Strategies for Equitable Climate Change Adaptation: Lessons from Buyback and Elevation Programs in Rhode Island

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Abstract

As the impacts of climate change become more pronounced, many coastal and riverine communities in the United States will face severe flooding from sea level rise and increased frequency of storms. From a municipal perspective, planners and elected officials will be confronted with questions of what tools and resources are available to help private property owners adapt to climate change impacts, when those tools and resources should be used, and who they should help. This thesis uses qualitative methods to examine how two communities in Rhode Island, Cranston and Westerly, have utilized buyback and elevation programs to adapt to future flooding risks. My questions include understanding how federal policies for acquisitions and elevations shape adaptation at the local level, how planners prioritize and fund these projects, how different aspects of equity are incorporated into municipal-level decisions, and how adaptation local-level efforts with private property owners should be pursued moving forward.

In my findings, I identify a merging of hazard mitigation activities with climate change adaptation, with existing federal disaster mitigation programs administered by the Federal Emergency Management Agency and the Department of Housing and Urban Development shaping and constraining adaptation efforts in Cranston and Westerly. Limited levels of federal funding impacts what municipalities will do, leads to incremental adaptation planning efforts, and means that communities need to act quickly to implement programs when funding becomes available after disasters strike. I find that Westerly and Cranston have prioritized the use of buyback and elevation programs based on spatial-environmental risk, but neither community has defined local-level standards for determining climate change risks, nor defined local level standards for incorporating socio-economic equity into their programs. I argue for an approach to adaptation planning that balances justice-oriented distributional and procedural equity at the local-level, and suggest supportive changes at the state and federal level that would facilitate stronger adaptation planning at the local level. In anticipation of increasing demand for help from private property owners in the future, communities should define clear equity standards to ensure that vulnerable populations can adapt and use public participation to help define municipal-level priorities for adaptation.

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Introduction: Climate Change Adaptation and Private Property

During the time I worked on this thesis, record-breaking levels of snowfall and intense snowstorms hit parts of New England. While home and business owners surveyed the damage, newspapers began to report about the prospect of retreat for some heavily impacted coastal New England towns. A February Boston Globe headline read, "A Call to Cull Homes Threatened by the Sea" and highlighted towns with properties facing severe repetitive losses from storms.[1] The story argued that "buying out" owners of flood-prone homes can make more fiscal sense than calling on municipalities to pay for emergency services and repairs to protective barriers like seawalls.

As the impacts of climate change become more pronounced, many coastal and riverine communities will face more severe flooding from sea level rise and increased frequency of storms.[2] From a municipal perspective, planners and elected officials will be confronted with questions of what tools and resources are available to help private property owners adapt to climate change impacts, when those tools and resources should be used, and who they should help. The example of buyouts from the Boston Globe highlights economic efficiency as a key decision-making criterion, but economic efficiency is just one consideration. With scarce resources, public officials will also need to consider the risks properties face, the potential mitigation benefits of different policy options, and the equity implications of different approaches to adaptation.

These questions will become increasingly salient. In 2010, the National Oceanic and Atmospheric Administration reported that 39 percent of Americans lived in counties directly on the shoreline and 52 percent of Americans lived in coastal watershed counties.[3] Therefore this thesis will explore how coastal and riverine municipalities can work with private property

owners as sea levels rise, storms become more intense, and flooding more frequent. Specifically, I approach these issues from the perspective of a municipal planner and look at two public responses to flood risks on individual parcels of private property: buyback programs[a] and elevation programs. The research questions I seek to answer in relation to these adaptation responses include:

- How do federal policies and programs for elevations and buybacks shape adaptation on private property parcels at the community level?
- How do planners prioritize projects and use available resources for elevation and buyback programs?
- How do planners incorporate equity into their decisions?
- How can municipalities finance elevation and buyback programs on private property parcels?
- What responsibility do municipal governments have to work with private property owners on adaptation?
- What role should private property owners play in adaptation?
- Given these realities, how should municipal governments pursue adaptation in collaboration with private property owners?

To explore these questions in-depth, I chose to focus my research in two communities in Rhode Island, the City of Cranston and the Town of Westerly. I focused on these two municipalities for three main reasons. First, both have been hit recently by severe weather

[a] In this thesis, I use the terms "buyback," "buyout," and "acquisition" interchangeably. Acquisition is the preferred FEMA term, whereas most people I spoke with tended to use buyback or buyout to talk about programs where local government purchased properties from private owners to help them leave a flood vulnerable area.

events. Cranston faced extensive damage after riverine flooding that hit the state in March of 2010. Westerly also faced riverine flooding in 2010, in addition to widespread damage to its coastline following Hurricane Sandy in 2012. Both of these storm events triggered federal disaster declarations and are cited by local officials as being unprecedented in recent memory, as well as an indicator of what will happen more often in the future as climate change impacts increase. Second, in response to these storm events both communities engaged in disaster mitigation efforts using Federal Emergency Management Agency (FEMA) and Department of Housing and Urban Development (HUD) programs. In my view, these are also climate change adaptation efforts. In Cranston, city planners worked with homeowners in two neighborhoods to buy back homes in severely flood prone areas. In Westerly, city planners initiated a buyback program along a section of its riverfront and the town is working to help property owners elevate homes located along the coastline. And third, the two communities are demographically comparable in terms of income distribution and poverty levels. Cranston has about 80,000 residents directly southwest of Providence. Westerly has about 22,000 residents in the southwestern coastal corner of the state.

I conducted in-depth interviews with 24 people who live or work in Rhode Island and focused on disaster mitigation and climate change adaptation. These interviews were mainly with government officials. Thus, my thesis emphasizes those viewpoints especially strongly and focuses on how local government action and federal programs have shaped adaptation on private property in these two communities. I supplemented my interview findings with reviews of federal, state, and local policy documents, studies completed about climate change adaptation in Rhode Island following severe weather events of the past several years, and theories and findings from secondary sources.

While these two case studies of Rhode Island municipalities are not representative of all waterfront communities nationwide, Rhode Island provides a useful test case for exploring the relationship between federal policy and municipal decision-making about local-level adaptation on individual properties. Rhode Island is only 48 miles long and 37 miles wide, yet it has over 400 miles of coastline. The state also has a vast network of rivers and a rich history of mill-based industries that led to a legacy of development in floodplains.[4] Finally, Rhode Island has several strong state-level government agencies and institutions that have taken a role in climate change adaptation including the Coastal Management Resources Agency, the RI Statewide Planning Program, the University of Rhode Island (URI) Coastal Resources Center, and several non-profit advocacy organizations.

I argue that as climate change impacts communities, local governments will increasingly be called upon to work with private property owners who seek assistance for rebuilding or relocation after disasters. This raises questions around how, when, where, and why local governments should intervene. In my findings, I identify a merging of local-level hazard mitigation activities with climate change adaptation in Rhode Island, particularly around storm and flood vulnerability. My findings show that existing federal disaster mitigation programs administered by FEMA and HUD have shaped municipal adaptation efforts in Cranston and Westerly. Further, the limited amount and timing of these programs' funding has seriously constrained adaptation efforts at the local level.

An in-depth study of buyback and elevation programs in these two Rhode Island localities can help explain how, when, where, and why such programs are being used. Six themes emerge from my study include:

- Fiscal shapers of adaptation efforts

- Prioritization of risk and spatial-environmental equity
- FEMA's benefit-cost analysis formula as a fairness standard
- Perceptions of municipal and individual responsibility for adaptation
- Public participation in adaptation planning
- Constraints on local-level action

Based on these findings, I argue that municipalities need to more clearly specify the criteria they will use in deciding whether and how to assist private property owners in adapting to climate change, particularly for resource-intensive programs such as buybacks and elevations. In both communities, efforts so far have arisen only in response to disasters and are not part of a larger existing municipal plan. Moving forward, and in anticipation of increasing demand for help from private property owners in the future, these communities should incorporate more robust public participation to collectively define municipal-level priorities, as well as define equity standards to help determine who receives benefits. I argue for an approach to adaptation planning that balances justice-oriented distributional and procedural equity at the local-level, and suggest supportive changes at the state and federal level that would facilitate stronger adaptation planning at the local level.

This thesis begins with a review of relevant programs, including FEMA and HUD programs along with the state and local context for hazard mitigation and adaptation planning in Rhode Island. I also review literature on equity in planning, building on existing theory to advocate for combining distributional and procedural equity. I then introduce my two case studies of Cranston and Westerly, showing how they have implemented elevation and buyback programs using FEMA and HUD funding sources. Next, I describe the six themes I identified from my interviews and case studies to show what has shape programs in these two communities. Finally,

I conclude by using my findings to pose several recommendations for local communities working on adaptation with private property owners.

Chapter 1: Federal, State, and Local Context for Adaptation Planning

FEMA and HUD Programs for Private Property Owners

While humans have always adapted to a varying climate, the pace of climactic changes and the potential impacts experienced today and forecasted for the future are unprecedented.[5] As a primary provider of funding for local-level adaptation, the federal government's programs and policies shape and constrain adaptation at the local level.[6] In particular, I find that existing federal disaster mitigation programs administered by FEMA and HUD have shaped municipal adaptation efforts with individual private property owners in Cranston and Westerly. By using federal programs to mitigate future flood and storm risks in riverine and coastal areas, these municipalities are also adapting to climate change impacts. FEMA and HUD are beginning to consider climate change in their program regulations, but the scope of the programs and funding have led to constrained implementation at the local level. In the section below, I describe the federal disaster mitigation programs available to local-level municipalities for buyback and elevation programs on private property. I also outline Rhode Island's state level policies that interact with and impact local-level adaptation.

The Robert T. Stafford Disaster Relief and Emergency Assistance Act was signed into law in 1988 and provides the framework for FEMA's disaster relief and hazard mitigation programs. The act's intention was to revise and broaden the scope of existing disaster relief programs, encourage the development of state- and local-level hazard mitigation and disaster preparedness plans, improve coordination and responsiveness of disaster preparedness and relief programs, and encourage hazard mitigation activities. To be eligible for federal funding after a disaster strikes, the President must designate the event a federally declared disaster. Much of the Stafford Act provides authorization for programs that assist communities immediately following

a disaster, but there also are a suite of disaster mitigation programs outlined in the Stafford Act that are designed to help reduce the risk of disasters to a community in the future.[7]

FEMA has grouped these mitigation programs under the heading of Hazard Mitigation Assistance (HMA). The agency defines mitigation as "the effort to reduce loss of life and property by lessening the impact of disasters. Mitigation is taking action now – before the next disaster – to reduce human and financial consequences later."[8] The definition continues and emphasizes the importance of understanding place-specific risks and the importance of making challenging choices now to enhance a community's long-term safety and wellbeing. While adapting to climate change also covers strategies to prepare for longer-term and slower-acting climate change risks, the adaptation field overlaps with hazard mitigation in its attention to building resilience to natural disasters.

To be eligible for FEMA funding, the agency requires a municipality to periodically write and adopt FEMA approved hazard mitigation plan to receive hazard mitigation assistance project funding. The hazard mitigation planning process is intended so communities can "identify risks and vulnerabilities associated with natural disasters, and develop long-term strategies for protecting people and property in future hazard events."[9] In the plans, municipalities identify and describe possible hazards and consequences, prioritize amongst needs, and put together an implementation strategy. Mitigation projects proposed in the plans should prevent future potential losses of life and damage to infrastructure and buildings through cost-effective and feasible projects. Ideally, a municipal request for funding via the HMA programs should align with the content of their hazard mitigation plan, though in practice that does not always happen due to new or unanticipated needs arising after disasters and staff time constraints within FEMA to cross-check program applications with plans.[10]

While FEMA's hazard mitigation programs do not explicitly include climate change adaptation language, the agency is increasingly recognizing that adaptation will be a part of its mission and programs. The agency writes in its 2015 Hazard Mitigation Assistance Guidance document, "FEMA encourages recipients and subrecipients to consider climate change adaptation and resiliency in their planning and scoping efforts."[11] In January of 2012, FEMA released its Climate Change Adaptation Policy Statement for the purpose of integrating climate change adaptation into agency programs, policies, and operations. Among its instructions, the directive calls for incorporating climate change impacts into FEMA's benefit-cost analysis (BCA) formulas and into its building standards.[12] Some scholarly writing has also begun to move in this same direction, with a recent issue of the Overseas Development Institutes journal, *Disasters*, dedicated entirely to the overlap between adaptation and disaster planning.[13] As my findings show, increasingly disaster mitigation and climate change adaptation efforts are merging, particularly in areas of rising storm and flood vulnerability. With very limited federal sources of funding explicitly dedicated to adaptation, cities in the U.S. are beginning to use FEMA Hazard Mitigation and other disaster mitigation programs to adapt to climate change.[b] At the same time, FEMA is beginning to modify its programmatic language to reflect climate change risks.

FEMA's largest Hazard Mitigation Assistance Program is the Hazard Mitigation Grant Program (HMGP). This program provides grants to states and local governments for mitigation projects after a federally declared disaster. An eligible project under HMGP must be used to reduce or eliminate losses from future disasters, and a project must pass a BCA test to ensure that

[b] Baltimore provides one example of a city explicitly using FEMA Hazard Mitigation funding, as well as other federal programs, for their climate change adaptation strategy. The city used an HMA grant to help fund the writing of their Climate Action Plan. More information is available at http://www.baltimoresustainability.org/climate-action-plan.

it will provide as much, or more, savings as the cost of the mitigation project. Generally, HMGP is available in areas of a state as requested by that state's governor, but the governor can also request that funds be made available statewide. To be eligible, projects must meet state and FEMA guidelines and pass through a layered federal system. Municipalities work with their communities to put together HMGP project applications, those applications are reviewed and evaluated as part of a state process, and then FEMA reviews the applications for eligibility based on federal guidelines. Funding from FEMA for approved projects then goes to the state, which distributes it to municipalities. HMGP funding is equal to 15 percent of the total funds obligated by FEMA to a state for recovery within the year following an event. This means it often takes a year before the total amount of HMGP funding is made available following a disaster. HMGP provides the greatest source of FEMA federal funding to local governments for hazard mitigation activities. However, since it is only available following a disaster, the window of opportunity for states and municipalities to use HMGP for mitigation or adaptation activities is limited.[14]

Two other smaller FEMA HMA programs include the Pre-Disaster Mitigation (PDM) program and the Flood Mitigation Assistance (FMA) program. The PDM program provides states with a modest amount of competitive annual funding for hazard mitigation planning and projects, subject to Congressional appropriations. Since the funding amount it limited, FEMA staff shared that many municipalities use this funding to develop or update their hazard mitigation plans. In recent years, states have been limited to allocations of just several hundred thousand dollars a year in PDM funding, and FEMA staff reported that they receive two to three times as many qualified project applications as they have funding available.[15] The FMA program is meant to reduce the long-term flood risk to properties and structures that are part of FEMA's National Flood Insurance Program. Currently, FEMA has prioritized projects that

reduce the number of severe repetitive loss properties and repetitive loss properties via this program. Repetitive loss structures are those that have sustained two or more losses, each exceeding $1,000, within a ten-year period. Severe repetitive loss structures are residential properties that have had at least four National Flood Insurance Program claims in any ten-year period, each over $5,000 or for a cumulative total of $20,000.

In addition to the HMA programs, the other large source of post-disaster funding used for mitigation and adaptation at the municipal level is the Community Development Block Grant Disaster Recovery (CDBG-DR) program. After Presidentially declared disasters, the program provides grants to help municipalities and states to recover. There is no set formula level of funding for CDBG-DR, so the amount of funding a state or locality receives is dependent on Congressional action following a disaster declaration and has varied. Following the Floods of 2010, for example, Rhode Island received a $9 million allocation while after Hurricane Sandy the state received $20 million, despite the latter disaster having less of an impact on the state. As the Rhode Island manager of the CDBG-DR program shared, since many cities and towns receive regular CDBG allocations, the CDBG-DR program was designed to work through those existing relationships and processes and therefore get funding to communities in need expediently following a disaster.[16]

Unlike FEMA's HMA programs, which do not specify recipient eligibility requirements, CDBG-DR grants are intended to primarily benefit low-income residents impacted by disasters. The usual requirement is that at least half of the grant funding must be used for activities that primarily benefit low- and moderate-income persons. This can be measured by beneficiary or by area eligibility, where a defined benefit area has at least 51 percent of its population at a low- or moderate-income level.[17] CDBG-DR funds can be used to fund a variety of unmet recovery

needs and mitigation activities, and can also function as a local cost-match for municipalities to use to pay for required program cost-shares of other federal programs, including FEMA's HMA programs.

Together the FEMA HMA programs and the HUD CDBG-DR program provide important sources of funding for communities to use in recovering from current disasters in a way that mitigates future risks. The National Hazard Mitigation Association aptly describes the range of federal programs available to communities after disasters as a "patchwork quilt."[18] In this thesis, I focus particularly on FEMA HMA programs and the HUD CDBG-DR program as shaping and constraining mitigation and adaptation activities at the local level. In my two case studies, I find that these are the programs the municipalities primarily draw upon when working with private property owners to help adapt their properties to climate change impacts via acquisitions or elevations.

State and Local Adaptation Programs

In recent years, Rhode Island has become more proactive at the state level on climate change adaptation, both from the legislative and the executive branches. In these actions, I identify a merging of natural hazard mitigation and climate change adaptation activities. In 2010, the legislature required that all cities and towns in the state account for climate change, including sea level rise and storm surge, in their comprehensive plans.[19] In the same year, the State Building Code Commission adopted new standards in the state building code, designating a minimum free board for buildings that requires structures to be built at the base flood elevation plus one foot. Rhode Island requires all of its 39 municipalities to update their comprehensive plans every five years to guide zoning regulations and land use, and these impact planning decisions at the local

level. Town and city councils review and approve comprehensive plans and the process of updating them requires public participation, including meetings and public information postings.

