

**COVER PHOTO:** Aerial view of Newburyport, a coastal community on the North Shore. *Photo: CABA Staff*

# BUSINESSES ACTING ON RISING SEAS

Final Report | 2018 Campaign



## CLIMATE ACTION BUSINESS ASSOCIATION

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Our mission is to help solve the climate crisis by organizing local business leaders to be more effective advocates for climate action within their businesses and communities, as well as at the state, national, and even international levels.

The Climate Action Business Association is a membership-based organization in Boston, Massachusetts that helps businesses take targeted action on climate change. We provide our member businesses with the resources and tools needed to work within their business on sustainability efforts, political advocacy and building a community of shared values. In 2016, we merged with the nonprofit Climate XChange to increase our capacity and enhance our organization's ability to influence climate policy.

Our Businesses Acting Rising Seas (BARS) Campaign is an award-winning program that educates local businesses about the impacts of climate change and prepares them for impending natural disasters. The BARS Campaign provides resources and critical data to local businesses and equips them with the tools necessary to be resilient and protected in the face of rising seas and extreme weather.

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March 2019

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Overlooking Rockport Harbor with our Businesses Acting on Rising Seas sticker. Participating businesses were given stickers to put on their storefront windows. Photo: CABA Staff

The Businesses Acting on Rising Seas Campaign (BARS) is a program of the Climate Action Business Association (CABA). It would not have been possible without the support provided by the CABA team.

We would like to extend our thanks to the number of State Legislators and staff, town administrators, urban planners, sustainability and conservation experts, and valued friends that reviewed our Small Business Resilience Guides and provided valuable advice and feedback.

**OUR PARTNERS**



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# INTRODUCTION



Flooding from a March 2018 nor'easter in Chelsea, Massachusetts overlooking the Tobin Bridge. Photo: Matt Frank

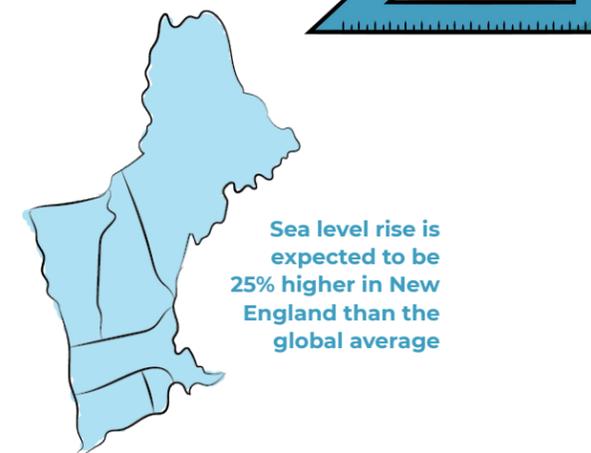
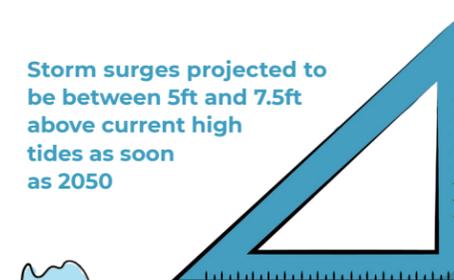
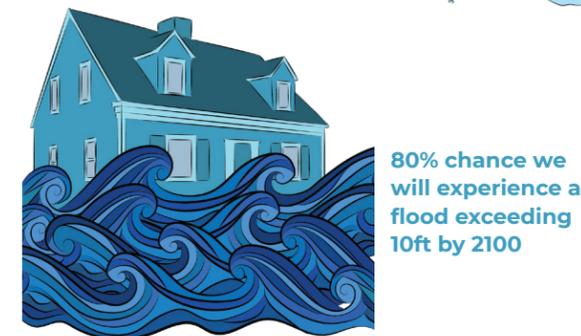
Climate change is expected to increase the frequency and intensity of weather events.<sup>1</sup> With hurricanes, erosion, and sea-level rise, businesses are already experiencing significant damage from weather events due to climate change.<sup>2</sup> Most often, it is the small and local businesses that are the most impacted by such events, and the least prepared to bounce back after them. In striving towards a more secure and resilient future, we must acknowledge the vulnerabilities of businesses when it comes to climate impacts and the repercussions they will have on local economies; only then will we be able to plan, legislate and cope with a new climate reality.

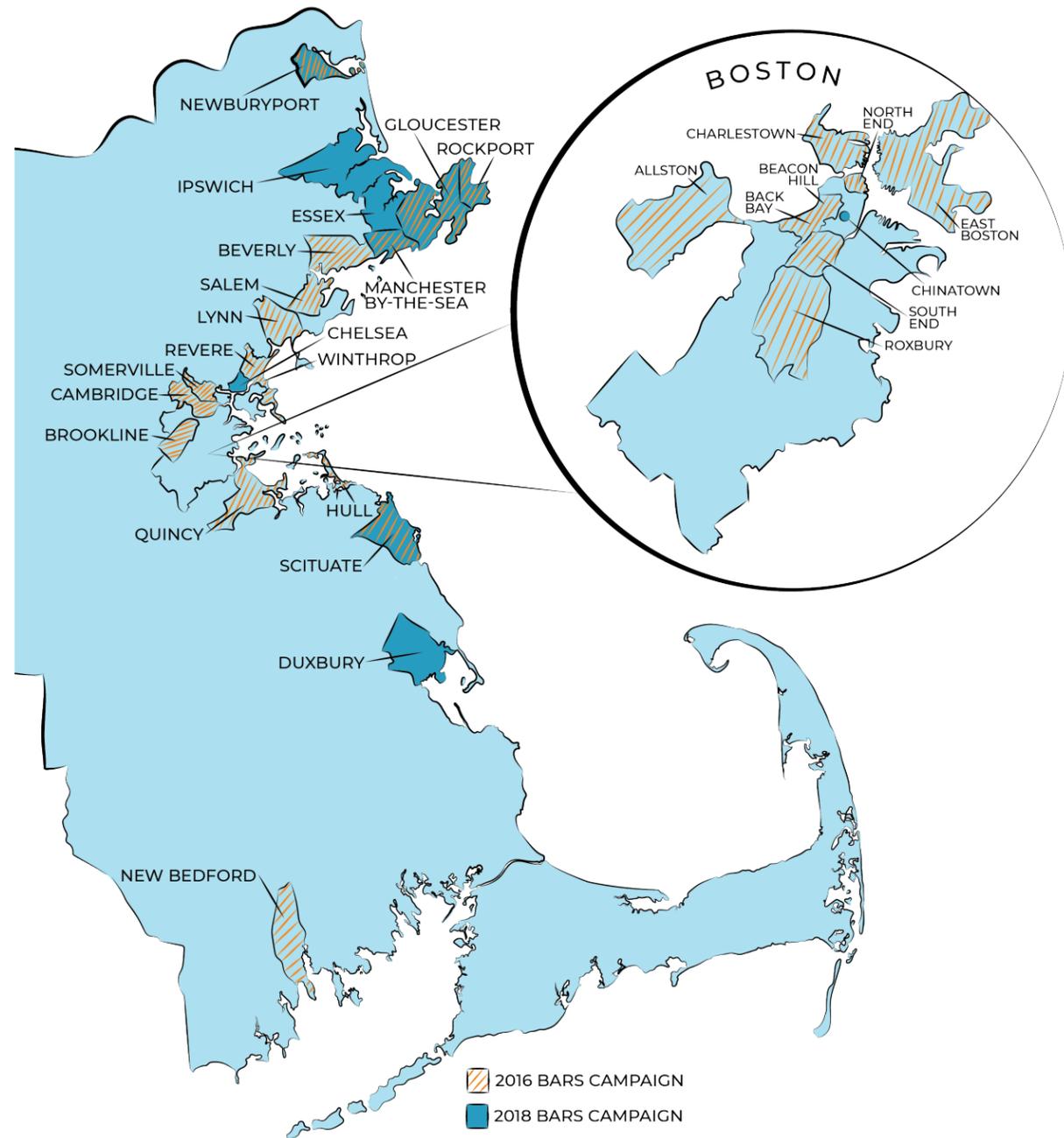
Small businesses are a foundational part of our economy, providing jobs, innovation, and cohesion to our communities. The small business sector has for over a decade been a main driver of job growth in the United States, accounting for nearly 61% of net new jobs from 1993 to 2016. Out of the 5.6 million employers in the country, those that employ less than 20 account for 89% of employers. In 2016, businesses with fewer than 20 employees represented 16.8% of the employed workforce.<sup>3</sup>

For this campaign, we developed curated accounts of climate impacts and aggregated data about risk perception and business resiliency as well as provided resources to businesses that offer simple, low-cost steps on how to prepare for climate change and take preemptive action. In this report, we use anecdotes from businesses as a means to communicate real and present climate impacts in our state combined with data to arrive at concrete policy recommendations for the state to ensure a more resilient future for its residents. The personal experiences of business owners help us better determine what tools are needed in communities and decide the best practices for adaptation.

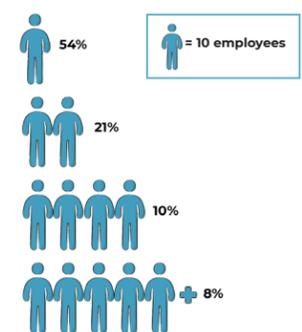
Businesses Acting on Rising Seas (BARS) is an educational campaign that helps local businesses understand their climate risk, and how their past experiences relate to extreme weather so they can plan for future climate impacts. In the past three years, the BARS Campaign has engaged with over 900 businesses in over 20 cities and towns. This (2018) was the second time the campaign was carried out in Massachusetts; we targeted 10 communities along the coast and in the City of Boston, reaching 350 businesses in 3 months of outreach, and conducting

**HOW WILL CLIMATE CHANGE IMPACT OUR COASTS?** With the population of Massachusetts highly concentrated in and around the metro-Boston area and along the coast, projected threats are a serious concern to citizens, government officials and planners. The repercussions of these changes on our businesses, infrastructure, and communities could result in significant economic and physical damage.





