

Pathways to Climate Resilience:

Strategies for the Greater Boston Area



An analysis for the Barr Foundation • By the Consensus Building Institute

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ABOUT THIS ANALYSIS

In the summer of 2018, the Barr Foundation contracted with the Consensus Building Institute (CBI) to conduct a scan of highlights of climate resilience activities in the greater Boston area and to identify opportunities for ramping up those activities in coming years. The CBI team reviewed relevant technical reports and interviewed 36 individuals who work climate resilience.

The ideas described in this document are the research team's synthesis of the broad knowledge about resilience activities today from the expertise of those with whom the team spoke and corresponded. The team would like to thank all of them for their insights and wisdom, while taking full responsibility for any errors or omissions.

CBI is a nonprofit organization with decades of experience helping leaders collaborate to solve complex problems. CBI staff are experts in facilitation, mediation, capacity-building, citizen engagement, and organizational strategy and development. CBI is committed to using these skills to build collaboration on today's most significant social, environmental, and economic challenges. Learn more at cbi.org

The Barr Foundation's mission is to invest in human, natural, and creative potential, serving as thoughtful stewards and catalysts. Based in Boston, Barr focuses regionally, and selectively engages nationally, working in partnership with nonprofits, foundations, the public sector, and civic and business leaders to elevate the arts, advance solutions for climate change, and connect all students to success in high school and beyond. Founded in 1997, Barr now has assets of \$1.8 billion, and has contributed more than \$911 million to charitable causes. For more information, visit barrfoundation.org or follow [@BarrFdn](https://twitter.com/BarrFdn) on Twitter and Facebook.



TABLE OF CONTENTS

02 About this Analysis

04 Introduction & Executive Summary

08 Research Methodology

07 Strengthening Climate Resilience in the Greater Boston Area: Emerging Strategies

- 07 1 Assess local vulnerabilities and plan proactively.
- 09 2 Improve municipal staff capacity to advance climate resilience.
- 10 3 Learn from and take action with peer communities.
- 12 4 Build resilience on a foundation of equity and community values.
- 14 5 Drive private sector action to strengthen local resilience.
- 17 6 Create public support for resilience action.
- 18 7 Institutionalize resilience through policy.

19 Opportunities

22 Appendices

- 22 Appendix I: People interviewed
- 23 Appendix II: Bibliography of resilience resources
- 26 Appendix III: Tabulated survey responses on resilience strategies

INTRODUCTION & EXECUTIVE SUMMARY

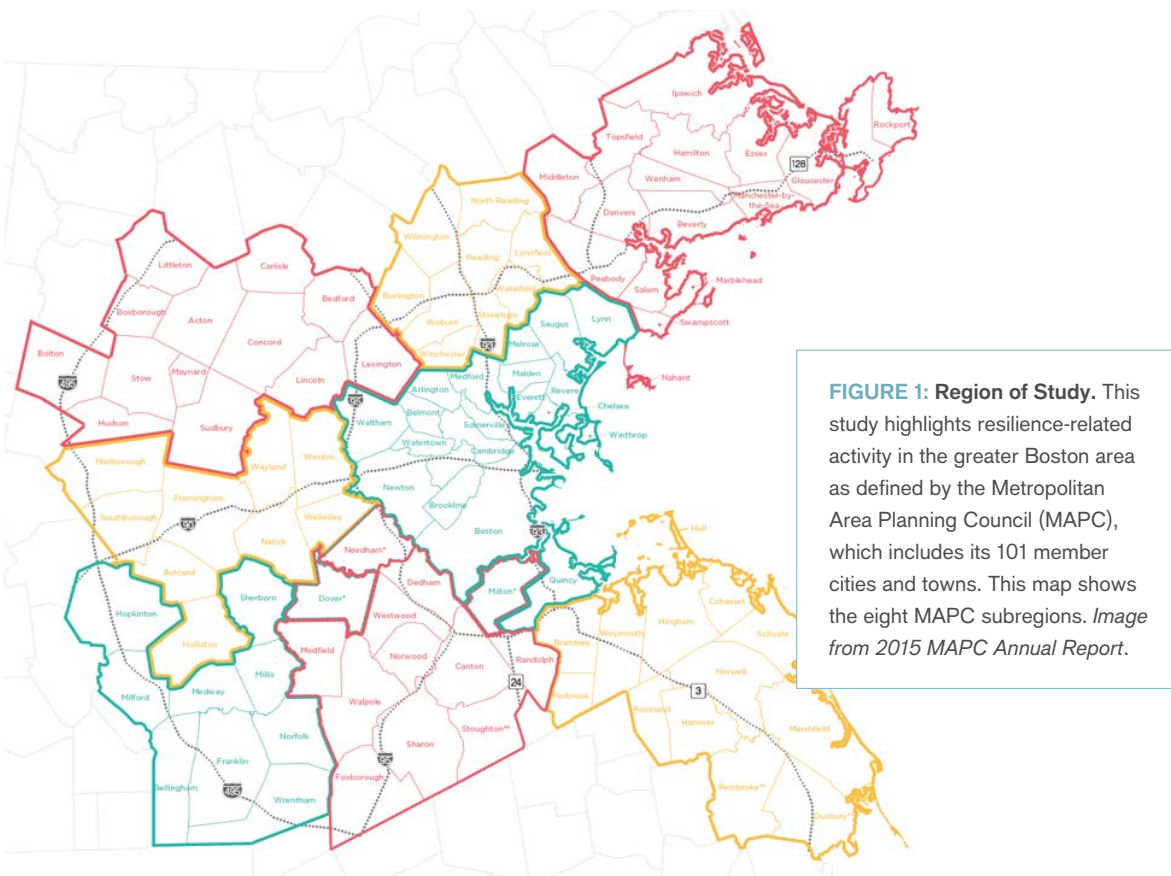
The Barr Foundation believes that:

Climate resilient communities protect and work for all people. To achieve this vital goal, neighbors, businesses, nonprofits, and governments must work together to design and implement equitable solutions for withstanding and adapting to climate impacts, strengthening physical and social infrastructure, and supporting community-led solutions.

While climate change is a global challenge, cities, states, and regions in the United States can act as leaders. Implementing innovative actions at these scales could catalyze movements for greater resilience across the country. Opportunities to strengthen climate resilience in the Metro Boston area increase daily: educational institutions are conducting critical research, leading municipalities are assessing

vulnerabilities and taking steps to enhance their infrastructure, state agencies are providing municipalities with pathways and resources, and businesses are increasingly tuning in to their role. Yet significant work lies ahead. Municipalities and institutions are, by and large, early in the process of adaptation and resilience planning. Limited funding, a lack of scientific knowledge, a lack of staff capacity, and political constraints obstruct ambitious resilience efforts.

There are abundant opportunities to do more and to try new approaches by sharing resources and lessons learned. Innovators are addressing climate risks by reaching into communities and across municipalities, by encouraging collective ownership and coordinated action, and by offering tools and aligning incentives. Among the many current activities we learned about in our scan, we have chosen to highlight a suite of seven municipal-scale strategies to strengthen climate resilience across this region. These are strategies that are especially needed and seem promising at this time.



1 Assess local vulnerabilities and plan proactively.

Vulnerabilities to and potential remedies for climate impacts are connected to many priorities which municipalities already work on. Inventorying these vulnerabilities can help identify opportunities to enhance resilience at a range of scales. Land preserved for open space and recreation can also contribute to stormwater management and mitigate the impacts of extreme precipitation; tree planting and green beautification efforts can also help keep neighborhoods cool. These intersections are opportunities to use existing mechanisms and funding to achieve resilience goals. Municipalities that fold resilience work into other planning efforts (e.g. stormwater management and hazard mitigation) will benefit from the efficient and opportunistic deployment of resources. Partnering across departments and sharing expertise will produce creative solutions to address the high priority issues at hand.

