governments fail to acknowledge the need for these types of changes, then NBS will not fulfill the potential for producing equitable climate outcomes in a community.

Currently, there is a willingness to adapt to coastal climate risks in Boston, but the expectations of stakeholders cannot be met if they are relying on present dynamics between the state and the organizations and residents it serves. There is a need for new

means of political representation to create the changes that deal with the climate risks the community faces (Adger et al 2012). In order to effectively address the climate change adaptation challenges for Boston, the diversity of local priorities must be accepted and pursued by re-examining existing power relations and decision-making processes. The lens of practiced social contracts helps to establish how current relationships and responsibilities among stakeholder groups are affecting local adaptation governance. Understanding the limitations of operating within these types of social contracts helps to illustrate the barriers to NBS in promoting transformational adaptation pathways. Unfortunately, despite decades of scholarship on the challenges of inclusion of through representation in political processes, rarely are the processes of how political voice is achieved addressed (Wijsman & Berbés-Blázquez 2022). In pursuing NBS though, it is important to address these processes as the root causes of these barriers will make NBS virtually ineffective and inefficient if the causes and structural conditions contributing to these challenges are not understood. To qualify as NBS, actions must have some societal benefits where interventions with nature have multiple and interlinked effects on a socio-ecological system and climate. Interventions then should be designed to create synergies between future climate resilience and socio-economic change (Seddon et al 2020).

NBS projects will evolve in locally specific ways that are subject to social, economic, and political forces that are relative to the power of various stakeholders (Woroniecki, 2019). Many forms of coastal governance are hindered by institutional legacies and rigidity as a result of standards and regulations that were designed for maintaining existing lines of defense along the coast through hard infrastructure rather

than working through and with nature (Rahaman et al 2023). In order to be successful, NBS requires governance structures that involve active coordination and cooperation among stakeholders, whether or not their values align, in order to create unified policy and consistency in adaptation actions (Seddon et al 2019). If stakeholders continue to view adaptation as the responsibility of one group or another, there is greater opportunity for creating trade-offs and conflicts. Therefore, to better integrate NBS and the principles of these approaches into urban resilience planning new relationships and partnerships need to be expanded (Bush & Doyon 2019). In order to deliver sustainability benefits, NBS rely on actions taken by stakeholders across different organization, institutions, and agencies, which requires joint initiatives to invest and develop these approaches across communities. In a review of NBS projects worldwide, Dorst et al (2022) found that limited collaborative governance to be a barrier to NBS uptake in urban development in all cases reviewed due to complex stakeholder dynamics, as well as silos in project management and government organization. Thus, if stakeholder groups are not effectively connected and coordinated, NBS cannot be designed and implemented successfully. These findings are particularly relevant to this assessment as various stakeholders in Boston have a stake in the development of NBS, but they are currently divided by institutional responsibilities and objectives. NBS can serve as pathways that disrupt unequal systems of power and enable equitable futures for the vulnerable groups who are often marginalized and on the frontline of climate change only if governance frameworks involve and incorporate measures that attend to past harms, present barriers to representations, and anticipated future challenges (Seddon 2020). Affected local

communities must fully be included in the decision-making processes, accounting for the social and cultural diversity of the city, and ensuring their involvement is a direct piece of adaptation initiatives.

5.3.1 Theoretical Framework Reflections

The design and implementation of adaptation strategies requires input from numerous actors, but the ways in which different groups inform the adaptation process will vary. In this assessment of the interviews, the social contracts framework was applied to help to illustrate how predefined roles and relationships can influence adaptation outcomes for both humans and the environment (O'Brien et al 2009). This stage of the analysis focuses on practiced social contracts to understand how current roles and responsibilities among stakeholders are shaping decision actions in reality (Blackburn & Pelling 2018). Examining the predefined roles and relationships among the stakeholders in this assessment helps to uncover the gaps that exist between imagined social contracts and practiced social contracts.

My assessment of the interview data focused on creating VFT networks for each of the stakeholder groups to distinguish between how each group is defining and shaping adaptation objectives that align with their underlying values. In creating the VFT networks I applied the theoretical framework to identify stakeholder objectives in the form of fundamental objectives, means-end objectives, and potential decision-actions. The practiced social contracts lens helps to differentiate between expectations across stakeholder groups and what is more likely playing out in reality due to their predefined societal roles and responsibilities. This assessment then acknowledges how individual

values among groups are informing potential adaptation actions. VFT as an approach helps to uncover objectives among stakeholders that are shaping adaptation strategies and the associated outcomes. This examination guided by ideas regarding practiced social contracts helps to frame these objectives in the context of stakeholders' relative power and agency over each other, considering potential for social reproduction (Blackburn & Pelling 2018). Connecting the fundamental objectives to the means objectives through the VFT approach with the social contracts lens helps uncover strategies for community adaptation based on the understanding of stakeholder preferences and roles regarding certain adaptation pathways.

The VFT networks I developed help to visualize how different stakeholder groups are thinking about adaptation given their current roles and responsibilities within governance systems. The VFT networks also help to illustrate the primary goals and objectives across stakeholder groups by interpreting the interview responses within each group to determine and present collective values for each group. This type of assessment uncovers adaptation considerations across stakeholder groups, exploring the role of different groups play in defining decision-making objectives and actions for the community, highlighting where priorities conflict as well as opportunities for change. However, in order to gain more insight on the underlying interactions and dynamics between groups further analysis is needed. A deeper investigation of the values and interests among stakeholders that builds on this VFT analysis would help to generate a better understanding of the current nature of societal relationships and interactions shaping adaptation decisions. Such an investigation would also serve to identify

opportunities for how community dynamics and social arrangements can evolve to address existing and future challenges. These are important considerations particularly for communities seeking and promoting transformative adaptation through interventions such as NBS.

5.4 Conclusions

The findings of this chapter build on the initial analysis of how stakeholders in Boston are defining broad climate change adaptation challenges and priorities for the city as they relate to coastal flood risks. This stage of the study consists of a closer examination of stakeholder objectives to minimize coastal flood impacts for the Boston community, including the means by which the stakeholders think these objectives should be addressed. By examining the interview responses by type of stakeholder group, including public and private organizations, community-based organizations, as well as local and regional officials, the differences and connections between the objectives of each group can be better understood. The VFT analytical approach to the interview data helps to provide insights for decision-making processes with multiple stakeholder groups that will shape adaptation strategy selection and outcomes. In turn, the social contracts lens helps to illuminate the roles and responsibilities of each stakeholder group in climate change adaptation for Boston. The next chapter explores how different stakeholder objectives can inform each other and be integrated to define adaptation strategies and outcomes for the community. Given the current nature of relationships between stakeholder groups and their perspectives, it will be important to determine how these relationships can evolve over time to support the adaptation outcomes that community

seeks, meeting diverse needs and values to foster resilience in light of the challenges climate change presents.

CHAPTER 6

INTEGRATING STAKEHOLDER OBJECTIVES TO GUIDE COASTAL ADAPTATION STRATEGIES

6.1 Introduction

This chapter builds on the examination of diverse stakeholder values and objectives determined from key informant interviews to explore how these varying perspectives can be integrated to inform coastal adaptation strategies for the City of Boston. Whereas the previous chapter distinguishes the various ways in which different stakeholder groups define adaptation objectives to minimize coastal flood impacts on the Boston community, this chapter focuses on connecting these ideas and values to define objectives that represent integrated perspectives. During this stage of the research, participants from interviews were invited to engage with one another in a group setting to discuss important characteristics of adaptation approaches, as well as further define priorities for coastal flood protection measures in the community. Working from the knowledge established in earlier stages of analysis, this final assessment investigates how dominating stakeholder perspectives are shaping adaptation efforts, and how stakeholder ideas can better be connected to form integrated objectives. In supporting the primary goal of this dissertation, this final stage of the analysis uncovers new decision

opportunities formed by diverse stakeholder perspectives that are essential to supporting the community's ideas for potentially transformative adaptation approaches.

Developing and implementing definitive actions for climate change adaptation are essential steps for preparing a city like Boston, which is vulnerable to coastal flooding from storms and exceptional high tides and risks that will increase in the future due to climate change and associated sea-level-rise (City of Boston 2016). The City of Boston is emerging as a leader in the Northeastern United States by committing to both climate change mitigation and adaptation strategies. However, as the city moves towards design and implementation of various approaches, particularly NBS, it is important to consider what stakeholders are influencing decisions and potential outcomes for the community. As established in the previous chapter, different stakeholder groups have varying ways of defining their values and objectives for adapting to Boston's changing environment and addressing community needs through certain approaches. If adaptation strategies for the city are to reflect this diversity and equitably address community challenges though, then it is important to connect stakeholders and ensure their role in climate change adaptation processes are better defined and understood.

While uncovering and defining diverse perspectives among stakeholders in the Boston helps to better understand how coastal climate change adaptation is envisioned for the community, the outcomes will be determined by the ideas that are intentionally considered and included in decision-making processes. Often, climate change adaptation projects and supporting efforts are dominated by mainstreamed processes, particularly existing planning and regulatory mechanisms, which tend to favor the interests of current

leadership and experts rather than including a range of perspectives among the population (Malloy & Ashcraft 2020). Adaptation processes at any level in a community are likely to be political and contested, but how individuals, organizations, and government interact in decision-making efforts will influence overall adaptation framing and the response options that are selected to meet those interests (Eriksen et al 2015). These factors are particularly relevant for the implementation of NBS, as the adaptation pathways for a community will be shaped by the policy and sectors involved in the planning processes, thus adaptation options such as NBS need to be viewed and examined in their socio-political context (Scolobig et al 2023). Stakeholder values are increasingly relevant in climate change adaptation research and planning. Values must be central to informing how adaptation strategies are developed and examined to manage climate risks (Helgeson et al 2023). The ways in which certain values are defined and considered in the adaptation process also matters. Formalized institutions and organizations are often viewed as the legitimate authority in climate change adaptation decision-making, but there are informal groups and actors operating at different scales who also shape and promote adaptation efforts for the community (Leach et al 2010, Malloy & Ashcraft 2020). The perspectives and values of formal and informal organizations and institutions are relevant to climate change adaptation processes and must be considered alongside one another.

In this chapter, I apply Keeney's (1992) VFT approach to integrate stakeholder objectives for coastal climate change adaptation to minimize flood risks for the Boston community. The findings from the initial application of VFT to assess key informant

interviews are expanded on in this stage of the analysis to determine how the objectives identified among the different stakeholder groups can be connected to generate integrated objectives. The results of focus group discussions with a mix of stakeholder participants from the initial interviews are assessed to determine where there are opportunities for integration and potential to define broad-based decision actions. Applying the VFT approach to assess these discussions helps to demonstrate how the interests of diverse stakeholders can inform decision-making processes, as well as what these interests mean in pursuing NBS for coastal flood protection. The results provide insights into how the development of adaptation strategies for the community can present new opportunities for stakeholders in the community to connectively influence and inform policy decisions.