Rhode Island's Statewide Planning Program oversees and approves municipal plan updates. In an interview, their chief explained that many communities are using their FEMA hazard mitigation plans as a basis for adding climate change considerations into comprehensive plans.[20] As he described: "In requiring local communities to integrate climate change in comprehensive plans, they are really starting with their hazard mitigation plans as the foundation and adding on top of those, transitioning those plans from an emergency response approach to looking longer term at adaptation." These municipal actions provide an example of the merging of hazard mitigation planning and climate change adaptation at the local level. The Statewide Planning Program is also working to incorporate climate change into its State Guide Plan, which guides long-range policy and planning across all state agencies, cities and towns. Over time, these changes should influence adaptation planning around the state. Despite this mandated change to comprehensive plans, however, many interviewees shared that they witnessed state and local government decisions being made without consideration of longer-term climate change risks and impacts. This may reflect that comprehensive plan updates that include adaptation are still in preliminary stages in many municipalities and agencies, or that comprehensive plan guidelines for climate change adaptation may not be followed when making planning decisions.

In February of 2014, then Governor Lincoln Chafee signed Executive Order 14-01 to create the Rhode Island Executive Climate Change Council (EC3), charged with taking "a lead role in developing a comprehensive approach to address the potential threats from climate change to the State's environment, economy, and its people."[21] In July of 2014, driven by a coalition of local non-profit organizations coordinated by Brown University, the governor signed the Resilient

Rhode Island Act, which expanded on the Executive Order. It created an Executive Climate Change Coordinating Council (EC4) to permanently reside in the Executive Branch and comprise of officials from state agencies to coordinate their efforts on climate change. Agencies represented on the board include the Rhode Island Emergency Response Agency (RIEMA). Among its duties, the Council is charged with advancing the state's understanding of climate change risks and impacts, and of identifying strategies for preparing for and adapting to climate change. The legislation also establishes advisory boards to incorporate viewpoints from municipal governments and science and technical leaders in the state. While advocates described the bill as positive in that it passed and made Governor Chafee's earlier Executive Order permanent, the legislation was substantially scaled back from its original versions that proposed stronger statewide action on climate mitigation and adaptation.[22]

Rhode Island has a strong coastal governance agency via its Coastal Resources Management Council (CRMC). The CRMC is an independent state management and regulatory agency charged with overseeing the preservation, protection, development, and restoration of the state's coastal areas. The CRMC has regulatory jurisdiction over all tidal waters in the state and all coastal features such as beaches, dunes, bluffs, coastlines, and manmade shorelines. The agency is heavily involved in developing strategies and policies for adaptation, shoreline erosion, storm surge inundation, and migrating coastal wetlands in the state. In 2008, the agency adopted a policy that its Coastal Resources Management Plan would consider climate change risks and anticipate three to five feet of sea level rise by the end of the century.[23] More recently, the CRMC has been providing guidance for Rhode Island municipalities by providing accessible models to see where future inundation is predicted.[24]

In partnership with the University of Rhode Island (URI) Sea Grant, a federally administered program linking university research and programs to coastal areas, the CRMC is engaging residents and stakeholders to develop a Shoreline Change Special Area Management Plan (Beach SAMP). The Beach SAMP also combines concerns about climate change and hazard mitigation, referring to the need to address sea level rise projections and natural hazards like Superstorm Sandy Beach.[25] The Beach SAMP seeks to understand and improve coastal erosion and flood risks along the coast. The CRMC and Rhode Island Sea Grant are engaging the public in a conversation about climate change impacts along the coast and adaptation tool and options, including elevation, moving back structures within properties, and retreat.[26]

At the local level in Rhode Island, the main planning documents shaping adaptation and hazard mitigation activities are comprehensive plans and hazard mitigation plans. My interviews show that municipal governments often look to zoning regulations, building codes, and public infrastructure improvements as their primary tools for adaptation planning and mitigating future hazards. One of my arguments in this thesis, however, is that as climate-change impacts increase, private property owners look to municipal governments for assistance with rebuilding or relocation after disasters. As a pass-through agency for federal funding and arbiters of local land use regulations, responsibility for helping individual property owners adapt will increasingly fall to local governments, especially given the growing link between hazard mitigation and adaptation planning. Two policy options for assisting individual properties facing flooding, a common hazard and climate change risk, are elevation programs and acquisition programs, also commonly referred to as buyback or buyout programs. In this thesis, I identify these programs as primary options being used by two communities in Rhode Island to work with

private property owners facing flooding from increased storm severity and sea level rise. Below, I outline the basic parameters of both programs, as defined by FEMA and HUD.

As part of FEMA's suite of HMA programs, structure elevation is an allowable activity. A structure elevation involves raising or retrofitting an existing structure so it is at the Base Flood Elevation (BFE) or frequently several feet above it, as required by FEMA or a municipality's ordinance based on the FEMA flood zone the property falls within. FEMA allows different approaches to elevations, including using continuous or open foundations, elevating on fill, or using piles, piers, posts or columns to raise the structure. Elevations must meet FEMA engineering standards for properly supported loads, as defined by the American Society of Civil Engineers/Structural Engineering Institute, and utilities must also be elevated.[27] In terms of financing, FEMA requires a 25 percent local cost match for elevation projects, to be paid by either the municipality or the property owner, though FEMA's portion of the cost share increases for severe and repetitive loss properties. Elevation projects must also pass a FEMA benefit-cost analysis (BCA) to be eligible, or stay below the pre-calculated benefit threshold of $175,000 for projects in Special Flood Hazard Areas (SFHA), though certain multiplier calculations are allowed for considering higher costs in more expensive areas.[c] Elevation programs are desirable in that they allow people to continue using a site and continue to provide municipalities with property tax revenue, which is often significant in coastal towns.[28] From a federal perspective, elevations lower flooding risks and future possible payouts via the Federal Flood Insurance Program. Many interviewees, however, identified elevation programs as temporary stopgap measures and noted that sea level rise would eventually catch up even to elevated coastal

[c] SFHAs are FEMA-designated areas at high risk for flooding where the National Flood Insurance Program's (NFIP's) floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies. These tend to be floodplains that adjoin a river, stream, or coastal waterway that have a 1% chance of flooding in any year, and thus are in the 100-year floodplain.

properties.

FEMA refers to the buying back of properties as acquisitions. This type of intervention is usually reserved for properties that have experienced severe flood damage multiple times. Under the HMA programs there are two options for acquisitions, buying back a property and moving the structure to another location or buying back a property and demolishing the structure. Interviewees shared that the latter option of demolishing structures is utilized much more often in New England.[29] FEMA requires that acquired properties be converted to open space and deed-restricted from future development in perpetuity, to be managed either by a government or non-profit entity. This serves to restore the land's floodplain functions and can help mitigate damage to structures further inland or downstream. The main advantage of acquisition programs is that they permanently remove structures from flood hazard zones, eliminating risks to buildings and people on those properties and providing additional floodplain protection for surrounding areas. However, acquisition programs are expensive and time- and resource-intensive to execute for local governments. Additionally, property owners may not be interested in moving, particularly from coastal properties, or may not be able to find equivalent housing in their neighborhood or community.[30]

FEMA acquisition programs require municipal staff to go through multiple steps that can take many months to years to complete. Properties must either go through a BCA or under the more recent fast track option, fall below the threshold of $276,000 for structures in SFHAs. Properties must also pass FEMA's Environmental and Historic Preservation Compliance Review. This includes a National Environmental Policy Act (NEPA) process that documents whether a property includes wetlands, floodplains, protected species or habitat, soil disruption, or hazardous materials. And finally, the acquisitions need to be voluntary for the property owners.

Local governments administering the program choose a process for determining the fair market value of the property and hire lawyers to handle the closing of the property once FEMA funding is approved. Municipalities are responsible for a 25 percent cost match, though FEMA will cover up to 90 percent of the cost for repetitive loss properties and 100 percent for severe repetitive loss properties. After the property is closed, a municipality has 90 days to demolish a structure and return the land to open space.[31]

HUD's CDBG-DR program also allows for acquisition programs, referring to them as buyouts. HUD allows voluntary buyouts to provide for parkland, open space, flood storage, or flood overflow areas. Rather than passing a BCA analysis, eligible properties under the HUD program must be tied to the federally declared disaster and located in designated areas, or if outside of such an area, be substantially damaged or pose a health and safety risk. States are allowed to determine what the criteria for a designated area for a buyout would be. However, the buyout program must also fall under one of HUD's required CDBG-DR categories, where the activity addresses a serious threat to community welfare following a disaster, or where the household or the area is classified as low- to moderate-income. States also determine if properties should be purchased at the pre-flood fair market value or the post-flood value. Similar to FEMA, both residential and commercial structures can be eligible for buyouts. Also similar to FEMA, renters who live in properties that are bought back are eligible for relocation assistance and funds to help them find comparable housing in the community.[32] CDBG-DR funds can also be used to elevate some structures, but notably not second homes. HUD's elevation program guidelines are not covered in the scope of this paper since neither case study community pursued this option.

Takings via eminent domain are one potential tool available for state and local governments seeking to create policies to address climate change impacts. For both elevation and acquisition programs, however, FEMA and HUD require that programs using their funding be voluntary for private property owners. FEMA provides voluntary interest and participation forms municipalities can use to work with property owners during an acquisition process. This voluntary requirement and the payment of fair market value for properties in acquisition programs means that communities implementing these programs using federal funding can avoid the issue of takings. U.S. takings doctrine states that the private property owners must be fairly compensated for government seizures of private property, which can range from physically taking a property to severely restricting uses on that property to a point where compensation would be required under takings law.[d]

Interviews conducted as part of this thesis indicated a strong desire to avoid takings wherever possible at the local level, combined with acknowledgment that in the future, it could be an increasingly necessary tool if a community considers larger-scale retreat options. Takings law in relation to coastal climate change impacts is developing without any major adaptation decisions at the federal level as precedent, making it difficult at present to draw climate change-specific conclusions about the latitude available to municipal governments. The Georgetown Climate Center finds that some property owners have lodged takings challenges around seawall restrictions and rebuilding restrictions for properties, though outcomes of such cases have varied and often favored municipalities.[33] Eminent domain does not seem to be a commonly employed

[d] The Fifth Amendment to the Constitution (the "Takings Clause") provides that private property cannot be taken "without due process of law; nor shall private property be taken for public use, without just compensation." The Fourteenth Amendment applied this prohibition to the states, "nor shall any State deprive any person of life, liberty, or property, without due process of law."

tool for adaptation, possibly due to the common use of federal programs and funding for buyback programs and the voluntary requirement of those programs.

Rhode Island is beginning to take action on climate change adaptation at the state level, particularly via its Statewide Planning Program and its Coastal Resources Management Agency. While legislation now requires state-level agencies and local governments to incorporate climate change considerations in their long-range planning, the state has not provided a dedicated source of funding for adaptation planning or programs at the state or local level. Municipal governments are looking to federal disaster mitigation programs and beginning to merge those efforts with adaptation planning. For cities and town working with private property owners, elevation and acquisitions are two programs being used in the two communities studied in this thesis, Westerly and Cranston. Both programs require a significant commitment of financial resources that primarily benefit private property owners, raising questions of equity in terms of the fair distribution of adaptation resources. The next chapter introduces concepts of procedural and distributional equity in the context of local-level climate change adaptation planning.

Chapter 2: Equity in Adaptation

Why Consider Equity in Adaptation Planning

In this thesis, I argue that it is important for planners to conceptualize equity in the context of any adaptation program they are designing and financing. In the section below, I provide a framework for thinking about dimensions of vulnerability and incorporating justice-oriented distributional and procedural equity into adaptation planning. I approach this analysis from the perspective of a municipal-level planner, as these are the main implementers of the buyback and elevation programs in my case study, but also recognize that they work at varying levels with city managers, mayors, and city councils to make decisions about equity in policies.

Within academic literature, equity has been considered in mitigation and adaptation planning from an international perspective, but far less often from a domestic perspective. Questions of international equity tend to focus on how developed countries should help pay for adaptation in developing countries. This argument is often based on an equity principle that countries that have caused the most harm and benefited the most from greenhouse gas (GHG) emissions, and who also have the most ability to pay, should have responsibility for helping those countries most vulnerable to climate change, which generally are less-wealthy countries with low GHG emissions.[34]

A similar argument can be made to support equity in adaptation at the domestic level in the United States. The most recent 2014 National Climate Assessment highlights that "certain people and communities are especially vulnerable, including children, the elderly, the sick, the poor, and some communities of color," to increased health and other risks because of climate change.[35] This vulnerability is due to higher susceptibility to climate-related health risks such as heat waves and water-borne diseases, having less resources available for avoiding climate

change impacts via evacuation or adaptation measures to protect homes, and that climate change may amplify racially based disparities as demonstrated during Hurricane Katrina.[36] Fainstein further argues that the emphasis in policymaking on market processes and cost-benefit utilitarianism make the role of the planner to prioritize values that the market processes do not.[37] The disproportionate burden of climate change risks and impacts that some populations in our society will bear, particularly when considered alongside historic patterns of discrimination and inequality that have created income and racial disparities, mean that adaptation planners must make equity a priority.

Adaptation planning is unique from other types of urban planning in several notable ways, considered here for how they tie to equity. First, the risks and impacts of climate change are uncertain. Climate change projections are based in large part on predictions of future GHG emissions, which are dependent on the uncertain behavior of individuals, industries, and nations.[38] This uncertainty means that planners have a range of possible futures to plan for, and must choose which level of risk to assume in adaptation plans. From an equity perspective, climate change risks are not evenly distributed in the population, neither spatially nor in relation to socioeconomic status or race and ethnicity. This uneven distribution means that when looking at climate risk projections, planners need localized information and need to consider the relationship between the level of risks they choose to plan for and its impact on equity and vulnerable populations.

Second, climate change adaptation will be an expensive undertaking. Susskind notes "most effective [adaptation] moves are likely to prove quite expensive in the short term even though the savings they will generate in the long term will more than justify their cost."[39] This reality is at odds with typical municipal financing structures, which generally do not have mechanisms for

capturing and incentivizing policies tied to long-term cost savings. The high cost to adapt means that planners need to be intentional in how they structure the financing of adaptation programs and determine who benefits. The next section develops the idea of justice-oriented distributional equity as a frame for thinking about adaptation costs and benefits.

Types of Equity

To define equity in adaptation, I draw upon literature from the planning and political philosophy fields exploring concepts of equity and justice. Many scholars have defined justice and equity, some in ways that keep the terms related, but separate and others in ways that merge the two. For my thesis, I have chosen to use the term equity, but acknowledge that my use of the term has strong overlap with and relation to the term justice. Since I draw from literature largely preferring the term justice, I will use the word justice when quoting or citing scholarly ideas that do the same, but otherwise use the term equity in my analysis.[40]

In her thesis exploring social justice in adaptation planning, Tandon argues that adaptation can improve justice outcomes, maintain the status quo, or worsen outcomes.[41] For planners, one of our goals should be to improve equity outcomes in adaptation. To understand what improving equity looks like in practice I begin by asking "equity over what?" and "equity for whom?" These questions lead me to a definition of equity from a justice-oriented distributional perspective and from a process-oriented participatory perspective. This dual approach allows one to critically consider distribution of costs and benefits in adaption, but also decision-making power.

Distributional Equity

A basic definition of equity can refer to the distribution of assets and burdens in a society. These assets and burdens could be measured in terms of different distributional definitions:

socio-economically in terms of finances or access to opportunity, spatially in terms of exposure to different climate risks burdens, or temporally in terms of how far into the future to consider benefits and burdens. A utilitarian approach to equity would define it as being the greatest good for the greatest number of people. In other words, benefiting the majority, a view that still predominates in U.S. policy-making. I argue, however, that adaptation planners need to incorporate a justice-oriented perspective when considering distributional equity in program structure and financing.

Justice-oriented distributional equity finds that those with the most ability to pay should and those with the least should benefit the most. As Fainstein describes, "A fair distribution of benefits and the mitigation of disadvantage should be the aims of public policy."[42] Rather than a utilitarian frame, this definition draws on the difference principle developed by Rawls to define fairness. The principle states that social and economic inequalities may exist in society, but should "be to the greatest benefit of the least-advantaged members of society."[43] This approach to equity sees potential in the distribution of government resources to build equity in society.

In applying justice-oriented distributional equity to adaptation program structure and financing, I find that those groups most vulnerable to climate change should benefit the most from policies while those least vulnerable should contribute more. Vulnerability in this case can be understood as a combination of the level of exposure to a climate risks, the level of sensitivity to those risks, and the adaptive capacity a community has to respond.[44] Adaptive capacity includes the financial, social, and political resources to respond to climate change risks. In describing equity planning, Krumholz and Forester argue that: "Equity requires that locally responsible government institutions give priority attention to the goal of promoting a wider range of choices for those . . . residents who have few, if any, choices."[45] Those who are most

vulnerable – those with the least choices or so-called adaptive capacity – should be prioritized by adaptation planners. I further develop dimensions of equity related to vulnerability later in this chapter.

The assertion to prioritize distributional equity in planning has led to academic critiques. Soja argues that distributional equity focuses on conditions of individuals at a certain place in time, and therefore overlooks the critical spatial and historical contexts that shape inequity and injustice.[46] Harvey offers a similar critique, finding that Rawls's difference principle is missing reference to the forces of production and the market that cause inequity in the first place.[47] From these perspectives, focusing on distributional equity overlooks structural forces that cause inequity without offering means for addressing them, and therefore will never fundamentally change the system that produced inequity in the first place. Related to these critiques is the argument that distributional equity does not incorporate non-material oppression, which could be based on race, gender identity, ethnicity, or culture.[48]

Despite these critiques, I argue that there is still an important place in adaptation for considering justice-oriented distributional equity. Adaptation planners function within existing social and political systems, and despite the flaws of those systems, an intentional approach to incorporating justice-oriented distributional equity into adaptation program structure and finance can improve equity outcomes and ensure that benefits and burdens are fairly applied and distributed. The mainstream alternative of the utilitarian distribution of costs and benefits leads to less equitable outcomes. Nor is prioritizing justice-oriented distributional equity at odds with also pushing for structural change in the decision-making system, which the next section discusses.