2 Improve municipal staff capacity to advance climate resilience.

In the resource-constrained context of municipal budgets, city staff must balance competing priorities and navigate a complex web of funding sources and other types of assistance. To develop and execute rigorous resilience-related plans, municipal staff need a clear political mandate and tactical knowledge of existing approaches and tools likely to be most beneficial. Increasing the number of municipal staff members who view preparing for and adapting to climate change as part of their work and increasing the capacity of those already working on climate issues are key steps to strengthening action on resilience.

3 Learn from and take action with peer communities.

Municipalities can learn much from each others' experiences, use of resources and tools, successes, and challenges. Creating networks and structures to share information, best practices, and resources will allow municipalities to progress more quickly and use their limited time and resources more efficiently than they would without such shared learning.

4 Build resilience on a foundation of equity and community values.

Action on climate resilience should address locally-defined community needs while also working to mitigate socio-economic disparities and environmental injustice. Investments into climate resilience that are not integrated with equity goals have the potential to deepen and exacerbate existing disparities. Buffering against climate impacts will require significant, ongoing investment; those funds should flow through channels that help lift up local communities, particularly

underserved populations. Investing in neighborhood services and beautification; local green job creation and training; and collective ownership of land, housing, and renewable energy developments will help counter historically inequitable patterns while strengthening the social and physical resilience of communities.

5 Drive private sector action to strengthen local resilience.

Government action is only one piece of the puzzle of enhancing resilience, as significant portions of vulnerable infrastructure, building stock, and social services sit outside of the public sector's control. Communities are more resilient—socially and economically—when businesses understand their climate risks, have emergency plans, are working to become more resilient, and can also serve as resources to the communities during emergencies. Businesses can support each other in identifying meaningful resilience strategies and creating a culture that reinforces the value of resilience.

6 Create public support for resilience action.

To strengthen the buy-in of community stakeholders and cultivate support from municipal leadership, those working on climate resilience must make a clear case for the opportunity to realize significant co-benefits, including a cleaner environment with more opportunities for recreation, more robust transit systems, and improved economic equality and investment in communities. A wide and varied group of partner organizations and community groups should be empowered to deliver these messages in the terms most relevant for their memberships and constituencies.

7 Institutionalize resilience through policy.

Even in the most forward-looking municipalities, policies have not yet been revised to account and plan for future conditions. The most updated climate vulnerability models and adaptation strategies must be comprehensively integrated into municipal planning, zoning, and regulation. New sources of funding will be needed for municipalities to implement and act on policies in alignment with resilience goals.

Below, each strategy is described more fully with the challenge it addresses, pathways for progress, and select case studies. The analysis concludes with a list of key opportunities for municipalities and their partners to pursue as they work to become more resilient.

Research Methodology

For this study, staff from the Consensus Building Institute (CBI)¹ conducted primary and secondary research to identify, at a high level, the characteristics of and trends behind leaders, catalysts, and capacity-builders working on climate resilience in the greater Boston region, with a focus on the municipal scale.

The CBI team interviewed 36 individuals from municipalities, state and federal agencies, non-governmental institutions, and research institutions to learn what climate resilience planning or action they have undertaken, or will be undertaking in the future, and to hear their thoughts on the state of resilience planning in the region. Interviewees were asked to describe 1) the state of climate resilience activities in the greater Boston area; 2) any vulnerability assessments or adaptation action planning or processes undertaken to date; 3) any climate resilience-related projects implemented or networks built; 4) key issues

intersecting with resilience they or their organization are working on; 5) current challenges to or opportunities for improving climate adaptation/resilience activities; 6) other key partners, leaders, funders, and resources in this area. See Appendix I for a list of interviewees.

CBI reviewed academic literature and white papers on resilience, including a number of plans and materials produced by interview subjects. See the bibliography in Appendix II for a list of resilience resources reviewed. Finally, CBI conducted a follow-up survey with interviewees after synthesizing findings into the strategies listed above. For each strategy, the survey asked respondents to assess its state of development and deployment in the greater Boston area, as well as the funding available to implement it, to the best of their knowledge. Tabulated aggregate survey results are in Appendix III.



¹ The CBI research team consisted of Elizabeth Cooper, Ona Ferguson, and Osamu Kumasaka.

Strengthening Climate Resilience in the Greater Boston Area: Emerging Strategies

The resilience challenges at hand are complex and must be dealt with holistically. The strategies described here require an all-hands-on-deck approach with unprecedented levels of collaboration across departments and among entities. Yet, there is no single path municipalities will follow to achieve climate resilience. Towns and cities across the Commonwealth face distinct resilience-related challenges and opportunities related to their populations, infrastructure, geography, governance, and budgets. While the most fruitful pathways and measures of success will vary widely among municipalities, these seven strategies will be key to improve climate resilience in the greater Boston area.

1 Assess local vulnerabilities and plan proactively.

CHALLENGES

Without an assessment of their vulnerabilities, municipalities cannot proactively plan for climate resilience and, instead, can only respond to emergencies and rebuild from disasters. Furthermore, municipalities that have not yet analyzed their local vulnerabilities and opportunities to build resilience are less prepared to participate in the cross-jurisdictional collaboration required to achieve resilience at a regional or watershed scale.

PATHWAYS

Better science and more precise data are resulting in new maps and models to predict climate impacts and form the basis for actionable resilience plans. For example, the

Massachusetts Department of Transportation worked with the Woods Hole Group, a private engineering firm, and University of Massachusetts and University of New Hampshire researchers to develop a sophisticated model of predicted flood risks and flood depths due to coastal storms and sea level rise in Boston Harbor. This modeling in 2015, conducted to analyze the Central Artery/Tunnel's vulnerability, has been the basis of much of the recent planning for flood impacts in Boston and the 13 "urban core" cities around it.

Unlike long-standing FEMA flood hazard maps² that are largely based on the damage wrought by historical storms, this flood model uses hundreds of simulated storms to better predict the water's path, with analyses accounting for storm hydrodynamics, future sea level rise, and predicted temperatures.³ Such maps help produce detailed vulnerability assessments to identify key local needs. *The Trust for Public Land (TPL)* has developed the Climate-Smart Cities program, an online

² Recent updates to FEMA flood hazard maps to better reflect the extent of flooding during past events like Hurricane Sandy have had and will have a profound impact on coastal communities in Massachusetts. Coastal towns like Scituate and Duxbury have had as many as a third of their residents' homes, as well as critical public infrastructure like sewage treatment centers, included in redrawn high-risk areas, putting a financial burden on property owners who are now required to purchase flood insurance. FEMA maps are a powerful driver of flood mitigation action by states, municipalities, and individuals, as they are the basis for the National Flood Insurance Program's regulations and flood insurance requirements, though the agency's maps still largely do not account for increased flooding due to climate change.

³ Humphries, Courtney (2016). "[In Boston, Climate Change Could Take the Food Off Your Plate.](#)" Next City.