6.2 Results

The results described in this chapter are reflective of the findings from the focus group discussions conducted with a mix of participants from previous interviews to represent a combined array of Boston stakeholders concerned with climate change adaptation processes for the city. The results presented here build on the previous VFT analysis that distinguished the different ways in which three primary stakeholder groups, including community-based organizations, public/private organizations, and local/regional government officials, are framing objectives for adaptation strategies to minimize coastal flood impacts on the Boston community. The objectives described by these groups are integrated based on the analysis of the information gathered from the focus group discussions. I present an integrated VFT hierarchy network that establishes fundamental objectives, means objectives, and potential decision actions that are

reflective of the various stakeholder perspectives. A final list of potential decision actions can also be found in Appendix F. I discuss these results in terms of the roles and responsibilities of the various stakeholders described and how they influence adaptation processes and their potential outcomes. Finally, the implications for NBS are discussed relative to the imagined and practiced social contracts between stakeholder groups.

6.2.1 Integrated VFT Hierarchy Network

A combined value hierarchy network was developed based on the integration of objectives from the previous VFT assessment, as well as by the results of the focus group discussions and ranking of fundamental objectives. The strategic fundamental objective to **minimize coastal flood impacts for the Boston community** remained the basis for the discussions about adaptation objectives that were identified with the participants. The participants agreed that minimizing coastal flood impact and damage is the primary reason for discussing and developing coastal adaptation strategies; it is the baseline need for any coastal climate change adaptation project and initiative. The integrated VFT network can be seen in Figure 8. The three overarching fundamental objectives to support this strategic objective include: maximize protection of people, maximize healthy landscapes, maximize protection of critical infrastructure.

There were various ways in which stakeholders framed the fundamental objective to **maximize protection of people.** Stakeholders discussed the protection of people primarily in terms of how adaptation strategies can be framed with a lens focused on equity.

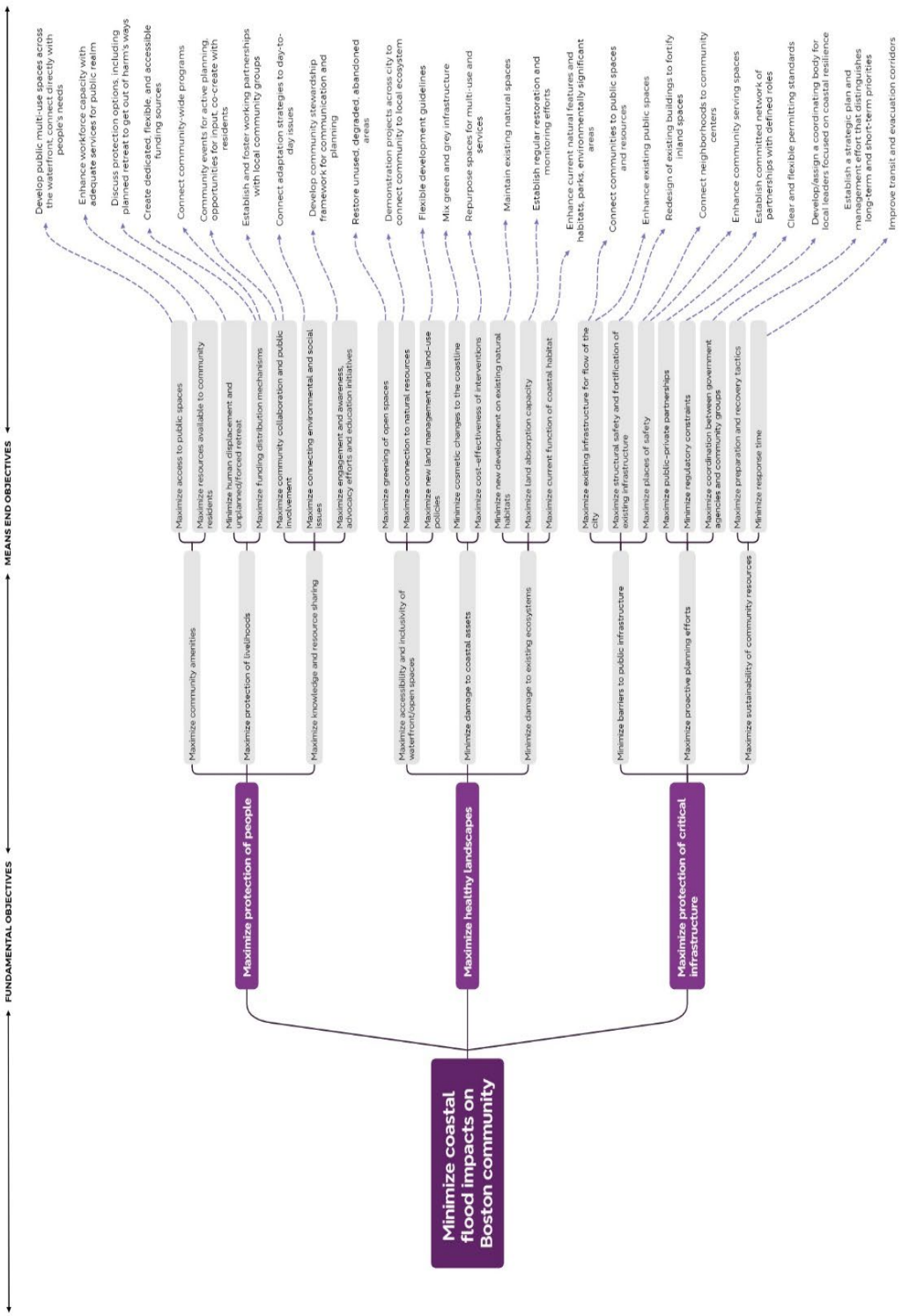


Figure 8 - Values-Focused Thinking Network of Integrated Objectives of Stakeholders. This VFT Network shows the integrated objectives of stakeholders to minimize coastal flood impacts.

As one participant stated, “How do we promote equitable coastal climate change adaptation strategies should be the question so that it doesn't become like, this is a checkmark on the to-do list, but it is the basis of the thing that we're trying to do” (Public/Private Organization, Focus Group 1). Promoting equity then should be a driving factor for coastal adaptation that underlies all planning efforts, particularly as it relates to the protection and support of people in the community. In line with this objective includes ensuring people’s livelihoods are protected and that they have access to community amenities to support them. Maximizing resources available to the community, as well as maximizing funding distribution mechanisms supports these goals. As one stakeholder described,

> One of the things that we've been pushing for some time is the inclusion of nonprofits' abilities to be recipients of this type of grant funding. Because for many years, it's only going to go to states and municipalities. There is a sort of innovative role, I think, for nonprofits to play… really advance the thinking and the understanding of what's possible in a way that government just really isn't set up to do or built to do. I think that's probably one of the biggest opportunities from a sort of nonprofit or private sector role is to really help advance and innovate a lot of the solutions that we're thinking about and talking about. (Public/Private Organization, Focus Group 1)

Broadening funding opportunities to include more nonprofit organizations, particularly community-based organizations can serve to protect people and their livelihoods. These efforts can also be supported by those stakeholder groups who typically receive the majority of resources. Another participant emphasized this point,

> The idea of working with communities, working with frontline communities, working with environmental justice communities, you name what community, big nonprofits and government entities they're trying to work with, it's

> mostly Black and Brown communities. It's mostly low to moderate-income communities. The community-based organizations that are representing those places and those people don't have the time and money because they have to have tangible deliverables, and they have grants that they're getting that don't fund overhead…Those are really critical things. It's getting down to we need to fund community-based organizations. (Public/Private Organization, Focus Group 2).

From this perspective, it is not only necessary to enhance the funding mechanisms that community-based organizations have access to, but there also needs to be consideration for the needs of these organizations and how they operate to conduct their work to support underprivileged groups in the community. Stakeholders also brought up the idea of working with communities and including them in the planning and implementation processes for any type of approach to adaptation. This includes minimizing the potential for forced displacement or unplanned retreat. A participant explained,

> One is coastal climate change adaptation strategies should incorporate the possibility of managed retreat, but they should also reduce the likelihood … that really again, points back to that equity question of you have nowhere to live. You were not in a place where you thought that you were vulnerable. You were only in rental housing. There's all sorts of scenarios. That links back more to equity and the people who are not in a position to be part of managed retreat or need a much larger system. (Community-based Organization, Focus Group 2).

Collaboration with the public then entails establishing and fostering working partnerships with community groups to support people for a wide range of situations that they may face due to climate change impacts. These collaboration efforts are particularly important for communicating the types of protection options available to people, including the potential to relocate and move out of harm's way. Maximizing community involvement

also supports the need for enhanced knowledge and resource sharing among stakeholders in the community. Part of this information sharing involves connecting climate change adaptation to day-to-day needs and challenges that people face on a regular basis. As one stakeholder explained,

> I think when we talk about these coastal adaptation strategies, you can never think about that in a silo of just, "This is a coastal sea level rise or storm surge issue." It does affect absolutely everything else…Going at that problem from the everyday culture, the everyday issues that people face is how you get people onboard with moving towards these actions. You get people onboard by saying, "Thinking about these things will affect how we pay for our food, it will affect protecting this grocery store so that you don't have to go these many miles after a storm or whatever it is," and, I don't know, somehow, really socializing these issues, and shifting the culture…We just have to find a way to make this relevant to people. Or rather find ways that the work can really help people's day-to-day lives. (Local/Regional Government, Focus Group 1).

In this sense, connecting adaptation strategies and what they entail to everyday issues makes the approaches more relevant to the community and even could help to garner more support for coastal adaptation initiatives in general. Some ways stakeholders suggested connecting with people includes offering more than meetings to provide input, and instead engaging through events in people's communities as well as in local spaces. Additionally, engagement efforts for developing adaptation strategies and seeking input should focus on generating and promoting community stewardship through the approaches. In order to maximize the protection of people in ways that are equitable across Boston, decision-making processes need to meet people where they are at, working with them to address current and future challenges for the community and the environment.