Procedural Equity

A second typology of equity for adaptation planners to consider is procedural. Procedural equity refers to the process by which decisions are made, and how democratic or inclusive that process may be. Procedural equity considers the process under which adaptation program funding was secured and who was engaged in making programmatic decisions. Inherent in most conceptions of procedural equity is the argument that a more inclusive or democratic process will lead to more equitable outcomes. Arnstein's article, "A Ladder of Citizen Participation," was one of the first arguments put forth for strong citizen involvement in the planning process. In her work, Arnstein developed a spectrum for considering citizen involvement in planning that ranged from types of non-participation, to tokenism, to citizen power.[49] On the highest rungs of the ladder, which she argued were most democratic, citizens are in partnership with planners, given delegated power, or given complete control over a planning process. Arnstein wrote that most attempts to involve citizens in planning were "the empty ritual of participation" without "the real power needed to affect the outcome of a process."[50]

Since Arnstein's work other theories of procedural equity have arisen in planning that offer ways to include citizens in procedure beyond the typical aggregative model of democracy, which sums up citizen preferences for majority-rules decision-making.[51] Here I will focus on two different approaches to considering procedural equity: consensus building and deliberative democracy.

Consensus building is an approach to participation and procedure where stakeholder groups are represented at a negotiation table and with the guidance of a neutral facilitator, work together to find mutual gains and to build consensus about issues in the public domain. Susskind and Cruikshank argue that consensus building offers an important alternative to majority rule, and

will ultimately lead to better outcomes by making sure that the interests of all stakeholders are considered in formulating outcomes that decision-makers can then choose to use.[52] From their experience with consensus building, they find that the process produces more stable, wise, fair, and efficient outcomes than do traditional approaches to public decision-making.[53] However, consensus building does not guarantee equitable outcomes. A negotiation table may not be inclusive or representative of all the interests (and people) in a community, and political and social power dynamics replicated at a negotiation table may undermine the interests of vulnerable populations.

Deliberative democracy is another alternative form of including a high level of citizen participation in decision-making, and one that could closely mirror Arnstein's vision of citizen control. As Young describes, "Participants in the democratic process offer proposals for how best to solve problems or meet legitimate needs . . . they present arguments through which they aim to persuade others to accept their proposals."[54] In deliberative democracy, decisions are not the result of an aggregation of individual preferences, but instead "by determining which proposals the collective agrees are supported by the best reasons."[55] Important to this model are the assumptions of inclusion of everyone affected by the decision to be made, of political equality in terms of everyone being able to participate on equal terms, that participants will be reasonable in how they hold their discussion and participate with an open mind, and finally of accountability to those in the decision-making process.[56] Where consensus building has stakeholder representatives making decisions on behalf of different groups, deliberative democracy assumes everyone can participate in a decision-making process.

Engaging in deliberative democracy about climate change adaptation could be tested at the local-level, especially if interest comes from people organizing and asking for decision-making

power. Planners and elected officials can help provide enabling conditions for citizen discussions about adaptation. Yet, Young points out that in societies like the U.S. where structural economic and social inequalities already exist, formal democratic procedures, such as deliberative democracy, may reinforce those inequalities.[57] Fainstein similarly writes," My criticism of the proceduralist emphasis in planning theory is not directed at its extension of democracy beyond electoral participation but rather at a faith in the efficacy of open communication that ignores the reality of structural inequality and hierarchies of power."[58] While the ideal in procedural equity is to devolve decision-making towards the top of Arnstein's ladder of public participation, existing structural conditions mean that both the consensus building and the deliberative democracy models cannot ensure equitable process or outcomes on their own.

A Combined Approach to Equity

The shortcomings in both justice-oriented distributional equity and procedural equity lead me to make a pragmatic argument: that adaptation planners should try to maximize both types of equity in their work. Due to inherent structural inequities, neither approach will necessarily lead to equitable outcomes on their own, but when combined, equity in both adaptation decision-making processes and outcomes can be improved.

Figure A below depicts a plot for thinking about procedural and distributional equity. If adaptation planners want to prioritize equity, they should aim to end up in the "A" quadrant. On the equitable distribution access, program structure and financing would be based on the difference principle, ensuring that those most vulnerable to climate change benefit the most relative to the costs of a program. In practice, this could mean establishing progressive financing mechanisms to fund programs, and designing adaptation program criteria and delivery to ensure

limited resources serve vulnerable populations. On the procedural axis, the aim of adaptation planners would be to use a decision-making process that is inclusive and democratic. This paper has introduced two approaches to procedural equity, consensus building and deliberative democracy, but there are many approaches to public engagement that can offer citizens meaningful opportunities to help shape programs.

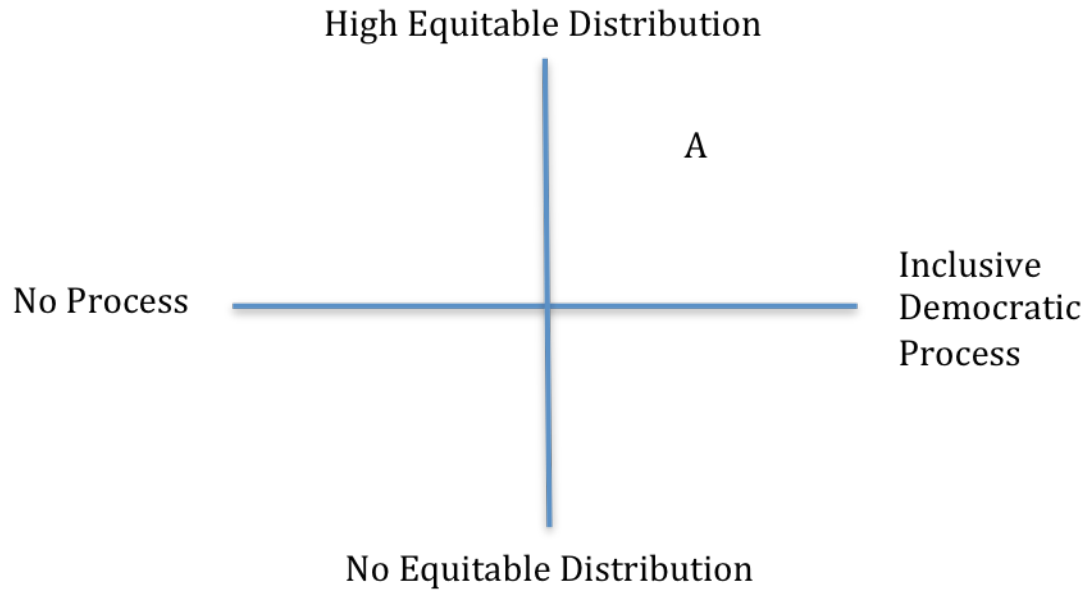

Figure 1: Equity Quadrants

Since both distributional and procedural equity operate within existing social and political structures, neither offers systemic solutions to ongoing societal inequities around race, ethnicity, class, culture, or gender. Not explored here are systems-changing theories such as the Right to the City, originated by Henri Lefebvre, which calls for those most marginalized to take more control over resources and social power.[59] While imperfect, however, I argue that adaptation planners can make local situations more equitable via intentional planning processes and program and financing structures.

Three Dimensions

Within the term equity, whether defined as distributional or procedural, there are three interrelated dimensions especially relevant to adaptation planning: the spatial-environmental, the socio-economic, and the temporal. These dimensions provide context for understanding who is most vulnerable to climate change. As described above, vulnerability is a combination of the level of exposure to a climate risks, the level of sensitivity to those risks, and the adaptive capacity a community has to respond.[60] I build on this definition by defining vulnerability as it relates to equity within these three dimensions.

The spatial-environmental dimension of equity asks who is at the most risk spatially to climate change. In an urban context, adaptation planners can help determine vulnerability of people, homes, buildings, and infrastructure using spatial mapping tools and climate risk projections for storm surge flooding, sea level rise, and other risks. Given the challenges of uncertainty in predicting climate change risks and impacts described earlier in this chapter, mapping spatial vulnerability to environmental conditions is not only a technical activity, but requires judgments about what level of risk to assume. Recent controversy over FEMA's updated floodplain maps underscores this point.[61]

Both Harvey and Soja argue that equity must be considered via a territorial lens. For Soja, the spatial and geographic frame is just as important for understanding equity as a historical or social frame. He writes, "Location in space will always have attached to it some degree of relative advantage or disadvantage."[62] The spatial nature of inequity leads Harvey to argue for an approach to justice that looks at the distribution of resources from a territorial perspective rather than as individualistic. He writes that the "geographical problem is to design a form of spatial organization which maximizes the prospects of the least fortunate region."[63] Neither Harvey nor

Soja's analyses consider environmental risk, but rather they focus on the spatial distribution of social and economic inequities. Adaptation planners, however, can combine their analyses of environmental risk with socio-economic data to build a clearer picture of vulnerability in the communities they serve.

The socio-economic dimension is perhaps easier to determine than other measures of equity. The term refers to a combination of education, income, and occupation that determine the social standing of a group of people or an individual. In this dimension, adaptation planners can use U.S. Census measures of household income and education to determine who might be most vulnerable to climate change based on socio-economic factors, but also to determine how to prioritize the least resourced in an equity-oriented distribution of benefits or adaptation. In thinking about the socio-economic dimension, planners should also consider the equity impact of certain policy choices, particularly where they impact lower-income or marginalized populations the most. Programs assisting private property owners, such as those explored in this thesis, largely provide adaptation resources to those with means to own homes and properties. And policies that require retrofits to buildings to increase flood resiliency may raise costs for those who rent properties in the area. Prioritizing this dimension will mean considering second-order impacts of policies and considering ways to mitigate disproportionate impacts of such policies.

A socio-economic dimension determined purely by quantitative measures, however, has weaknesses. Brisely et. al. advocate for thinking about broader social factors that can lead to climate vulnerability as well. They write in favor of adaptation planning that considers the social context in which people live in addition to individualistic measures of socio-economic status. In an adaptation context, this could include the safety of one's neighborhood, social isolation or support networks, or the institutions in one's community.[64] This type of approach can also be

helpful when thinking about public health impacts of adaptation planning. While more difficult to measure, some scholars have been developing equity mapping techniques to try to capture the presence of broader social resources as well as burdens in a community.[65]

Socio-economic status is also correlated with other non-material factors that tie to social inequity, including race and ethnicity, that equity-oriented adaptation planners should also consider. In a study of the CDBG-DR program administered in Mississippi and Louisiana following Hurricane Katrina, Gotham found that the **"**formula used to allocate grants to homeowners had a disproportionate impact on thousands of African American homeowners by tying recovery dollars to the depressed values of their pre-storm segregated housing instead of the actual cost of repairing the damage."[66] Related, Golumb and Kelly find that because of historic and present patterns of discrimination, many minority and low-income communities are located in areas of high exposure to climate risks.[67] This underscores that adaptation planners need to consider the broader social and historical factors that shape the present environment in which they are making decisions about how to incorporate procedural and distributional equity into plans.

A final dimension for planners to consider is temporal. Adaptation planning is unique because of the long time horizon of climate change risks and the impact on future unborn generations. Planners – or the public if procedural equity is emphasized – will need to consider what time horizons and risk levels they will use in making determinations of what to prioritize in adaptation planning. They will also need to consider how long to measure the risks and benefits of adaptation. A buyback program run today, for example, will have different costs and benefits now than over the long run. Finally, decision-makers will need to decide how to value the needs of future generations versus those alive today when making adaptation plans.

Considering Alternative Priorities: Efficiency and Effectiveness

Efficiency and effectiveness are two policy-making values often framed in competition with equity that adaptation planners will need to consider. Efficiency is typically a utilitarian measure of the overall costs and benefits to society from a policy. Effectiveness refers to the ability of a policy to meet program objectives.[68] While some argue that planners must determine trade-offs between these priorities, others only see trade-offs where the definitions used for these priorities create them. Fainstein writes, "the justice criterion does not necessarily negate efficiency and effectiveness as methods of choosing among alternatives, but rather requires the policy maker to ask, efficiency and effectiveness to what end?"[69] She argues that if planners consider policy outcomes only in Pareto optimal monetary terms, then efficiency and effectiveness will seem like opposing values. However, if "we inquire as to the benefits and costs to those least well-off or those most directly and adversely affected, we are still concerned with efficiency."[70] In creating evaluation measures for adaptation policies, planners should consider alternatives to traditional cost-benefit analyses that ask how a policy improved equity outcomes for target populations and consider success through such an alternative lens.

Given the uneven landscape of vulnerability to climate change risks and impacts, planners need to consider the role of equity in adaptation. However, there is no strict formula for operationalizing theories of equity in practice. Instead, I argue that planners should take a framework approach to thinking about equity in adaptation. This includes incorporating justice-oriented distributional equity into adaptation programs and plans, ensuring that those least-resourced and most vulnerable benefit the most from adaptation policies. At the same time, it means opening up the planning process to ensure procedural equity, aiming towards broad public participation and deliberation tied to outcomes.

Operationalized at the local level when considering programs to help private property owners, an equity frame would seek to find who is most vulnerable to climate change risks, what options there are for assistance, what the potential costs and benefits of those options are, and what trade-offs may come from focusing limited resources on these efforts. Local governments should also use a public engagement process to solicit ideas and feedback from the public about potential adaptation programs, focusing especially on those populations most vulnerable to climate change. From that process, planners can form transparent criteria to use in setting priorities and implementing programs.

A dual approach of distributive and procedural equity can help to overcome some of the barriers inherent in each approach. Planners can incorporate equity in making singular programmatic decisions, but more ideally would ensure that this dual approach to equity is part of a larger adaptation planning process. Within both distributional and procedural equity, planners should also conceptualize vulnerability via interrelated dimensions: spatial-environmental, socio-economic, and temporal. Vulnerability to climate change can be seen as a combination of exposure to risks, the capacity to prepare for and respond to those risks (on the individual, community, and institutional level), and the uncertainty of the effects of actions today on the future. This underscores that understanding how to determine who pays for and who benefits from equity-oriented policies should be considered from multiple dimensions, and within relevant historical, social, political, and spatial contexts. From this theoretical foundation, the following chapter explores how two communities in Rhode Island have used buyback and elevation programs to work with private property owners on adaptation, and the equity implications of those decisions.

Chapter 3: Rhode Island Case Studies

Cranston

The City of Cranston is located directly to the southwest of Providence and considered part of the Providence metropolitan area. Cranston has approximately 80,000 residents. With a total area of 39 square miles, the Pawtuxet River, the Pocasset River, and the Meshanicut Brook run through parts of the city. The eastern edge of the city borders the Narragansett Bay. Major industries include education, health care, and social assistance, retail trades, manufacturing, and professional, scientific and technical services. According to the most recent 2013 Census estimates, the median household income in Cranston was $60,283 and 10 percent of the population had incomes below the federally defined poverty level. Eighty-three percent of Cranston's population identifies as White, five percent as Black, one percent as American Indian, and five percent as Asian. The remainder report another race or a mix of races. Twelve percent of Cranston's population identify as Latino or Hispanic.

A Summary Risk Assessment conducted as part of MIT's New England Climate Adaptation Project found that a key climate-related risk facing Cranston is increased riverine flooding due to more frequent and intense precipitation events.[71] In particular, the city's inland flooding risk is expected to be concentrated along the Pawtuxet and Pocasset Rivers and Meshanticut Brook. Further expansion of impervious surfaces resulting from future development, both in Cranston and upstream, may exacerbate flooding. In contrast, Cranston's coastal floodplain is narrow due to the coast's sharp incline, making sea level rise less of a direct influence on flood risks in Cranston apart from development along the shoreline. Cranston interviewees report increasing levels of concern about climate change risks and impacts in Cranston, particularly in recent years.[72]

In March of 2010, the Pawtuxet River rose to its highest level ever recorded, 20.79 feet – nearly 12 feet above flood state, following three intense spring storms that brought precipitation levels 300 percent higher than normal.[73] These floods caused major damage to homes, businesses and infrastructure, especially those in floodplains. The floods also hit at a time of major economic distress in the nation and Rhode Island, when the state's unemployment rate was 13 percent. While the floods had widespread impacts in Cranston and neighboring communities, low-income populations were particularly hard hit, with qualitative reports following the floods citing high proportions of low-income and renting populations in the region affected.[74]

Figure 2: Perkins Avenue in Cranston after buyouts (2014)

Following the floods, many residents turned to the City of Cranston for help with recovery. In response, the mayor and city council established a flood commission as a location for people to share their concerns with local government officials. One Cranston official identified the

flood commission as a place where people could testify about how the flooding had impacted their lives, and that "the flood commission listened and passed information on to the administration." Another described the public response following the floods as, "people were screaming for action" and shared that citizens would venue shop, talking to the city council, the mayor, the flood commission, and the planning department to share the impact of the flooding on their homes or businesses. Of note, the flood commission serves as an informational and fact-finding body, but does not implement or run programs for the city.

A group of residents severely impacted by the flooding organized to form a citizen's group called the Pawtuxet River Flood Association. Their Facebook page describes the group as forming "out of frustration but mostly out of a hope for a better future" and it shares that their mission is "to provide assistance and support to the victims of the continuous flooding and devastation of the Pawtuxet River. Our focus is to alleviate our members suffering drastic economic and personal hardship through the creation and consummation of a Government buyout program of these properties."[75] Interviewees described the group as one of the major voices for residents following the flooding and as a source of strong support for a home buyback program in Cranston.