**NUMBER OF EMPLOYEES AT 2018 BARS BUSINESSES**



**BARS 2018**

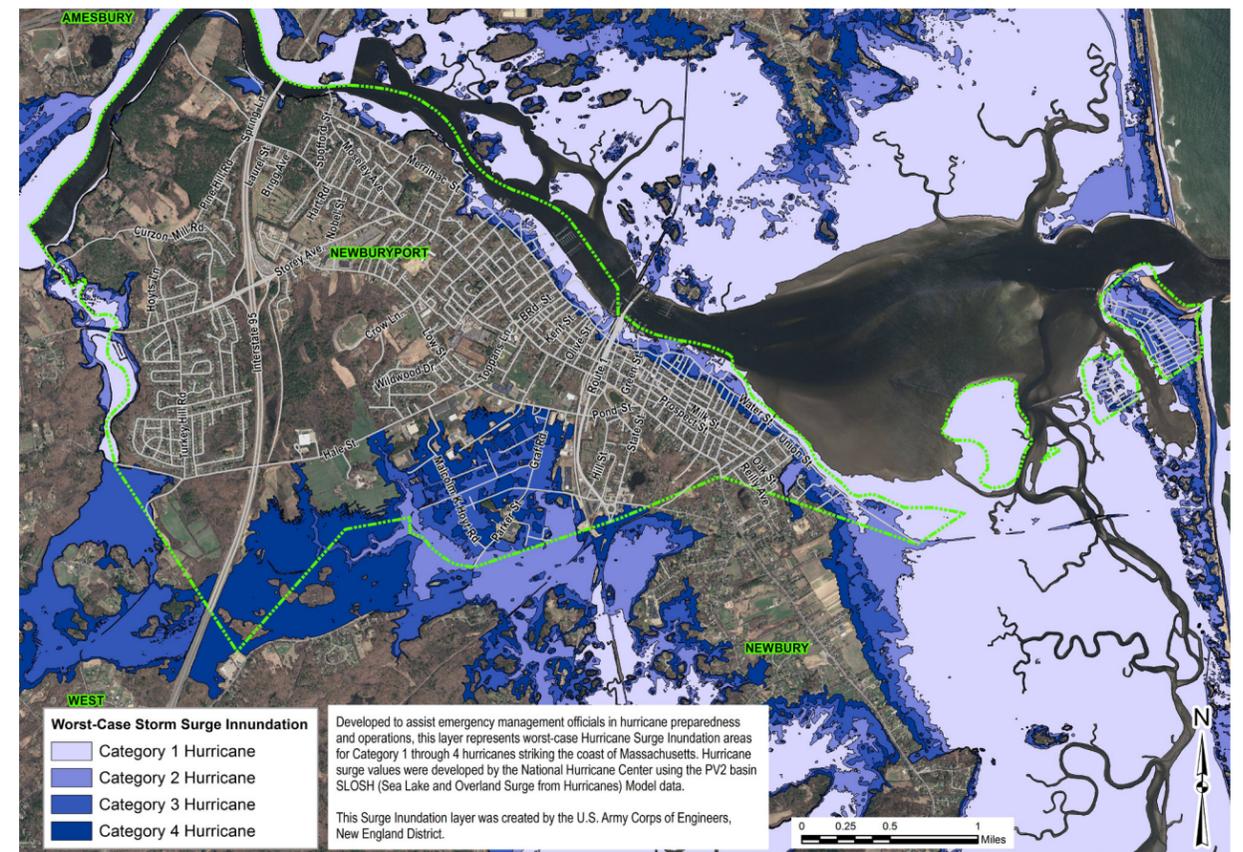
- Newburyport
- Essex
- Ipswich
- Manchester-by-the-Sea
- Rockport
- Gloucester
- Chelsea
- Boston's Chinatown
- Scituate
- Duxbury

**BARS 2016**

- Boston: Allston, Back Bay, Beacon Hill, Charlestown, East Boston, North End, Roxbury, South End
- Cambridge
- Brookline
- Somerville
- Beverly
- Gloucester
- Lynn

**Manchester-by-the-Sea**

- Newburyport
- Revere
- Rockport
- Salem
- Winthrop
- Hull
- New Bedford
- Quincy
- Scituate



**NEWBURYPORT WATERFRONT AREA 2070 0.2% INNUNDATION DEPTH (WOODS HOLE GROUP)** Predicted worst-case hurricane surge inundation for category 1-4 hurricanes striking in Newburyport Massachusetts. Individualized maps of the 10 communities from the campaign, like this one, can be found in our Small Business Resilience Guides. Map: Joe Teixeira.

in-depth interviews with 100 businesses. We took time to speak with businesses who had been affected by the storms of the 2017- 2018 winter season, which was particularly damaging in the state.

The BARS Campaign is unique in that we speak directly with business owners and managers of businesses who are facing the first impacts of climate change. Traditionally, these main street storefronts have been marginalized in favor of big business voices when discussing climate impacts and responses. Small business owners often lack the financial resources and time necessary to learn about the potential future effects of climate change and relate how they will affect their day-to-day business practices. Our goal with the campaign is to bridge this gap and bring the information right to those who need it most.

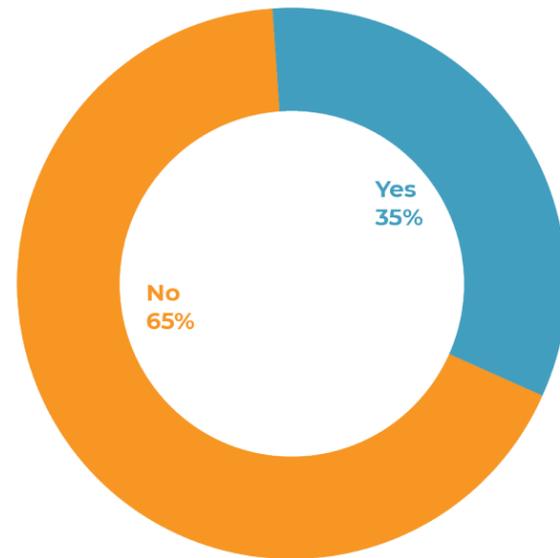
Moreover, business owners are already engaging in energy efficiency and sustainable practices, and understanding this bottom-up approach to adaptation and mitigation is also crucial in looking towards

climate solutions. Businesses in the state are facing more frequent incidents relating to extreme weather including concerns with the reliability of electricity, the safety of their supply chains, and the loss of productivity in the event of extreme weather. This has led many to recognize the local impacts of global climate change, and therefore understand the need to work towards implementing sustainable business practices and even advocating for greenhouse gas reductions through policy.

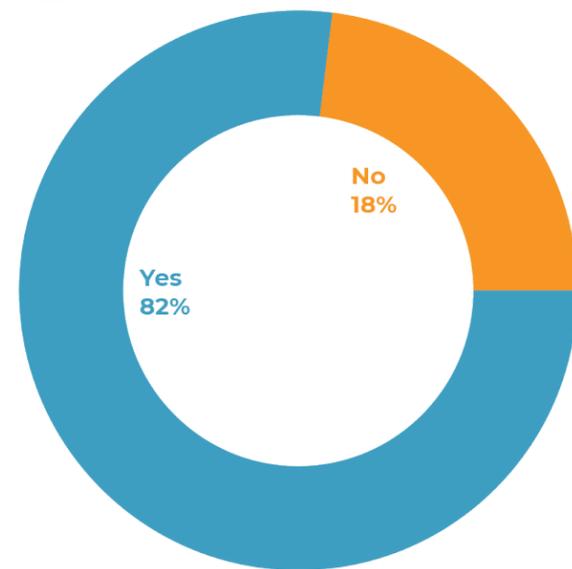
Businesses that have emergency plans in place and know their insurance policy fare better when encountering storm events. However, only 35% of businesses we engaged with have a plan in place, even though over 80% were negatively affected by winter storms in 2018. Greater education and resources are needed to tackle this challenge. 86% of businesses found education and engagement with local community groups to be helpful in becoming more resilient.

Resilience is the measure of the amount of change a system can take without facing irreversible dam-

**INTERVIEW QUESTION: DO YOU HAVE AN EMERGENCY PLAN IN PLACE?** Only 35% of Businesses Have an Emergency Plan in Place.



**INTERVIEW QUESTION: WERE YOU NEGATIVELY IMPACTED BY WINTER STORMS IN 2018?** 82% of Businesses were negatively impacted by winter storms in 2018.



age, in other words, the ability of a system to cope and adapt to change without losing its basic qualities and functions. In the case of business, resilience is achieved through the reduction of risk, vulnerabilities, and uncertainty in the face of potential threats.<sup>4</sup>

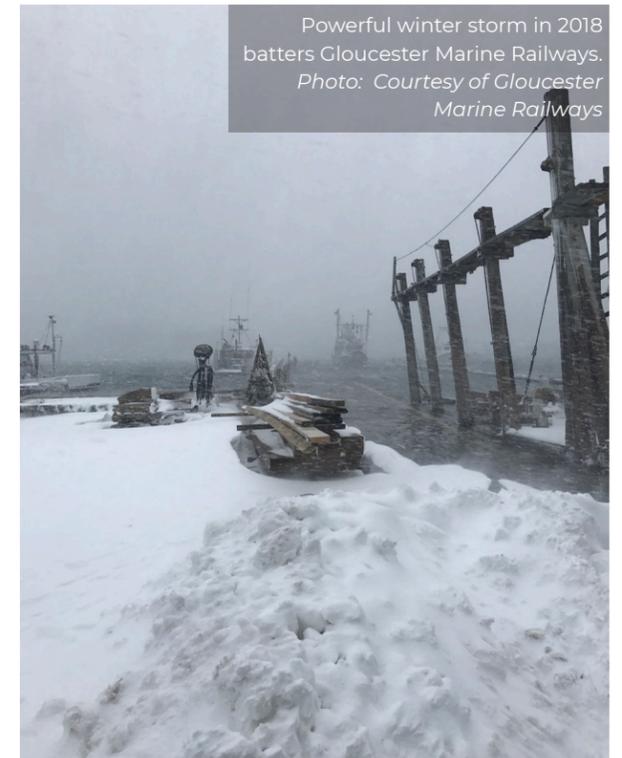
This research provides actionable data used to foster greater interaction, education, and engagement with the small businesses community. With small businesses being drivers of local economies, they need a seat at the table when planning for the future. During the campaign we identified and engaged with businesses that serve as local champions, identifying the need for advocacy and laying the groundwork for future emergency planning. This report also serves as a highly effective tool for lawmakers, community groups, and local businesses when communicating climate change and advocating for climate solutions. It presents facts and analysis on how Massachusetts communities are being affected, highlighting examples of impacts, and it presents collaborative approaches and policies that will stimulate and strengthen municipalities. Its findings serve as a catalyst for key actors and community members in the movement for a sustainable future to strengthen local and state-level responses to climate change. Comparing the findings from our first BARS Campaign in 2016, 52% of businesses considered climate change to be a high priority for their decision making – this number rose to 77% in 2018. Events such as Hurricanes Katrina, Sandy, Harvey, Maria, and most recently Florence, have contributed to feelings of anxiety around extreme weather, climate change, and the risks posed for small business owners.