The fundamental objective to **maximize healthy landscapes** considers how climate change impacts will affect the existing landscape and natural features in Boston and the surrounding areas in the region. This objective is supported by stakeholders emphasizing the need to create inclusive and accessible open spaces in the community, ensuring coastal assets remain intact or are improved, and that current ecosystems are restored to face minimal damage. The health of Boston's landscape is then dependent on the current function of natural spaces and enhancing the capacity of these spaces to support the community, so that they can act as a natural buffer that can absorb potential flood impacts. Adaptation approaches to support these objectives align well with the ideas behind promoting NBS for coastal flood protection and for flood protection further inland. One stakeholder described an approach that a neighboring state employed after a major storm that could be an example for Boston's efforts:

> One of my favorite examples of flood adaptation is Vermont put a whole bunch of soccer fields and playgrounds in the flood plain after Hurricane Irene. They're not minimizing the flood impact to infrastructure technically but they're minimizing the damage that happens to people. So actually, that's a more equitable approach, that's protecting critical infrastructure but they're not minimizing flooding, they're just minimizing what's actually being impacted by flooding. (Public/Private Organization, Focus Group 2).

Examples like this were frequently raised amongst stakeholders in the focus group discussions. The participants were generally in agreement that enhancing open spaces and working with current natural resources can serve multiple purposes to meet adaptation and community needs. Stakeholders also viewed the objective as significant for adaptation efforts that sustain and adapt over time. As one participant noted, "The idea of

something that can sustain and adapt over time by nature told me that there was something of a functional ecosystem happening there because the things that can sustain and adapt over time often have an ecosystem component" (Public/Private Organization, Focus Group 2). Another stakeholder supported this point stating, "If you're truly building something that can sustain itself over time and ideally has minimal maintenance, then in an ideal world, that would be a natural solution where you're just letting nature take its course. It's doing a job that you want it to be doing and that it's serving all these other purposes" (Local/Regional Government, Focus Group 2). Stakeholders seemed to be promoting NBS for coastal adaptation, and they were focused on the community benefits of enhancing the capabilities and longevity of the natural environment. Participants also focused on connecting the community more directly with the coastal environment to better understand how they can operate for both public use and protection. Additionally, participants raised the point that working with the current landscape as part of adaptation approaches should consider what places need to be protected over others. One stakeholder explained,

> You don't always have to build the wall to do this, you just have to think about how you're configuring your community to do this. There are places where flooding may occur, the question is, is it okay to flood there? This is I think a question in Dorchester where DCR owns a huge amount of waterfront. Does DCR need to elevate every single piece of their parks or do they just need to make sure that their properties are the last place the flooding gets before you get to say someone's home or a piece of critical infrastructure like the T? (Community-based Organization, Focus Group 2).

It is important then to consider what places could be flooded as a means to protect other places and infrastructure that are important for community function and support.

Strategies for working with natural spaces and ensuring healthy landscapes will need to context specific even across different areas of Boston, as design and restoration strategies will be dependent on the vulnerabilities and needs to be addressed in various places across the community.

Finally, the fundamental objective to **maximize protection of critical infrastructure** is reflective of stakeholders considering how current public spaces work for the community, how they could be improved, and the planning and coordinating efforts that are needed. Underlying this objective are ideas about what aspects of the community absolutely need to remain functional or be responsive to potential increased flooding events. As one stakeholder stated, "If we don't have clean water and if we don't have roads to travel on, then nobody can function in our communities. That has to be a baseline. The very definition of critical infrastructure often has equity implications" (Local/Regional Government, Focus Group 2). Thinking about community necessities also needs to reflect how current systems of operation and public resources are supporting people. In particular, adaptation strategies for community protection need to be concerned with the availability and access to these spaces, as well as whether or not the resources serve everyone equitably. One participant explained,

> If the priority is to keep us here and protect ourselves and have the ability to recover after something, all this other stuff has to happen. If we want to then minimize the potential damage so we can do it, that kicks into a bunch of other things. Right now, the way we're operating is, we're going to get hit, we're going to get hurt, how quickly can we get back up and get people going? It's all about recovery. That's going to remain our theme forever, is can we get back up and running. (Local/Regional Government, Focus Group 1).

Given the risks that Boston faces in terms of its coastline and potential for exacerbated conditions in the future, stakeholders generally agreed that protection of critical infrastructure entails preparing communities to respond and places to withstand or absorb impacts. In order to be better prepared and able to recover though the people involved in decision-making processes need to consider new approaches and ways of thinking. This idea is particularly relevant for climate change adaptation strategies that focus on working with and improving current natural spaces. As one stakeholder stated,

> Climate change strategies should have regulatory support. I think right now good designs are being stymied by the existing regulations. I don't actually think it's what's in the words, I think it's the humans doing the regulating. I think that's a really big concern that there are designs being proposed that are being watered down or shrunken back because you can't affect a very damaged ecosystem when in fact making these changes would create a significantly better ecosystem. (Community-based Organization, Focus Group 2).

In this sense, some of the ideas behind promoting NBS, such as restoring ecosystems as a means of creating natural protections against flooding and to prevent damage to other internal infrastructure and systems that the City relies on, are being hindered by current policies and regulators. In order to ameliorate this situation, better coordination and communication are needed amongst stakeholders involved in decision-making processes. As one participant noted,

> We need someone to get people together and figure out how to coordinate, because right now part of the struggle is, you have agencies who may have really good intentions and really great plans, and even possibly some really great solutions, and no one's doing this…I feel like that may be, that's jumping up as like, "That should be a priority. Figure out how to work better together. (Public/Private Organization, Focus Group 1).

Interestingly, when talking about protecting critical infrastructure, various stakeholders are concerned with how people are working together to develop projects and get plans in place to support preparation efforts. If stakeholders are not connected or working with each other there is greater difficulty in moving forward with adaptation processes. Another participant explained,

> Something I think about a lot is creating a feedback loop between government, community, businesses, all the different sectors, groups, so that there's that education piece that's constantly happening regardless of who is currently holding positions of power. That in a situation where progress might be getting stalled, there's still this strong foundation of, in this case, the nonprofits, or cultural institutions where I'm from that we are continuing to convey that information and the importance of all of this so that at least that baseline foundation stays strong. (Community-based Organization, Focus Group 1).

The coordination and communication needed for critical infrastructure projects and adaptation efforts then needs to remain consistent even when there are technical or regulatory hurdles that are affecting the development and implementation of adaptation strategies. This includes relying on organizations and institutions that operate outside of the typical government and decision-making frameworks. Rethinking current systems of operation, including the roles and responsibilities among these various stakeholders informing adaptation approaches, could be useful to working towards more resilient futures for the community.

6.2.2 Roles of Government & Partnerships

In examining how values and objectives can be better connected and integrated to reflect the diversity of needs and expectations for coastal climate change adaptation

strategies to minimize flood risk the roles of responsibilities of various stakeholders are crucial to consider. A particular aspect of the focus group discussions concentrated on how certain objectives are going to be addressed, let alone achieved. The ways in which stakeholders view particular roles and responsibilities for each other and how they view their participation in the system has implications for the way adaptation challenges will be tackled and the potential outcomes for the Boston community. Overall, participants agreed that there is important work already underway for climate adaptation for the city, but efforts to organize and formalize this work further are needed. As one participant noted about various objectives for coastal climate change adaptation strategies, "I was thinking that a lot of these things yes, they're happening now but they feel at some level to be just based on the goodwill of the people doing the work. I think that it needs to be more like this is written into the systems and this is why we have to do all of the other things" (Community-based Organization, Focus Group 2). While there are current efforts in Boston working to address some of the objectives that participants raised as crucial to the adaptation process, there is a lack of formal support and guidance in how to continue this work and move it forward. On numerous occasions, participants described the role of government in ensuring these adaptation initiatives can be pursued. Even one participant representing local/regional government stated,

> When we're thinking about funding and regulatory, equitable policy, cost-effectiveness, we're talking about federal regulations…We're talking about state-level regulations and policy. Then we're talking about local government capacity to have these conversations with communities, to hire the engineers to do all the on-the-groundwork, and then advocacy groups, obviously come in and support as needed, but ultimately, I personally see the

> role of government as being a main driving force here. (Focus Group 2).

In order to move climate change adaptation work forward, elevated workforce capacity and support is needed and that support is needed from various levels of government. Another local official noted,

> I think government has a responsibility, and I look at the state level. The state government has a responsibility to ensure the livelihood of its people. Then that comes down to the cities and towns, but the state has a lot of power, a lot of control, a lot of ability to execute things that even at a local level can't be executed. They have the power to change regulations. That, I think, is a primary responsibility, and I've been advocating that even for all our coastal strategies, we need a state-sponsored group to get all the cities and towns, which are way too parochial, get us all together so that we do the right thing first. (Focus Group 1).

Here, current stakeholders working for local agencies are advocating for more support from higher levels of government. Although officials recognize their role in supporting adaptation processes on a local level, they are looking to higher levels of government to connect agencies and other groups involved in the work. The idea of establishing a coordinating body charged solely with coastal resilience work for the region was raised as a means of improving communication across different agencies and levels of government. In order for such a body to be created or selected though, this would require support for enhanced capacity building, which many see as a directive coming from a higher government authority. However, when thinking about the capacity and support communities need to tackle these climate challenges, the roles of other stakeholders operating outside of government systems also need to be considered. As one participant stated,

> It's a call to action for leadership, but I think that also comes from the people who appoint the leaders. There has to be some greater sense of urgency amongst the general public. We're living in a time where people are having trouble affording their groceries, and their rents, and their gas all at the same time, and so, thinking about protecting critical infrastructure and installing heat pumps and things like that is hard to prioritize, and I think there has to be a more concerted effort, yes, from the government, but also, this broader engagement across sectors to communicate with people both the importance of these issues, but also inviting people into participating in this, and creating the solutions as well. (Public/Private Organization, Focus Group 1).

In this case, other sectors need to be doing their part to move climate change adaptation work forward as well. Engagement work across sectors to connect to local communities needs to be enhanced, but in ways that encourage participation rather than selecting solutions for people. As one participant noted,

> There are people who are skeptical of government, people who are not willing to fund government adequately, people who have just totally different priorities, and so that's where the role of the non-profit sector often comes in, at least in its best form where it can be supportive to government. It can push government from a particular direction and say, "Yes, we want this." The government does something that no one seems to have asked for, then people like, "Why'd you do that?" If there's people out there saying, "We need this, we need these changes, we want this kind of change." Those voices are needed to enable government as it exists today to make these kinds of decisions investments. (Community-based Organization, Focus Group 2).