After the flooding, the Cranston City Planning Department also searched for ways to proactively respond and help residents. In response to a question from the mayor about how best to respond, Planning Director Peter LaPolla explained, "I said buy houses. It's simple, if they aren't there they can't be flooded." After the flood, LaPolla's department began working with other city colleagues on an aggressive long-term effort to find federal funding to support buying back properties. LaPolla noted that buybacks are not always the fastest or best solution to prevent future flooding, and that they were one of several flood mitigation strategies the city is

pursuing.

Cranston has over 1400 properties that fall in the 100-year floodplain, though only 352 are National Flood Insurance Policy holders. The city has chosen to prioritize eligibility for its buyback program based on flood risk, though without using a precise definition or criteria for defining different levels of flood risk.[76] One area where the city chose to focus was on Perkins Avenue, a neighborhood built into an oxbow of the Pawtuxet River. The geography of the river means that during severe storms and precipitation events, this section of the river is likely to flood. The second area identified by the city for buybacks includes Amanda Court and Warren Avenue, a neighborhood built build on former wetlands in the 1960s. Based on flood risk maps, the homes prioritized for buybacks in this neighborhood fell in the floodway, the land immediately next to a river where water will first flow during a flood event.

In both buyback sites, LaPolla emphasized that the homes on those sites were "original sins" in the sense that they were built before floodplain building regulations were established. In the case of Amanda Court, for example, since the land is a floodway it could not be developed under current floodplain regulations. The Perkins Avenue neighborhood has dealt with flooding for decades and residents first asked the city for assistance in the 1980s.

To fund the buyback program, the city applied for $7 to $8 million to buy back 33 homes in the Perkins Avenue and Amanda Court areas with FEMA funding from the Hazard Mitigation Grant (HMGP) program. Before applying for funding, city officials went to the impacted neighborhoods and spoke with residents about the buyback option to gauge their interest and get their initial voluntary consent to be considered for the program. Based on the benefit-cost analysis formula at the time, however, in December of 2011 FEMA determined that the homes in the Perkins Avenue neighborhood did not qualify for acquisition under the program due to a lack

of historical data about floods impacting the area and using data from flood maps created with data in the 1980s.[77] At the time the Cranston Director of Administration Gerald Cordy shared: "Part of the handicap we were dealing with here is a lot of these homes were built in the 1940s and '50s and there was no real reporting mechanism for floods until the 1980s. The flood maps that we're working with from FEMA are still operating on 1984 data. The frequency and the velocity of these storms have increased by quantum amounts since the '80s."[78]

Figure 3: Perkins Avenue looking towards the Pawtuxet River (2014)

City officials next looked to HUD's Community Development Block Grant Disaster Recovery program (CDBG-DR). After getting permission from HUD, in May of 2012 the Mayor announced that the city would reallocate $1.27 million of the city's CDBG-DR funding to purchase up to nine of the hardest hit homes in the Perkins Avenue neighborhood.[79] To be eligible, the CDBG-DR program required homes to be in a low- or moderate-income area,

located in areas with high risk for future disasters, or to be considered a health or safety risk. After receiving this funding, city officials again met with residents to see if they wanted to participate in the program, which was voluntary. Officials then worked through the additional administrative steps to make the buybacks happen, which included getting an independent appraisal on the homes of their pre-flood value and working with a title lawyer on the sale of the property from the homeowner to the city. In another round of CDBG-DR funding shortly after, Cranston received $400,000 to acquire two additional houses on Perkins Avenue.

In August of 2013, over three years after the Floods of 2010, six houses on Perkins Avenue were torn down, the first since the buyback effort began. Speaking at the teardown event, the mayor noted that the program would allow for the city to restore the floodplain and help prevent future flooding in the area. Rhode Island's Senator Whitehouse connected the buybacks to larger climactic changes: "The weather, as you know, is continuing to change. As we load up our atmosphere with more and more carbon dioxide, Mother Nature gets a little sterner with us with her storms, we're going to see it on our coasts, we're going to see it in flooding and it's really important that these programs continue to be there for the people of Rhode Island."[80] He also noted that the process was long and arduous, and should be faster in the future. The long timeline of the buybacks and the economic downturn meant that some homeowners went into foreclosure on their homes or had spent so much on repairs, that the buyback option was not financially viable. In the case of rental homes on Perkins Avenue, the city followed CDBG-DR provisions to help the renters find comparable housing elsewhere.[81]

Amanda Court and Warren Avenue were not low- or moderate-income CDBG-DR eligible areas of Cranston, and the city continued to pursue FEMA HMGP funding for those sites. In 2010, the city received approval to buy back one home on Amanda Court for $200,000 with a

$50,000 city cost-match. In 2014, the city received $750,000 from FEMA's HMGP to buyback five more houses in the area, requiring a $250,000 city cost-match. Since FEMA enacted its national average benefits for acquisition and elevation projects located in Special Flood Hazard Areas, Cranston city planners shared that many more properties have been eligible for buybacks based on the $276,000 threshold set nationally for acquisition projects. This simplified BCA calculation also saves the city in the extensive amount of time and resources it takes to conduct a full FEMA BCA calculation.

FEMA's 25 percent cost-match requirement for HMGP meant the city needed to find local sources of funding for the program. It used funds raised from selling development rights in a floodplain area to the federal National Resources Conservation Service, as well as funds from its Open Space Bond to make up the match. Cranston interviewees describe elected officials as being very supportive of the buyback effort and of providing the 25 percent cost-match. If anything, city council members reportedly wanted the city to move faster and buy back more homes.[82] However, every Cranston interviewee expressed that buybacks were only financially feasible to the degree that the federal government provided the bulk of the funding. City officials currently have a $4 million authorization from the 2008 Open Space bond and are planning ahead for future buyout cost-matches by including that calculation in the next city bonding. Cranston residents must vote in favor of city bonds, however, they generally do not review the specifics of the bonds and instead vote in favor of open space, rather than a specific program like home acquisitions. Reportedly the only opposition to the buyback program came from some residents, either because they were frustrated with how long the program took, the amount of compensation they were offered, or because their homes were not deemed eligible for the program based on federal program standards.

To date, Cranston has acquired and demolished 14 houses on Perkins Avenue, Amanda Court, and Warren Avenue via its voluntary buyback program. In interviews, city officials speak very positively about the program and plan to continue the effort, though some interviewees expressed concern at setting a precedent of buying out homes when the city may not be able to afford it in the future. Due to the nature of federal funding, the program has been incremental and slow in

Figure 4: A foreclosed home on Perkins Avenue in Cranston (2014)

its implementation. In terms of the program's benefits, people I spoke with cite the program as a win for residents, who can move out of high-risk areas and a win for the city, which restores the land to open space in perpetuity. Cited benefits include mitigating flood risk to other properties and not facing the risks and costs of rescue and recovery during future flood events.

When asked about why the city felt responsible for helping private property owners facing

flooding in these neighborhoods, one city official explained:

> If not us, then who? We [the city] didn't build those roads and houses. No one is really at fault, but it's in everyone's best interest to stop flood claims from happening. We need to draw the line and say enough is enough. All taxpayers pay for it in the end. It's the right thing to do. People can get behind it and see the numbers and that they work.[83]

This sense of joint responsibility between the city, taxpayers, and homeowners was expressed in other interviews as well. Interviewees also shared that it was important that the city take better preventative action and stop people from building in floodplains where possible, or require stricter building procedures to better protect structures.

From a distributional equity perspective, the 14 homeowners who benefited from the buyback program were prioritized based on a city determination that they faced the greatest spatial-environmental risk, and that neighboring areas would benefit from restoring the floodplain. Secondarily, but not intentionally, the homes purchased back via this program were described by planners as modest, though area statistics show that those on Perkins Avenue had a lower socio-economic status than those on Amanda Court and Warren Avenue. Homes bought back on Perkins Avenue were valued between $115,000 and $150,000 each and fell within HUD's CDBG-DR program requirements for low- to moderate-income households. The 2013 median household income in the census tract Perkins Avenue falls within was $58,958, as compared to a citywide median of $60,532.[84] In the case of Perkins Avenue, the buyback program was also a response to demand from an organized public citizens group for assistance. In contrast, home values on Warren Avenue and Amanda Court were more expensive, ranging between $150,000 and $200,000, which is closer to the median home value in Cranston of $191,000.[85] The homes on Warren Avenue and Amanda Court were not eligible for CDBG-DR funding, and would be described as middle to upper-income homes in the city. The 2013 median household income in

the correlated census tract was $101,442, which is higher than the citywide media, showing that these homes likely belonged to households with greater socio-economic means than those on Perkins Avenue.[86]

In terms of procedural equity, Cranston has regularly offered opportunities for citizens to contribute to updating the city's comprehensive plan as required by state law. However, prior to the Floods of 2010, the city did not engage its citizens in any discussions around planning for flooding, buybacks, elevations, or other adaptation efforts. The city did establish a Flood Commission as a place for citizens to go to voice their concerns, but the commission was not linked to any decision-making process or programming. The Pawtuxet River Flood Association was an active resident-led group pushing for a buyback program at the time, but their advocacy was not part a broader process with the city and it was narrowly focused on one street in Cranston.

From an outcome perspective, one could argue that the buyback program in Cranston did include elements of distributive and procedural equity. However, without an established or defined process for determining how to evaluate risk and prioritize eligibility for a buyback program, it is not possible to determine if the program benefited those most vulnerable to climate change risks in the city.

Westerly

Located in the southwest corner of the state and covering approximately 30 square miles, Westerly is a town of 22,000 year-round residents. During the summer months, the size of the town doubles based on seasonal residents. Westerly contains twelve different districts and villages. The Pawcatuck River flows through the western side of the town, providing a natural border between the states of Rhode Island and neighboring Connecticut. Block Island Sound, three saltwater ponds, several beaches stretching for seven miles, and the Atlantic Ocean border the southern part of the town.[87] Historically Westerly had a robust granite industry, but today tourism and textiles are the two strongest industries in the town. According to the 2013 Census estimates, the median household income in Westerly is $60,532 and 11 percent of residents had incomes below the federal poverty level. Westerly's population is 94 percent White, one percent Black, half a percent American Indian, two percent Asian, and the remainder are people who identify as two or more races or another race. Two percent of Westerly's population identifies as Latino or Hispanic.

Westerly's most recent hazard mitigation plan was completed in December of 2010. Based on the town's geographic location, the plan finds Westerly to be vulnerable to hurricane damage. The plan identifies several of the town's villages – Watch Hill, Misqaumicut, Weekapaug and Shelter Harbor – as "particularly vulnerable areas" due to their proximity to the ocean and lack of natural protection. It also notes that these neighborhoods are primarily occupied by seasonal residents, but also growing in population due to new construction and upgrades to existing homes. The hazard mitigation plan identifies the Pawcatuck River as a flood hazard, vulnerable during heavy rain events, from rapid snowmelt, and from storm and hurricane surges that can go up river. As one of the fastest growing areas in New England, the increasing amount of

impermeable surface throughout the Pawcatuck River watershed increases flood risks. Westerly's hazard mitigation plan briefly considers sea level rise and coastal erosion, finding that homes along the shore may be more vulnerable due to sea level rise and increasing storm intensity.[88]

Figure 5: Rebuilt dunes along Atlantic Avenue in Westerly (2015)

Similar to Cranston, interviewees from the Westerly area said the last five years in the town as being unprecedented in terms of severe weather, described by one interviewee as "I have never seen anything like this in my life." Westerly was hit by the March of 2010 floods. City officials said it as a three-day event with significant amounts of rain and the ground still frozen from winter, which exacerbated flooding. The Blue Pond Dam north of Westerly in Hopkinton broke and surged the north end of town and heavy rains caused the Pawcatuck River to flood its

banks. That was the first major disaster in recent past. The rains and subsequent flooding caused a large-scale power loss, major road blockages, and flooded out businesses and residential buildings along the river, including some major manufacturing areas and densely populated areas with low- to moderate-income populations. The storm event was a 100 to 500 year intensity level in different parts of the town.[89]

Since the March of 2010 Floods, Westerly has been impacted by three other federally declared disasters in a very concentrated period of time: Tropical Storm Irene in 2011, Hurricane Sandy in 2012, and Winter Storm Nemo in 2013. Interviewees cite Hurricane Sandy as being particularly devastating, hitting hard in the coastal section of the town, especially in the Misquamicut area. Atlantic Avenue, which runs parallel near the beach, was buried in six feet of sand after the storm hit and many buildings were wiped away or severely damaged. One interviewee described small business along the beach, including restaurants, bars, hotels, eateries, and gift shops, as being hit very hard. Fifteen-foot waves, a five-foot storm surge, and wind gusts up to 86 miles an hour were measured in the town during the storm.[90] Yet, even with these severe impacts, the hurricane was still described by one interviewee as "a glancing blow that did a lot of damage," implying that future storms have the potential to be even more severe and damaging compared to Hurricane Sandy.

These storm events opened up federal HMGP funding opportunities to Westerly. In response to the Floods of 2010, in 2011 Marilyn Shellman, the town planner, applied for FEMA funding to buy back eight properties along Canal Street, just north of the downtown area. She said this area was one of the most marginalized neighborhoods in the town, with a mix of residential rental, manufacturing, and commercial properties. Rather than being driven by resident demand, the town chose to prioritize this area, describing the area as distressed and in a high-risk area of

the floodplain. Shellman explained, "We tried to select areas slated for rehab that were detrimental to the neighborhood. Abandoned houses. A trash yard on the river. A warehouse on the river with historic issues. There were utility issues with the houses as well. Getting that out of the floodplain was important. Then we went after five other badly flooded residential properties that were interested. Properties that were most distressed."[91] Prior to submitting the application, city staff visited each property owner to tell him or her about the potential acquisition opportunity and to get their initial consent to participate. The town applied for HMGP funding and proposed using CDBG-DR funding for the 25 percent cost match.

Figure 6: A property purchased by the Town of Westerly via its buyback program (2015)

In the end, Westerly officials said that it took four years from the time of applying for buyback program funds until the first building was demolished. They described a high learning

curve for participating in the program, which required local officials to run time intensive benefit-cost analyses on each property. It took time to meet with property owners and to go through all the steps to fill out the paperwork. And then there was time on the side of the state and FEMA as the application was considered. After two years, the town's application was approved and FEMA awarded just over one million dollars in funding. Westerly officials shared that it took another two years to finish planning and to complete the legal steps necessary. There were also challenges with HUD and in the end the town could not use CDBG-DR funding as a cost match. The state's CDBG-DR program manager said that other projects in Westerly were deemed better uses of the recovery funds based on HUD's measures of merit and program value.[92] This meant the town needed to pursue other sources for its 25 percent cost match, eventually getting city council approval to tap into a pool of restricted funding the town had set aside for other projects.

Due to the long time period – four years – to actually implement the project, half of the property owners who were originally interested decided not to participate. Town officials described some of the property owners as losing interest in the program, particularly since the delay meant that they had to borrow more money to repair their properties and their risk perceptions decreased over time. Since the Floods of 2010 were the first serious flooding incident in Westerly in recent memory, there was a perception amongst many interviewees that this event was something of an anomaly and not necessarily linked to climate change or longer-term trends. The town building official explained, "The mindset of a lot of home and land owners is that this is the worst storm I've seen in 30, 40, 50 years, so I'll take my chances and figure it won't happen again. That's the way it is down on the beach as well."[93] Mindsets may also not have changed since the town did not offer a public engagement process around the

buyback program, which was driven by local officials rather than resident demand or interest. From a procedural equity standpoint, there was no public process for making decisions and prioritizing where to focus program resources.

Town officials shared that another challenge of the acquisition program was in helping renters relocate. Of the four properties Westerly has purchased, three are rental properties. While participation in buyback programs is voluntary for property owners, it is not for renters. Tenants in the acquired properties received 90 days notice that they needed to move and some funding to help with the move as part of the Federal Relocation Act. Town officials described this process as a communications challenge, and that is was difficult to help tenants to understand why they needed to move. Additionally, since Westerly is relatively small and does not have a housing agency or real estate expertise, it took staff time and capacity to assist tenants.

Figure 7: Elevation preparations for a beachfront home in Westerly (2015)

In contrast to the town's acquisition strategy along a riverine floodplain, Westerly has

pursued a strategy of elevating flood prone homes along the town's coastal waterfront. When asked about what they saw as the difference between coastal and riverine strategies for vulnerable private properties, town officials provided four answers. First, that pursuing acquisitions in riverine areas provided positive benefits to the community in restoring the floodplain and removing vulnerable structures that could impact neighboring areas in a flood. However, since buybacks require the town to hold the land in perpetuity and provide a 25 percent cost match, it is a strategy best utilized in strategic locations. Second, they shared that coastal properties in the town were likely too expensive to pass FEMA's BCA. While the actual value of physical home structures on the coast was described as between $40,000 and $100,000, the land values on the coast range from $300,000 to over $1 million dollars, making acquisitions cost prohibitive from a city cost-share perspective.[94] Third, officials explained that coastal properties provided an important part of the town's economy and tax base. And fourth, they said that coastal property owners did not want to move. One Westerly official said, "People want to come and live on the coastline. Change is gradual enough that people are not yet concerned." This reasoning provides some guidance in terms of when acquisitions or elevations make sense as a municipal strategy.

On the elevation side, the town applied for HMGP funding available from Hurricane Irene and has received just under $900,000 in federal funding to help elevate nine homes in the Misquamicut area of the town along the oceanfront. Westerly has also applied for HMGP funds for elevations from Hurricane Sandy and Winter Storm Nemo funding streams. They recently received funding for four additional elevations from Hurricane Sandy HMGP and are waiting to hear about funding from Winter Storm Nemo. Amy Grzybowski, the Director of Planning, stated that they are applying for funding under the PDM and FMA programs, looking to multiple

sources of funding to support coastal elevations.