We engaged with businesses in communities that have experienced climate impacts, many with natural hazard incidents that have triggered a federal or state disaster declaration and are highly susceptible to flooding and extreme weather in the near future. These communities included Newburyport, Plum Island, Essex, Ipswich, Manchester-by-the-Sea, Rockport, Gloucester, Chelsea, Boston’s Chinatown, Scituate, and Duxbury. We targeted communities that are particularly vulnerable to sea level rise and other climate risks, such as the heat island effect, providing tailored resilience guides to help each business prepare for weather events, protect supplies, and re-open sooner after a disaster. The Small Business Resilience Guides feature a flood map of each



Flooding in Newburyport, Massachusetts during the winter of 2018. Photo: Courtesy of the City of Newburyport

community, findings from municipal disaster planning, and outline eight steps to enhance resiliency. In creating the guides and reaching out to the individual communities, we cultivated partnerships with community groups, such as nonprofits, chambers of commerce, rotary clubs, and officials at town halls including town administrators, urban planners, and conservation managers. These groups and individuals had local expertise to ensure our Small Business Resilience Guides contained the most up-to-date, relevant information, and they helped us identify businesses that were local leaders as well as businesses that have been the hardest hit. By working with local groups, we accelerated the impact of our outreach and increased recognition and community trust in our work.



Powerful winter storm in 2018 batters Gloucester Marine Railways. Photo: Courtesy of Gloucester Marine Railways



## SETTING THE SCENE



View of Gloucester Harbor, a summer destination and a prominent commercial fishing port. Photo: CABA Staff

### THE IMPORTANCE OF FUNDING RESILIENCE

The exact cost of climate change is hard to quantify. However, with projections of 2.8 feet of sea-level rise by 2100, costs could reach over \$90 billion in the Northeast.<sup>5</sup> With commitments to reduce greenhouse gases, like the Global Warming Solutions Act,<sup>6</sup> Massachusetts needs to ensure climate change mitigation and adaptation is adequately funded and may need to pick up the slack due to inaction at other levels of government.

After the extreme weather events that disrupted and impaired businesses and citizens in Massachusetts within the last few years, different avenues have emerged to better protect the state. Governor Charlie Baker's Executive Order 569 in 2016 ordered the creation of a Climate Adaptation Plan that includes a statewide adaptation strategy, and under his direction, the Executive Office of Energy and Environmental Affairs began the Municipal Vulnerability Preparedness Program (MVP).<sup>7</sup> The MVP program "provides support for cities and towns in Massachusetts to begin the process of planning for climate change resiliency and implementing priority projects."<sup>8</sup> The program also provides funding for communities to conduct vulnerability assessments and develop resiliency plans. It brings together key stakeholders in municipalities and facilitates much-needed conversations at a local level, as well as develops future funding.<sup>9</sup> During our BARS Campaign, we supported the program by including contact information of designated MVP leaders within each of the communities we targeted in our Small Business Resilience Guides, in addition to sitting in on MVP workshops. Local leaders we spoke with relayed how important business districts were within their communities, and asked our Resilience Team to connect them to businesses, stating that a greater local business presence in resilience efforts would serve as a benefit. The MVP program is an inspiring step to stimulate community engagement around climate change. To keep up this momentum, and further engage with communities, funding streams need to be plentiful and secure.

Currently, MVP receives funding from the 2018 Environmental Bond Bill,<sup>10</sup> and prior funding was from the 2014 Environmental Bond Bill.<sup>11</sup> A bond bill is a statement of support by the legislature for fund-

ing. However, line items and suggested funding that appears within a bond bill is not necessarily distributed. The executive branch has full authority under the legislation to proceed or not proceed with any earmarked project. The Capital Debt Affordability Committee, under the Governor's Executive Office of Administration and Finance,<sup>12</sup> determines how much money the state borrows annually, and that may not align with the funding suggested in bond bills.<sup>13</sup> The 2018 Environmental Bond Bill, signed into law in August 2018, authorized \$2.4 billion to mitigate the impacts of climate change.<sup>14</sup> It recommended \$75 million over 5 years for the MVP program.<sup>15</sup> That accounts to \$15 million per year. However, in the Governor's Five Year Capital Plan [FY2019 - FY2023], Municipal Vulnerability Preparedness Planning<sup>16</sup> and Implementation<sup>17</sup> accounts for \$10,970,000 for 2019. An annual funding gap of about \$4 million is a \$20 million shortage over 5 years. Such essential programs should not have to only rely on the promise of funding that may never be actualized.



BARS sticker on the window at One Ocean One Love. Photo: CABA Staff

## BUSINESS CONNECTION TO THE SEA AND THE TOURISM ECONOMY

Tourism is one of the largest industries in Massachusetts. Out of 350 businesses we engaged with during the campaign, over half were directly dependent on tourism. In 2017, the state welcomed 25.9 million domestic visitors, 1.8 million overseas visitors, and 700,000 Canadian visitors. In Massachusetts, over 149,000 jobs are supported by the tourism industry, with direct spending on tourism reported at \$22.9 billion for 2017.<sup>18</sup> With 192 miles of coastline in Massachusetts, disruption to coastal industries is felt across the state and impacts many industries, even beyond tourism and fishing.<sup>19</sup>

### ONE OCEAN ONE LOVE ROCKPORT

Local fishing and lobster shacks along Bearskin Neck in Rockport have transformed into a quaint and charming pedestrian stretch filled with tradesmen and boutiques. With such a heavy reliance on tourism and the seasonal nature of these businesses, the pressure to ensure that buildings are ready and structurally sound during the spring season is high.

One Ocean One Love is a values-driven, women-owned and operated screen print clothing shop in Cape Ann. Their mission is to clean up the ocean and prevent further pollution by leading local beachside clean-ups. However, while their name promotes the friendly nature of the ocean, their business has been impacted by high tides and storm surges.

Sarah, the General Manager at the Rockport location relayed their experience.

“We had in Massachusetts historic flooding and high tide. Being [located] right on the water on stilts or pilings that affected us. The water came right up, pretty much to the max level before it could come through the floorboards. We could hear a lot of creaking and other sounds that was a little bit intimidating. After the storms were over we found that we did lose a couple of pilings.”

While their landlord quickly sought to remedy the structural issues with their shop, Sarah knows that this may be a short-term fix.

“It’s definitely really concerning for us, we were lucky enough not to flood, but that doesn’t mean it’s not going to happen next time. I know that these high

Studies show that small businesses have a greater chance of not being able to recover after weather impacts. Research also shows that businesses, decision-makers, and managers have difficulty addressing “unexpected changes in their organizations’ environment.”<sup>20</sup> Many coastal communities in the state are in fact already living with routine flooding and extreme heat, with August of 2018 receiving the record for hottest August in over 120 years.<sup>21</sup> In our BARS Campaign, we sought to help businesses prepare for impending climate impacts along the coast, targeting already vulnerable businesses and those located within FEMA designated flood zones.

Seaside economies host a vibrant blend of local businesses that include marinas, hotels, and vari-

ous other services such as recreational boating and fishing. With tourism and recreation being the largest employer in Massachusetts’s ocean-dependent economic sectors,<sup>22</sup> picturesque seaside views often lead to vibrant tourism sectors complete with restaurants and shops.<sup>23</sup>

We spoke with businesses across sectors, from local convenience stores to antique shops, art galleries, and marinas. Small businesses will continue to face ongoing struggles with physical damage to buildings, interruptions in supply chains, and reduced foot traffic because of climate change; frequent extreme weather events, heat waves, droughts, and floods will increasingly be to blame. These interruptions can cause a chain reaction impacting other businesses across industries.<sup>24</sup>

Businesses are facing increasing pressure to strengthen their capacity to be able to better “absorb the impact and recover from drastic environmental change.”<sup>25</sup> We heard stories of local businesses being unable to operate, which significantly impacts their business performance and bottom line. We found that 82% of businesses were negatively affected by storms during 2018. Losses from just 25 businesses collectively exceeded \$500,000. We also found that many businesses are choosing to rebuild reactively as a result of the impacts from the storms this winter. As these events increase in frequency and strength due to climate change, without proper planning local economies will suffer and recovery could be fragmented and incomplete. In this sense, it is important to continue educating communities and businesses on preparing for future impacts to minimize losses.



BARS Resilience Team reviewing the Small Business Resilience Guide with Sarah Steward, the Rockport General Manager at One Ocean One Love  
Photo: CABA Staff

## KEY TAKEAWAYS

A significant portion of MASSACHUSETTS’ SMALL BUSINESS ECONOMY IS DEPENDENT ON COASTAL TOURISM, affecting marine-based businesses as well as businesses that are nestled along the coast.