Rather than solely relying on government directed initiatives and support, it is important for groups working with the community to have a voice in the decision-making process, particularly as a guide as they are more in tune with local peoples' needs. This is not to say that government does not have a supporting role to play, but instead illuminates how

partnerships can create new roles, or even enhance existing relationships among stakeholders and their work to provide a better foundation for climate adaptation decision-making. One participant explained,

> I also see the role of partnerships as the main driving force…we need all these different entities and partnerships between municipal governments, neighboring, and the same region partnerships between municipalities, and non-profits between municipalities, and the state…Also, partnerships with NGOs has been absolutely crucial to getting this done. When I think about Green Gentrification, I think about-- I don't know how to fix that, but I know that I need to be partnering with somebody who does know how to fix that. I think good adaptation requires really, really strong cross-sectoral partnerships. (Public/Private Organization, Focus Group 2).

Without cross-sectoral partnerships and rethinking of how different groups can work together, it will be difficult to move any kind of action for climate change adaptation forward. In this sense, relying primarily on government entities for their support and decision-making power could hinder climate change adaptation initiatives, but more collaborative work could shift the momentum. These diverse stakeholder groups each have a role in advancing the objectives that they have defined and raised to shape coastal climate change adaptation strategies. Yet, some objectives tend to be prioritized and advanced over others because of current systems of operation that have come to define decision-making processes for the community. Such a realization may call for structural changes in order for systems to enable the type of equitable adaptation many stakeholders envision. However, in order for this structural change to occur, incremental changes must be promoted as part of the process. It is important then to recognize that one group's way

of prioritizing does not hold more importance over others, but rather multiple objectives can be championed simultaneously by different groups working more collaboratively.

6.2.3 Implications for NBS

The findings of from the above analysis demonstrate how stakeholder objectives for coastal climate change adaptation strategies for the Boston community can be integrated to reflect their overarching goals and priorities. Although the results help to connect ideas among stakeholders and demonstrate the importance of collaboration among groups, they also highlight the need for more formalized recognition and promotion of these efforts. An integral part of promoting change in a community in order to address the challenges it faces includes establishing frameworks that recognize the need for institutional settings and systems that can foster the working towards that change (Scolobig et al 2023). Communities need long-term strategies that are going to support and protect them into the future, which requires adaptive, multiscale, and cross-sectoral efforts. Such efforts then should promote integration of transformative adaptation goals into various sectors and policies.

In the case of Boston, stakeholders must recognize that adaptation strategies alone will not lead to the transformative adaptation futures that they seek. In particular, the city is promoting NBS to address environmental and societal challenges, but if current institutional dynamics go unaddressed, these strategies cannot subjectively create the equitable outcomes that they promote. Rather, NBS without consideration of the dynamics of dominating governance systems and stakeholder objectives that they prioritize could lead to greater marginalization across the community (Woroniecki et al

2020). Transformation cannot just be assumed through choosing and implementing NBS – there are various dynamics and internal structures that are shaping these strategies and affecting their outcomes. Such systems need to be considered and addressed if any strategies are to succeed in meeting community needs. While NBS can be a tool and even an opportunity to leverage transformative goals, there are numerous factors that need to be acknowledged for any solutions to fall into place.

Instead of promoting NBS alone as the transformative concept for adaptation, there must be considerations for social transformation as well. It is unclear exactly how NBS can bring about transformative change, but the concepts and ideas that drive these strategies can support a broader societal response to environmental changes (Seddon, et al., 2016, Woroniecki, 2019). Crucial to achieving transformative adaptation with NBS then is creating transformative institutional frameworks (Scolobig et al 2023). The stakeholders engaged through this research and those who are participating in climate change adaptation initiatives tend to promote transformative thinking and planning, but the current institutional and governance system that Boston relies on does not reflect these ideas in action. As one participant described,

> It's hard, I think, for those of us who have been in the space so long and have gotten like, slapped across the head with like, you can't do that. Go back to the drawing board and think of a different way... There are so many projects that come across and you're like, this would be a good project and it would probably contribute to the strategies. From where we sit right now with the power that we have, it can't happen. Same thing goes for, folks who sit in DEP and folks who sit at CZM. It's, to me, it's an interesting question of like, when are we talking about these strategies? In what frame of mind are we currently trying to rank these? Are we open to a lot of these things already? Are we like,

> sitting, putting our hat of the regulatory agencies on, or putting the hat of the multibillionaires that are like, who cares how much money it costs to save the world? We have tons of it. Right? (Public/Private Organization, Focus Group 1).

In pursuing innovative strategies such as NBS, stakeholders face frustrations and blockages that are preventing these approaches from coming to fruition in the ways that they are intended. While stakeholders across groups can envision adaptation pathways that require new ways of working together and with the environment, current governance structures restrict the ways in which adaptation occurs. In this case, adaptation approaches are limited by historically rooted regulations and funding structures, which ultimately maintains the status quo of benefitting public/private groups that have access to current financing programs, limiting access and support for local and community-based groups.

If current dynamics are not re-examined, and if the diverse preferences and perceptions presented and connected here are not considered, then it will be difficult to achieve equitable adaptation outcomes for the community. Another participant stated, “In an ideal situation, you would have strong enough government structures and funding that a lot of this could just move forward, and people would agree with it, but I think the reality is that there's many of us from non-profits here because that's not the way our government is structured today” (Community-based Organization, Focus Group 2). Many community-based organizations and nonprofits see their role in pursuing resilience and approaches like NBS as operating outside of current governance structures. These groups have not been supported by the existing governance structures and funding mechanisms, but they are still willing to put in the work for the benefit of their community. These

groups also consider the issue of election cycles and appointed positions, as described by another participant,

> I think that was going to be the point I was going to make with government, especially by the nature of it, people come and go from positions, whether they're publicly elected or appointed, and they get a new job. One person can advance work because they're a strong advocate, but if they leave that role, and someone else is in it who doesn't believe in it, that can stunt progress. (Community-based Organization, Focus Group 1).

Even when local groups have support from governing bodies, the ways in which current governments operate are unreliable without steadfast leadership and support. These points are demonstrative of the frustrations local organizations are facing in Boston, but they are also reflective of common challenges communities face in trying to achieve innovative climate change adaptation in urban areas. NBS requires organization and collaboration to be strengthened and sustainable, which requires the commitment of many actors (Durant 2017, Frantzeskaki & Bush 2021). Some local officials can see ways in which to improve collaboration and support for one another. One participant described,

> I think the funding structures that do say, "Oh, we'll give you this grant funding for collaborating or being in partnership or coalition with these other people," those are helpful for this because then you're both getting compensated. You both have a reason and there's some level of regularity or this project that we have to have an output for. I think that does help in terms of talking about it's not just a one-to-one relationship because if it's a whole partnership, then at some level, you're going to have to pull in other people from your organization or just like, "Oh yes, we did work with them that one time. Let's reach out again." I think those are really helpful for formalizing those relationships and having the time and money to dedicate to that. (Local/Regional Government, Focus Group 2).

In this sense, if funding structures can become more supportive and geared towards supporting collaborative partnerships, then there is opportunity to foster new relationships that can become more longstanding for the work that adaptation requires. However, it will be important that these funding structures shift to generate opportunities and accommodate partnerships with local and community-based organizations, rather than creating more opportunities for groups who already benefit and have primary access to funding. Designing and implementing NBS requires cooperation within and between governments and stakeholders with differing priorities. These strategies can rarely be mainstreamed with existing planning and policy tools, and they rely on secure and sustainable finances that are suitable to the local sociocultural context, supporting communities that need it most (Seddon 2022). There are ways in which current funding structures and regulations limit adaptation priorities from being reflective of the subjective visions that stakeholders have for a resilient future. As one local official noted,

> I think it's a question of what do we prioritize, what do we want to prioritize as human beings, and what holds us back in actuality, right? If we can't build a harbor to put marshland in downtown Boston because of regulatory issues, then we just can't do that. If it costs us $50, $100 million, a billion dollars to build a barrier protecting the entirety of Boston Harbor, probably can't do that. There are these just fundamental things stopping us from doing the things that maybe we want to do from a design or human perspective, right? (Local/Regional Government, Focus Group 1)

Even when local officials are supportive of NBS and innovative approaches, current systems prevent groups from being able to pursue these strategies, as the mechanisms required to implement NBS effectively are not available. The responsibility of adaptation is typically placed on local governments without strengthening their capacity to

implement approaches that require technical and financial investments supportive of the socio-environmental distribution of risks, vulnerabilities, and adaptive capacity (Shi et al 2016). Governance structures and decision-makers promoting adaptation objectives then must assess how existing development strategies affect adaptation plans and create uneven opportunities and outcomes. Without supportive institutional systems in place, implementing NBS becomes difficult, as governance barriers can result in adaptation that fails to address underlying vulnerabilities and produces inequitable and uneven outcomes for communities most affected by climate change impacts (Davies & Lafortezza 2019). Stakeholders operating inside and outside of government must coordinate their roles, responsibilities, and values to assemble the resources and authority needed design and implement NBS in the ways they are intended, creating opportunities for transformative adaptation pathways. Bringing together different perspectives to inform adaptation processes is necessary – as one participated noted,

> I think what we've all been saying is the fact that we're all coming at this from different perspectives is a strength … Our strength is in – to sound like one of those motivational posters – Our strength is in our diversity, but it's so true. Our ability to get anything done comes from the fact that when we're partnering, we're not duplicating efforts. We're bringing different perspectives. I think any list of here are the objectives of climate adaptation needs to recognize that there's different organizations and different individuals and different individuals within those organizations and the same people in the same organization on different projects will prioritize these differently. (Public/Private Organization, Focus Group 2)

The development of NBS requires support from affected communities and political leadership (Davies & Lafortezza 2019). Stakeholders recognize the importance of their diversity in influencing and informing adaptation processes, but it is a matter of how their

priorities are managed and considered in the selection and implementation of these strategies. Equality of participation is necessary, and this requires consideration of previously marginalized and excluded interests and experiences (Ellis et al 2024). There is complexity and uncertainty inherent climate change adaptation challenges, especially in the context of urban development, in which NBS must account for in design and implementation (Frantzeksaki et al 2019). These strategies require reconsideration of roles and responsibilities in current governance structures, and they must be codesigned among stakeholders using their diverse knowledge to ensure transformative pathways that are relevant to a city's needs and context.

6.2.4 Summary

While stakeholders were able to define primary objectives that support the overarching goal to minimize coastal flood impacts on the Boston community, there are underlying conditions that need to be addressed. Stakeholders tended to note that they share mostly the same objectives in terms of protecting people, promoting healthy natural landscapes, and strengthening critical infrastructure, but they vary in the ways that they prioritize these objectives. The focus groups helped to demonstrate the importance of learning the different ways in which people working in the climate change adaptation spaces are framing issues, as well as some of the ways in which they could better work together to complement each other's focuses and strength. Climate change adaptation work, particularly the development and implementation of climate change adaptation strategies like NBS, requires a comprehensive understanding of people's priorities at various levels of government and society. Many aspects of this work to pursue NBS

should be occurring simultaneously, but current systems rely on prioritizing objectives over others rather than connecting objectives to one another. There is opportunity here then to work with a menu of objectives to help people better understand how to address climate change adaptation challenges and connect this work directly with community needs and values.