Figure 8: An elevated home along Atlantic Avenue in Westerly (2015)

Town officials described elevations as being somewhat faster to implement than acquisitions. However, significant staff time is required for the application process and accountability measures that require information collection and inspections to ensure the property owners use received funding properly. Elevations are only allowed for existing structures and homeowners cannot make additions to their homes in the process. For the elevation program, the town decided that property owners would pay the 25 percent cost match rather than the town, since the value of the property stays with the owner. To facilitate elevations, in 2013 the Westerly Town Council adopted an ordinance to waive the town's maximum height restriction for storm damaged structures being rebuilt. Now buildings can be raised up to three feet above the base flood elevation in a 100-year storm event.

The town views elevations as a temporary and important solution to coastal flood risks that buys more time. Grzybowski shared that they have developed a rolling process for property

owners to apply for elevation funding. They advertised the program via their town website, emails, and newspaper articles, though have not held any public meetings about the program. From a procedural equity standpoint, officials do describe holding other public meetings about disaster relief resources from FEMA and the state following Hurricane Sandy. However, those meetings were focused on resources for recovery and not on soliciting public input or any collaborative decision-making.

Figure 9: Home elevation construction on Atlantic Avenue in Westerly (2015)

Westerly officials have 21 elevation applications in cue. While FEMA does not require a BCA for elevation costs under $175,000, Westerly officials stated that internally they still use BCA to determine a fair rank order for their applications. Grzybowski described, "We still use BCA to prioritize based on risk and use it equitably across the board."[95] Interviewed town officials felt that BCA provided a fair and neutrally applied standard the town could use to

prioritize homes for elevations. Notably, however, the town does not make any distinction between elevating first or second homes. The director of planning said that "Secondary property owners in this area are not wealthy, [they are] passed down from generation to generation . . . Some places prioritize primary properties, but we do second homes because that is what we have in Misquamicut."[96] She also said that FEMA allows for elevations of secondary homes, showing that Westerly officials look to FEMA to set fair program standards.

Westerly prioritized spatial-environmental risk in determining where to target its buyback and elevation programs. For the town's buyback program, staff reached out to property owners they determined were most negatively impacted by the 2010 floods. Secondarily, the properties involved in the buyback program fell into HUD's designation of a low- to moderate-income neighborhood, reflecting a prioritization of socio-economic equity in the program. Of the properties purchased back, the town paid between $114,000 and $231,000 per property.[97] These amounts fell well below the median home value of $307,000 in Westerly. The correlated median household income for the census tract where the buybacks took place was $46,804 in 2013, as compared to a town-wide median or $60,532.[98] However, since three of the four properties purchased back were rental properties, household income statistics for the area do not necessarily demonstrate the socio-economic status of the property owner.

Within the pool of potential applicants for its elevation program following Hurricane Sandy, the town used FEMA's BCA formula to rank applicants, seeing the tool as a neutral and fair standard for prioritization. Elevations of the eight coastal homes that have participated so far have cost between $70,000 and $142,000.[99] The properties themselves are valued between $348,000 and $1.7 million, thought the majority of the elevated properties fall under $500,000 in value.[100] In contrast to the buyback program, these values are far higher than the median home

price in the town of $307,000.[101] The median household income for the correlated census tract was $81,797 in 2013, which is higher than the town-wide median of $60,532.[102]

From a socio-economic standpoint, equity was not a priority in the elevation program and the homes targeted were second homes along the coast. The buyback program incorporated socio-economic equity in terms of which homes were purchased, but that result did not come from intentional prioritization. In terms of procedural equity, neither program's evolution involved a public participation process. During interviews with town officials, they explained that Westerly did not have a public process to set priorities for buyback, elevation, or other adaptation programs, indicating a need for procedural equity in the town. Similar to in Cranston, in the absence of defined local criteria and procedures for determining which areas are most at risk and vulnerable from climate change, it is challenging to determine if those assisted by these programs were most in need of assistance through an equity-based lens. This reality points to the need for municipal governments to define standards for how they will use elevation and buyback programs.

Chapter 4: Comparative Case Analysis and Interview Findings

To learn more about these municipalities, the state level context, and their interaction with federal programs, I conducted interviews with 24 different people who live or work in Rhode Island and work on disaster mitigation and climate change adaptation. In my interviews, I focused especially on speaking with government officials, since I wanted to learn how government actions and programs have shaped adaptation on private property in these two communities. The interviews lasted between thirty minutes and three hours, with the majority of interviews lasting approximately one hour. They were semi-structured based on pre-developed interview protocols, and each included questions tailored to the interviewees' areas of expertise and experience. I conducted the majority of the interviews over the phone, but interviewed Cranston and Westerly planners in-person in their respective communities. I used a snowball method to find interviewees, beginning by speaking with planners in the two communities and then building out to interviews with contacts at the local, state, and federal level. I transcribed each interview and analyzed every transcript at least two times to pull out key themes and arguments. A complete list of interviewees appears in Appendix 1.

In the chapter below, I describe key themes that came from the interviews. These themes arose out of my research questions:

- How do federal policies and programs for elevations and buybacks shape adaptation of private property parcels at the community level?
- How do planners prioritize projects and use available resources for elevation and buyback programs?
- How do planners incorporate equity into their decisions?
- How can municipalities finance elevation and buyback programs on private property

parcels?

- What responsibility do municipal governments have to work with private property owners on adaptation?
- What role should private property owners play in adaptation?
- Given these realities, how should municipal governments pursue adaptation in collaboration with private property owners?

From these research questions, I organized my interview data around six major themes that arose most often during my interviews and help to answer my research questions. These include fiscal shapers of adaptation efforts, prioritization of risk and spatial-environmental equity, FEMA's benefit cost analysis formula, responsibility for adaptation, public participation in the two communities, and staff and timing constraints on adaptation efforts. I contend that these themes show how Westerly and Cranston are helping private property owners adapt to climate change following natural disaster utilizing disaster mitigation programs.

After considering these themes, I have found that municipal governments should develop transparent criteria to make clear when they will utilize buyback and elevation programs and other strategies to work with individual private properties, as well as how these efforts fit into comprehensive plans. Current efforts in both communities have resulted in differing levels of spatial-environmental and socio-economic equity in the programs, but the lack of consistent decision-making criteria mean that the programs are still ad hoc in nature, and may not be benefiting those most vulnerable to climate change. Moving forward, local-level criteria should include equity standards that prioritize a just distribution of resources to populations most vulnerable and opportunities for meaningful public participation to help set local priorities.

Fiscal Shapers of Adaptation Efforts

To help answer my research questions, "How do federal policies and programs for elevations and buybacks shape adaptation on private property parcels at the community level," "How can municipalities finance elevation and buyback programs on provide property parcels," and "How do planners incorporate equity into their decisions," I identify four fiscal shapers of adaptation efforts with private property owners in these two communities. First, the availability of funding for local-level programs, second, storm events as opportunities for funding and rebuilding, third, the incremental nature of adaptation planning caused in part by limited funding, and fourth, longer-term, lower cost planning tools that interviewees identified as critical for adapting to climate risks over time.

Funding Availability

One of the key takeaways from my interviews is that federal funding strongly shapes what municipalities see as possible in terms of hazard mitigation and adaptation. Different interviewees shared that local governments in Rhode Island have very limited financial resources to support adaptation efforts. This is partly attributed to the culture in Rhode Island, with one interviewee describing, "While we are a blue state, we have convinced ourselves that we can't raise taxes anymore. So there is very little in the way of local resources that we can throw into adaptation programs and projects." Rhode Island's governor is a strong supporter of the state's property tax cap, which only allows for a four percent increase in local property tax revenues in a given year, which is particularly restrictive because it does not exempt tax revenue from new development. At the state level, funding has also been limited in recent years, with climate change legislation such as the Resilient Rhode Island Act not including any programmatic funding or support for local level action on adaptation. Similarly, Rhode Island's Statewide

Planning Program explained they currently have few dedicated resources to offer in the way of technical assistance or funding for local adaptation efforts.[103]

In the absence of significant local or state contributions, interviewees shared sentiments such as "a lot of what we do is based on funding," indicating that federal funding strongly shapes and constrains local action. Beyond the lack of local funding, acquisition and elevation programs on private property are also expensive undertakings for local communities. Another interviewee elaborated: "Unfortunately [we] need FEMA or other agencies to contribute money. The city alone cannot buy back all the businesses and houses that are on the floodplain. It would just be too expensive for the city." Nearly every interviewee working at the local level said that their sense of what is affordable for the city in terms of acquisition and elevation programs was tied directly to the amount of federal funding available. Without federal funding, interviewees saw these programs as prohibitively expensive for local governments.

Interviewees also indicated that they saw federal funding for projects with private property owners as making the projects more feasible, not just from a financial perspective, but also from a prioritization perspective for how to use local funds. One local official who favored acquisition programs as a strategy described this logic:

> It's got to be affordable. We can't put all resources into a reserve account for that type of purpose, but we can put in extra money as it comes along into that type of account. How big it will be depends on how well the city does. This all needs to be done without raising taxes, one of the problems you run into. We can't be asking homeowners who are not affected by flooding to pay for those who built or bought homes in floodplains. We can't expect everybody to bail them out, but what we can do set aside some money to alleviate the problem. But it's not the only problem in the city. It's kind of a balancing act, try to do the best for everybody, and try to do what's best for people who are hurting at the same time. It is not an easy thing to do.

This interviewee explained that where possible, his city should save extra funds to be able to meet the 25 percent FEMA cost-match required for acquisition programs. However, he also felt

that the city would not be able to help private property owners without federal program funding. His sense was a mix of empathy for property owners in very flood prone areas, combined with not wanting local taxpayers to have to bail out others by footing the bill for an expensive program with very specific beneficiaries. It seemed that if the collective responsibility to pay for hazard mitigation programs with private property extended to the entire federal tax base, rather than just the local taxpayers, coming up with a city cost match became much more politically palatable.

In a similar vein, while both communities provided the local cost-match for acquisition programs from city funds, for its elevation program Westerly has required homeowners to pay for the 25 percent cost-match. Since elevation programs allow the property owner to retain benefits including using their land and building, interviewees from Westerly shared that it was appropriate for the property owners to cover the cost-match rather than the town.[104] Westerly town officials indicated they might try to increase the cost-match from property owners for their elevation programs in the future, but did not indicate that they are considering a sliding scale for the cost-match based on homeowners' income or assets or other socioeconomic equity criteria.[105] In contrast, with an acquisition program, a municipality keeps the land it has purchased back, increases its natural floodplain, and avoids future expenses of flooding on those properties. So in both Westerly and Cranston, the 25 percent cost-match has been covered by local taxpayer funds. For acquisition programs in both communities so far, however, beneficiaries have tended to be low to middle-income, likely another contributing factor to the municipalities covering the full cost match. The different approaches in how these communities apply the cost-match contrast between elevation and acquisition programs, and it is one of the stronger indications of socio-economic equity present in how these programs operate at the local level.

The CDBG-DR program can also increase the socio-economic equity dimension of acquisition and elevation programs. CDBG-DR funds allocated to a city or town are considered local funds for federal purposes, so they can be used as the local cost-match for FEMA programs. Additionally, since CDBG-DR funds carry restrictions requiring a portion to be used in LMI designated areas they are intended to benefit lower-income populations more than non-designated funding.[106] One FEMA employee describes, "A lot of times the hard part is the match. That can be a fair amount of money, especially in a community or with a homeowner who is not well off . . . CDBG is great because they can use it and it can really help out in a low-income area." More than FEMA programs, which lack a specific income allocation requirement, CDBG-DR funding availability can increase the socio-economic equity of acquisition and elevation programs via its eligibility determinations. However, HUD's requirement is that at least half of the grant funding must be used for activities that primarily benefit low- and moderate-income persons. This can be measured by beneficiary or by area eligibility, where a defined benefit area has at least 51 percent of its population at a low- or moderate-income level.[107] If a municipality uses area eligibility requirements, low- and moderate-income persons may be less likely to benefit from programs targeting private properties and structures, particularly in communities with lower rates of homeownership amongst those populations.

Interviewees were mixed in terms of their predictions about where future funding for adaptation programs for private property owners should originate. Many argued that funding would need to come from all levels: "No one entity should pay for this. Not all federal, state, or local. It needs to be across the board. [We] need investment at every level to make us more resilient." Others, however, felt that the current federal political climate meant that "everything rolls downhill" and in the absence of federal or state funding municipalities will need to bear

more of the burden for funding adaptation programs.

Storm Events as Opportunities

In the absence of dedicated federal or state programs to help municipalities in Rhode Island adapt to climate change, communities have been merging their adaptation efforts with hazard mitigation programs. They are using FEMA and HUD disaster mitigation programs to fund what many interviewees also consider to be adaptation efforts. However, as discussed in my earlier literature review, FEMA and HUD's disaster mitigation programs provide the most funding for local governments after a federally declared disaster event. As one FEMA official described, "With HMGP there must be a disaster in order to get money. Will there be more disasters? That seems to be the general consensus. More disasters will mean more funding is available." Many other interviewees also connected this increase in disasters to the impacts of climate change on the state. Rhode Island's track record in the last five years includes four federally declared disaster events, further supporting that in recent years significantly more funding for disaster mitigation is now available in the state than in the past.

Some interviewees even described storm events as opportunities since they open the window for funding opportunities and to pursue bigger projects. As one interviewee explained, "One of the things we are counting on because you can't be proactive, we are waiting to get wacked by another big storm because that is when the money becomes available to finance projects that really do the job." This approach to disaster mitigation and adaptation may seem fatalistic, with local governments needing a disaster to trigger funding for projects that will increase their resilience in the future. Indeed, a FEMA interviewee shared that many communities even have project proposals written up and in the queue, just waiting for a funding opportunity from FEMA or another federal agency.[108]

Storm events present an adaptation opportunity in another sense as well, in that they increase local levels of concern and willingness to participate in disaster mitigation programs, particularly when a local government can act quickly. In Cranston, local officials describe impacted residents as "banging down the door" for assistance after their homes were flooded and an organized group of Cranston's residents requested a buyback program from the city. In contrast, after Westerly's buyback program took four years to implement, half of the property owners who had earlier indicated they would like to participate changed their minds. Westerly town planners attributed this shift in their willingness to participate to the time since the last disaster, positing that the property owners' risk perception of future flooding had decreased.[109]

Scale of Adaptation Efforts

Given limited federal funding and limited windows of opportunity to use disaster mitigation funding when it is available, interviewees explained that they try to leverage federal resources as best they can before the next storm. Ultimately, however, the constrained nature of federal funding, both in terms of when it is released and the amounts available, means that adaptation planning is often incremental or piecemeal at the local level as officials try to put together programs with limited resources. One interviewee described incremental planning as being a choice by municipalities based on funding constraints: "Money is unfortunately one of the biggest things that can help make the right decision. Cities hit those kinds of situations where they pick the shortest, cheapest choice, even thought it might be more expensive in the long run." This interviewee implied that it is easier for municipalities to make decisions that will have an impact in the short-run and be more efficient to implement, rather than picking what may be a more effective but expensive or challenging-to-implement solution. Interviewees also described the strong desire amongst residents to "get back to normal" as driving quick repair efforts and

shorter-term project priorities.

The majority of interviewees, particularly those working at the state or federal level, expressed that they would like to see more comprehensive planning for adaptation at the local level. However, the limited nature of funding and the window of time to use it, mean that projects are usually incremental in their implementation and impact. One state-level employee shared, "The planning story in Rhode Island seems positive to me. Action is happening and agencies are coordinating. Where there seems to be a shortcoming is in funding and opportunities to plan comprehensively rather than incrementally. We have seen this in how towns can work with private property owners." Both the FEMA HMGP and HUD CDBG-DR programs obligate their funding incrementally, impacting project realities on the ground. HUD's CDBG-DR manager explained that depending on the rules tied to the funding, CDBG-DR funding has different deadlines for disbursement. Regulations also require funding to be distributed on a project-by-project basis making implementing more comprehensive projects challenging.[110] Similarly, FEMA's HMGP funding is based on a formula allocation tied to total FEMA response and relief expenditures in the region, meaning that state and local officials will not know the total amount available for mitigation until a full year after a disaster. Combined with detailed FEMA application processes and regulatory requirements, this reality also makes funding longer-term and bigger projects challenging for communities.

The incremental nature of FEMA and HUD funding is apparent in the piecemeal funding of acquisition and elevation programs in Cranston and Westerly. Particularly in the case of Cranston, the city's original application for HMGP funds for acquisitions was for 33 homes at $7 to $8 million. After many years of effort and additional applications, the town has purchased back 14 homes in two areas of the city using multiple streams of federal funding. In contrast to

this reality, officials who administer federal disaster mitigation interviews all expressed that to be successful, adaptation programs such as acquisitions really need to be undertaken at scale. One interviewee described, "I think communities should look at bigger projects to solve problems. I'm more interested in seeing long-term resiliency and mitigation projects that protect a community rather than just a few here and there." If not done at scale, acquisition programs can leave patchwork neighborhoods and have less flood mitigation impact. However, elevation programs can arguably be implemented in a more incremental manner since they provide shorter-term solutions to future flood risks from sea level rise and more frequent and increased storm intensity.

In some cases, however, local officials find that an incremental approach to implementing mitigation projects on private property works well. As Cranston's planning chief describes, "Don't let the perfect be the enemy of the good. If you try to do it all at once, you can't do it, it is too complicated and expensive. But to do it incrementally and identify the pieces you can do at any given time, it all gets done over time. [You] need a sense of where you want to go, but can't do the whole at once."[111] Similarly, a Westerly official argued that municipalities are "better served at mitigating existing situations than restructuring the fabric of the community." This sense that an incremental approach is more feasible seems to tie to a common perception amongst interviewees that the expense of buyback and elevation programs limits what is possible at the local level. Notably, interviewees from the non-profit sector and the state level tended to be more supportive of longer-term, less incremental planning than local-level officials.