THE COSTS TO SMALL BUSINESS OWNERS FROM WEATHER EVENTS ARE ALREADY COMPOUNDING. Major costs include physical damage and lack of customers visiting retail-based businesses for long periods of time.

LOCAL BUSINESSES THAT BENEFIT AND RELY ON TOURISM ARE CHOOSING TO REBUILD after extreme weather events and sea level rise, despite increasing costs and future threats.

ADAPTATION MEASURES AND PLANNING IS CRITICAL to keep local economies strong and prepared as they become more susceptible to damage with more frequent and extreme weather events. Sufficient government funding should also be allocated for this purpose.

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Creating business innovation and recovery plans is essential in ensuring we have resilient coastal businesses. As we plan for the future, it will be more urgent for regions in our focus areas; Newburyport, Plum Island, Essex, Ipswich, Manchester-by-the-Sea, Rockport, Gloucester, Chelsea, Boston, Scituate, and Duxbury, which benefit from coastal tourism, to be aware of their susceptibility and exposure to climatic changes. This should further encourage business owners, government officials, and community residents to take the necessary adaptation measures. Weather events that have disrupted coastal economies have resulted in calls for understanding and developing risk and crisis adaptation mechanisms to support the small business community across Massachusetts.<sup>26</sup>



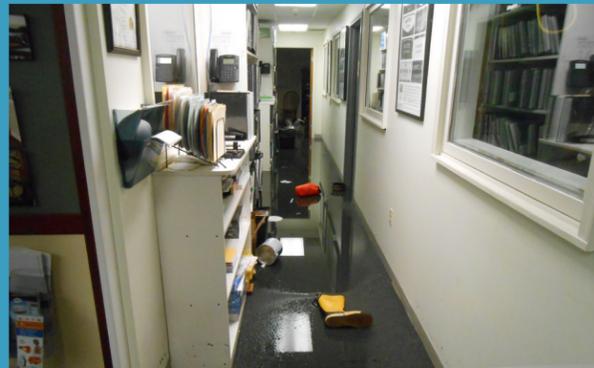
**MANCHESTER MARINE**  
MANCHESTER-BY-THE-SEA

Local business vulnerability to flooding is dependent on a number of factors. Marinas experience firsthand the damaging effects of strong storms as they are located directly on the water, facing significant damage and disruption to their ports, docks, storage, and shops as the water encroaches due to sea level rise.<sup>27</sup>

A combined effect from the wind, high tide, and full moon, along with sea level rise, had a powerful and detrimental effect on the crew at Manchester Marine in the winter of 2018. We spoke with General Manager, Adam Cooper.

“We were affected in the January storm; it had the southwest wind which blew right into us. All of the other storms were out of the east, which allows the water to blow out of the harbor. We were crippled for almost two months; we lost January and February for service work. We lost a couple of hundred thousand dollars’ worth of tools and equipment, and that’s not to say the labor that we lost during that time. It was a significant hit.”

Adam relayed how the water levels throughout their facility in Manchester-by-the-Sea reached 11 inches. Inside their facility, they had to replace all the sheetrock, outlets, carpet, painting, the water heating system, tile floors, and workbenches. To reopen for the upcoming summer tourist season, they had to hire a professional remediation company. To prepare for future storms Adam shared how they have raised central air conditioning units above expected floodwaters, as well as elevating valuables and computers.



Flooding at Manchester Marine during the winter of 2018. Water levels throughout their facility reached 11 inches. They had to replace all the sheetrock, outlets, carpet, painting, the water heating system, tile floors, and workbenches. *Photos: Courtesy of Manchester Marine*

**COMMUNITY FABRIC**

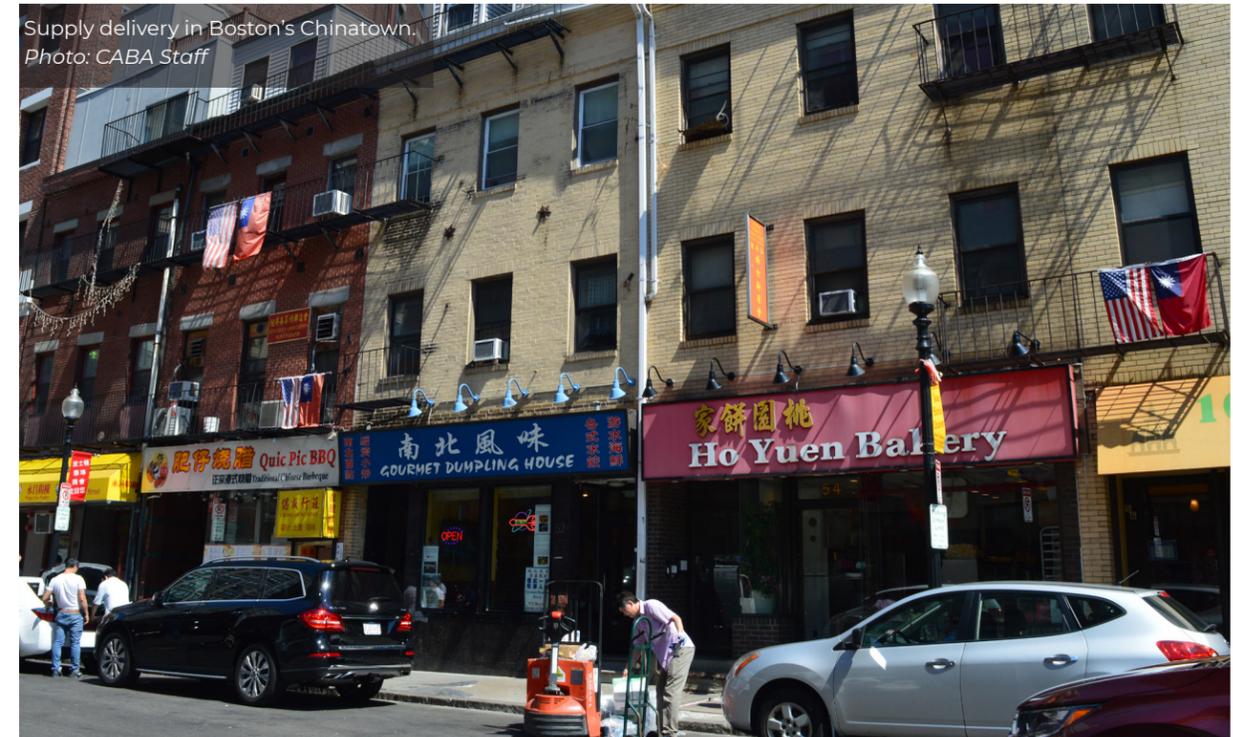
Collective consciousness, attachment to place, loyalty toward communities, and a sense of inclusion, have proven to be instrumental factors in successful resilience solutions.<sup>30</sup> With social cohesion and a sense of trust, along with direction on how to adapt to climate change, studies show there is a greater chance that communities will make the connection to the causes of climate change, thereby enhancing their mitigative as well as adaptive capacity.<sup>31</sup> Many business leaders we spoke with during our campaign that had undergone significant physical damage as a result of storms worked within their towns and community groups to promote recovery efforts, seek funding, and support other individuals within the business community. This mentality will give communities a greater chance to withstand traumas, return to the affected areas and rebuild – further increasing the success of the recovery.

The ability to successfully adapt to potential and future climate changes are in part determined by collective community action and interdependence between different groups and actors. Social capital, therefore, plays an integral role when thinking about resilience to change in the face of new threats. Daniel Aldrich, Director of the Security and Resilience Program at Northeastern University, defines social

capital as “the connections between individuals that allow them to easily work collectively, share norms, and exchange information.”<sup>32</sup> It is the ties and bonds among individuals and groups in a community, which in times of stress can be used as a support system to facilitate recovery.

Studies have found that in the aftermath of a disaster, social capital and established networks serve as essential links in a resilient community, and can determine not just survival rates, but the success of recovery after shocks or stresses to the system. A resilient community is one that is able to deal with unpredicted shocks in an efficient way, and able to return to a state of normalcy through collective action.<sup>33</sup> It is oftentimes assumed that preparing for climate impacts and potential pre-disaster mitigation is the sole burden of municipalities, however, research shows that strengthening social capital and working on social cohesion can have an instrumental role in helping a community before and after a climate event.<sup>34</sup>

Data from around the world supports the conclusion that building social, rather than physical infrastructure holds the key to resilience – whether that be from extreme weather, terrorism, or any other type of shock. While it may seem like an elusive, almost imaginary concept, it turns out that social capital is not only real, but it is a quantifiable resource



Supply delivery in Boston's Chinatown. *Photo: CABA Staff*



Flooding during the winter of 2018 outside of Flowers and Festivities on Front Street in Scituate.  
Photo: CABA Staff

### SCITUATE SANDBAGS SCITUATE

Front Street in Scituate is prone to chronic flooding. During our campaign, we spoke with 27 local businesses in Scituate. We found that the community as a whole acknowledged that their downtown is at risk for serious damage from creeping floodwaters. Businesses are vulnerable to damages from storm surges and high tides, which can cause lasting structural damage. Water damage can lead to continued dampness, causing mold, and salt water can corrode. We spoke with businesses that have individual plans to keep their goods and materials out of harm's way.

"Yes, last year we flooded twice. Those two storms in January and then two weeks after. We lost power – it completely shut me down for like, two weeks. I lost my computer. Now we raise everything up; I have my computer on bread crates, and everything's up and if we hear there is a flood coming, even a higher tide, I bring in all my tables and we put everything up." – Lisa, Flowers and Festivities

At Finer Things, a local antique shop, they also moved valuables to higher elevations.

"We did have a storm, but my husband and I had to put everything up on pieces of wood. The rug got saturated underneath the door all the way to the back stairs. We ended up moving furniture and then we knocked out half the wall because we were afraid mold and mildew might appear because it got soaked. It really got soaked. The landlord paid for it all and fixed the damages as quickly as possible.

It hindered our business for three weeks in March. Who's going to come in when the place is a mess and

the guys are working. It was very loud, and I know the places next door even had worse damage."