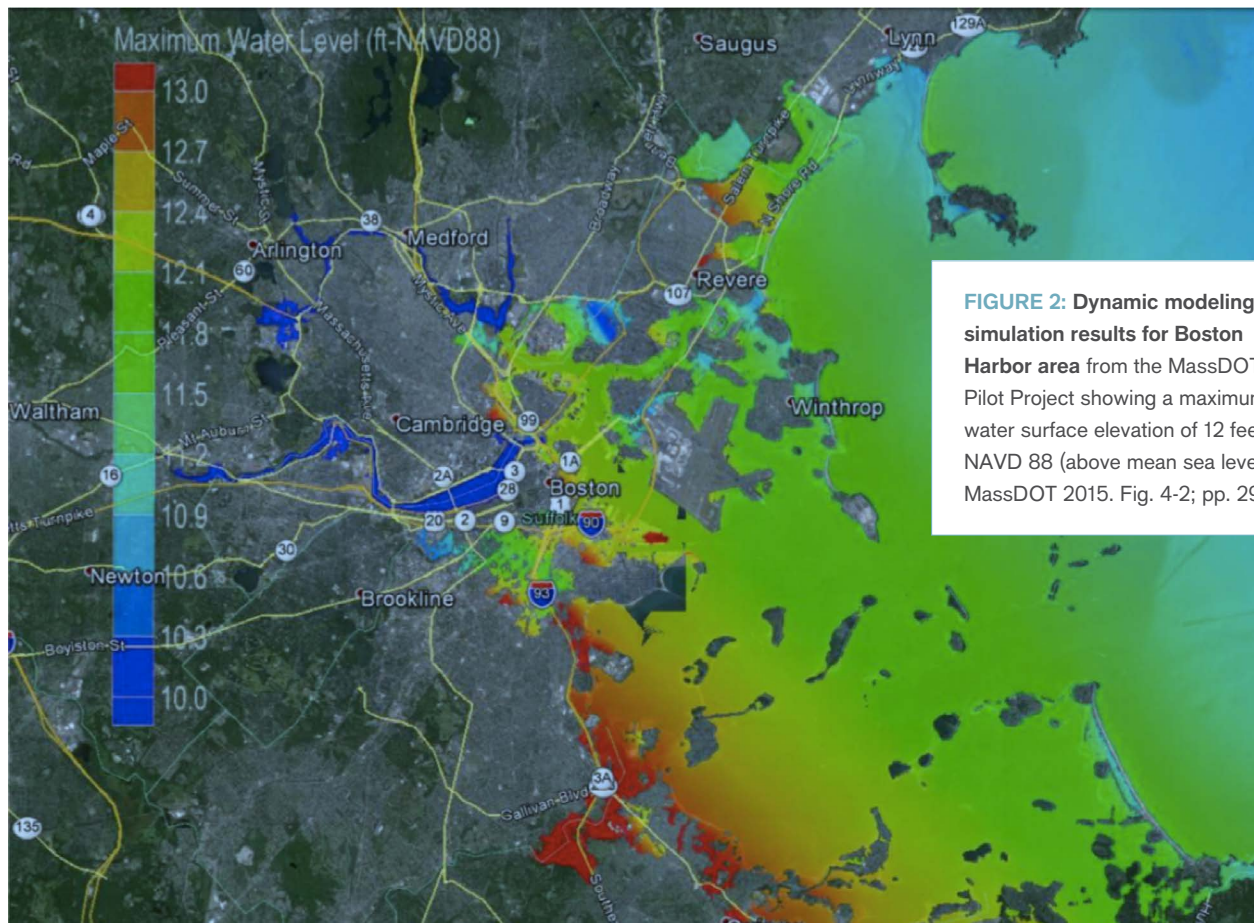


FIGURE 2: Dynamic modeling simulation results for Boston Harbor area from the MassDOT Pilot Project showing a maximum water surface elevation of 12 feet NAVD 88 (above mean sea level). MassDOT 2015. Fig. 4-2; pp. 29.

interactive mapping tool that helps communities design and implement green infrastructure solutions. TPL has collaborated with city agencies and other partners in the cities of Melrose and Medford to demonstrate how this decision support tool can identify and evaluate sites for green infrastructure, which have multiple benefits for vulnerable communities including improved stormwater management, heat mitigation, and pedestrian/bike paths.

Agency support and guidance is helping many municipalities begin to plan for climate impacts. *The Metropolitan Area Planning Council (MAPC)*, the regional planning agency, has developed a methodology to help municipalities conduct climate change vulnerability assessments (analyzing municipalities' physical and social vulnerabilities and broadly developing action recommendations, including analysis of their policy and financial feasibility). After the assessment, a broad interdepartmental working group of staff are convened to jointly address issues identified in the assessment. MAPC

emphasizes the value of the process and relationships strengthened through this assessment methodology as much as the rigor of the analytical product.

Both the MAPC vulnerability assessment methodology and the MVP Community Building Resilience workshops (see Strategy 2) have helped more municipalities define their own climate hazards and risks, identify prime vulnerabilities, and begin to prioritize actions and opportunities to improve resilience. Both processes broaden municipal employees' view of their current programs and obligations in order to, with a holistic lens, seek opportunities to incorporate resilience as an objective in every infrastructure project, building code, zoning law, or even public beautification process. Projects that are already funded and slated for development and projects aimed at resilience-adjacent goals—like stormwater management, hazard mitigation planning, climate mitigation, and energy efficiency—are prime targets for alignment with resilience enhancements.

CASE STUDY



The Cities of Cambridge and Boston:

Guided by detailed information from mapping and modeling their climate vulnerabilities, Boston and Cambridge—two municipalities with relatively advanced vulnerability assessments and the resources to embark on implementation—have invested significantly in adaptation planning. *Climate Ready Boston* undertook a comprehensive effort to map and plan for flood and heat effects citywide in 2016. In partnership with residents, neighborhood associations, businesses, and regional partners, staff are now developing local climate resilience plans for the vulnerable neighborhoods of East Boston, Charlestown, and South Boston to prioritize actions in near-term strategies as well as in long-term visions. The City of Cambridge is devising a broad-reaching preparedness plan and is also beginning to develop an urban forest master plan. Cambridge has created guidelines that have largely been adopted for new development to elevate above a 2070 100-year flood risk estimate.

2

Improve municipal staff capacity to advance climate resilience.

CHALLENGES

Municipalities must draw from a range of resources to advance resilience planning, including state grant programs; planning and technical assistance from public agencies and private consultants; federal grants; and partnerships with peer communities, non-profit organizations, institutions, and private sector actors. In the resource-constrained context of municipal budgets, municipal staff need to balance competing priorities and navigate a complex web of funding sources and other types of assistance. To develop and execute rigorous plans, municipal staff need a clear political mandate, tactical

knowledge about what approaches exist and which tools will likely be most beneficial, and the ability to secure resources and recognize milestones to measure and demonstrate progress.

PATHWAYS

Those championing resilience, including municipal staff and community stakeholders, are working opportunistically to fund and implement projects. The Municipal Vulnerability Preparedness (MVP) program has helped cultivate these champions by marshaling internal support and resources to accomplish resilience goals, highlighting opportunities for action, and positioning staff to pursue other state grants and assistance programs including combining funding sources to accomplish bigger projects. Following its MVP community workshop, the City of Chelsea determined that fortifying its shoreline was a key priority and secured a Coastal Remediation Grant from the Massachusetts Office of Coastal Zone Management (CZM) to create a design for a living berm and improved coastal wetlands management. The Town of Arlington was awarded a \$399,000 MVP action grant to expand upon an existing project to improve public access for a park bordering Mill Brook while simultaneously enhancing the natural resources of the brook, using Community Preservation Act funds for the required 25% match.

Municipalities are forming teams across departments to address climate resilience and incorporate resilience planning into their core responsibilities. Expanding the number of municipal staff members who see climate change as a key part of their portfolio and increasing the capacity of those already working on climate issues is necessary to strengthen municipal action toward resilience. One benefit of the working groups and public workshops convened for the MAPC and MVP processes is that they helped break down silos between departments and spheres of municipalities' work, creating more opportunities for staff to identify synergies and avenues for collaborative action on resilience.

PROGRAM



Municipal Vulnerability Preparedness Program

The Massachusetts Office of Energy and Environmental Affairs' (EEA) [Municipal Vulnerability Preparedness \(MVP\) Program](#), created in 2017, is designed to reduce hurdles for municipalities to embark on climate vulnerability preparedness planning by offering an accessible, community-led process tool as a gateway to technical assistance and funding. EEA anticipates reaching 45% of municipalities in the Commonwealth by the end of 2018.