Longer-run Planning Tools

In the absence of dedicated and predictable funding sources, interviewees pointed towards more traditional, low-cost planning tools that can support climate change adaptation in the longer

run. Zoning was the most mentioned tool local municipalities have for working with private property owners. Secondarily, interviewees also frequently mentioned strengthening building codes. One official described these approaches succinctly, "Make sure people don't build in floodplains and if they do, that they fortify their homes." Zoning and building code changes can regulate future building in flood prone areas and require that new building and significant upgrades to existing buildings make structures more resilient. Flood proofing and raising utilities or entire structures are examples of what municipalities can require. Rhode Island's CDBG-DR manager highlighted the program as especially useful for rebuilding since the program generally allows more flexibility than FEMA program funds for rebuilding in ways that are different or more resilient.[112]

While zoning and building codes were often mentioned as solutions in interviews, they also are limited in their scope in that changes generally apply only to new building or significant upgrades. A Rhode Island Statewide Planning official elaborated on the challenge of tackling both issues: "We see climate change and its impact central to our role, and particularly our focus on land use planning in the development process. We are not only thinking about how we develop in the future to not put ourselves at risk, but also that we are doing . . . to address things that have already been built and ensure they do not create risks in the future." The latter point of working with existing structures has led Cranston and Westerly to pursue buyback and elevation programs as strategies for working with private property owners.[113] Officials at the state and local level shared that zoning and building codes were an important part of any adaptation strategy, but insufficient on their own since they did not impact existing properties.

Risk and Spatial-Environmental Equity

Interviews showed how planners prioritized projects and available resources for elevation and buyback programs. In both Cranston and Westerly, participation in adaptation programs for private property owners was prioritized based on what I refer to as spatial-environmental equity. This dimension of equity asks who is at the most risk spatially to climate change. In every interview, respondents answered that those most at risk from climate change should be prioritized when planning and implementing buyback and elevation programs with limited resources. One interviewee from Cranston described, "Those areas of the city that are most vulnerable to bay or riverine intrusion should be prioritized first. It should be done geographically and not politically." Another recommended using "objective criteria related to hazards, so proximity to floodplains, presence in floodplain, proximity to the lowest part of the coastal plain." Prioritizing limited program funds based on risk was seen by interviewees as a fair approach, and planners in both Cranston and Westerly explained that they first looked to the most vulnerable properties from a flood risk perspective for their buyback and elevation programs. Notably, however, neither community has outlined a public strategy or criteria for how they determine which properties are most at risk from climate change impacts and therefore should be prioritized in buyback and elevation programs. This indicates a need to formalize how risk on properties is determined into comprehensive plans, hazard mitigation plans, or another planning or policy mechanism that clearly outlines objective criteria.

Building on prioritizing risk as a key factor in making programmatic decisions, many interviewees also pointed to the shared community benefits of acquisition programs in that they restored natural floodplain functions. A Westerly official explained, "The buyback program was on riverine flooding, based on risk. With the program there will not be as extensive of flooding.

It allows for storing [water] and reduces risk elsewhere." Cranston's Planning Director described similar logic: "Anytime you remove structures from the floodplain and return that land to a floodplain function, you increase the ability of a floodplain to absorb flooding." When asked about how his city prioritized locations for the buyback program, he immediately went to a map in his office and showed how the areas designated were in the oxbow of the river or in a floodway, two areas that should function as floodplains. Many interviewees described acquisition and elevation programs as a "win-win for the city and the homeowner" because homeowners either moved or elevated their homes and the city mitigated future risk. Interviewees shared that every time a disaster strikes vulnerable properties, local government had to risk lives to rescue people, insurance needed to pay, and affected residents would look to the city for help, so there were many points of motivation for removing or reducing flood risks to properties and for municipalities to provide a level of financial commitment to such projects.

While both Cranston and Westerly prioritized their buyback and elevation programs based on risk, to date buybacks have only been used as a tool in riverine areas in the communities. Interviews showed that this was partly due to FEMA's benefit-cost analysis formula (discussed further in the following section) and due to many coastal homeowners being uninterested in moving, despite flood risks. But there also was a sense amongst local officials that homes and other structures built along riverine floodplains were a "pre-existing sin" for local government to confront, built before there were floodplain regulations. Cranston's Planning Director stated that, "We let all of this happen before we regulated it. We either live with it or go back and correct it." He said that today's regulations can't stop someone from building in most floodplain areas because of takings rules, but local regulations in Cranston now require people to protect themselves by elevating the first livable floor in their structure to a one-foot freeboard. Some

interviews also revealed that risk was less often seen as the fault of a home or business owner along rivers since development upstream impacts those living downstream.

Though spatial-environmental equity seems to be most prioritized in determining programmatic priorities around adaptation and private property owners, connected to this priority is a secondary dimension of equity that is socio-economic. Several interviewees explained that Rhode Island has a legacy of development in floodplains to house mill workers, and those areas are now largely inhabited by lower-income populations. One interviewee shared that adapting to climate change would be harder in vulnerable lower-income communities since they may not be able to get out of harm's way when storms strike or reinvest in rebuilding afterwards. And for lower-income households that do not own property, a decision to rebuild lies with the landlord and not with a renter. Another interviewee combined spatial-environmental and socio-economic equity concerns saying, "In climate change, [we] need to remember a lot of attention is on coastal areas. Not all are wealthy, but many are. There are many not so wealthy people in coastal areas and we need to pay attention to inland flooding, often on less well-to-do areas along rivers." Several interviewees also pointed to CDBG-DR's prioritization of projects in lower-income areas as making buybacks in flood prone areas more likely to happen. With prioritizing riverine areas for buybacks, in Cranston and Westerly we see a melding of spatial-environmental and socio-economic distributional equity. Notably, however, planning staff in both cities did not share the view that this melding was intentional, but rather resulted from prioritizing spatial-environmental equity in riverine areas.

Interviews and reviews of local hazard mitigation plans showed that neither Cranston nor Westerly had a defined set of criteria or objectives for when and where to use buyback and elevation programs as tool. The section below will discuss further how both municipalities used

FEMA's benefit-cost analysis formulas to rank project applications, but it seems that the decisions for which areas to prioritize were made ad hoc based upon post-storm damages and local risk perceptions. Criteria may be difficult to settle upon and can somewhat limit a municipality's flexibility, but is also important to determine based upon underlying equity concerns. As one interviewee shared: "In a buyout with a limited pool of money, who do you prioritize? [You] need to sort that out for sure. Do you buy out the elderly folks with a small cottage somewhere and next door there is a multi-million dollar mansion? I'm not sure how you go about that mix of prioritizing, but it certainly needs to be considered." I argue that municipal governments should develop more clearly defined guidelines for when, where, and how they will use tools like buyback and elevation programs to help private property owners. While neither community shared receiving any negative feedback about their approach to these programs so far, developing criteria in the future could ensure fairer distributional and procedural equity.

FEMA Benefit-Cost Analysis (BCA) and Distributional Equity

Beyond providing funding, federal program standards also shape how buyback and elevation programs have been implemented on the ground. In both Cranston and Westerly, local planning officials reported using FEMA's benefit-cost analysis (BCA) tool to prioritize projects and ensure fairness based on what they see as neutral standards in their buyback and elevation programs for private property owners. In contrast, interviews with FEMA officials showed the authorizing legislation for FEMA's HMA programs, the Stafford Act, does not allow for the explicit prioritization of funding for some communities over others based on socio-economic status. This discrepancy highlights a difference of interpretation of responsibility for ensuring equitable project standards between the local and the federal level, as well as a difference in

interpretation about what equity may mean. Through my interviews, I found that the structure of FEMA's BCA process, particularly FEMA's project cost thresholds, reportedly benefited lower- to moderate-value homes in Westerly and Cranston for acquisitions and elevations. Different from FEMA, the CDBG-DR program does include some standards for incorporating socio-economic equity. Another layer for incorporating criteria is also built in at the state review level, where both FEMA and CDGB-DR projects go through a state review for eligibility.

FEMA's BCA tool was first developed in the late 1990s based on the Office of Management and Budget Circular A-94. This Circular, titled Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs, provided detailed direction for government departments and agencies on how federal programs need to demonstrate a return on investment. The goal is described: "to promote efficient resource allocation through well-informed decision-making by the Federal government"[114] This highlight on the value of efficiency, typically a utilitarian measure of the overall costs and benefits to society from a policy, could prevent the inclusion of equity standards into decision-making. However, my interviews at the federal and local level show that in Westerly and Cranston, FEMA's BCA tool has functioned in a way that helps ensure different dimensions of distributional equity in elevation and buyback programs at the parcel level (rather than the community level), including socio-economic, spatial-environmental, and temporal dimensions. While the Stafford Act does not allow FEMA to designate funding to some communities over others based on socio-economics status, a measure of the socio-economic status for individual property owners is factored into the BCA process, particularly through threshold designations explained below.

When using FEMA's online BCA tool for an acquisition, a user first enters basic property information, including the useful life of the project so that future benefits can be discounted (in

the case of acquisitions, FEMA has made this time period 100 years). The user enters appraisal information, the fair market value of a property, and estimates the total cost of a project, including the demolition of a structure. The software then considers hazard information based on FEMA flood insurance program information. Town officials need to enter detailed structure information, including the replacement value of the structure and the first floor elevation. The software will calculate estimated damages based on structure information and flood risk. The program considers additional impacts and costs including displacement from a home and damage to belongings. More recently, in December of 2014, FEMA has allowed towns the option to consider sea level rise in flood risk, and also will award bonus points to certain projects that restore wetlands, riparian areas and other critical shoreline habitats. To be eligible for these bonuses, a project needs to have at least a one to one ratio of benefits to costs, and ideally higher.[115]

It takes a significant investment of time and resources to complete a BCA at the local level. In an interview with FEMA's federal-level manager of BCA, he shared that it can take 20 to 40 hours for a municipal-level planner to complete a BCA. It can also cost several hundred dollars or more to complete engineering evaluations required. To alleviate some of the burden on local governments, in recent years FEMA calculated maximum thresholds for projects that were deemed cost-effective without undergoing a full BCA process. For acquisitions, this amount is $276,000 per property and for elevations it is $175,000. FEMA also allows for some cost multipliers in certain high cost areas. These calculated maximum thresholds for avoiding a full BCA analysis show one important way that FEMA incorporates a level of socio-economic equity into the BCA process. While not explicitly redistributive, the thresholds allow lower-cost properties do avoid the BCA process and qualify for the buyback program. In contrast, the

threshold does not necessarily preclude elevations, especially for smaller physical structures on highly valued plots of land.

While the Stafford Act does not allow FEMA to provide differential funding to entire areas based on socio-economic status, the BCA tool does ensure some measures of distributional equity at the parcel level, though this effect may be unintended at the federal level. From a spatial-environmental equity perspective, FEMA's BCA ensures distributional equity, prioritizing and giving more weight to properties in the most flood vulnerable areas. From a temporal equity perspective, FEMA's use of a discount rate tries to ensure that the useful life of a project is considered as part of BCA analysis. And while an applicant's income level is not considered, to the degree that one's property values are a comparable measure of socio-economic status, socio-economic equity becomes a factor in BCAs. In acquisition programs, for example, FEMA pays for the value of the structure and the land. FEMA's expert on BCA shared, "In coastal areas a lot of time the value of the property is so high it will not pass BCA in many cases. The threshold depends on flood hazard data and the cost of the project."[116] Since projects need to meet a cost-benefit ratio, interviewees explained that more expensive homes and properties can have a harder time reaching eligibility.[e] Though FEMA will not consider an applicant or community's wealth, given equal natural hazards risk, interviewees reported that lower-cost buildings and properties can more easily reach a beneficial cost-benefit ratio. However, from a socio-economic perspective, those who do not own properties or homes are excluded from participating in these programs all together. And in the case of repetitive loss and severe repetitive loss properties, the high cost of National Flood Insurance Program payouts has made

[e] Access to the complete BCA formula was not available for analysis in this thesis. As such, the argument that BCAs can benefit lower cost properties is based on interviewing FEMA's BCA expert and based upon the project cost thresholds set by FEMA for acquisitions and elevations.

FEMA willing to buy back properties of many sizes and costs.

At the local level, interviewees in Cranston and Rhode Island both pointed to BCA as a way to determine which projects to prioritize. Local planners highlighted BCA as a way to establish a fair standard to apply for funding projects at the local level and felt that the external federal standard could help avoid controversy in deciding which projects to fund. In the case of Westerly, even though properties in their elevation program stayed under the cost threshold for not needing a BCA, planning staff still used BCA's internally to determine a way to prioritize projects for funding. The town's planning director described BCA as ensuring that there is no favoritism and providing a way to prioritize based on risk. While town officials did not explicitly mention socio-economic equity, they did share that the BCA tool prevented high-value properties from participating based on BCA ratios.[117]

In the case of Cranston, the city's planning director pointed to FEMA's maximum funding thresholds for projects that do not require a BCA as being an indicator of socio-economic equity standards, since they exclude higher-value properties unless they can pass a full-scale BCA. In Cranston as well, city officials highlighted the importance of external standards as providing fair and neutral criteria for determining project eligibility.[118] These responses highlight an interesting dynamic between FEMA and the local level in project prioritization, where each side looks to the other to help prioritize projects and make decisions. On the FEMA side, an interviewee shared, "It's really up to the community to prioritize what they are requiring for us. FEMA wants something that is cost effective, 1.0 or better." However, he went on to describe how many communities, such as Westerly, rank applicants based on BCA formulas so they can acquire or elevate the most cost effective properties.[119]

While FEMA's HMA programs do not specify recipient eligibility requirements,[f] I find that the BCA requirement does constrain eligibility in the program with more hidden equity considerations described above. In contrast, HUD's CDBG-DR grants do not require a BCA, but instead incorporate more explicit socio-economic equity-based criteria. CDBG-DR funds should primarily benefit low- to moderate-income (LMI) residents impacted by disasters, with LMI defined as individual beneficiaries or based on area eligibility. Following disasters, the usual requirement is that at least half of the grant funding must be used for activities that primarily benefit LMI persons, though Congress and HUD can raise or lower this threshold. One interviewee shared that CDBG-DR block grants reverse priority order consideration for projects compared to FEMA programs, making local communities first consider what areas would fit an area by socio-economic qualifications, and then based upon a flood risk profile.

Ultimately the final prioritization of projects, including acquisitions and elevations, is left to the local and state-level as FEMA requires applications to be submitted in a priority order by states. Both FEMA's HMGP and HUD's CDBG-DR programs have a base level of eligibility screening criteria for projects to meet, but interviewees who administer those programs all pointed to the local level for determining project needs and priorities. One FEMA official described: "Good mitigation comes from the local and state level. It's really up to the locals to come up with good ideas and project types because at the end of the day we review what they submit to us."

Local mitigation project applications are assembled at the municipal level, but also require review at the state level. For both FEMA and HUD's mitigation programs, the State of Rhode

[f] One exception to this is the Pre-Disaster Mitigation Program's consideration for small, impoverished communities, which may be eligible for a cost share up to 90 percent rather than the usual 75 percent.

Island decides how to manage and prioritize the applications before submitting to the federal level. For example, the state has an HMGP administrative plan in place at the state level, as well as defined criteria for evaluating eligible projects. An interviewee explained that the state has a review committee in place comprised of different state-level agency representatives, as well as ranking system and process for evaluating applications based on environmental, land use, socio-economic, mental health and other criteria. The full guidelines were not available for critical analysis in this thesis, so further analysis of distributional equity at the state level cannot be made.

From my interviews, I find that both FEMA's HMA and HUD's CDBG-DR programs do incorporate equity considerations. In the case of FEMA, this comes via the BCA formula, which has dimensions of spatial-environmental, socio-economic, and temporal equity built into its calculation. And in the case of CDBG-DR, the socio-economic equity considerations are incorporated directly into the program's eligibility standards, though the area eligibility requirement does not necessarily ensure program benefits go to lower-income households. I also identify an interplay between the local level and the federal level, with town and city governments using FEMA's BCA formulas to establish priority order for projects. While few interviewees indicated that socio-economic or temporal equity should be a priority in their decision-making processes, the structure of FEMA's BCA and use of it at the local level mean that these factors have some level of inclusion in local decision-making in Cranston and Westerly. As I argue in this thesis, however, more explicit planning and decision-making criteria that consider distributional and procedural equity are needed moving forward. Given the deference to federal standards as providing a sense of neutrality or fairness at the local level, these standards could be more impactful coming from the federal level.

Municipal and Individual Responsibility for Adaptation

> The town recognizes the importance of maintaining a resilient community and the impacts and damages of these storms also effect the municipality. As a group these private property owners are impacted, but if they can't get on their feet then we are also not helping ourselves out with them.
>
> - Amy, Grzybowski, Westerly Director of Planning

The concept of municipal-level government, supported by federal funds, intervening to assist individual property owners with disaster mitigation and climate change adaptation raises questions of responsibility. This pertains to two of my research questions: "What responsibility do municipal governments have to work with private property owners on adaptation" and "What responsibilities should private property owners have for adaptation." In asking interviewees about this topic, at the municipal level, the most common answers included the role of education, the role of protection, the obligation to not keep doing business the same way, and a moral obligation for government to intervene. From the private property owner perspective, the most common answers included the responsibility to be protected as best as possible, to have insurance, and to be engaged in public processes about adaptation.