– Susan, Co-owner of Finer Things

While individual plans are important, the business community and the entire town has come together in Scituate to focus on low-cost, easy-lift measures that are bringing different groups across town together to prevent the floodwaters from entering into the shops.

Local businesses had incurred negative impacts from the first storm, and stories of the physical damage to shops across town came across the desk of Chief Murphy at the Fire Department.

"After seeing damages from the January 2018 storm, we took action as a community. At the Fire Department, we spearheaded an initiative to bring sandbags to vulnerable businesses and residents along Front Street, our center of commerce in town. We reached out to the Massachusetts Emergency Management Agency (MEMA), explained the situation, and they donated bags to create sandbags. Sandbags can reduce the impact of water damage in the event of the flood. We then worked with the local Department of Public Works to acquire the sand, equipment, and shovels. Saint Mary's, a local Catholic Church, became our hub where we filled the sandbags in their parking lot. The entire community came to support this effort, with AmeriCorps volunteers as well as familiar faces in the business community, and at the high school. In just over a day and a half, we filled and distributed over 1,000 sandbags."

– Chief Murphy of the Scituate Fire Department

These sandbags are beneficial to businesses and help them prepare for future storms.

"I keep the sandbags right in the back for the next storm. Everybody else put a lot of sandbags out [in preparation for the second storm]. The first time nobody was ready because they didn't see it coming." – Local business owner based in Scituate Harbor for over 50 years

We are going to be experiencing even more frequent flooding events, and we have to take more proactive steps, especially for the businesses on Front Street. We are now applying for an Emergency Preparedness Grant sponsored by MEMA to put towards [our] own sand bagging machine that can fill 600 sandbags an hour so we can keep this operation going and prepare for future storms. We are also investing in a dewatering pump with that is 100% supported from [a] grant from the Department of Fire Services spearheaded by State Senator Patrick O'Connor that can remove water from neighborhoods that have drainage concerns. MEMA is further helping us improve our resiliency by expanding our sheltering capabilities, and training more local vol-

unteers to prepare for emergency events, like the Blizzard of '78 or a hurricane." – Chief Murphy of the Scituate Fire Department

Businesses and community members across different groups, from the Fire Department to the high school, to the church, and businesses along vulnerable Front Street all look out for each other. Not only did the community work together to source a solution to protect vulnerable main street businesses, they also help each other after the storm. Rudolph Adamo Salon mentioned that their beautiful sign was blown off its hinges during the last storm, and it landed down the street. Their friends at Galley Kitchen picked up the sign and returned it to their neighbors. This sense of community among business owners is critical in remaining resilient. While in this occasion it was distributing sandbags, the ties locals have built with MEMA to acquire resources as well as the bonds among the business community, the Fire Department, the church, and the high school will prove to be helpful in future emergencies.

that has been proven to save lives in times of disaster and create communities better able to recover after a disturbance.

Professor Aldrich's research has found that recovery is not only measured by the amount of disaster relief funding given to a community, but it can also be measured by social bonds in the region.<sup>35</sup> Organization among different social groups can spread important information to official networks coordinating disaster recovery through policymakers and powerful figures who have the influence to benefit communities in need. People and communities with greater social ties are therefore more likely to survive climate-related events, as well as return to the flooded or damaged areas after a disaster, thereby accelerating the recovery process. Individuals or families with strong ties can draw on 'informal insurance' networks to acquire critical resources such as food, water and assistance with childcare when formal systems may be out of service.<sup>36</sup>

Interdependence between social capital and government support systems can also bring about faster recovery by creating networks in conjunction with governmental actors at the state or town level to distribute

much-needed resources and information. Collective action in addressing changes also helps business owners when stressful shocks occur.<sup>37</sup> Social organizations – like church groups collecting money for a local business that shut down after a storm, as well as ties that are established through social organizations (where individuals of different cultures and socio-economic groups work together) can lead to greater cooperation in business resiliency.<sup>38</sup> Local residents both serve as immediate first responders and long-term caregivers. From the moment after a disaster and in the following months, social systems are immediately available to communities and prove to be helpful.<sup>39</sup> In this instance, the business community can be framed through the lens of ecological systems, where the networks and connections between suppliers, producers, and stakeholders mimic those of natural processes. They continuously evolve to meet challenges, and some local business owners and managers may emerge as leaders. These leaders act in a "mutually supportive" environment, calling attention to the interdependence within the business community, and potentially serving as powerful figures after a disaster, connecting their municipality with needed resources.<sup>40</sup>

## MARINAS OF ESSEX

In Essex, Massachusetts, the Causeway is the town's main street and center of commerce. During the January and March 2018 storms, it completely flooded and had to shut down to car traffic. The slew of marine-based businesses that are peppered throughout the causeway had particular concerns, one of which was protecting the boats stored in their yards.

"The first one [January storm] is when we had the icebergs about the size of cars. Two feet thick. It came up all around the boats and the area where we store the boats." – Local marine owner along the Causeway

"I have boats stored all along the sea wall, and I lost quite a bit of sleep during each of those storms in fear of those boats floating away due to the rising tide, and now it's making me rethink how I'm going to store those boats this winter. The last thing I want to do is call one of my customers and say, 'Sorry your \$200,000 boat just floated away.' That's not the phone call I want to make." – Curt, the owner of Essex Marina

Perkins Marine and Essex Marina, both located on the Causeway, are in constant communication during extreme weather events, keeping a close watch for high tides and storm surges, in order to protect their property.

During the January 2018 winter storm Curt, his employees, and friends were out in waders in frigid water, pushing against the river's current to lift the boats in the yard higher on their stilts to keep them from floating away. While Curt's dedication and true friends kept all of the boats in his yard, Cape Ann Stand Up Paddle Board (SUP) was not as lucky. Cape Ann SUP has a shipping-storage container on the Essex Marina property where they launch their clients on their paddle boards. The water rose so high and the current was so fierce that the entire shipping container floated away and ended up in Perkin's Marine down the river.

Scott at Perkins Marine on the Causeway reached out to Curt to conceive a plan to recapture the shipping container before it took on too much water and began to sink. With their collective machinery and Perkins Marine's traveling crane, they fished out the shipping container, loaded it onto a flatbed truck and towed it back to its home within the Essex Marina boat yard. This an essential base for Cape Ann SUP's business continuity.

While the local marinas are taking the necessary steps to adjust their infrastructure within their boatyards to mitigate any further concerns in winters to come, this incident is a key example of how they came together, and showed leadership.

"That particular incident is just people helping other people, which is awesome. That's when you see peoples' colors shine with who comes out to help. I was very grateful to have some good people here to help out for that storm. Because like I said, it was pretty extreme, the most extreme storm I've seen in my lifetime, and I'm 50 years old. It's going to happen again so you have to live and learn." – Curt



Perkins Marine in Essex. A number of marinas in Essex keep in constant communication during weather events in case high tides and storm surges impact their boat yards. Photo: CABA Staff

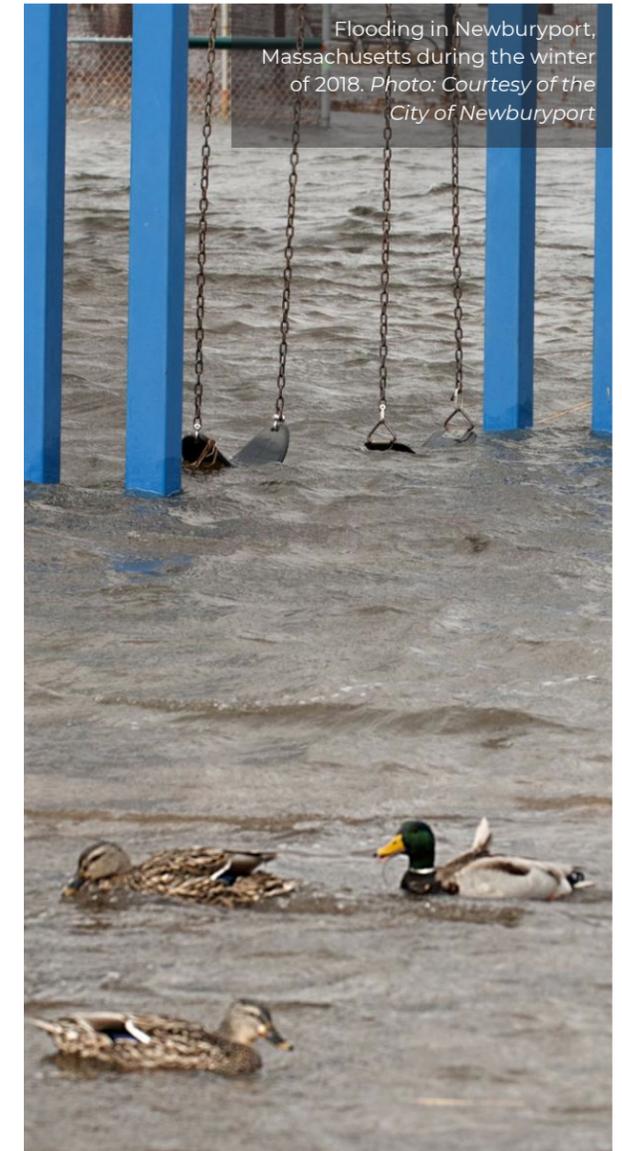
When communities can take control of their resilience, this promotes a communal sense of belonging that can support cooperative policy planning that will lead to long-term well-being. The good news is that investing in people and communities is less expensive than building massive seawalls or levees, which will also most likely not be enough to protect our cities. Investing in social capital also means bridging some of the social inequities that plague our communities and remedying racial and social justice issues. We can become more resilient and better prepared to deal with future threats, while at the same time tackling the issues we currently face.