6.3 Discussion

Governance systems and decision-making processes affect the types of knowledge and voices that dominate decision actions with outcomes that have implications for the entire community. In order to engage and promote different forms of local knowledge in decision-making processes, the governance processes themselves may need to change (Bennett et al 2016). However, these types of transformations do not occur overnight; they require recognition of challenges of current systems, while encouraging incremental ways in which systems can be revised to better benefit the communities they serve. If transformations in governance and even in stakeholder relationships are deferred in adaptation processes, there is risk of increasing and exacerbating the challenges that already exist. In this case, it is important to prioritize adaptive management not only in the design of adaptation strategies, but also in the adaptation processes themselves to recognize the fundamental shifts that are necessary for creating the resilient futures the community desires (O'Brien et al 2009, O'Brien 2011).

In the case of Boston, pursuing NBS for coastal flood protection in light of climate change will require a reassessment of governance structures and stakeholder

involvement in adaptation processes. The stakeholders participating in this study recognize the different roles that each group can play in designing and implementing adaptation strategies that are beneficial to the community. Unfortunately, they do not have many opportunities to come together on a regular basis to acknowledge and consult each other regarding adaptation priorities and preferences due to current governance structures. Additionally, actions and planning for NBS to promote socio-environmental changes are hindered by historical funding patterns and regulatory standards. There is a need for new means of political representation to create the changes that deal with the climate risks the community faces (Adger et al 2012). In order to effectively address the climate change adaptation challenges for Boston, the diversity of local priorities must be accepted and pursued by re-examining existing power relations and decision-making processes. The lens of practiced social contracts helps to establish how current relationships and responsibilities among stakeholder groups are affecting local adaptation governance. If Boston is to continue to pursue NBS as primary coastal adaptation approaches for the city, these groups must find more ways to come together to design and implement strategies that benefit all sectors of the community.

In order for NBS to be successfully implemented in cities, communities a collaborative governance approach among municipalities, citizens, and local organizations is necessary. It is not enough to rely on the innovative potential of NBS to address adaptation challenges. In order for NBS to have the intended socio-environmental benefits, stakeholders must participate in projects together to co-create new forms of knowledge that connect social and scientific practices (Brink et al 2018). Brink et al

(2018) suggest models that promote transdisciplinary governance to be more reflective of the nexus between citizens and municipalities, focusing on real-world strategies that connect social, economic, and environmental sustainability challenges. Additionally, Dorst et al 2019 find that NBS can be effective in drawing attention to the potential of nature in developing pathways for sustainable and transformation adaptation in urban settings following these types of governance schemes. In fact, these processes are necessary to achieve any potential success with NBS. NBS can serve as entry points to addressing urban challenges by addressing climate change related problems like increased coastal flooding, and by calling for co-development of strategies between groups in the community, creating new opportunities for open dialogue and influence amongst various stakeholders (Frantzeskaki 2019). These strategies require establishing, or re-establishing connections between different stakeholder groups and communities. Frantzeskaki & Bush (2021) suggest finding opportunities for intermediation between different stakeholder groups, promoting this as a governing strategy across institutional and community spaces to advance NBS and inclusive resilience agendas. In this case, intermediaries are stakeholders who can facilitate connections within and across groups in governing bodies and local organizations. Creating these connections helps to develop networks that encourage knowledge sharing and broadening roles and activities of stakeholders to inform changes in policy or new policy development. Significant time and attention are required, accounting for dynamics and roles to change as activities between groups may shift as new processes unfold (Frantzeskaki & Bush 2021). Such processes enable transitions in governance to create new social contracts that can

encourage transformative adaptation pathways. The relationships and responsibilities in an urban system can be reevaluated and assessed to ensure community groups that are most at risk have a voice in the planning and implementation of NBS while being supported by other stakeholder groups to fully engage and benefit from adaptation processes. These types of collaborations must occur in a sustainable continuum, working beyond the design and implementation stages to fulfill and address community objectives well into the future.

6.3.1 Theoretical Framework Reflections

The assessment of the focus group data to create an integrated VFT network is guided by the social contracts framework. The application of the social contracts framework focuses on how the analysis could consider both imagined social contracts and practiced social contracts to determine how these relationships and responsibilities could inform decision-making processes for adaptation. Whereas imagined social contracts reveal the subjective priorities of various stakeholders, including how they hope and envision climate change adaptation will play out to address community challenges, practiced social contracts distinguish current, established systems of decision-making and how they affect adaptation priorities that will define implementation approaches. (Blackburn & Pelling 2018). Connecting these types of social contracts is relevant to determining the implications of stakeholder objectives for the design and implementation of NBS as a coastal adaptation approach that promotes transformational pathways. The social contracts framework then helps to identify current obstacles for achieving

transformative adaptation and where there are opportunities to reconsider various stakeholder roles in the adaptation process.

Applying the VFT approach helps to further define objectives among stakeholder groups and to integrate their ideas to form a more cohesive decision framework. The social contracts analysis framework also helps to understand where imagined social contracts and practiced social contracts connect and conflict to determine how these relationships can inform each other to integrate perspectives. Including the social contracts lens in this the assessment also helps to uncover how different types of stakeholder preferences are influencing each other and the ways in which roles could shift to generate more equitable outcomes. This analysis sheds light on the mechanisms by which stated objectives can be integrated and addressed with considerations for the characteristics of adaptation strategies like NBS, as well as the roles and responsibilities among the stakeholders to meet community expectations for adaptation responses.

It is important to note though that VFT is an analytical approach that is prescriptive in nature, designed to produce results that directly inform policy and decision-making processes in communities. This approach helps to address community challenges and priorities by understanding diverse stakeholder values to determine objectives and decision-actions. Some of the interactions and relationships between stakeholders can be interpreted based on the ways in which they articulate their values and frame policy objectives. This assessment helps to uncover the ways in which formal and informal relationships among stakeholders are shaping adaptation processes and the selection of adaptation strategies. By examining how various groups are considering each

other and accounting for different community needs informs how objectives are defined for decision-making processes. Such an approach demonstrates ways in which objectives can be connected to integrate stakeholder values to inform policy. The approach also identifies some of the gaps and needs that should be addressed moving forward in order to effectively continue to pursue transformative adaptation through interventions like NBS. In order to gain better understanding of the underlying dynamics that will affect the potential for sustainable transformational outcomes though, further critical analysis is needed. Future research can then better investigate and determine whose objectives are being prioritized in selecting, designing, and implementing adaptation strategies. This work would also benefit from full consideration for the stakeholder relationships, including an examination of existing roles and responsibilities, and where shifts could be appropriate.

6.4 Conclusion

This chapter focused on integrating stakeholder values and objectives to guide coastal climate change adaptation strategies for the Boston community. The findings presented here are the result of combining and building on the initial application of VFT to define stakeholder framings of climate change adaptation objectives for minimizing coastal flood impacts on the city. In this stage of the analysis the different stakeholder groups were connected to generate an integrated VFT objectives network. The results of focus group discussions with a mix of stakeholder participants from the initial interviews were assessed to support this integration process. This discussion also helped to shed light on how various stakeholder interests can define broad-based decision actions. The

results provide insights into how the development of adaptation strategies for the community can present new opportunities for stakeholders to influence and inform policy decisions.

Beyond defining integrated coastal climate change adaptation objectives for Boston though, this assessment provides insights into how current systems may need to change to enable the types of actions that stakeholders envision, particularly for NBS. Increased collaboration and communication among different sectors and stakeholders support the notion of reframing engagement for decision-making in the community. Nonetheless, without systematic changes to institutional and governance systems there is potential to fall short of goals for building a more resilient city through NBS. Ultimately, Boston and its stakeholders support ideas and the possibilities for transformative adaptation, but such outcomes are dependent on how current socio-political conditions can change to achieve these objectives. Many people in this community are ready to act on climate change adaptation, which is clear in the promotion of innovative approaches like NBS, but they are unsure where to start. However, if these stakeholders are willing to begin with a reassessment of how they conduct current decision-making actions and remain open to encouraging new forms of governance there is potential for transformative community outcomes.

CHAPTER 7

CONCLUSION

This research generates a better understanding of how to incorporate human values and community knowledge into adaptation planning, including the design/implementation of NBS for coastal flood protection. This research also can serve as a guide to how NBS can support people's needs and values, considering adaptation challenges as they relate to the coastal urban context. I acknowledge the existence of multiple social contracts, focusing on imagined social contracts and practiced social contracts, to examine individual and group values among stakeholder groups. I assessed how relationships between diverse stakeholders and shaping their values and informing adaptation planning efforts, including how their objectives are defined and accounted for in these processes. By considering the evolving roles and responsibilities of various stakeholders in adaptation planning processes this study demonstrates how communities need to reexamine and redefine relationships in existing governance structures in order to foster the transformational adaptations that NBS promote. My research finds that the subjective priorities and motivations for climate change adaptation across stakeholder groups differ from what is playing out in reality due to engrained policy and funding mechanisms, as well as limited forms of engagement. Stakeholders are mostly proponents of actions for transformative adaptation, but they are stuck in current siloed systems of

operating. If communication and coordination across stakeholders can be adjusted for more flexible and consistent interactions, then relationships between groups can evolve to integrate ideas to more holistically inform and shape adaptation strategies and associated policies. In this final chapter, I summarize the core findings of my research, discuss limitations of the work, and offer recommendations for future studies.

7.1 Summary of Findings

7.1.1 Research Question 1

My first supporting research question to understand how motivations and priorities among stakeholders are affecting perceived notions of acceptable coastal adaptation strategies, specifically NBS, is addressed through an initial assessment of key informant interviews to develop two cognitive maps that reflect climate change adaptation challenges and priorities identified by stakeholders. Additionally, the theoretical framework and lens of imagined social contracts applied in this assessment helps to reveal the subjective ideas for adaptation across stakeholder groups, considering how they define challenges and hope to them addressed. The participants could agree that adaptation to climate change is necessary, and they are concerned with the questions of how, when, and what it will take to meet community needs, The cognitive map of challenges helps to visualize issues focused on funding and investment, community consensus and engagement, and governance and management, including some of the causes and concerns underlying these issues. These challenges have implications for NBS, reflecting reflect some of the barriers to implementing NBS that will need to be addressed to ensure their effectiveness. While NBS can create opportunities for

addressing these challenges as they promote social and environmental change, community dynamics and relationships will ultimately determine the outcomes. The collective identification of challenges surrounding funding, governance, and community engagement for adaptation indicate the need for solutions that involve stakeholders interacting at different levels, local and regional, which may impose new responsibilities to better address climate change risks (O'Brien et al 2009, Cash et al 2006). The ways in which the frame these challenges also indicate that social and cultural shifts are necessary in order to better connect the community and address longstanding issues. This assessment further informs the overarching ideas that may be shaping the adaptation priorities of various stakeholders.