Community Building Resilience Workshops

The program is structured to help municipalities integrate planning and action on climate preparedness into their work. Municipalities can apply to receive funding to conduct a [Community Resilience Building](#) workshop, or complete their own planning process. During the process, communities strive to:

- Define local extreme weather and natural and climate change related hazards
- Identify existing and future community vulnerabilities and strengths
- Develop and prioritize actions and opportunities to reduce risk and build resilience

Action Grants

Participating communities become eligible to apply for MVP action grants, which help fund priority actions identified during the planning process. With funding from summer 2018 action grants (the first round offered), municipalities are pursuing a wide variety of projects. For example:

- Medford is adapting its open space plan to incorporate climate change projections.
- Brookline is undertaking a comprehensive audit of its bylaws and policies to see where there might be discrepancies between state and local policies and to identify opportunities to improve the integration of preparedness into existing policies.
- Salem will evaluate and identify a feasible solution to relocate critical sewer infrastructure out of a hazardous area where it is subject to damage from storms and storm surge.

3 Learn from and take action with peer communities.

CHALLENGES

Addressing current and future climate threats is one of many urgent, competing priorities for communities. Municipalities face political, technical, and financial hurdles to undertaking innovative resilience strategies. Those that act without the benefits of peer learning and coordination sacrifice efficiency by recreating the (complicated) wheel themselves. Lack of communication and collaboration can also exacerbate impacts for “downstream” neighbors. For example, extensive development of “gray,” impermeable infrastructure to armor an

upstream community may lead to increased flooding in watershed communities downstream. Coordination across municipalities is needed to address problems that no single municipality can solve alone.

PATHWAYS

Communities are learning from others' experience with resilience policies and actions. Though each municipality has unique geographic, demographic, and infrastructure features that shape their particular vulnerabilities, innovative methods are constantly being developed and piloted in other communities facing similar impacts across Massachusetts, the United States, and the world. Municipalities are learning from each

other and benefiting from the experiences of policies and actions tested in peer communities. Municipal staff—particularly those in municipalities with more advanced resilience plans—have cited the significant benefit of professional learning networks such as ICLEI, Local Governments for Sustainability, Urban Sustainability Directors Network, and American Society of Adaptation Professionals in shaping their resilience efforts.

Coalitions of municipalities are sharing strategies across jurisdictions, with help from NGOs and regional planning agencies. Some peer networks of municipal officials and staff have formed to build capacity, communicate successes and challenges, disseminate innovative practices, and advocate with a strong, united voice for resources and policy at the state level. For example, MAPC convened sub-regional groups of municipalities, including the *Minuteman Advisory Group on Interlocal Coordination (MAGIC)*, a group of thirteen communities northwest of Boston,⁴ and the *Metro Mayors Coalition Climate Preparedness Taskforce*, comprised of fifteen urban core cities⁵ in the Metro Boston Area. These groups coordinate data gathering, share modeling resources, meet with legislators and state and federal agencies to advocate for responses to regional issues, and undertake shared capacity-building opportunities.

FIGURE 3: Resilient Mystic Collaborative meeting to discuss regional priorities and strategies. (Photo credit: MyRWA)



⁴ Acton, Bedford, Bolton, Boxborough, Carlisle, Concord, Hudson, Lexington, Lincoln, Littleton, Maynard, Stow, and Sudbury

⁵ Arlington, Boston, Braintree, Brookline, Cambridge, Chelsea, Everett, Malden, Medford, Melrose, Newton, Quincy, Revere, Somerville, and Winthrop

CASE STUDY



The Mystic River Watershed Association (MyRWA)

has a long track record of partnering with individual municipalities and state agencies for science-based advocacy and restoration projects in the Mystic River watershed, which spans 21 cities and towns. MyRWA has begun convening municipalities, businesses, and community organizations to create an action-oriented, regional climate resilience strategy at the watershed scale. To advance this goal, MyRWA is working to identify larger resilience projects as targets for collective advocacy to the state. The organization recently advocated for the state to invest in additional resiliency investments at the Amelia Earhart Dam as part of a larger environmental bond bill, given predictions that the dam will be flanked in a storm surge sooner than the Charles River Dam will. In its call to secure Amelia Earhart Dam, MyRWA has been joined by the united voice of mayors, city managers, and elected representatives in the watershed. Municipal members sat down with the state agencies to support investment in and protection of this key regional resource that is threatened by climate change.

Build resilience on a foundation of equity and community values.

CHALLENGES

Marginalized and underserved communities in the greater Boston area will face the most acute impacts of climate change. Marginalized communities are often the least well represented in forums where municipal priorities are determined and resources are allocated. Municipalities have the opportunity to rectify persistent injustices in the process of planning for resilience; however if they do not learn from, listen to, and respond to the values and needs expressed by local communities, they will exacerbate historic inequities and displace people. Improvements to housing stock, neighborhoods, and infrastructure to make them more resilient could contribute to rapid gentrification and displacement of current, low-income occupants if not explicitly addressed.

PATHWAYS

Community leaders and nonprofit advocates are broadening the definition of climate resilience, linking it with social resilience, community development, and movements for equity and justice. Many of the populations that are most environmentally burdened today will be most vulnerable in the future to climate impacts. In these communities, organizations are building networks of local residents to help disseminate information about emergency preparedness, provide support during emergencies, and create channels through which community members can shape municipal action. For example, *Neighborhood of Affordable Housing's (NOAH)* work in East Boston spans micro-level interventions such as helping households prevent basement flooding to broader strategies such as convening the Adaptation Planning Working Group, which coordinates planning across East Boston municipal departments.

Community advocates are implementing solutions that center on empowering individuals and collective ownership. Community-based organizations in the Greater Boston area are developing and testing tools to counter displacement, economic inequality, and political disenfranchisement. Some of these solutions have been explicitly aligned with improved resilience: *Neighbor to Neighbor* incorporates residents' feedback in municipal planning to ensure that resilience-focused infrastructure investments reflect local community values without increasing costs for existing residents and contributing to the broader trend towards income inequality, displacement and racialized gentrification in the greater Boston area.⁶ *The Green Justice Coalition (GJC)*, a coalition of community-based environmental and labor organizations, is organizing communities to advocate for "Community Choice Energy" projects, through which residents of a municipality can aggregate their electricity demand into a single contract to collectively source their energy. This is one way to protect residents from price spikes and make clean energy affordable for every household. Following residents' interests, GreenRoots is exploring project opportunities for community-owned microgrids through the Massachusetts Clean Energy Center, which would increase the resilience of the grid and protect residents from network outages.

The Dudley Street Neighborhood Initiative in Boston is nationally recognized for employing community land trusts and limited-equity cooperatives, which are effective tools for producing healthy, affordable homes and stable neighborhoods. As multi-family housing units are bought out by community organizations to keep them affordable, they can be renovated and weatherized. This keeps families safe from extreme temperatures and precipitation.

⁶ Jennings, James (2016). ["Gentrification as Anti-Local Economic Development: The Case of Boston, Massachusetts."](#) Trotter Review: Vol. 23 : Iss. 1 , Article 4.