## KEY TAKEAWAYS

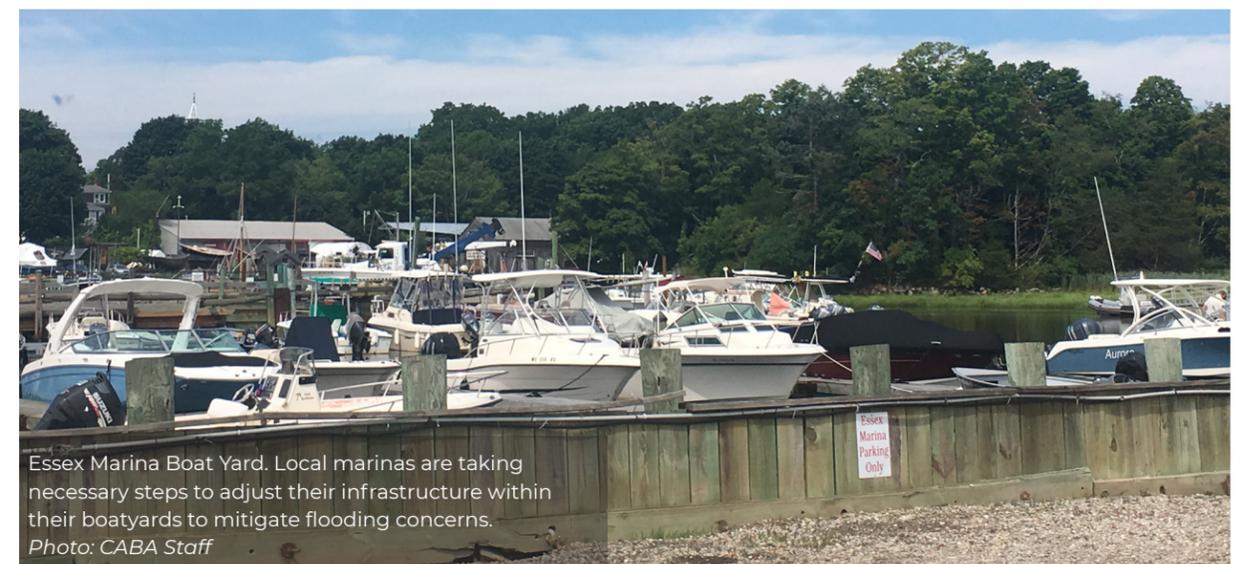
**SOCIAL NETWORKS INCREASE A COMMUNITY'S RESILIENCE** to natural disasters and other events.

**INTERCONNECTIONS BETWEEN THE GOVERNMENT AND SOCIAL AND BUSINESS CAPITAL** can lead to reduced recovery time.

Businesses with strong ties to their communities and **DIRECT EXPERIENCE WITH EXTREME WEATHER EVENTS ARE MORE LIKELY TO GET INVOLVED IN SOCIAL GROUPS**, allowing them to better prepare for future climate change impacts and recover after events have occurred, making them more resilient.



Flooding in Newburyport, Massachusetts during the winter of 2018. Photo: Courtesy of the City of Newburyport



Essex Marina Boat Yard. Local marinas are taking necessary steps to adjust their infrastructure within their boatyards to mitigate flooding concerns. Photo: CABA Staff



# THREATS



Depicts flooding from a March 2018 nor'easter making a road impassable in Ipswich Massachusetts.  
Photo: Courtesy of Ipswich Emergency Management

## INSURANCE & EMERGENCY PREPAREDNESS

### FLOOD INSURANCE

The most common result of natural disasters in the United States is flooding. The National Flood Insurance Program was established in 1978 by the Federal Emergency Management Agency (FEMA) and has since received upward of 1.8 million in insurance claims. Since the program began, the number of claims made each year has been steadily increasing.<sup>41</sup> Nearly 46% of those claims being made since 2005. The years 2005 and 2015 alone account for 12% and 8%, respectively, of all claims since the program's inception.<sup>42</sup> While there may not be a singular reason for the growth of insurance claims, rapid coastal development, as well as climate change, are major factors that have contributed to this trend. As the climate continues to change, we will see an increasing regularity of extreme weather events and thus more insurance claims, along with changes in the cost of real estate. A study conducted by Jesse Keenan, a Professor at the Harvard Graduate School of Design, found that places in higher elevations are starting to be priced higher than those more prone to flooding.<sup>43</sup> If coastal real estate markets continue on this trend, small businesses that are financially struggling may be unable to relocate. The past and expected future growth of insurance claims highlight the growing need for resilience across all areas of commercial, governmental, and residential sectors of our society.

While flood insurance is required for some businesses located in flood zones, which speeds up recovery times, we found some business owners who faced high financial burdens during the winter of 2018 due to a lack of insurance. For many, this was their first time encountering high costs from weather-related damages. The Federal Government requires that any building located in a 'high-risk' area, meaning that it has a 1 in 4 chance of flooding during a 30-year mortgage, must have flood insurance if the lending body is federally regulated.<sup>44</sup> If businesses are familiar with their policies, this can be a safeguard, fostering recovery. However, we encountered a number of local businesses that have owned their property and managed their businesses for over 10, 20, or 30 years without major flooding concerns. Some of these business owners have not been required to purchase insurance plans. Businesses on



Powerful winter storm in 2018 batters Gloucester Marine Railways  
Photo: Courtesy of Gloucester Marine Railways

Cape Ann, where over 70% of businesses rated their climate change risks as a high priority, were particularly affected. Businesses experienced significant water damage in local restaurants and boutiques for the first time in decades, causing business owners to pay for damages out-of-pocket, and re-evaluate their need for a robust flood insurance policy.

It's estimated that after disaster strikes, a small business has a 1 in 4 chance of not reopening.<sup>45</sup> The costs associated with flooding, like increased insurance premiums, have caused a trickle down of concern around overall costs, including rent prices, foreclosures, and the economic viability of some vulnerable areas.<sup>46</sup> Small businesses such as hotels, bars and restaurants, gift shops, and other small retail stores often don't have the financial capacity to absorb the costs from increased premiums and from flooding events.<sup>47</sup>

Curt at Essex Marina, summed up these feelings by saying, "You know flood insurance is expensive as it is; it's not going to be long before the insurance companies start increasing that, because let's face it, they're in business to make money, they're not going just give it out. They'll raise rates and it's going to hurt the small business owner for sure. That's where the government needs to step in a little bit, I think, and help out." Many of the businesses we spoke with

## CRAVE: MAD FOR CHICKEN BOSTON'S CHINATOWN

Over the years, the City of Boston has been hit by severe winter weather. Chinatown may have been spared from the worst of those impacts as the neighborhood is not directly on the water. However, it still faces parking and travel bans after heavy snowfalls. When the city declares a snow emergency, business owners salt and shovel in front of their storefront, many remaining open to feed the neighborhood. Older residents and friends in the neighborhood may not venture far, but they will walk a block or two to visit their favorite local dumpling house. When these businesses are unable to remain open, it can create sudden downswings in their revenue.

Throughout the year locals and tourists flock to Boston's Chinatown, a bustling cultural district filled with restaurants and entertainment. Crave: Made for Chicken is a staple in Boston's Chinatown neighborhood, serving all-natural Korean-style fried chicken. We spoke to owner Susan Cheng about the winter of 2018:

"We had to close, and regarding insurance, we didn't know the fine guidelines, so we apparently had to close for 96 hours before we got compensated for anything. We had shut down for two days and we didn't get compensated for anything but we lost two days' worth. But this past January wasn't as bad as a couple years ago when we were shutting down every week. We've also had a flood in here, down in our basement where there's a lot of goods — again. In this case, we didn't realize with insurance we had to be closed for 96 hours to get compensated for anything. With all the paperwork, it's easy for them to take your payment but there's a lot of paperwork to get any compensation."

It's hard to imagine a scenario where opening actually causes a business harm, but as we have seen it can happen. Insurance policies are supposed to act as a safety net in times of distress, but only within the parameters set by the contract. Knowing those key details is actually very important. In our Small Business Resilience Guides, we included eight steps that any business could take to be more resilient, such as, specific instructions to know your insurance policies and highlighted the importance of crucial redundancy.

fall within a flood zone, causing a growing sense of anxiety around the issues of sea level rise, climate change, and extreme weather.

The science and models projecting sea level rise are abundant, and as our climate continues to change we can only expect things to get worse, as demonstrated by the rising rate of flood insurance claims. The increasing claims can be partly attributed to rapid coastal development and subsequent redevelopment, due to government subsidies and various insurance policies.<sup>48</sup> Climate change will fundamentally change the way we go about developing coastal areas — in fact, it already has.

### EMERGENCY PREPAREDNESS

From the sandy beaches of the Cape Cod National Seashore to the rocky nooks and crannies of Cape Ann, small businesses throughout the state are taking note of climate change and the threat of sea level rise. Extreme weather events can have a negative impact on the operations of an organization; there are a variety of measures that can be taken in advance of an incident to make a storefront less sensitive, such as having an emergency plan.<sup>49</sup> An emergency plan can take many different forms and will vary widely between industries and businesses as they are catered towards an individual's needs. FEMA defines an emergency plan as a document to help businesses identify goals and objectives that should be expected to be carried out during an emergency. It covers tasks such as evacuating employees and visitors, providing first aid, and securing any important documentation.<sup>50</sup>



Crave Mad for Chicken in Boston's Chinatown. Photo: CABA Staff



Flooding from a March 2018 nor'easter in Chelsea, Massachusetts. Photo: Matt Frank

### CHELSEA BANK, A DIVISION OF EAST CAMBRIDGE SAVINGS BANK CHELSEA

Our world has been constructed by and around technology — protecting these critical assets is a continuous and important job, particularly during extreme weather events. The economy can come to a full halt when these systems are disrupted. From ATM withdrawals and bank transfers to internet routers and phone lines, it is when these systems fail that real consequences matter. Creating more resilient systems around critical pieces of infrastructure will have far-reaching benefits for any community that chooses to take such steps. In Chelsea, the city is looking into creating a microgrid (see our Grid Resilience section for more detail). Chelsea Bank, a division of East Cambridge Savings Bank, takes pride in ensuring that their customers can easily access their money in a time of need. They have dedicated phone lines that employees can call to get information about closures, as well as providing alerts. To further serve their community Chelsea Bank continuously updates their website, noting how this information is critical during emergency scenarios.