The ways in which stakeholders identified climate change adaptation priorities are more reflective of how ideas of approaching these challenges differentiate between social groups. The responses of participants shaped priorities that are more appropriately situated within the respective societal roles of the stakeholders, as they are concerned with the policies, partnerships, and responsibilities for decision-making processes regarding adaptation (Guarinieri et al 2016, Eden & Ackermann 2004). While public/private organizations and local officials tended to describe priorities as action-items to address within the current system, community-based organizations focused on different paths forward to meet adaptation goals that encourage rethinking current systems of management and organization. Public/private organizations are seeking ways to effectively operationalize funding and land management for adaptation strategies that are legally and physically practical. Local officials are seeking ways to enhance

community connectivity and improve the urban environment. Community-based organizations are seeking adaptation efforts to promote social reforms to address past harms, emphasizing priorities that consider social and environmental challenges together. This breakdown of adaptation priorities helps to show the hopes and expectations participants hold for Boston's approach to climate change adaptation and demonstrate that they are influenced by the current social and political landscapes that the stakeholders operate within. The priorities that stakeholders identified are reflective of how they differ in thinking about the mechanisms by which adaptation will occur. This analysis helps to show how the different framings of priorities among stakeholders, where they are diverging and where they can be connected.

The overall assessment in this chapter sheds light on how Boston stakeholders generally align in defining the primary climate change adaptation challenges for the city, and then where they diverge in priorities for addressing these challenges. The cognitive mapping approaches and imagined social contracts lens applied in this assessment helps to understand a stakeholders' risk perception and ideas of community resilience to determine what level of climate change adaptation capacity the community plans to achieve. The cognitive maps developed present the subjective conceptions of climate change adaptation for Boston among stakeholders, reflective of ideas that are sensitive to their collective culture and history, as well as their social relations and boundaries. In identifying baseline adaptation priorities across stakeholder groups though, the analysis framework provides insights that reveal some of the obstacles and motivations for climate change adaptation, as well as those challenges and incentives for implementing NBS in

Boston. In order for NBS to be effective, changes to current governance and funding strategies will be necessary to overcome these broad challenges and to ensure community-wide benefits are achieved. The ways in which stakeholders work with each other moving forward will determine how whether and how these challenges priorities can be addressed simultaneously and cohesively.

7.1.2 Research Question 2

The second supporting research question addresses the role of various stakeholder groups in defining decision-making actions for adaptation strategies, considering how stakeholders are articulating their values and objectives for adaptation differently. This question is explored through further analysis of key informant interview, applying a VFT analysis approach and assessing responses with a practiced social contracts lens. The findings of this chapter build on the initial analysis of how stakeholders in Boston are defining broad climate change adaptation challenges and priorities for the city as they relate to coastal flood risks. This stage of the study consists of a closer examination of stakeholder objectives to minimize coastal flood impacts for the Boston community, including the means by which the stakeholders think these objectives should be addressed. By examining the interview responses by type of stakeholder group, including public and private organizations, community-based organizations, as well as local and regional officials, the differences and connections between the objectives of each group are better understood.

This assessment uncovers objectives across the three stakeholder groups, including public/private organizations, community-based organizations, and

local/regional officials. These objectives reflect the perspectives informing and affecting the selection of adaptation strategies and associated decision actions. The analysis distinguishes what stakeholders want to see in climate change adaptation actions versus what is likely to play out in reality due to differences in power and agency across stakeholders. The VFT analysis helps to distinguish the overarching goals and mechanisms different groups see as meaningful to minimize coastal flood impacts on the community. Each of the different stakeholder groups have different ways of describing fundamental objectives, but they mostly align in terms of prioritizing protection of people, as well as protecting and enhancing existing landscapes and infrastructure. Although objectives are similar across groups, the means of achieving these objectives are defined differently, particularly in how each group assesses their associated roles and responsibilities to address adaptation challenges. The framing of adaptation objectives affects adaptation outcomes and the distribution of impacts, which makes it important to determine how objectives are prioritized and by who, with particular implications for NBS outcomes.

Whether it is looking towards city leaders, state agencies or even the federal government for their support, guidance is sought to create a sense of direction on adaptation actions, all stakeholder groups seem to be looking for some sense of leadership. Public/Private organizations are looking for directives from local/regional government officials in order to pursue adaptation initiatives, whereas community-based organizations are looking for various agencies and organizations to better connect local initiatives and support community groups. Stakeholders are currently restricted by the

structures of governance in which they are operating. Relationships between groups will need to shift and responsibilities will need to be redefined if the holistic and equitable outcomes that NBS promise are to be fulfilled. Otherwise, there is a great chance for uneven outcomes, where some stakeholder groups will continue to benefit over others. These findings are particularly relevant to this assessment as various stakeholders in Boston have a stake in the development of NBS, but they are currently divided by institutional responsibilities and objectives. All affected local stakeholders in the community must fully be included in the decision-making processes, accounting for the social and cultural diversity of the city, and ensuring their involvement is a direct piece of adaptation initiatives.

7.1.3 Research Question 3

The third and final supporting research question addresses the opportunities for integrating stakeholder objectives for climate change adaptation with the goal to ensure adaptation strategies promote and produce equitable outcomes. The analysis covered in this chapter examines how imagined social contracts and practiced social contracts can inform one another to acknowledge underlying and observed objectives that shape adaptation strategies. The findings are the result of combining and building on the initial application of VFT to define stakeholder framings of climate change adaptation objectives for minimizing coastal flood impacts on the city. The analysis involved assessment of focus group discussions with a mix of stakeholder participants. The focus group discussions provide insight on how various stakeholder interests can define broad-based decision actions. My examination of the group responses sheds light on how the

development of adaptation strategies for the community can present new opportunities for stakeholders to influence and inform policy decisions. Ultimately the focus groups helped to demonstrate the importance of learning the different ways in which people working in the climate change adaptation spaces are framing issues, as well as some of the ways in which they could better work together to complement each other's focuses and strength.

Participating stakeholders were able to define primary objectives that support the overarching goal to minimize coastal flood impacts on the Boston community. These groups share mostly the same objectives in terms of protecting people, promoting healthy natural landscapes, and strengthening critical infrastructure, but they vary in the ways that they prioritize these objectives. These findings suggest that there are underlying conditions that need to be addressed. Stakeholders recognize the importance of their diversity in influencing and informing adaptation processes, but it is a matter of how their priorities are managed and considered in the selection and implementation of these strategies. Creating connections between groups helps to develop networks that encourage knowledge sharing and broadening roles and activities of stakeholders to inform changes in policy or new policy development. Such processes enable transitions in governance to create new social contracts that can encourage transformative adaptation pathways.

The development and implementation of climate change adaptation strategies like NBS requires a comprehensive understanding of people's priorities at various levels of government and society. These strategies require reconsideration of roles and

responsibilities in current governance structures, and they must be codesigned among stakeholders using their diverse knowledge to ensure transformative pathways that are relevant to a city's needs and context. Current governance systems rely on prioritizing objectives over others rather than connecting objectives to one another. However, stakeholders must be willing to reassess how they conduct current decision-making actions and remain open to encouraging new forms of governance if NBS are to have the potential to promote and produce transformative community outcomes. The relationships and responsibilities in an urban system can be reevaluated and assessed to ensure community groups that are most at risk have a voice in the planning and implementation of NBS while being supported by other stakeholder groups to fully engage and benefit from adaptation processes. There is greater opportunity to work with diverse objectives to help people better understand how to address climate change adaptation challenges and connect this work directly with community needs and values. These types of collaborations must occur, working beyond the design and implementation stages to fulfill and address community objectives well into the future. Without systematic changes to institutional and governance systems NBS will fall short of building a more resilient city to address climate change.

7.1.4 Overview

This assessment provides insights into how current governance systems may need to change to enable the types of actions that stakeholders envision, particularly for NBS. Increased collaboration and communication among different sectors and stakeholders support the notion of reframing engagement for decision-making in the community.

Ultimately, Boston and its stakeholders support ideas and the possibilities for transformative adaptation, but such outcomes are dependent on how current socio-political conditions can change to achieve these objectives. The chapters that I present here demonstrate separate but interconnected ways of examining stakeholder perspectives and relationships to understand the opportunities and limitations of NBS for transformative adaptation. In particular, understanding the promotion of NBS through a social contracts lens helps to uncover some of the ways that current adaptation governance processes need to be adjusted to enable transformational adaptations in communities. Communities with diverse socio-ecological dynamics, cannot be jumping ahead to claim and implement NBS as transformative adaptation – they need to consider stakeholders values and community dynamics that influence decision making and prospective adaptation outcomes.

While NBS offer opportunities to transform nature and society, the desired ecological and social outcomes are dependent on conditions that enable flexible and adaptable governance (O'Leary et al 2023). For the coastal urban context in particular, communities need to consider local history, current conditions, and the needs of residents. Restoration and enhancement of urban systems involves rethinking the design, development, and management of the environment and infrastructure, which requires stakeholder input and participation in establishing sustainable futures (Klaus & Kiehl 2021). The principles defining NBS encourage new forms or engagement between researchers, government, and citizens to generate collaborative approaches to adaptation and recognize diverse social and cultural values within communities (Frantzeksaki et al

2019). However, fully integrating NBS into adaptation schemes requires shifts in how organizations and institutions connect and operate (Seddon et al 2019). There are socio-political challenges and barriers to overcome in pursuing NBS in order for the potential benefits to be fully realized.

7.2 Reflections & Recommendations

7.2.1 Considerations for Theoretical Framework

In thinking about adapting to climate change, addressing vulnerabilities, and building resilience requires cross-scale approaches. As such, adaptation approaches need to consider the social-ecological dynamics across systems, including new and shifting responsibilities that will occur within communities under changing conditions (O'Brien et al 2009). Social contracts help to understand the current nature of societal relationships and responsibilities, as well as how these arrangements and interactions may evolve over time to address the complexity and uncertainty of climate changes risks (Adger et al 2012). This dissertation applies Blackburn & Pelling's (2018) concept of multiple social contracts to account for the roles of state and non-state actors in climate adaptation planning and implementation. I connect social contracts theory with values-based adaptation planning to better understand how human values and stakeholder relationships are informing adaptation strategies, considering the potential to achieve transformative adaptation.