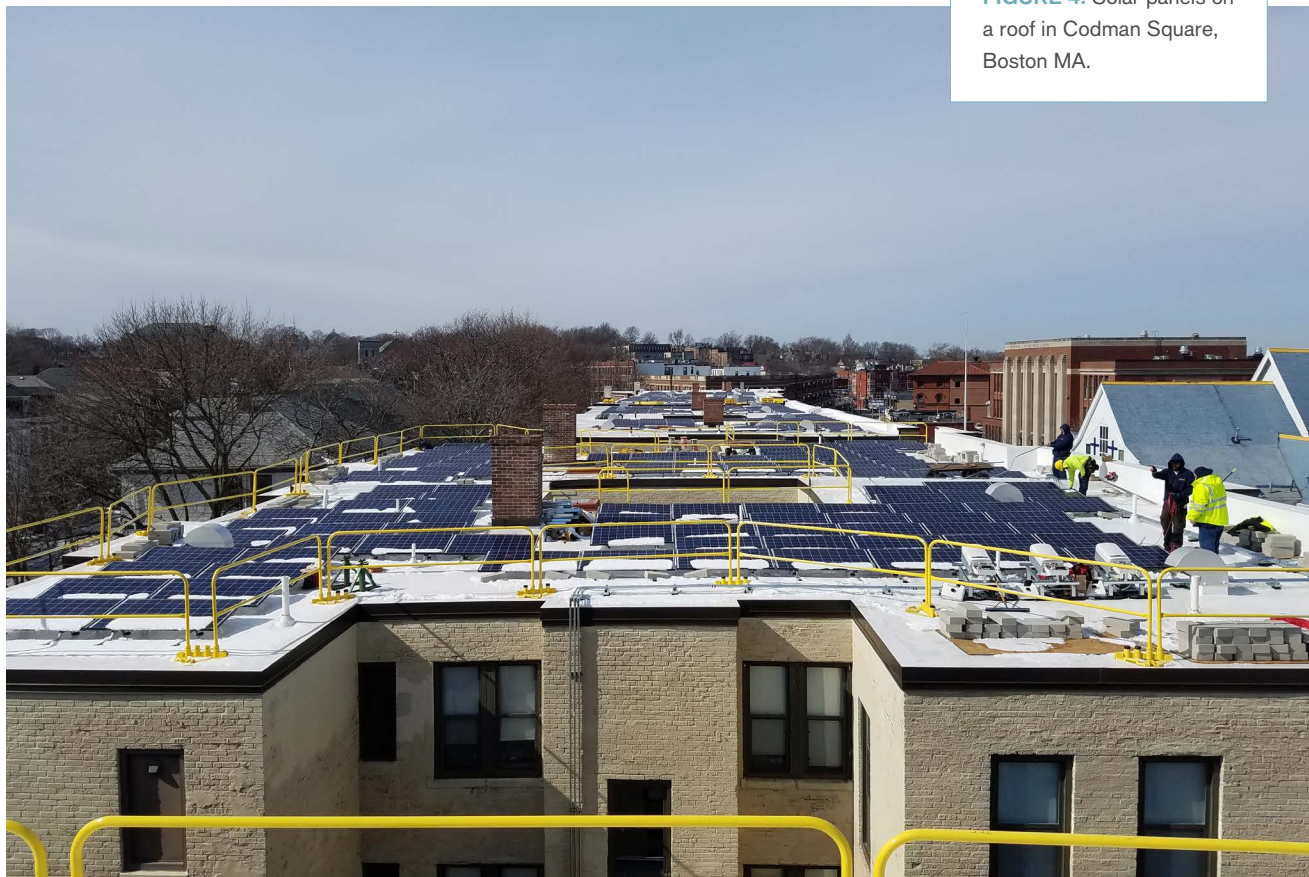
CASE STUDY



The Codman Square Neighborhood Development Corporation (CSNDC)

has begun modeling how sustainability and green job creation can be focused on uplifting local, marginalized, and economically depressed communities. CSNDC has pursued innovative ideas designed to mitigate the impacts of climate change, while also providing practical solutions for the residents it serves. Through tree planting and measuring the impact of those trees using climate related metrics like CO₂ reduction, particulate matter uptake, and increases in property values, residents begin to see the direct impact of the trees they have planted on their collective health and income. Other green infrastructure projects such as raingardens and rainwater buffers provide an opportunity for residents to learn about constructing and maintaining such installations, and then obtaining a certification in green infrastructure construction. By hiring and training local people from marginalized populations in their own neighborhoods for green infrastructure work, the benefits emanate from and stay in the community. Similarly, CSNDC is pursuing community shared solar by virtually net metering on-bill credits to local residents from any excess energy it produces. Along with green affordable housing, these various efforts provide a web of sustainability related services that will better enable lower income residents to stay in their homes and live in a healthier neighborhood.

FIGURE 4: Solar panels on a roof in Codman Square, Boston MA.



5

Drive private sector action to strengthen local resilience.

CHALLENGES

Government action is only one piece of the resilience puzzle, as significant portions of vulnerable infrastructure, building stock, and social services sit outside of the public sector's control. When businesses are forced to close during extreme weather events, they, their workers, and the communities in which they are situated suffer. After Hurricane Sandy, about 40% of businesses damaged by floods never reopened. When massive snow storms led to the MBTA shutting down in 2015, the cost of lost business and lost employee wages totaled over \$260 million across the state.⁷ The financial case for strengthening resilience is currently less developed and less persuasive to the private sector than that of other climate change-related investments such as energy efficiency improvements.

PATHWAYS

Private sector costs of inaction are becoming increasingly clear, though market signals are still lagging somewhat.

For example, Cambridge's climate change vulnerability assessment showed that the predicted economic losses from business disruption from extreme weather events dwarfed the predicted costs of private infrastructure damage alone. Further work to communicate the risks faced by different sectors, as well as more accurate pricing of risk by insurance and financing entities would provide strong signals to property owners and businesses, incentivizing them to incorporate climate risks and preparedness into their decision-making.⁸ Updated floodplain maps would trigger these higher premiums in vulnerable areas.

Municipalities are partnering with businesses on resilience.

When businesses remain open during extreme weather events or can open again promptly afterwards—and avoid closing permanently—employees and the local economy benefit. Furthermore, if storefronts remain open, businesses can be a first resource for nearby residents in times of emergency. Municipalities have begun to collaborate with key business districts, distribution centers, and privately-owned utility infrastructure for food, healthcare, and energy to protect these local and regional resources from future impacts.

CASE STUDY



Climate Action Business Association (CABA),

a non-profit membership organization focused on helping businesses take targeted climate action, has done substantial work to support small businesses in developing emergency preparedness and resilience plans. It provides small business guides and support to help municipalities act on inexpensive strategies to become more resilient, including planning for continuity, emergency communication, and precautions to protect administrative information from loss in emergencies. It has also facilitated preliminary discussions on developing resilient micro-grid infrastructure. CABA has served as a liaison for municipal resilience efforts to its network, surveying business needs to communicate to officials and acting as an ambassador for planning processes such as Climate Ready Boston.



FIGURE 5: Businesses Acting on Rising Seas Resilience Team with the crew at Manchester Marine in Manchester-by-the-Sea, MA (Photo credit: CABA staff)

⁷ Ba Tran, Andrew. Feb 2015. ["How much shutting down for snow costs Massachusetts business, economy."](#) Boston Globe.

⁸ Sustainable Solutions Lab. 2018. ["Financing Climate Resilience: Mobilizing Resources and Incentives to Protect Boston from Climate Risks."](#) UMass Boston.

Business associations are forming networks and partnerships to share strategies and increase private sector ambition on resilience action. Climate-focused business networks are emerging in specific sectors, geographies, and scales to offer peer-to-peer learning opportunities for participating members. Members can hear from leaders within industries they trust about the rationale and effects of working on business climate resilience. Professional organizations are well-positioned to serve as or create a trusted forum where businesses can act as models for and encourage more ambitious action by their peers. As businesses become increasingly aware of the stakes, they become allies in driving action.