Interviewees pointed to the role of municipal government to educate people in their community about climate change risks, mitigation options, and insurance. As one example of an educational role, a Westerly town official explained, "At this point with climate change and what we know . . . the best thing we can do is just alert people when they come in to buy properties, you know that, buyer beware." Westerly town officials shared that property sales agreements require realtors to include a flood risk disclosure, but that they also were not sure if people noticed those warnings or if they impacted decision-making. The town has also created an online tool that walks people through what their flood insurance covers and what it doesn't whether they are a resident or a commercial business owner.[120] Some interviewees highlighted

that local governments could make sure people in their towns learned about the risks they likely face. To this end, Rhode Island Statewide Planning and the Rhode Island Coastal Management Resources agency have invested in developing tools for communities to use to evaluate flooding and other risks from climate change in their communities. Education can also reduce future responsibility that may fall upon municipal governments as climate change impacts continue to be felt, particularly if they encourage private property owners to be proactive in protecting their homes and buildings where possible.

Many interviewees highlighted the role of local government to provide protection from flooding and other climate change risks. Protective measures were proposed from several perspectives: in terms of building defensive structures such as flood walls and culverts and more effective storm water management systems, in terms of enacting and enforcing relevant zoning codes and ordinances, and in terms of incentivizing, or "stimulating" individuals to take action and defend their own properties through programs such as FEMA's Community Rating System. Many interviewees also highlighted the obligation of government to focus on government-owned assets that serve everyone. One state official shared: "Municipalities need to focus first and foremost on the publicly owned infrastructure that allows their communities to continue on, and to ensure that they know what is at risk, and prioritize how they will respond to those risks. Whether it is the location of your fire stations, your schools, your sewage treatment facilities, your drinking water sources, these are all things that we know are definitely at risk in Rhode Island communities and they are very important things." Evident in these responses is the sentiment that municipal government first and foremost has a responsibility for protecting shared community assets, and secondarily, but also important, for pursuing strategies that could protect many private properties.

Related to the role of government in protecting municipalities and shared assets, several interviewees pointed to the responsibility of local government to not just pursue business as usual and instead to try to build back differently after storm events. One interviewee explained, "A lot of people just want to get back to normal the way things used to be. There is a glimmer of understanding that normal isn't going to be the same, but there is a lot more conversation that needs to happen at the local level for people to really grapple with what lies ahead." Zoning and building codes were mentioned in several interviews as tools to use to compel property owners to rebuild in a different way, particularly if strong and clear standards are put into place. The CDBG-DR program manager for Rhode Island highlighted that the program encouraged re-building in new ways, whereas FEMA funds were more restrictive in what they allowed. Not discussed in this paper, but frequently written about in other places, is the role of the National Flood Insurance Program in incentivizing rebuilding in risky areas.[121]

Finally, the theme of responsibility arose on moral grounds, in a sense of, "if not us, then who?" Mayor Scott Avedisian of Warwick, the town bordering Cranston that has also experienced severe flooding clarified, "Legally I don't think you have any [responsibility], but there is a moral responsibility if it is a quality of life issue. For a majority of people, property is their largest and most expensive asset." While many interviewees shared the sentiment that municipal government had some moral imperative to help private property owners impacted by flooding, they did not provide any bright lines for when and where municipal government should intervene to help private property owners. A few interviewees raised equity concerns, pointing to the primacy of the government's role to protect those who were least-resourced and most vulnerable to climate change impacts. Some interviewees shared that in many cases, property owners did not know they were in a floodplain when they purchased their homes, perhaps

meaning they could not be held responsible. Some homes on the coast of Misquamicut in Westerly, for example, have been passed down for several generations, long before sea-level rise became a risk. Yet these sentiments were balanced by a sense that municipal governments also had to be fiscally responsible in the strategies they pursued, and that securing federal funding to take action was necessary to move adaptation projects forward. And particularly where private property owners knowingly purchased land and buildings in known hazard areas, there was less empathy or expectation that municipal government should intervene.

Common in the interviews was also pragmatic economic argument tied to municipal responsibility to work with private property owners on adaptation. Namely, private properties in flood vulnerable areas are often important parts of a community's economic base. Amy Grzybowski from Westerly explained, "It's much easier for someone to say just move—for our case—just move Atlantic Avenue, take those businesses and move them back. It's easy to suggest that, but for a town, that's where our tax base is. We have those houses. We have those businesses. And that helps run the community. And if we lose that tourism industry, we lose a lot of what we bring in, in order to support the town."[122] This describes the paradox facing many coastal communities as they grapple with where to prioritize and what types of adaptation to pursue, and it helps explain why Westerly has been focused on elevating homes on the coastline. It also underscores that the sense of responsibility for working with municipal property owners ranges from the moral to the economically pragmatic. From a perspective of first-order socio-economic equity, it likely makes sense to focus assistance on lower-income households. However, a secondary consequence of such a focus could be a loss of coastal properties valuable to a community's vitality and tax base. As theses types of decisions become more common for communities to make, having clearer decision-making criteria will be important for adaptation

efforts, and municipalities will need to decide how to balance where to invest limited resources, who should benefit from them, and why those properties were prioritized

From the private property owner perspective, the most common answers included the responsibility to be protected as best as possible, to have flood and other types of insurance, and to be engaged in public processes about adaptation. Interviewees felt that property owners needed to take responsibility for protecting their property as much as possible, and suggested measures included flood proofing of properties or elevations of either utilities or entire structures. Another key protective measure mentioned was insurance. Many interviewees said that property owners were responsible for knowing about their flood risk and ensuring that they had thorough insurance policies for flooding. A Westerly town official explained, "It is up to the property owner to carry the right insurance so a town isn't responsible for every house in a disaster area." In the case of some properties, such as businesses, this could include purchasing multiple type of insurance to ensure protection including protection for the contents of a business and business interruption.[123] And finally, a majority of interviewees mentioned that property owners needed to be involved and engaged in public participation processes around adaptation and disaster mitigation in their communities.

In these answers, there is a balance in responsibility between private property owners and municipal government. There is a sense that property owners should take all necessary steps possible to protect their buildings against the risks of climate change, both via protective measure and via insurance. And a majority of interviewees felt that where properties were in truly dangerous places, municipal governments could step in and help via programs like buybacks and elevations, particularly where there are clear financial benefits to a community from doing so. Further defining criteria for what responsibility municipal government has to

help private property owners adapt will provide better clarity and expectations for what residents can expect from their local government, as well as expectations for what municipal government expects private property owners to do. As an example, in providing private assistance to businesses after Hurricane Sandy, the Westerly Chamber of Commerce used a criteria matrix to prioritize where limited funds could go. Their criteria included the economic impact of the business on the community, whether the business had adequate insurance coverage, and if the business took other protective measures before the storm. They used criteria like these to prioritize supporting businesses that took responsibility to mitigate damage before Hurricane Sandy hit.[124]

Role of Public Participation

> I wish there was one answer to find, but [there is] no one true answer for every community. Needs to be community by community with everyone at the table.
>
> - Dave Prescott, South County Coastkeeper, Save the Bay

I argue that as climate change impacts increase and we see disaster mitigation continue to merge with climate change adaptation efforts, municipal governments will increasingly be looked upon by private property owners for assistance. As such, municipal governments should more clearly define and plan for when, where, and how they will intervene to help private property owners.[125] Ideally these decision-making criteria will consider longer-term outcomes and include distributional equity criteria from different dimensions highlighted, including socio-economic. There is another dimension of equity that municipal governments can facilitate and support as part of adaptation planning: procedural equity. As discussed in Chapter 2, procedural equity refers to the process by which decisions are made, finding that a more inclusive or

democratic process will lead to more equitable outcomes. When asked about the role of public participation in adaptation planning, every interviewee cited it as extremely important, but also challenging.

Across the board, interviewees agreed that public participation should play an important role in adaptation planning at the municipal level. One interviewee explained, "Climate change affects everyone no matter where you live, it has impacts to everyone. They need to be at the table." This sentiment reflects what many interviewees described, the idea that climate change risks and impacts will impact whole communities means that decisions should be made with collective input, particularly where resources are limited. In some cases, including for municipal comprehensive plan updates, a minimum threshold of outreach to the public is required by state statute. And since municipal comprehensive plans now require the incorporation of climate change adaptation planning, some level of public participation in Rhode Island communities is ensured.

Public engagement is very important for figuring out the direction people desire for adaptation policies and for building public support for potential strategies. Mayor Scott Avedisian of Warwick reflected on his past experiences with disaster mitigation planning: "We would go in with a different ask next time with homeowners: what can we do to use the money in a different way? Maybe we do levees around whole neighborhoods or beach erosion work in a different manner. We didn't get buy-ins on buyouts." He explained what many interviewees shared, that public participation was important for making sure that adaptation priorities were collaboratively determined and reflected public preferences.

Interviews with public officials revealed that while public participation is important, it is also very challenging to get people involved and to figure out tangible steps and outcomes. When

asked about public engagement in the Cranston Comprehensive Plan update, an interviewee who sits on the Planning Commission shared that that he did not see a great response or turnout at public meetings around the recent plan update. However, he did note that in the past five years, he has seen a rise in interest and concern about climate change in Cranston.[126] In Westerly, town officials explained that there was a window of opportunity after storm events for public participation, and that they saw good turnout at the public meetings they held to share information following Hurricane Sandy. However, without a focusing event, interviewees felt that public engagement was challenging, particularly due to the uncertain nature of climate change risks and impacts and how to best intervene. One interview said, "It is really important to engage people in conversation. It is really difficult because it is hard to find the positive actions people can take . . . [we need to] think about taking steps that will increase short-term resilience of community and use that as an opportunity to get people engaged and thinking about what we will do." She expressed that public engagement was difficult, but focusing on tangible steps and outcomes could help get people interested.

It is important to acknowledge that public participation is a broad category and it can scale from city officials providing information to engagement where citizens have power to recommend or make decisions.[127] In this thesis, I argue that to ensure procedural equity, municipal governments need to develop inclusive and democratic public participation for adaptation planning both apart from and associated with disasters. In Cranston, municipal officials responded in part to organized demands from some citizens for action following the Floods of 2010. And in Westerly, there was also an expectation of municipal action to help private property owners after Hurricane Sandy. Both communities engaged some segments of the public following these storm events, but could do more to involve a wide range of residents

in proactive adaptation planning either via existing channels such as hazard mitigation planning or comprehensive planning, or through a separate process. Proactive public engagement strategies before and after storm events can ensure that citizen voices and needs about adaptation can be incorporated in a fair and equitable manner, both in a procedural sense and in terms of distributional equity.

Constraints on Action

> It's not for weak kneed or the faint of heart.
>
> -Marilyn Shellman, Westerly Town Planner

Interviews revealed several constraints from the buyback and elevation programs in Westerly and Cranston, which help to answer the question "How do federal policies and programs for elevations and buybacks shape adaptation on private property parcels at the community level?" These constraints include the timing of funding, staff capacity, and a reluctance of those living in coastal areas to move. Additionally, some of the fiscal shapers explained earlier in this paper, particularly funding availability, can also be viewed as influential constraints on adaptation planning.

Timing

In addition to the funding limitations, both FEMA and HUD funding, particularly after disasters, is slow to move. FEMA interviewees shared a challenge of their programs as being the pace at which HMGP funding moves. One employee who administers the program explains, "Our funding is not going out the door at the beginning. Typically it takes a good year before it moves . . . what is challenging is you don't have the final amount available until at least one year

later. You won't know how to prioritize and maximize funds if you don't know the amount." Here she describes how the HMGP funding allocation is a formula of 15 percent of the total funds obligated by FEMA to a state for recovery within the year following an event. This delay in determining the total amount of funding stretches the amount of time it takes to get projects prioritized, approved, and funded at the local level. Even when the HMGP funding amount is known, there still are many procedural steps at the local, state, and federal level to go through before a project can be completed. FEMA officials explained that while they try to review applications quickly, if any information is missing or incomplete, there is a delay as the application passes back to the local level for modification. From the local side, municipal-level officials describe applications for projects such as acquisitions as being complex and requiring significant investments in staff time to complete.

Similarly, HUD CDBG-DR funding does not move rapidly to communities. First, Congress must approve funding following each disaster. In the case of Hurricane Sandy, the process became politicized and took three months.[128] And since funding after each disaster declaration is subject to Congressional authorization, the guidelines HUD must follow and pass on to the local level often change, as do timelines for how long states have to use funds. After the Floods of 2010, there was no timeline for when funds needed to be allocated, whereas for Hurricane Sandy funds, the state has until 2017 to obligate before funds revert back to the Treasury Department.[129] Finally, CDBG-DR funding has detailed criteria projects must follow, and developing applications at the local level takes significant amounts of time.

As a result of these timing constraints, disaster mitigation projects do not happen quickly following storm events. In terms of acquisition programs in Cranston and Westerly, the slow-moving nature of federal funding meant that people spent many years in limbo waiting for

project funding. City officials report resident frustration as they searched for different sources of funding. In the case of Cranston, city officials have tried to tap multiple federal funding sources for acquisition projects after an initial FEMA funding application was rejected after the Floods of 2010. In Westerly, the multi-year time delay in implementing its acquisition program meant that half of the originally interested applicants decided not to participate. A Westerly official explained, "In the height of the incident, people want to move, but after time passed, people forgot what they went through and changed their minds. The delay in getting funding meant that they had to borrow to make repairs and their mortgages were too high." Another interviewee shared that despite trying to communicate well, local residents may have lost trust or confidence that the buyback would happen and therefore declined to participate once funds finally became available. These findings point towards a need for changes at the federal level that facilitate moving funding to communities faster.

Staff Capacity

A second commonly identified constraint from my interviews was staff capacity. A majority of interviewees shared that pursuing adaptation options such as buyback and elevation programs required significant staff capacity, both in terms of time, and in terms of the learning curve required to effectively access federal disaster mitigation programs. As the town planner from Westerly explained, "FEMA came out with a buyout program . . . because it was my first time, it was daunting; I really had no background in doing anything. I didn't know how to do a BCA. So I struggled through it and the score that qualified us for the buyback program. It took two years to award the funding. And another two years just to get it planned and to hire the lawyers and do the legal work of the buyouts."[130] She described that especially during the first few times using FEMA or HUD programs, it took an investment of time and capacity to go through the

necessary steps to apply for the programs. A FEMA official agreed, saying, "Westerly and Cranston have relatively small staff and these are time intensive projects. I've heard from towns that we overwhelm them in terms of time it takes and information that is needed. It's a lot of work on the side of the towns."[131]

The amount of commitment it takes to apply for federal disaster mitigation funding meant that Rhode Island had a staff capacity gap, especially following the Floods of 2010, which were the first federally declared disaster in the state in recent memory. In response to the influx of funding, some cities, like Cranston, hired a dedicated staff person to look out for grants and apply for federal and other funding opportunities. Rhode Island's CDBG-DR administrator explained that now that the state has utilized the program for a few years, it is getting easier to work with municipalities to develop eligible applications, whereas in the early years municipalities left unused money on the table.[132] Several interviewees pointed to distributional equity issues tied with amount of staff capacity required to apply for federal funding. This reality can produce inequities at the local level as better resourced cities are in better positions to get funding, particularly from FEMA which does not have socio-economic considerations built into it's programs as HUD does. Since FEMA funding requires a hazard mitigation plan and both HUD and FEMA require grant applications to be developed at the local level, federal funding for disaster mitigation is not likely distributed evenly across Rhode Island's impacted communities.

Reluctance to Move

A final commonly identified barrier is a reluctance to move amongst some homeowners who may otherwise be eligible for acquisition programs. In this thesis, I did not try to collect evidence of this phenomenon, but it arose as a reoccurring theme in my interviews. As the

Cranston City Council President described, "The only barriers were some of the homeowners who didn't want to move or sell. They wanted to stay where they were and were attached to their houses."[133] In both coastal and riverine areas, interviewees shared there was reluctance amongst home and other property owners to move, but that it was especially strong in coastal areas, possibly due to high property values and the high value placed on natural beauty in those areas. A FEMA employee explained her experience with acquisition program usage as, "People who live on the coast want to be there and elevate. More often you see acquisition demolition inland." The reluctance of people to move illustrates the challenge faced by local officials as some residents demand acquisition programs and others refuse to participate.

Several forces beyond the high cost per property may also be keeping acquisition programs from happening more often. First, interviewees explained that towns have an incentive to keep coastal properties in place as long as possible to keep their property tax based robust. Second, the National Flood Insurance Program continues to provide coverage to property owners living in high flood risk areas, and some interviewees argued that the collectivization of this risk encouraged living in coastal areas. And finally, some interviewees pointed towards private property rights as a burden. One Westerly official described the challenge in his community, "You have the private property rights of people. I'm not sure if people will give up their beachfront property. Beachfront properties also contribute a significant amount of taxes to the town. You have a double-edged sword. Who wants to go from front row to back row?" In interviews in both Cranston and Westerly, town officials expressed strong reluctance to use takings or other more heavy-handed property management approaches to address climate change risks. Federal funding also supports the rights of private property owners by requiring acquisition and elevation programs to be voluntary.

Interviewees pointed to education and opportunities for public participation as two potential ways to encourage participation in acquisition and other adaptation programs. One FEMA official shared that in her experience, resident participation was successful to securing support for acquisition programs. This reality underscores the importance of meaningful public engagement to make sure those in flood vulnerable areas are aware of their risks and options, and a defined strategy on the part of local governments for when, where, and how they will use different adaptation program options to assist private property owners.

Summary of Findings

By examining in-depth how Cranston and Westerly are using buyback and elevation programs on private property to mitigate disasters and prepare for climate change, I found six key themes to answer my research questions. My questions included understanding how federal policies for acquisitions and elevations shape adaptation at the local level, how planners prioritize and fund these projects, how different aspects of equity are incorporated into municipal-level decisions, what the responsibilities are of municipalities and private property owners for adaptation, and how adaptation efforts with private property owners should be pursued at the local level moving forward. The findings from my research questions include:

- First, the availability and structure of federal disaster mitigation funding shapes adaptation planning at the local level. The limited levels of funding available impact what municipalities will do, leads to incremental adaptation planning efforts, and mean that communities need to act quickly to implement programs when windows of opportunity for funding open after disasters strike. Apart from federal funding, municipalities in Rhode Island look to more traditional planning tools such as zoning and

building codes to adapt to a changing climate.