Through my research I present a novel approach to bring together important theories and prescriptive analysis methods to inform policy. The social contracts theory provides a critical lens to address questions surrounding the roles and responsibilities of

stakeholders in securing resilient futures for communities facing increasing climate change risks. Such a lens is important for considering who is responsible adaptation actions, accounting for the conditions under which current governance systems are limiting approaches that seek to foster more equitable outcomes and ways that these systems can be challenged and renegotiated ((Blackburn & Pelling 2018). I employed cognitive mapping and VFT as analytical approaches to better understand the values and objectives that are shaping adaptation planning processes, distinguishing between different stakeholder groups, as well as finding opportunities to integrate objectives to generate cohesive decision-actions that can inform policy. However, these types of analysis are prescriptive in nature, and provide broad understanding of stakeholder relations and their levels of influence. These approaches are useful in determining new ways to connect and reflect on stakeholder perspectives to inform climate change adaptation policy, but they are limited in providing a fuller understanding of community dynamics. Such insight is necessary for thinking more deeply about processes that influence transformative adaptation. The application of my theoretical framework in employing these approaches to interpret the qualitative data I collected offers insights into how these analytical methods can benefit from including a critical lens to an otherwise prescriptive assessment.

Expanding assessments such as the one I have presented through this dissertation will be useful in continuing to explore opportunities for transformative adaptation through NBS. This study demonstrates some of the key considerations in designing and implementing these innovative approaches, by accounting for the role of human values

and perspectives in community adaptation process. Yet more work is needed to identify the underlying processes that affect prospects for sustainable transformation through NBS. It will be important to determine how stakeholder relationships can evolve over time to support the adaptation outcomes that community seeks, meeting diverse needs and values to foster resilience in light of the challenges climate change presents. This type of work will need to further consider the role of various stakeholder groups in defining decision-making actions and whose objectives are prioritized for adaptation strategies for the community. I believe there is further opportunity here to apply the theoretical framework that I have developed to inform future studies and analytical approaches. This framework is particularly relevant for research that seeks to determine paths forward for transformative climate change adaptation, whether through policy interventions or to investigate the significance of shifting governance structures in determining more equitable community outcomes.

7.2.2 Limitations of the Research

In considering the limitations of my research, I focus primarily on expanding the diversity of stakeholders involved in these types of studies. As illuminated through my assessments, stakeholder participation in designing and implementing NBS is crucial to promoting sustainable futures and potentially transformative adaptation. Urban greening and design can often reinforce power relationships by solely considering supporting views, which calls for enhancement of participation and input from typically underrepresented stakeholders (Xing et al 2017). For this research, I primarily interviewed people working in climate change, environmental conservation, and

environmental policy spaces. Each individual and group participating had a diverse set of interests and perspectives, and not all participants work primarily on environmental challenges. However, there are other stakeholders who need to be considered and involved in this work, particularly organizations not directly or indirectly involved in work focused on climate change and the environment. Additionally, there are opportunities for more community-based organizations to participate in these types of studies if compensation is offered for their participation. Unfortunately, there were some participants from community-based organizations who were interested in taking part in this research, but they were unable to due to time and budgeting constraints. Compensation needs to be offered for participants' time and knowledge, especially community-based organizations, in order to encourage their participation while acknowledging the significance of their contributions. Also, residents and Indigenous Peoples were not included in this study. Although, I focused my research on the dynamics and relationships between institutions, organizations, and local government the lack of consultation of these groups is a significantly limiting factor if this work is to be fully representative of the diversity of the community. Such participation would enhance the depth and breadth of this work. Finally, my research does not include consideration for legal-institutional contracts, another form of social contracts, which could be considered in future research to complement this study. The design and implementation of NBS requires input and knowledge from multiple stakeholders, and partnering with different actors is viewed as a mean of overcoming socio-political barriers to these approaches and adaptation in general (Dushkova & Haase 2020). In order to deliver effective and

equitable outcomes, the design and implementation of NBS needs to be inclusive of all relevant stakeholders. Enhanced engagement in the development, monitoring, management, and evaluation of NBS can foster community ownership in reshaping their landscapes for improved overall wellbeing (Seddon et al 2020).

7.2.3 Opportunities for Future Research

My research is just one way of beginning to examine social and political processes that could contribute to the ability of NBS to be transformative, by investigating peoples' values and objectives to identify current opportunities and limitations. There are numerous opportunities for future research that can build on this study, exploring new ideas and concepts to understand the opportunities and limitations of NBS for transformative adaptation. For instance, more work is needed to consider the culture of adaptive management in climate change conditions, assessing the feasibility and constraints of governance to meet evolving needs (Ellis et al 2024). Frantzeskaki & Bush (2021) also suggest that research in cities to showcase how to transform governance to tackle climate change adaptation is important, particularly to investigate the role of intermediaries and the opportunities they can offer in shaping new agendas. This type of research could include a deeper examination of imagined social contracts and whether roles and responsibilities could shift to meet subjective goals for adaptation. Opportunities for collaborative governance also need to be explored, particularly in urban settings to explore avenues of social innovation and reshaping institutional spaces (Frantzeskaki 2019). Such research could inform ways for co-creating and co-maintaining NBS for climate change adaptation and urban sustainability. Dorst et al

(2019) also pose opportunities for future research to examine the multiple urban services that NBS can provide given the contextual significance of these approaches, including the socio-spatial implications. This work could inspire new modes of environmental governance. The challenges and opportunities surrounding NBS offer various future research possibilities and opportunities to enhance knowledge that are important to pursue in order to understand the full potential of these approaches for climate change adaptation and transformative pathways.

APPENDICES

APPENDIX A: PARTICIPATING ORGANIZATIONS AND INSTITUTIONS

Public/Private Organizations

- Fort Point Associates (Tetra Tech)
- Barr Foundation
- A Better City
- BSC Group
- Green Ribbon Association
- Weston & Sampson
- The Nature Conservancy (TNC)
- The Trustees
- Conservation Law Foundation (CLF)
- The Boston Foundation
- Lendlease
- Beth Israel Deaconess Medical Center
- Wharf District Council

Community-based Organizations

- Museum of Science Boston
- New England Aquarium
- Boston Children's Museum
- Save the Harbor/Save the Bay
- Mystic River Watershed Association (MRWA)
- Charles River Watershed Association (CRWA)
- Neponset River Watershed Association (NRWA)
- Eastie Farm
- Boston Harbor Now
- Neighborhood of Affordable Housing (NOAH)
- The American City Coalition

Local/Regional Government

- Boston Planning & Development Agency
- Boston Water and Sewer Commission
- City of Boston (1 City Councilor, 2 City Employees)
- Massachusetts Executive Office of Energy and Environmental Affairs (Municipal Vulnerability Preparedness program)
- Office of Coastal Zone Management
- Department of Conservation and Recreation
- US Army Corps of Engineers

APPENDIX B: INTERVIEW PROMPTS

Interview Questions

To begin, please introduce yourself and explain your current role, including the nature of your work [describe the general work that you carry out, as well as your level of involvement]

1. How are you thinking about/considering climate change in your work?
    a. What future climate change conditions are you most concerned about (if any)? Please explain.

2. What do you feel are the most important considerations in preparing for future climate change impacts?
    a. Why do you think these factors are important?

3. What do you think about climate change impacts related to sea-level rise and coastal flooding?
    a. What is your level of concern?
        i. Please rate your level of concern on a scale of 1-5, with 1 being not at all concerned and 5 being extremely concerned.
        ii. Can you please explain/describe your answer, including how this affects your work?

4. Regarding your concern for climate change risks related to sea-level rise – what do you think should be the priorities for Boston (including Metro Boston) regarding preparing for coastal flooding (now and in the future)?
    a. Please explain.

5. What types of climate change adaptation actions do you believe (or foresee) to be the most beneficial to Boston?
    a. What types of actions do you think should be prioritized? Please explain.
    b. What do you think are the major challenges to taking these types of adaptation actions?
        i. How do you think these challenges should be addressed? Please explain.

6. Among various adaptation strategies, nature-based approaches have emerged as a primary strategy to address climate threats (specifically in terms of coastal flooding) in Boston – do you agree with this approach?
    a. Why or why not?
    b. What do you think should be considered when applying these strategies in communities? Please explain.

c. Is there anything about nature-based approaches as a climate change adaptation strategy that you would like to know more about?
d. Do you think other approaches should be considered/prioritized? Please explain.

7. How do you view the timeline for climate change adaptation – what actions do you believe are necessary to take steps towards adapting to climate change impacts and coastal flood risks now (present day) versus action that could be taken further into the future (e.g., 5, 10, 15, 20 years from now)? Please explain.
    a. How do you think adaptation efforts should be prioritized?
    b. What do you believe is the realistic timeline for action/implementation of adaptation strategies? Please explain.

8. Given this outlook and timeline, what type of adaptation actions would you like to see now versus in the future? Please explain. (Response can be personal and/or professional perspective)

Wrap-up/Debrief:

- Is there anything that I missed in this conversation that you would like to discuss? Anything that you would like to expand on?
- Do you have any suggestions for other people to talk to/important to get their perspectives?
- Would you be willing to participate in a focus group discussion with other participants in this study [later this summer – likely August]?
    - Aim is for results to be presented back to participants

APPENDIX C: INTERVIEW CONSENT FORMS

University of Massachusetts Boston
Department of the School for the Environment
100 Morrissey Boulevard
Boston, MA 02125-3393

Consent Form for *Developing Nature-Based Approaches for Coastal Flood Protection in Boston: A Values Focused Approach*

Introduction and Contact Information
You are asked to take part in a research study. **Participation is voluntary.** The researcher is Jessica Lillquist, PhD Student, School for the Environment. The faculty advisor is Paul Kirshen, PhD, Professor of Climate Adaptation, School for the Environment. Please read this form and feel free to ask questions. If you have questions, Jessica will discuss them with you. Her telephone number is 1 (860) 271-9538. If you would like to contact the researcher's faculty advisor, Paul Kirshen will discuss any questions with you. His telephone number is 1 (978) 831-4391.

Description of the Project:
The purpose of this research is to generate a better understanding of how to incorporate human values and community knowledge into adaptation planning, including the design and implementation of climate change adaptation strategies for coastal flood protection, specifically considering nature-based approaches. Using the City of Boston as a case study, we are particularly interested developing climate change adaptation strategies and associated policies that support equitable outcomes and address community vulnerabilities.

Your participation in this study will consist of a one-on-one interview lasting approximately 1 hour with the expectation of no more than 2 hours participation maximum over the course of the study, including follow-up communications as needed.