FIGURE 6: Flooding during winter 2018 outside of Flowers and Festivities on Front Street in Scituate, MA. (Photo credit: Flowers and Festivities, Scituate MA)

CASE STUDY

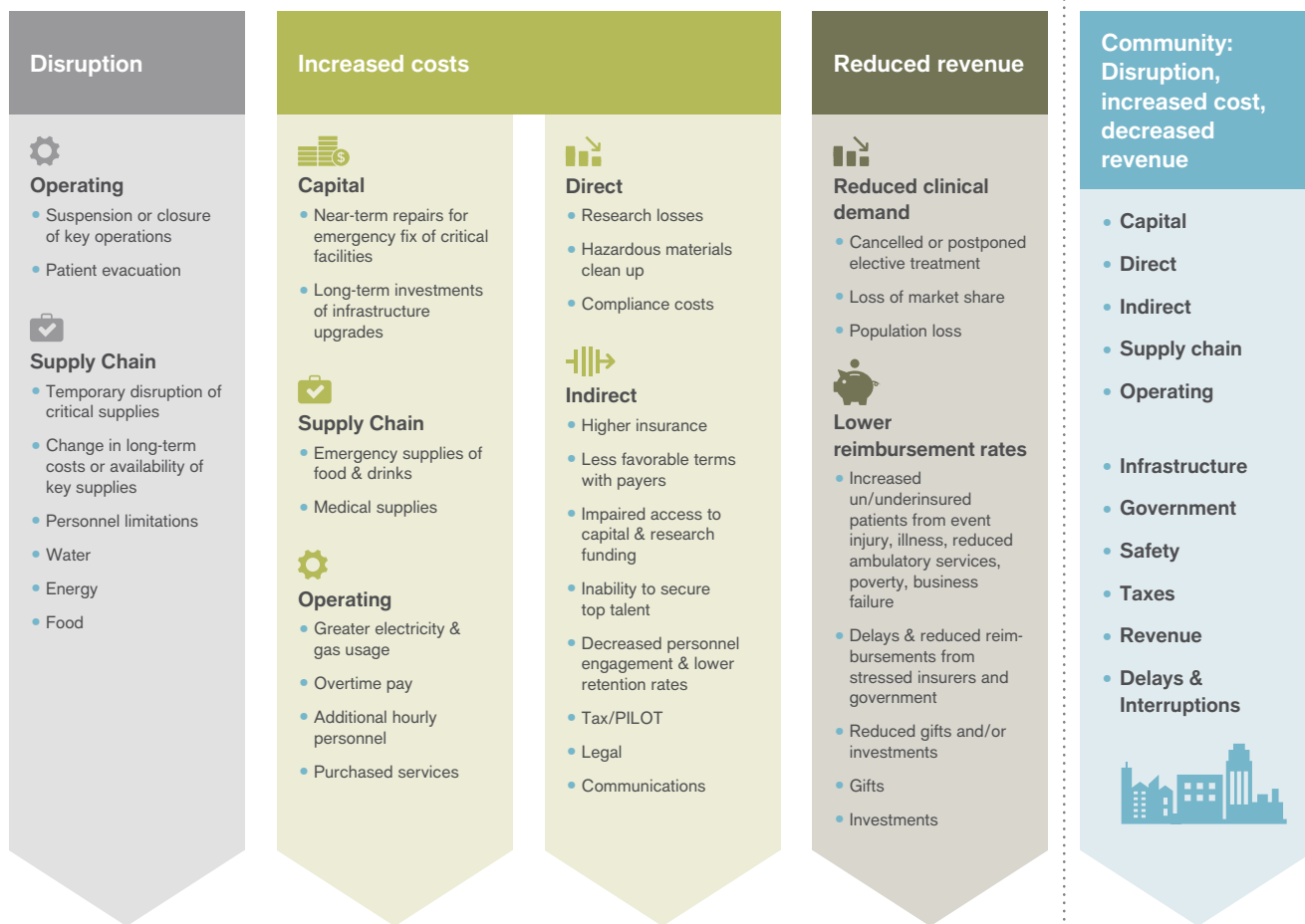


Healthcare Without Harm (HCWH)

As the largest sector of Massachusetts' economy and with direct connections to vulnerable populations, health care is an area ripe for partnerships on climate action. *Healthcare Without Harm (HCWH)*, a non-profit membership organization of health care industry members, equips hospitals to lead on environmental sustainability and climate resilience, helping them identify opportunities to improve community resilience, mitigate their own risks, and improve their bottom line. One of HCWH's priorities is to help hospitals expand their roles as community anchors, especially during emergency events. For example, Boston Medical Center (BMC) has extended its resilient energy system to include a key node in the City of Boston's Emergency Communications network to allow it to remain operational if the region's grid fails. Partners HealthCare collaborated with HCWH to create *Resilience 2.0*, a multi-stakeholder working summit to explore how hospitals can better anchor community resilience. HCWH leverages its network of hospitals to help them share learnings and increase collective ambition, encouraging leader institutions to model opportunities for peers to take action.

Costs of being ill-prepared

The bottom line damages for health care



Downward pressure on margin

FIGURE 7: HCWH's report "Safe Haven in the Storm: Protecting lives and margins with climate-smart health care" analyzes billions of dollars in losses and resilience-related savings to demonstrate to hospital executives how preparing for extreme weather can make or break a health system and the communities they serve. (Credit: Health Care Without Harm & PricewaterhouseCoopers Advisory Services LLC)

6

Create public support for resilience action.

CHALLENGES

Many municipalities do not have the capacity to accomplish all of the community engagement, public education, and network-building necessary to build active community support around resilience action. In the context of a public ambivalent about the role of government, municipalities may not always be the best messenger about the need for ambitious climate action. Coordinated actions that address regional vulnerabilities will require an unprecedented degree of public support across municipalities. Municipal staff have cited lack of will from their elected and administrative leaders and lack of public awareness as barriers to further resilience action.

PATHWAYS

Cultural and civic institutions are beginning to convene and engage communities on the topic of resilience on a range of scales. Municipalities need partners to serve as community ambassadors and to engage stakeholders. Though conservation nonprofits have long worked to engage the public in climate action via awareness-raising campaigns and member engagement, new civic partners—from museums, to youth-focused community organizations, to community groups and nonprofits whose work intersects climate vulnerability—are increasingly willing to get involved. These institutions have the ability to tap into diverse constituencies who may not be activated by traditional forms of engagement in government and planning. Broad and deep engagement is needed to create the political space and a collaborative, all-hands-on-deck outlook to develop resilience across the Metro Boston area.

Effective public communication efforts are focusing on resilience co-benefits. For example, public health and health impacts are a powerful lens to communicate about climate risk, making the risks real, personal, and immediate. Projects that strengthen resilience frequently help achieve other local priorities. Identifying and targeting those co-benefits in project design and engagement will garner public support; this could mean improving air quality near a school, creating habitat that preserves biodiversity, generating high-quality jobs that sustain the local economy, or improving access to or quality of public spaces.

CASE STUDY



New England Aquarium

launched the National Network for Ocean and Climate Change Interpretation (NNOCCI) in 2009 to increase the capacity for informal science learning centers (ISLCs) nationally to educate the public about climate change and translate that awareness into personal and community action. The network now includes over 170 museums, zoos, and other ISLCs in 38 states and has had success increasing community engagement and changing individual visitors' outlook on climate change and their role in addressing it. The Aquarium and its partners have substantial resources to draw upon, including their staff capacity, venues, and the well-spring of respect and positive regard for their institutions from their members, visitors, youth program participants, and the wider community. Their strong platform and numerous constituents enable them to act as trusted climate ambassadors, educators, and conveners.



FIGURE 8: Climate change interpretation in action at the New England Aquarium (Credit: New England Aquarium)

CASE STUDY



The Center for Climate, Health, and the Global Environment

at the Harvard T. H. Chan School of Public Health (Harvard C-CHANGE) is focused on translating the latest research from faculty and students to communicate the threats to public health from climate change, such as increased instances of Lyme disease, asthma attacks, longer and more severe allergy seasons, and floodwater as a vector for mold and communicable diseases. They also focus on communicating how the solutions to climate change improve health outcomes in the near term, such as through reduced air pollution and improved transportation systems. Their work focuses on providing relevant and understandable information to the public, and to public and private policymakers to ensure that broad population-scale benefits and community health outcomes serve as a motivator for climate action and to inform program and investment decisions.

7

Institutionalize resilience through policy.

CHALLENGES

Even in the most forward-looking municipalities, policies have not yet caught up with the challenge of creating physically and socially resilient communities in the face of ever more severe and immediate climate impacts. Given the highly localized nature of planning and policy, particularly in Massachusetts, forward-looking local regulations are crucial to drive investment in resilience. The state building code supersedes municipal standards and limits municipal ability to mandate stricter resilience standards for building construction.