At the bank they look to the future, and they have seen how modern banking has changed with the rise of online transfers.

"Although we've made it a lot easier for people to get at their money with ATMs using debit and credit

cards, there are people that still need to get to the bank to get their money. If an event were to happen around the 1st of the month, there would be a lot of people that would be upset. A lot of people live from paycheck to paycheck and they need to pay their rent, and some landlords aren't understanding of late payments. I would say that a bank needs to be very resilient and be available when it can be to help its clients because it is still cash that talks." - Joseph Vinard, Division President of Chelsea Bank

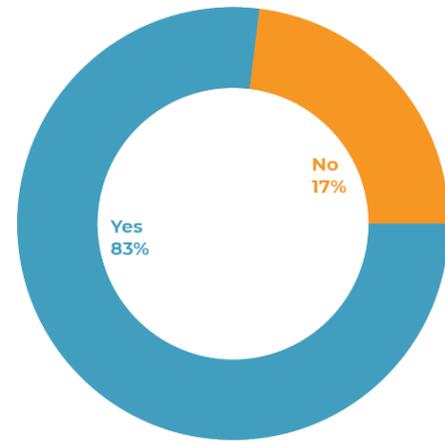
Communities all over the world, not just in Massachusetts, continue to rely on hard currency. As they say, "cash is king." We are inching closer and closer to becoming a cashless society. Whether you are looking to access your money to pay rent, or to make an electronic transaction to purchase a sub-pump or a shovel at your hardware store, banks — along with other institutions like schools, hospitals, and other community services — are important to keep online at all times. Damage to a bank's technological infrastructure could be devastating for customers and other businesses. Chelsea Bank understands the need for resilience and is looking ahead to see potential hurdles so they can take the necessary to protect their customers.

Organizational resources that better allow businesses to adjust to climate vulnerabilities can help maintain critical systems and help with response time after a weather event. Recovery from disruptions can include knowing your insurance plan, using waterproof paint or moving electrical machinery to higher levels, having local emergency contacts on hand like the local fire department, as well as having a backup supplier and knowing your inventory (perishable and nonperishable). Slack resources, or flexible resources, can be particularly valuable to increase resilience. A business could take advantage of slack resources that are not stationed in a single location, in times of stress to maintain the status quo; this can include financial institutions such as banks, data centers, and other critical technological systems.<sup>51</sup>

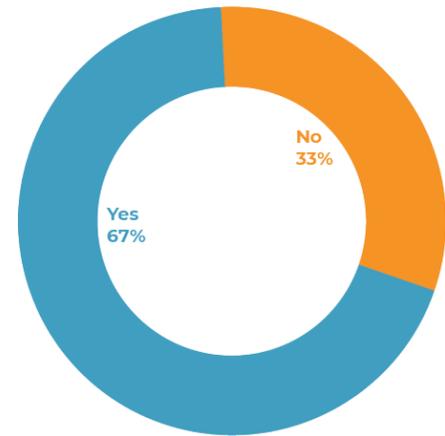
Variability and the fear of future instability can prompt business owners to act, adapt their emergency plans, or create an emergency plan for the first time. After surviving extreme weather, looking to past experiences proactively helps businesses determine their risks. Experiences from these weather events can teach business owners and managers to better prepare for their unique set of circumstances, whether it be from flooding, weak power lines, or increasingly hot days leading to droughts.<sup>52</sup> Creating emergency plans can even help businesses avoid losses due to reputational damage to an area, where the public may be under the impression that businesses in a region are still recovering and are not open. As the impacts of climate change intensify, these events are going to become normal, making the need for resiliency a growing one.

The winter storms of January and March in 2018 had lasting impacts across Massachusetts. From all of the businesses we interviewed, only 35% had an emergency plan in place. This is an increase from the results of the 2016 BARS campaign, which found that 20% of businesses had an emergency plan. We found that businesses were interested in reading through our tailored Small Business Resilience Guides, determining the best recommendations for their business and outlining the steps to create an emergency plan. After speaking with us, 83% of businesses reported that they were interested creating or improving an emergency plan. We heard many stories about how business owners are buying the best insurance policies they can for maximum protection, particularly with flood insurance, where 55% expressed concerns about rising insurance costs.

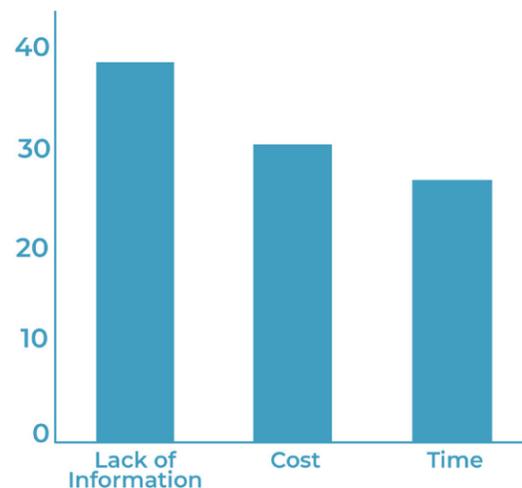
**INTERVIEW QUESTION: ARE YOU INTERESTED IN CREATING AN EMERGENCY PLAN?** 83% of businesses are interested in creating or improving an emergency plan.



**INTERVIEW QUESTION: DO YOU CONSIDER CLIMATE CHANGE A HIGHER PRIORITY AFTER THE PAST TWO YEARS?** 67% of businesses consider climate change to be a higher priority after weather events within the past two years.



**INTERVIEW QUESTION: WHAT IS STOPPING YOU FROM DOING MORE TO PREPARE?** What is stopping businesses from doing more to prepare for climate change.



**RUDOLPH ADAMO SALON SCITUATE**

When disaster strikes, people want information quickly. Employees need to know if their place of work opens or closes, how conditions will change, whether their friends and family are safe and much more. Rudolph Adamo Salon in Scituate remembered us from the 2016 BARS Campaign, where they expressed concern with contacting employees and customers about weather-related closures. Powerful waves and floods have become increasingly frequent on Front Street, where the Salon is located. Customers that live across town may not realize the severity of the flooding until they have almost reached the salon. To adapt to the frequency of flooding, the inaccessibility of the salon due to road closures, and the lack of information across town, the owners of Rudolph Adamo Salon have invested in an online communication system that can be accessed remotely. Managers can even cancel appointments on their cell phones! This allows them to inform their employees about weather-related closures, and they can reschedule appointments with clients. Individual businesses have different needs in an emergency, and Rudolph Adamo Salon has created an emergency plan that suits their unique needs.



Insurance costs are rising for many around the country<sup>53</sup> along with the growing likelihood of storms with increased participation and flooding events. This new financial burden has caused some people to make risky decisions by forgoing insurance altogether.<sup>54</sup> We heard many stories about the increase of routine flooding. On Water Street in Newburyport, even during a light rain storm, the drainage system is unable to handle the increased load, causing flooding on the street and dirty water rising in front of businesses.

**KEY TAKEAWAYS**

Rising insurance costs, changing flood zones, and increased regularity of storm events have caused **MAJOR FINANCIAL AND OPERATIONAL CONCERNS** for business owners.

Businesses that carry bank loans and are in “high-risk” areas are often required to have **INSURANCE POLICIES**, however, business owners who already own their buildings may not have insurance.

**HAVING AN INSURANCE PLAN** and knowing the details of the plan **WILL ENSURE BUSINESSES ARE BETTER PREPARED** for increasingly common weather events.

Over 80% of the businesses we spoke with were **NEGATIVELY AFFECTED BY STORMS IN THE WINTER OF 2018**, but only 35% had an emergency plan in place.

**EMERGENCY PLANS** can include having contact information for emergency services accessible to staff, as well as having a flexible supply chain, extra stock readily available, and purchasing goods that will make storefronts more resilient.

Emergency plans **HELP BUSINESSES RECOVER QUICKLY AND HELP THEM AVOID REPUTATIONAL RISK** or perceptions by consumers that specific regions may remain closed after a storm.

## GLOBAL IMPACT AND SUPPLY CHAIN

Climate change is not an isolated problem. According to the most recent IPCC report, keeping global warming to 1.5 degrees Celsius above pre-industrial levels will require, “rapid, far-reaching and unprecedented changes in all aspects of society.”<sup>55</sup> It is clear that climate change will have unequal impacts, with nations in the global south facing higher risks.<sup>56</sup> Moreover, while the direct impacts of climate change might vary from country to country and city to city, there are a variety of ways in which its effects on businesses are felt across borders.

Here in Massachusetts, we spoke with companies involved in both retail and professional services. We connected with over 80 restaurants and cafes, antique and art shops, and companies focused on law, architecture, and marketing — all businesses that can be impacted by disruptions in their supply chains.

47% of businesses we interviewed indicated that their supply chain was vulnerable to the impacts of climate change and extreme weather events. Our Small Business Resilience Guides recommend having extra supplies on hand, having more than one supplier, and being mindful of sourcing as ways to ensure redundancy and make businesses more resilient overall.<sup>57</sup> This provides both an opportunity and a challenge for businesses, as they can increase the sustainability of their overall operations by considering the environmental impact of their supply chain. Yet they can also be limited in their options for suppliers, forcing them to choose from what’s

available and most cost-effective based on the market demands, and not necessarily based on the most sustainable options.<sup>58</sup>

The complexity of supply chains can also increase climate risks. For grocery stores, climate change can have an impact on both the availability and quality of the food supply.<sup>59</sup> Changes to the natural environment that are either abrupt, from natural disasters, or more gradual from sea level rise or increasing drought conditions, can cause agriculture lands to become nonexistent or inaccessible, causing farmers to move. This means that climate impacts in countries other than the U.S. for which industry here relies on for imports, also have ripple effects and end up affecting the local economy.<sup>60</sup>

Businesses can embrace automation and blockchain technology to improve their logistics and enhance their sustainable sourcing. Severe weather events can make it impossible to drive or fly products to their destinations. Businesses like restaurants, retail shops, and marine repair shops are heavily dependent on a steady stream of supplies. Any delay in a delivery can have a negative effect on business continuity. Businesses need to re-evaluate their global supply sourcing and determine if any of their day to day goods could be affected.