If you decide to participate in this study, you will be asked questions regarding adaptation strategies and associated policies. The broad themes to be covered by questions asked in these interviews include climate change considerations, perceptions of vulnerability, perceptions of climate risks, as well as views and experiences with risk management and adaptation planning.

Risks or Discomforts:
A risk of participation is a loss of confidentiality. We will do everything we can to protect your information. You may feel uncomfortable when completing the research materials. You may skip any questions or stop participating at any time.

Benefits:
There is no direct benefit to you from participating in this study. Your participation may help us learn more about effectiveness of climate change adaptation strategies that seek to support the community in which theylive and work.

Confidentiality:
Your part in this research is **confidential**. That is, the information gathered for this project will not be published or presented in a way that would allow anyone to identify you. Information gathered for this project will be password protected or stored in an encrypted drive and only the research team will have access to the data.

The University of Massachusetts Boston Institutional Review Board (IRB) that oversees human research and other representatives of this organization may inspect and copy your information.

Participants will be assigned an ID number such that the participant's specific identity can only be linked to theirdata via a coding system known to only the researcher.

Voluntary Participation:
The decision whether or not to take part in this research study is voluntary. If you do decide to take part in thisstudy, you may end your participation at any time without consequence. If you wish to end your participation, you should directly tell the researcher by contacting them by phone. Whatever you decide will in no way penalize you or involve a loss of benefits to which you are otherwise entitled.

Questions:
You have the right to ask questions about this research before you agree to be in this study and at any time during the study. If you have further questions about this research or if you have a research-related problem,you can reach Jessica Lillquist, her telephone number is 1 (860) 271-9538. If you would like to contact the researcher's faculty advisor, Paul Kirshen will discuss any questions with you. His telephone number is 1 (978)831-4391.

If you have any questions or concerns about your rights as a research participant, please contact a representative of the Institutional Review Board (IRB), at the University of Massachusetts, Boston, which oversees research involving human participants. The Institutional Review Board may be reached by telephone or e-mail at (617) 287-5374 or at human.subjects@umb.edu.

Signatures:

I HAVE READ THE CONSENT FORM. MY QUESTIONS HAVE BEEN ANSWERED. MY SIGNATURE ON THIS FORMMEANS THAT I CONSENT TO PARTICIPATE IN THIS STUDY.

Signature of Participant	Date	Signature of Person Obtaining Consent
Printed Name of Participant		Printed Name of Person Obtaining Consent

APPENDIX D: FOCUS GROUP PROMPTS

Focus Group Discussion

The focus groups will serve as follow-up discussions to the previously conducted interviews. The conversations will cover the climate change adaptation objectives identified in interviews with various stakeholders, and participants will be provided with an objectives list garnered from the interview analysis to rank their preferences and discuss. Before questions there will be time for introductions, which will cover: a brief project overview and purpose of the discussion, Zoom etiquette, review audio recording and consent, notetaking, pauses/breaks, and finally everyone introduce themselves.

1. [Present objectives list and polling activity]
   Given the objectives identified and outlined here, please rank items based on your preferences and which you believe to be most important.
   [provide online polling link]
   a. Emphasis that there is no right/wrong answer.

2. [Display results from Question #1 for participants]
   Given the rankings of overall objectives, what are your initial thoughts on the results?
   a. Do these results reflect what is most important to you?
   b. Do these capture necessary characteristics of adaptation?

3. Are there any objectives in this list that you feel overlap or could be connected?
   a. Please identify and explain.

4. Are there any objectives you believe are missing from this list?
   a. What objectives should be added/included (if any)?
   b. Please explain.

5. Of the preferred objectives you have identified, how do you believe these should be prioritized?
   a. In what order/on what timeline? Gradually or immediately? Simultaneously or separately?
   b. Please identify and explain.

6. Of the objectives you believe should be prioritized, how do you believe they should be executed?
   a. What action is needed?
   b. Who is responsible/involved?
   c. What resources are needed?

7. What other considerations do you believe to be important for addressing these objectives?
    a. Is there anything that these objectives do not cover/address?
    b. Please explain.

Wrap-up/Debrief: Is there anything else that you feel is important to discuss before wrapping up our discussion? Thank you for participating! Your comments are valuable and we sincerely appreciate your time. If you have any comments or concerns, please do not hesitate to contact me after we close.

APPENDIX E: FOCUS GROUP CONSENT FORM

University of Massachusetts Boston Department
of the School for the Environment100
Morrissey Boulevard
Boston, MA 02125-3393

Consent Form for *Developing Nature-Based Approaches for Coastal Flood Protection in Boston: A Values Focused Approach*

Introduction and Contact Information
You are asked to take part in a research study. **Participation is voluntary.** The researcher is Jessica Lillquist, PhD Student, School for the Environment. The faculty advisor is Paul Kirshen, PhD, Professor of Climate Adaptation, School for the Environment. Please read this form and feel free to ask questions. If you have questions, Jessica Lillquist will discuss them with you. Her telephone number is 1 (860) 271-9538. If you would like to contact the researcher's faculty advisor, Paul Kirshen will discuss any questions with you. His telephone number is 1 (978) 831-4391.

Description of the Project:
The purpose of this research is to generate a better understanding of how to incorporate human values and community knowledge into adaptation planning, including the design and implementation of climate change adaptation strategies for coastal flood protection, specifically considering nature-based approaches. Using the City of Boston as a case study, we are particularly interested developing climate change adaptation strategies and associated policies that support equitable outcomes and address community vulnerabilities.

Your participation in this study will consist of a total of 1 focus group lasting approximately 1-2 hours for a total of 2 hours maximum participation over the course of the study.

If you decide to participate in this study, you will be asked questions regarding adaptation strategies and associated policies to be tested. The broad themes to be covered by questions asked in these focus groups include climate change considerations, perceptions of vulnerability, perceptions of climate risks, as well as views and experiences with risk management and adaptation planning.

Risks or Discomforts:
A risk of participation is a loss of confidentiality. We will do everything we can to protect your information. You may feel uncomfortable when completing the research materials. You may skip any questions or stopparticipating at any time.

Benefits:

There is no direct benefit to you from participating in this study. Your participation may help us learn more about effectiveness of climate change adaptation strategies that seek to support the community in which theylive and work.

Confidentiality:

Your part in this research is **confidential**. That is, the information gathered for this project will not be published or presented in a way that would allow anyone to identify you. Information gathered for this project will be password protected or stored in an encrypted drive and only the research team will have access to the data.

The University of Massachusetts Boston Institutional Review Board (IRB) that oversees human research and other representatives of this organization may inspect and copy your information.

Participants will be assigned an ID number such that the participant's specific identity can only be linked to theirdata via a coding system known to only the researcher.

Due to the nature of focus groups, confidentiality cannot be guaranteed. To respect the privacy of your fellowparticipants, do not repeat what is said in the focus group to others.

Voluntary Participation:

The decision whether or not to take part in this research study is voluntary. If you do decide to take part in thisstudy, you may end your participation at any time without consequence. If you wish to end your participation, you should directly tell the researcher by contacting them by phone. Whatever you decide will in no way penalize you or involve a loss of benefits to which you are otherwise entitled.

Questions:

You have the right to ask questions about this research before you agree to be in this study and at any time during the study. If you have further questions about this research or if you have a research-related problem,you can reach Jessica Lillquist, her telephone number is 1 (860) 271-9538. If you would like to contact the researcher's faculty advisor, Paul Kirshen will discuss any questions with you. His telephone number is 1 (978)831-4391.

If you have any questions or concerns about your rights as a research participant, please contact a representative of the Institutional Review Board (IRB), at the University of Massachusetts, Boston, which oversees research involving human participants. The Institutional Review Board may be reached by telephone or e-mail at (617) 287-5374 or at human.subjects@umb.edu.

Signatures:

I HAVE READ THE CONSENT FORM. MY QUESTIONS HAVE BEEN ANSWERED. MY SIGNATURE ON THIS FORMMEANS THAT I CONSENT TO PARTICIPATE IN THIS STUDY.

Signature of Participant	Date	Signature of Person Obtaining Consent
Printed Name of Participant		Printed Name of Person Obtaining

APPENDIX F: LIST OF POTENTIAL DECISION ACTIONS

Policy Theme	Decision Action
Protection of People	Develop public multi-use spaces across the waterfront connect directly with people's needs
	Enhance workforce capacity with adequate services for public realm
	Discuss protection options, including planned retreat to get out of harms way
	Create dedicated, flexible, and accessible funding sources
	Connect community-wide programs
	Community events for active planning, opportunities for input, co-create with residents
	Establish and foster working partnerships with local community groups
	Connect adaptation strategies to day-to-day issues
	Develop community stewardship framework for communication and planning
Healthy Landscapes	Restore unused, degraded, abandoned areas
	Demonstration projects across the city to connect community to local ecosystem
	Flexible development guidelines
	Mix green and grey infrastructure
	Re-purpose spaces for multi-use and services
	Maintain existing natural spaces
	Establish regular restoration and monitoring efforts
	Enhance current natural features and habitats, parks, environmentally significant areas
Protection of Critical Infrastructure	Connect communities to public spaces and resources
	Enhance existing public spaces
	Redesign of existing buildings to fortify inland spaces
	Connect neighborhoods to community centers
	Enhance community-serving spaces
	Establish committed network of partnerships with defined roles
	Clear an flexible permitting standards
	Develop/assign a coordinating body for local leaders focused on coastal resilience
	Establish a strategic plan and management effort that distinguishes long-term and short-term priorities
	Improve transit and evacuation corridors

APPENDIX G: AUDIO RECORDING & TRANSCRIPTION CONSENT FORM

Consent to Audio Recording & Transcription

Developing Nature-Based Approaches for Coastal Flood Protection in Boston: A Values Focused Approach

Jessica Lillquist, UMass Boston, School for the Environment

This study involves the audio recording of your focus group discussion with the researcher. Neither yourname nor any other identifying information will be associated with the audio recording thetranscript. Only the researcher team will be able to listen to the recordings.

The recordings will be kept for approximately 8 months (the duration of the project period). The recordings will be transcribed by the researcher and erased once the transcriptions are checked for accuracy. Transcripts of your interview may be reproduced in whole or in part for use in presentations or written products that result from this study. Neither your name nor anyother identifying information will be used in presentations or in written products resulting fromthe study.

Immediately following the interview, you will be given the opportunity to have the recordingerased if you wish to withdraw your consent to recording or participation in this study.

By checking the box in front of each item, you are consenting to participate in that specific procedure:

- ☐ having your focus group recorded;
- ☐ having the recording transcribed;
- ☐ use of the written transcript in presentations and written products.

Participant's Signature_____ Date_____

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