- Second, Westerly and Cranston have prioritized the use of buyback and elevation programs based on spatial-environmental risk. Neither community has defined standards for determining which properties are at the greatest risk and should therefore be prioritized. However, on a more informal basis, each has prioritized properties with high flood risks during storm events for acquisition and elevation programs.
- Third, FEMA's benefit-cost analysis tool also prioritizes spatial-environmental equity, calculating the costs and benefits of a proposed project based in large part on future projected risks from flooding and other disaster. Secondarily, the BCA also incorporates a level of socio-economic equity, particularly since the agency has set maximum project cost thresholds for avoiding BCAs that favor lower-cost acquisition and elevation projects.
- Fourth, interviewees shared that municipal governments have a responsibility to work with private property owners, particularly in terms of providing relevant risk information, protection where possible, and in rebuilding to increase resilience. However, there are no established bright lines around where the responsibility of the municipal government should be focused and where private property owners should be responsible.
- Fifth, public participation in adaptation planning decisions was seen as important in nearly every interview, but it is not a regular part of adaptation planning in either Westerly or Cranston.
- Sixth, constraints on local action for buyback and elevation programs include the long amount of time it takes to receive FEMA and HUD funds, limited staff capacity at the local level, and reluctance of people to move from their homes where retreat is an option.

These findings show how adaptation planning and its overlap with disaster mitigation planning is still relatively new in Westerly, Cranston, and other coastal communities facing climate change risks. Given the constrained nature in which buyback and elevation programs have been implemented at the local level, the following section highlights future potential directions for improving adaptation planning on private property at the local, state, and federal level. In particular, I argue that at the local level, municipalities should work to combine distributional and procedural equity into their adaptation plans for working with private property owners.

Conclusion: Future Directions for Local-level Adaptation on Private Property

As the impacts of climate change rise, federal programs from FEMA and HUD that have been designated for disaster mitigation will increasingly be used for adaptation. However, I find a strong mismatch between the scale and structure of these programmatic resources and the level of local need. The majority of federal disaster mitigation funding is linked to the occurrence of disasters, making it challenging for communities to prepare proactively in advance of future storm and other climate-related events. In the two municipalities in my thesis, Westerly and Cranston, federal mitigation programs have shaped and constrained local action. Following disaster events, planners came up with broader plans for using acquisitions and elevations to reduce future flooding risks, but federal program constraints led to delayed implementation and patchwork results. These case studies point to a federal funding system mismatch with climate change impacts and disasters, which leads to reactionary and incremental planning. Further, there is little state or local-level funding dedicated to adaption or disaster mitigation in Rhode Island, leaving local governments to depend on federal funding.

Both Westerly and Cranston have used a combination of buyback programs, elevation programs, and long-term planning tools to work on adaptation on individual parcels of private property. However, buyback and elevation programs are expensive undertakings, and targeting such programs towards private property owners means they will benefit some people over others. Given the scarcity of resources and the disproportionate risks and vulnerabilities to climate change within communities, I argue that local level adaptation needs to include both procedural and justice-oriented distributional equity. Procedural equity refers to the process by which decisions are made, and how democratic or inclusive that process may be. In the case of adaptation planning, procedural equity also needs to be proactive, with planning taking place

before disasters strike, so plans can be collectively determined. Justice-oriented distributional equity finds that policies and programs should prioritize those facing the greatest risks from climate change, and who have the least ability to address those risks. Below I outline future opportunities for building equity, both distributional and procedural, into adaptation decision-making. I also propose ideas for improving buyback, elevation, and other adaptation efforts with private property owners at different levels of government.

Local Level

Though I find that adaptation efforts at the municipal level are largely shaped by federal program structures and funding opportunities, local governments still ultimately have agency to decide what adaptation programs and goals to pursue. Within the constraints of federal programs, municipalities can proactively plan for how to take advantage of federal funding resources, particularly those tied to disasters. And apart from federal mitigation funding, municipalities can plan for climate change impacts, particularly by looking at everyday planning and funding decisions and adding climate risk considerations to those decisions.[134] My analysis in this thesis focuses on the former, looking at how municipalities can operate more effectively within the confines of the federal disaster mitigation funding system. Even within the current fractured system, local governments can plan and prioritize ahead of disaster events, making it easier to put adaptation programs into place once funding is available or by carving out separate funding sources and programs.

In Cranston and Westerly, I found that properties targeted for acquisition or elevation programs were prioritized by local officials after disaster events primarily based on designations of spatial-environmental risk, and secondarily based on socio-economic criteria from FEMA's BCA tool and HUD CDBG-DR program guidelines, where applicable. Given the relative

newness of adaptation planning, however, neither community has developed clear public processes or criteria to define when they will work with private property owners, how they will prioritize who they work with, and what level of resources they will dedicate. Based on the disproportionate levels of climate change-related vulnerability facing some people and communities, equity must be a priority consideration when planning for adaptation programs.[135]

Specifically, I argue that municipal governments need to prioritize procedural equity and use a public participation process to develop criteria for buyback, elevation, and other disaster mitigation programs that are merging with adaptation. This means designing an inclusive and democratic strategy for engaging citizens in setting priorities for adaptation planning related to disaster mitigation and for incorporating their input before disasters strike. In both Cranston and Westerly, buyback and elevation programs were reactive, put in place with little to no public input in response to disaster events and not from a pre-disaster public planning process. Local governments in Rhode Island already have existing opportunities for the public to participate they could use. Municipalities must periodically update their comprehensive plans and hazard mitigation plans and invite the public to participate, both of which provide the opportunity to develop objectives, processes, and standards for how they will pursue adaptation with private property owners.

However, local governments can and should go further to engage citizens, particularly populations most vulnerable to climate change risks. Ahead of a disaster event, they can organize a public decision making process to determine how the local government should prioritize using disaster mitigation funding and how to work with private property owners on adaptation. Planning for adaptation and mitigation before a disaster strikes opens a window for engaging the public around issues of vulnerability and equity in their community. Susskind

suggests towns convene representative stakeholder groups and use strategies such as joint fact-finding, role-playing, and scenario planning to facilitate making adaptation decisions.[136] The mayor of Warwick, Rhode Island emphasized that participation was especially important for ensuring that municipal actions aligned with what people wanted, asking people in affected neighborhoods "what can we do to use the money in a different way?"[137]

I do not advocate for a singular approach to public participation in this thesis. Instead I argue that whatever process is chosen, to be equitable it must be inclusive, involving a broad representation of the public, particularly populations vulnerable to climate change. The process also must be democratic, allowing for deliberation so participants can raise different ideas and discuss priorities for adaptation programs on private property, working toward consensus with the guidance of a neutral facilitator. Ahead of time, elected officials and planners should commit to how they will use the outcomes of the process. Municipalities should use criteria generated by such a process to establish more formal programs at the local-level around how they will spend disaster mitigation funding, including on acquisitions and elevations.

Pursuing procedural equity alone, however, will not guarantee equitable outcomes. Municipal governments also need to determine justice-oriented distributional equity standards, which can be developed as part of the public participation process. Equity standards should include programmatic criteria for when acquisitions, elevations, and other adaptation strategies will be employed, as well as how to determine cost-matches. Specific equity criteria should be defined locally, but at a minimum need to include clear guidelines for how to prioritize helping vulnerable populations and properties. Guidelines should be based on spatial-environmental risks to storm impacts and flooding and socio-economic criteria including household income and wealth. Spatial-environmental and socio-economic equity need to be considered in tandem since

climate vulnerability arises from both geographic risk and from how socio-economic status may limit people's ability to protect themselves from climate change risks. Using these two criteria, for example, a community may find that it should not prioritize elevating second homes and should instead focus on lower-income and lower-wealth primary homeowners and renters in high-risk areas.

Depending on the community, other criteria may be found important as well. These could include the age of residents, the length of time they have lived in the community, the mobility of residents, whether someone owns their home or is a renter, and the mortgage on a property. However, adding more equity criteria can complicate determining vulnerability and prioritizing interventions. One potential adjudication method could be to offer an appeals process for property owners who would like to participate in an elevation or buyback program, but may not meet locally-defined spatial-environmental or socio-economic criteria. Such a process could provide space for considering equity criteria that may be harder to apply or measure across the board.

A carefully structured public engagement process can introduce equity concepts and potential criteria for prioritizing risk, vulnerability, and adaptation projects in a community. Before engaging in adaptation projects, municipalities should also consider how to gauge the potential impacts of adaptation projects on surrounding areas and to evaluate second-order impacts that may fall to vulnerable populations. Ultimately, equity criteria will not look the same in each community. Criteria should be developed based on a combined approach that emphasizes procedural and distributional equity, encouraging public input from citizens through an inclusive and democratic process, but ensuring that priority setting includes equity standards for vulnerable populations.

In addition to determining priorities and equity criteria, local governments should also consider how they will fund adaptation efforts at the local level. Currently municipal governments have limited resources to adapt to climate change and in the case of Westerly and Cranston, federal hazard mitigation program funding from FEMA and HUD has largely determined the scale of their adaptation programs with individual private property owners. Knowing the need to adapt to rising sea levels and more intense storm events in New England, municipal governments can begin to build dedicated adaptation funding streams that ensure they can meet federal cost-matches when opportunities arise. In the case of Cranston, the city has anticipated some of its adaptation needs by setting aside funds for future property acquisitions via its Open Space Bond.[138] The Massachusetts Community Preservation Act provides another model municipalities could use. It allows communities to create a Community Preservation Fund for local conservation and community development programs by adding a surcharge on local property taxes. In Massachusetts, the act was approved at the state level, but requires local ballot initiatives at the local level for initiation.[139] In Westerly, the town planner shared a land bank program as another potential long-term strategy. In the town's case, a core business district is located near the oceanfront and will eventually need to move back. The town could preemptively begin to buy properties in another part of the town as they come onto the market and begin to assist and encourage businesses in relocating via a revolving loan fund.[140] With all local cost-matches for adaptation programs, municipalities can also scale the cost match obligations of private property owners based on their socio-economic status, which will allow city resources to stretch further.

The experience of Cranston and Westerly showed that buyback and elevation tools can be effective adaptation strategies, but they should be used strategically and as part of a broader

local-level plan for adaptation and disaster mitigation. Interviewees described acquisitions as providing the "ultimate" mitigation since they remove properties from at-risk areas entirely. However, they are expensive and time intensive, so should be prioritized especially towards vulnerable populations who live in high risk areas and have less means to adapt. Buyback programs also provide flood mitigation benefits to surrounding properties by restoring more of the floodplain. Elevation programs are the best flood and storm resilience strategy for private property owners who want to stay on their properties. They are less expensive than acquisition programs, allow towns to maintain their tax base, and municipal governments can offset the cost of the program by requiring property owners to cover the local cost match, which can be scaled based on socio-economic status. Elevations are a temporary solution, however, and given their use in Westerly in coastal areas and on second homes, may be disproportionately benefiting wealthier people. With both programs, local governments should consider the precedents they set when offering the programs to some private property owners and not others. A precedent based on clear programmatic criteria and with equity standards built in will produce fairer results in a community and ensure that vulnerable populations are not left behind.

State Level

Rhode Island has strong state-level institutions including the Coastal Resources Management Council (CRMC) and the Rhode Island Statewide Planning Program. These agencies have begun to work proactively with local governments on adaptation planning by providing climate risk information, facilitating public participation around coastal management strategies for adaptation, and overseeing comprehensive plan updates that include adaptation. The state could be more proactive, however, in ensuring that equity standards become part of adaptation planning at the local level.

First, the state could incorporate stronger equity standards into statewide plans for administering hazard mitigation funds, including the state's Hazard Mitigation Grant Program (HMGP) Administrative Plan and its CDBG-DR Administrative Plan. Both of these plans include criteria for how the state reviews proposed local-level hazard mitigation projects, and could be strengthened to include criteria for prioritizing projects based on spatial-environmental and socio-economic equity. Second, Rhode Island could focus on providing capacity building for less resourced and vulnerable Rhode Island municipalities. Applying for hazard mitigation funds is time intensive and the two communities in this thesis have been more proactive than other Rhode Island communities in applying for program funding. The state's CDBG-DR program manager shared that generating strong applications has been challenging due to limited staff capacity resulting in federal mitigation funding left unused by some municipalities.[141]

Rhode Island should also be more proactive in providing funding support for municipal governments seeking to adapt to climate change. The Rhode Island legislature should consider passing adaptation legislation that includes dedicated funding sources for local-level efforts and to support proactive planning. Currently the state has no dedicated adaptation programs with funding streams for local governments, helping to drive local projects shaped by the timing, scale, and programmatic requirements of federal hazard mitigation funds. The Community Preservation Act model described in the section above is one potential option for funding local-level adaptation. The legislature should also consider making its property tax cap law more flexible, which could be done by exempting tax revenues from new growth from the cap. This approach could help provide local governments with a dedicated funding stream for adaptation.

Funding at the state level could also take more innovative forms. The state could create financing programs that help property owners pay for retrofits that increase disaster resilience. A

CRMC staff member shared that the agency is beginning to explore a partnership with the Insurance Institute for Business and Home Safety that will allow Rhode Island to participate in the Fortify Program to retrofit existing coastal homes and businesses to make them more resilient to storm surges and high winds. The program offers property owners insurance discounts of increasing levels as they retrofit their homes, businesses, or other buildings.[142] Financing programs to help homeowners with resiliency retrofits can also be designed to meet the needs of lower-income property owners by providing more generous interest rates or subsidies, or to encourage landlords to renovate properties that house lower-income tenants. Given their financial interest, banks with mortgages on flood vulnerable properties could also be partners in financing retrofits. State financing to help property owners protect their buildings can provide an important alternative where federal funding for adaptation is lacking.

Federal Level

Change at the federal level can be considered in terms of administrative changes to disaster mitigation programs at FEMA and HUD and in terms of legislative changes via Congress, though the latter may be more aspirational than possible currently. In terms of low-hanging administrative changes, FEMA and HUD could work to decrease the administrative burden of their programs so less local-level staff capacity is required to utilize them. Similarly, they could work to shorten the administrative process from the federal side that contributes to making disaster mitigation funding slow to reach communities. To help increase distributional equity in their programs, FEMA could require that hazard mitigation plans include standards and criteria for how municipalities will use buyback and elevation programs and more generally address the needs of vulnerable populations in their communities. FEMA could also revisit its BCA formula and add prioritization to the formula for populations vulnerable to climate change. And HUD

could evaluate the impact of its area eligibility option for distributing CDBG-DR funding to see if funds distributed in that manner are benefiting low to moderate-income households.

As climate change impacts increase and disaster mitigation programs are being used for climate change adaptation, Congress will need to determine if federal funds for climate change adaptation should stay dispersed throughout different federal departments and agencies or if a new more unified structure is needed. In particular, decoupling disaster mitigation funding from disaster events could have a positive impact for adaptation planning at the local level. Local governments would be able to plan and prioritize ways to adapt to climate change impacts apart from a post-disaster environment when they most lack capacity. Significant funding for adaptation could be raised through channels that link adaptation costs to beneficiaries, such as by adding a surcharge to flood insurance premiums or to home sales. Increasing federal support for local-level adaptation planning and programs now could also save resources in the long run by allowing communities to proactively prepare for climate change impacts.

Concluding Reflection

With global mitigation efforts failing, climate change adaptation has become a local level responsibility and needs to become a local level priority. In the case of Rhode Island, state-level changes to local comprehensive plans mean that municipalities are beginning to incorporate adaptation into everyday planning decisions. However, more traditional planning tools such as changing building codes and zoning will not impact or protect existing structures and buildings. In smaller coastal communities, a fractured federal funding system means that municipalities strongly rely on federal disaster mitigation funding to work with private property owners on adaptation. As disasters and their severity increase, local-level governments need to proactively

plan for how they will prioritize limited resources and work with private property owners on adaptation. I argue for an approach to adaptation planning that combines procedural and justice-oriented distributional equity. Specifically, priorities should be set via a public participation process that is inclusive and democratic, and at a minimum, equity criteria need to consider the spatial environmental risk and socio-economic status of a property owner and those who live on that site. Coastal communities have a range of interventions they can use when working with private property owners; however, without proactive planning, those efforts are not likely to be comprehensive or to produce equitable results.

List of Interviews

Cranston		
	Jason Pezullo	Principal Planner
	Peter LaPolla	Director of Planning
	Larry DiBoni	Economic Development Director
	Mark Motte	Planning Commission Member
	John Lanni	City Council President
	Arthur Handy	RI State Legislature Representative
Westerly		
	Amy Grzybowski	Director of Planning, Code Enforcement, and Grant Administration
	David Murphy	Building Official
	Marilyn Shellman	Town Planner
	Jason Parker	Zoning Official
	David Thompson	Tax Assessor
	Dave Prescott	South County Coastkeeper, Save the Bay
	Lisa Konicki	Chamber of Commerce Director
FEMA		
	Donna Nelson	FEMA Hazard Mitigation Assistance Specialist
	Jody Springer	FEMA BCA, Grants Data Analysis and Tools
	Stephanie Leydon	FEMA Hazard Mitigation Assistance Specialist
Rhode Island		
	J. Timmons Roberts	Professor of Environmental Studies and Sociology at Brown
	Meg Kerr	Clean Water Action Rhode Island Director
	Scott Avedisian	Mayor of Warwick
	Jared Rhodes	Rhode Island Statewide Planning Chief
	Abel Collins	South Kingstown City Council Representative
	James Boyd	Coastal Resources Management Council Policy Analyst
	Laura Sullivan	State Office of Housing and Community Development Program Services Officer

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