However, in many cases, a lack of political will, silos dividing various aspects of municipal administration and planning, and the complexity of overlapping regulations and policies are the main barriers hindering local leaders from implementing more ambitious policies. Municipalities also tend to be risk-averse and face disincentives to adopting strong regulations alone, for fear of losing development, investment, and other opportunities to communities with different regulations.

PATHWAYS

Municipal planning, zoning, and regulation must be comprehensively integrated with the most updated climate vulnerability models and adaptation strategies. Planning and zoning regulations have not generally been designed to meet future needs based on predicted climate impacts, even those that are well understood. For example, rules frequently allow more impervious surface than is reasonable in a neighborhood given the levels of precipitation and resultant storm-water runoff. Many municipalities allow the construction of new homes in future flood zones despite expectations of dramatic sea level rise and increasingly violent storms. This will likely a) make living on that site long-term impractical and unsafe for the homeowner and b) lead to increasingly expensive emergency response and infrastructure maintenance for the municipality to serve these residents.

In this region, municipalities preparing to become more resilient are mostly in the planning stages, identifying local vulnerabilities, developing resilience plans, and drafting action plans of various types for approval, adoption, or implementation. Even where climate resilience is being advanced proactively, integration between climate adaptation plans and broader master planning is frequently lacking. There are some exceptions, including the new Boston Planning and Development Agency's Smart Utilities Policy: this two-year pilot policy, developed with stakeholders, sets more resilient design standards for new, large buildings. The policy requires building owners and utilities to incorporate five technological solutions including district energy microgrids, smart streetlights, and green infrastructure.⁹

⁹ BPDA. "Boston Smart Utilities Project." *Boston Planning & Development Agency*, 2018, www.bostonplans.org/planning/planning-initiatives/boston-smart-utilities-project.

Opportunities

The following are the key opportunities we hope entities in the greater Boston region will seize in coming months and years.

A Encourage municipalities to begin or continue forward-looking resilience planning by providing progressive steps and support. Resources and programs should be broadened to bring all municipalities in the Metro Boston area through the early phases of vulnerability planning and to help them take graduated steps to implement those plans. There is an opportunity to engage those communities that are currently inactive by helping them incorporate resilience planning into other planning processes, such as FEMA Hazard Mitigation Planning (HMPs). More comprehensive, long-term climate adaptation planning can be shepherded in under HMP updates, which must be completed every five years for local municipalities to be eligible to receive FEMA funds for mitigation projects and other non-emergency disaster items. Municipalities that have progressed through early planning should be linked to funding for priority projects and should have next steps and accountable entities clearly defined so they can best implement plans and monitor progress.

B Improve municipal capacity to secure resources and implement projects. Making it easy and affordable for municipalities to obtain accurate local climate impact modeling, clarify best practices, and identify implementation partners will encourage them to conduct vulnerability assessments and other resilience-related activities. This could be accomplished through shared regional funding for climate model updates, analytical tools, and process models. Generous sharing and downscaling of data products via regional planning agencies and regional networks has helped reduce the costs borne by municipalities. Funding and technical expertise gaps for resilience planning and implementation could be filled by “circuit riders” deployed by a technical assistance provider or agency. These circuit riders could be experts in grant-writing, engineering, planning, architecture, process design, or project management skills, who consult with municipalities on their strategies for securing funding, analyzing data, designing projects, or engaging stakeholders.

C Empower grassroots groups and local liaisons to lead and convene resilience work in marginalized and vulnerable communities. Because people hear and understand those they already know and trust, there is an opportunity to fund or otherwise support grassroots organizations and local residents to help their communities discuss local vulnerabilities and decide on priority actions. Avenues for enhancing community input and improving accountability to those most impacted include:

- Ensuring more robust representation from members and advocates from vulnerable communities on municipal resilience committees
- Identifying and training local leaders to serve as community liaisons to the public
- Undertaking neighborhood-scale pilot projects which address community equity and historic environmental justice issues while contributing to greater resilience
- Creating neighborhood resilience hubs to increase social connection and emergency response capacities
- Co-hosting public forums with community partners (e.g. houses of worship, local businesses, community centers) to gather neighborhood-scale input on policy and planning.

When investing in infrastructure upgrades or other actions that will enhance resilience locally, municipalities should engage and plan directly with community stakeholders.

D Cultivate a range of credible messengers to engage stakeholders in climate resilience. The urgent need to disseminate information about what is happening to our climate, what it means for residents, businesses, and communities, and what can be done about it should be amplified by new voices. Given the interconnected nature of climate impacts on human systems, actors in media, the arts, public education, recreation, public health, housing, and food systems who may never before have focused on this topic have a critical role to play in making resilience relevant. A broad set of nontraditional community and civic partners should be cultivated to serve as ambassadors for climate resilience plans and, potentially, to act as catalysts for broader civic engagement. In addition to building stakeholder support for municipal resilience, cultural institutions with broad credibility and reach may be able to serve as conveners for municipalities and their partners seeking to network and collaborate on resilience planning.

E Create compelling messages, metrics, and stories to build public support for climate resilience. A variety of creative approaches will be needed to raise awareness about climate change resilience to inspire and motivate action. Municipalities and their partners should be supported in developing effective communication strategies, tailored to their audiences, about climate change and resilience. They must pilot and adopt ways of communicating that draw a connection between the needs and experiences of communities and the benefits of actions to improve resilience. The interconnected impacts of climate change—and the potential co-benefits of taking action, like improved public health, public spaces, and local economies—must be made explicit and relevant to specific constituencies.

F Make the financial argument to encourage private sector actors to take action. Borrowers (businesses, real estate developers, property owners) need better signals about the benefits of taking steps to improve resilience.¹⁰ Encouraging lenders, insurers, and bond-rating agencies to use rigorous data and accurate climate models will help them align incentives with predicted risk. Municipalities and other climate action advocates can also develop incentives to encourage developers to incorporate resilience into project design from the start. New tools and models for quantifying societal well-being as a project outcome¹¹ provide a structured method to analyze and evaluate different nature-based solutions.¹² However, further work is needed to create more flexible funding and financing options to encourage private sector investment in resilience: for example, cities could test the financial performance of resilience improvements by piloting environmental impact bonds.¹³

G Create model regulations and establish ambitious and regularly increasing standards. Supporting entities like research institutions, technical assistance providers and business associations have an opportunity to, in consultation with local governments, develop model resilience-related regulations in areas such as green infrastructure requirements, building retrofits, tree canopy management, and land use and zoning requirements. Model regulations developed with buy-in from municipalities that they could adopt with little or no modification would decrease the time and capacity needed to update local codes. Municipalities could adopt more ambitious policies together to help local policymakers feel politically secure.

Amending the State Building Code (and other statewide laws) to include resilience considerations is an even more ambitious goal. This would free individual municipalities from having to generate local political will, and would equalize the playing field

¹⁰ Sustainable Solutions Lab. 2018. "[Financing Climate Resilience: Mobilizing Resources and Incentives to Protect Boston from Climate Risks.](#)" UMass Boston.

¹¹ e.g., the RAND Corporation's [Resilience Dividend Valuation Model](#) funded by the Rockefeller Foundation

¹² Raymond et al. (2017). "A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas," *Environmental Science and Policy*. Volume 77, pp. 15-24.

¹³ Environmental Defense Fund & Quantified Ventures (2018). "[Financing Resilient Communities and Coastlines: How environmental impact bonds can accelerate wetland restoration in Louisiana and beyond.](#)"

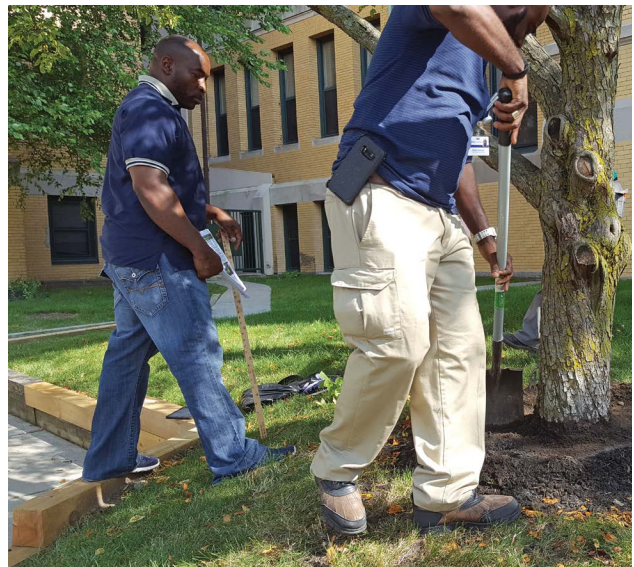
for businesses and landowners across the Commonwealth. Such policies should include clauses for regular, indexed increases where possible to drive incremental improvement, as well as standard timeframes for review and revision to incorporate the latest technology and science.

H Help municipalities undertake joint planning and collaborative action on key regional issues. While a few municipalities are starting to partner and share information, efforts to collaborate across political boundaries on policy and project implementation are nascent. Strong multi-municipality collaboration requires time, staffing and capacity that is often outside of individual municipalities' reach. Municipalities could be supported to jointly develop regional or watershed-scale plans addressing climate resilience with their neighbors. Issues to take up for collaborative action could include increasing watershed absorption capacity; mitigating the urban heat island effect; strengthening communal infrastructure and emergency response systems; developing renewable energy microgrids; connecting and managing climate-vulnerable ecosystems; and instituting local land use and zoning policies.

I Create new sources of public funding to drive resilience action. Numerous and plentiful funding sources are necessary for all the action that has to be undertaken for the region to become resilient. A short list of ideas of possible future sources includes the following, which would need to be supplemented with other innovative funding sources over the long term:

- A statewide resilience fund, funded by a carbon tax
- A tightening of the Regional Greenhouse Gas Initiative cap, in which some of the resulting additional funds are deployed for adaptation and resilience and/or an increase in the gasoline tax

- Municipal fees, e.g. from water and sewer bills
- Value capture mechanisms, such as Business Improvement District formula fees
- Municipal general obligation bonds
- An expansion of electric and gas utilities' Mass Save program to incentivize and subsidize resilience measures through building retrofits
- A state matching fund for municipal resilience activities similar to the Community Preservation Act, which is funded by real estate transaction fees.



¹⁴ In spring 2018, the Sustainable Solutions Lab at UMass Boston published Financing Climate Resilience: Mobilizing resources and incentives to protect Boston from climate risks. As a point of reference, the analysis estimates that the total needs for Boston alone until 2030 will total \$1-\$2.4 billion (these costs would be shared among district-level, municipal, state, and federal sources.) This list of potential strategies to expand the funding pie for resilience is largely drawn from the SSL report.

Appendices

Appendix I: People interviewed

A number of these individuals have received or are receiving funding from the Barr Foundation.

- | | | |
|--|---|---|
| 1. John Bolduc, City of Cambridge
Community Development
Department, Environmental
Planner | 14. Anne Herbst, MAPC, Senior
Regional Environmental Planner | 27. David Queeley, Codman Square
NDC, Director of Eco-Innovation |
| 2. Kelly Boling, Trust for Public Land,
Parks for People Program Director | 15. Patrick Herron, MyRWA,
Executive Director | 28. Susanne Rasmussen, Cambridge
Compact for a Sustainable Future,
City of Cambridge, Director of
Environmental and Transportation
Planning |
| 3. Roseann Bongiovanni,
GreenRoots (Green Justice
Coalition), Executive Director | 16. Rebecca Herst, UMass
Sustainable Solutions Lab,
Director | 29. Bill Ravanese, Healthcare Without
Harm, Boston Regional Director,
Senior Director of Health Care
Green Building and Energy
Program |
| 4. Bruce Carlisle, Massachusetts
Office of Coastal Zone
Management, Director | 17. Rachel Jacobson, American
Society of Adaptation
Professionals (ASAP), Senior
Program Manager | 30. Bud Ris, Boston Green Ribbon
Commission/Climate Ready
Boston, Senior Advisor |
| 5. Jack Clarke, Mass Audubon,
Director of Public Policy | 18. Barry Keppard, MAPC - MAGIC
13 Subregion, Director of Public
Health | 31. Oliver Sellers-Garcia, City of
Somerville, Office of Sustainability
and Environment, Director |
| 6. John DePriest, City of Chelsea,
Chelsea Director of Planning and
Development | 19. Paul Kirshen, UMass Sustainable
Solutions Lab, Academic Director | 32. Mark Smith, Harvard C-CHANGE
School of Public Health, Program
Director |
| 7. Rick Dimino, A Better City,
President and CEO | 20. Steve Long, The Nature
Conservancy, Director of
Government Relations | 33. Billy Spitzer, New England
Aquarium, Vice President of
Planning, Programs, and Exhibits |
| 8. Nancy Durfee, Town of Scituate,
Coastal Resiliency Officer | 21. Mia Mansfield, Climate Ready
Boston, Program Manager | 34. Heidi Stucker, MAPC - MAGIC,
Subregion Coordinator |
| 9. Trish Garrigan, US EPA Healthy
Watersheds Initiative, Coordinator | 22. Atyia Martin, Consultant | 35. Larry Susskind, MIT Department
of Urban Studies and Planning,
Professor of Environmental and
Urban Planning |
| 10. Phil Giffey, NOAH CDC,
Executive Director | 23. Andrea Nyamekye, Neighbor to
Neighbor (Green Justice
Coalition), Climate Justice Field
Coordinator | 36. Katie Theoharides, MA Executive
Office of Energy & Environmental
Affairs, Director of Climate and
Global Warming Solutions |
| 11. Michael Green, Climate Action
Business Association (CABA),
Executive Director | 24. Lisa Owens, City Life/Vida
Urbana, Executive Director | |
| 12. Cynthia Green, EPA New
England, Energy and Resilience
Unit Manager | 25. Cammy Peterson, Metro Mayor's
Coalition Climate Committee and
MAPC, Director of Clean Energy | |
| 13. Elizabeth Turnbull Henry,
Environmental League of MA,
President | 26. Martin Pillsbury, MAPC,
Environmental Planning Director | |

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Appendix III: Tabulated survey responses on resilience strategies

After synthesizing findings from interviews and a literature review into seven strategies for improving resilience in the greater Boston area, our team asked interviewees to rate, on a 1-5 scale, the development, deployment, and availability of finance for each strategy. 27 out of 36 interviewees responded to the online survey. The table below gives the average rating respondents assigned to each metric. Note that Strategies 3 and 7 are broken out into two parts for purposes of the survey, but were combined in the report.

Resilience Strategies		How developed ¹⁵ is this strategy for working on climate resili- ence in the Greater Boston Area?	How widely deployed ¹⁶ is this strategy for working on climate resili- ence in the Greater Boston Area?	How available is funding ¹⁷ to implement this strategy for working on climate resilience in the Greater Boston Area?
1	Assess local climate vulnerabilities and plan proactively.	3.6	2.7	2.5
2	Improve municipal staff capacity to advance climate resilience.	3	2.6	2.4
3a	Learn from peer communities in Massachusetts and beyond.	3	2.7	2.3
3b	Implement resilience related projects with peer communities.	2.4	2.1	2
4	Build resilience on a foundation of equity and community values.	2.6	2	2
5	Drive private sector action to strengthen local resilience.	2.7	2.2	2.3
6	Create public support for resilience action.	3	2.6	2.4
7a	Institutionalize resilience through municipal policy.	3	2.4	2.5
7b	Institutionalize resilience through state policy.	3.2	2.8	n/a

¹⁵ "Developed" means methods for working on this strategy are known and trusted to provide certain outcomes.

¹⁶ "Deployed" means methods for working on this strategy are presently utilized in private/non-profit organizations, as well as govt. departments or agencies.

¹⁷ Funding or financing could come from within organizations/municipalities or from external sources.