Companies on our main streets and within our business districts are tied into the global marketplace. Within this marketplace, automation and blockchain can build and benefit from each other. Automation can trigger the switch to a different supply route due to expected inclement weather,



Flooding at the New England Produce Center in Chelsea. Photo: Matt Frank



Flooding from a March 2018 nor'easter in Chelsea, Massachusetts. Photo: Matt Frank

## PRODUCE CENTER AND GROCERY MARKETS CHELSEA AND CHINATOWN

Businesses that use perishable products rely on timing to get their supplies in before they decay. Businesses that involve produce are vulnerable to changes in the climate in the regions where those products are grown, as well as the transportation of perishable foodstuffs. We spoke with 40 businesses in Chelsea, where it was impossible to ignore the prevalence of refrigerated trucks around town, most with logos and designs including carrots, grapes, and bananas.

Some of the freshest produce can be found in the local Chelsea markets we visited, like Luna’s Market and Community Latin Grocery. Local business owners are quick to mention that a central part of the Chelsea landscape is The New England Produce Center. The center plays a huge role in the distribution of fruits and vegetables — it supplies produce to over 8 million people all over New England, even extending to parts of New York and eastern Canada.<sup>63</sup> However, the supply chain from this location is already at risk. Abutting the Mystic River, the location has experienced an increasing number of flooding events.

Higher intensity and frequency of such events not only puts the produce distribution facility at risk, but also threatens transportation, as flooding is expected to overtake train tracks, a major shipping method for produce in and out of the center, and make roads to and from the facility impassable. This not only impacts all of the individual distribution facilities within the produce center, but all the businesses relying on them for deliveries.

There are a number of grocery stores and produce suppliers in nearby Chinatown in Boston that are vulnerable to the impact of climate change on their supplies. Not only can climate change affect the timing of when they are receiving their products, it can also affect their cost. An employee at Heng Fat Produce, one of the produce suppliers in Chinatown, spoke to us about how the cost of fruits and vegetables has increased due to availability. Changes in temperature and challenges in producing a certain crop where it is grown can cause its price to increase.

or let a business know when they are running out of a product and instantly re-order it, saving valuable administrative hours. Blockchain technology is a distributed ledger that is available to everybody, allowing every kind of asset to be moved and transacted without the need for an intermediary. It creates a public registry of who owns what and who transacts what, all encrypted and linked together.<sup>61</sup> Along with automation, blockchain can assist in tracking goods (shipment), quality assignment (sustainable or organic sourcing), linking goods with digital tags, and sharing information about suppliers and vendors. Providing this information together promotes transparency, scalability, security, and room for innovation. By removing intermediaries, it promotes greater efficiency, and it can ensure businesses have supplies needed prior to a storm or route supplies to avoid inclement weather altogether.<sup>62</sup> Blockchain and other innovations in technology have great potential when it comes to allowing businesses to become more resilient and find solutions to climate impacts, especially as those become more disruptive for their operations.

## KEY TAKEAWAYS

**ECONOMIC GROWTH IS STUNTED** by increasingly common extreme weather events, impacting production and global trade.

Massachusetts small businesses are impacted through disruptions in their supply chains.

**SUPPLY CHAIN DISRUPTION** includes goods stuck in transit from weather events as well as sources that are becoming rare and unattainable due to gradual or sudden changes in the natural environment.

**BUSINESSES NEED TO EVALUATE THEIR SUPPLY CHAINS** and determine if they can retrieve needed products from multiple suppliers.

Embracing **AUTOMATION TECHNOLOGIES CAN BRING ABOUT EFFICIENCY** and sustainable sourcing.

**RETRIEVING THE CONTACT INFORMATION OF ALTERNATE SUPPLIERS** will allow businesses to recover from weather events and disasters in a more timely fashion.

## DESIGNER'S CHOICE CHELSEA

Climate change can not only impact how food is grown, but other plants as well. When speaking with Miguel at Designer's Choice, a local distributor of fresh-cut flowers in Chelsea, he made the connection between climate risks and his supply chain. When asked about his risk to climate change, Miguel rated it as a 7 out of 10. However, when he considered that his shop's flowers are dependent on the climate where they are grown, he increased his risk to a 9 out of 10.

"All of our product comes from South America and it comes into the US through Miami typically. So our product travels a long way to get here in trucks. Whenever there are storms, our trucks are delayed and we work on a pretty tight schedule so, even a couple hours throws everything off." With perishable products traveling such a long distance, any weather-related events along the way can disrupt their inventory and affect their sales.



Designer's Choice employee preparing bouquets for shipment.  
Photo: Courtesy of Designer's Choice

## ELECTRICITY

With more common extreme weather events expected to increase due to climate change, our communities are facing higher threats of power outages. Over 70% of the businesses we engaged with during our Businesses Acting on Rising Seas Campaign were concerned with their infrastructure, including the resilience of electric grids. Severe weather events can have a significant impact on our power systems due to the decreased reliability of interworking components, including towers and overhead lines. The greater the intensity of the weather, the more transmission disruptions there are, causing longer and more severe outages throughout the community.<sup>64</sup> It is critical to integrate resilience initiatives into our power infrastructure.

More frequent and prolonged power outages are already taking a social and financial toll on local small business communities. In speaking with small business owners, a majority expressed an interest in updating the electric network. They relayed how the grid needs to be able to tolerate a weather disturbance and continue delivering affordable energy services. Communities are looking for a resilient system that can speedily recover from shocks.<sup>65</sup> To further address concerns and accelerate recovery, utilities try to "minimize the duration and magnitude of a power outage," by preventing power disruptions that can have a domino effect and negatively influence interconnected systems.<sup>66</sup> Businesses have even gone

a step further to mitigate interruptions with some identifying vulnerable hot spots and requesting electric poles and lines be shifted underground.<sup>67</sup>

Businesses face significant economic setbacks from power outages. If the power is out for a few hours or days, businesses have long periods where production is stopped and their shops are not open. Restaurants and other food service businesses are particularly vulnerable to power outages because of the perishable nature of their inventory. Additionally, weather events impact foot-traffic and can hurt businesses' expected customer base. As of 2012, studies report that storm-related outages cost the U.S. economy between \$20 billion and \$55 billion annually.<sup>68</sup> These numbers are expected to increase.

## KEY TAKEAWAYS

Over 70% of businesses had **CONCERNS OVER INFRASTRUCTURE**, including grid resilience.

**ELECTRICITY OUTAGES DUE TO WEATHER EVENTS** can have multifaceted impacts on businesses, such as closures, lost inventory, and lost business.

Power outages pose serious risks for all community members. Having **ACCESS TO ELECTRICITY** during these times allows people to charge devices like laptops and cellphones, emergency management messages to be sent, and stock to be saved.

## PAN Y CAFÉ CHELSEA

When he started Pan y Café, Roy Avellaneda was inspired by the coffee shops of the 18th and 19th century, where people would discuss new ideas. The walls of the shop are lined with images of protests and the ceiling is filled with quotes of inspirational words condemning civic complacency and indifference. His coffee shop has become a place where locals in Chelsea go to catch up on the news. Pan y Cafe is more than a place to grab a coffee — it is a central meeting spot where locals are encouraged to speak their minds and embrace their heritage. Roy ensures all cultures are welcome and valued, and he highlights his own Latin heritage by offering traditional South American food specials.

Coffee shops like Roy's can also become key pieces of a resilient neighborhood. A welcoming shop like Pan y Cafe can be a place to warm up, charge

your phone, and let your loved ones know you are safe during an emergency. Yet, with increasing extreme weather events, Roy relayed how he is fearful that high winds can knock over trees and intercept power lines and poles. "I'm one of the very few that keeps on telling everybody we should be putting all electrical lines underground. This past winter (2018) the whole North Shore was impacted by the lack of electricity for days. I'm seeing it. Everyone's thinking about the instances and I'm over here connecting all the dots." Roy is looking ahead; as a business owner and city councilor he is a critical community voice. With the electricity on in cafes like Roy's, these shops can serve as a sanctuary and safe haven in the community during snowstorms and extreme weather events.



## BUSINESSES TAKING ACTION



Corner Market, at the intersection of Broadway and Eleanor Streets. One of many local variety stores owned by independent shopkeepers in Chelsea.  
Photo: CABA Staff

### ENERGY EFFICIENCY

Energy efficiency is a high priority in Massachusetts, which has been ranked by the American Council for an Energy Efficient Economy as the most efficient state for 8 years in a row.<sup>69</sup> In a region with dramatic seasonal swings such as Massachusetts, from hot and humid summers to cold and dark winters, there is an uneven demand for energy throughout the year. This past summer season (2018) ISO-New England predicted that peak demand could reach 28,120 MW or roughly a 10% increase of the average daily summer demand.<sup>70</sup> Any time there is a heat wave, an increased strain is put onto the grid as efficiency drops and demand for air conditioning increases. To combat the pressures set during peak demand times, the Commonwealth of Massachusetts has worked hard on increasing energy efficiency throughout all commercial and residential sectors.

Every three years since 2010, the commonwealth has issued the Three-year Energy Efficiency Plan, with the 2019–2021 plan currently under develop-

### GALLEY KITCHEN AND BAR SCITUATE

The Mass Save Program has helped small businesses throughout Massachusetts reduce their energy demand and increase efficiency. We learned from the Galley Kitchen and Bar about their transition to a more energy efficient space while they were conducting an energy audit. Located right along the heart of Scituate's main strip, the restaurant features a large glass facade which can be opened up during hot summer days, reducing the need for cooling systems. The owner, Brian Houlihan, has taken many steps to reduce the restaurant's overall environmental footprint, a cause he takes very seriously at all 4 of his restaurants, which are located throughout the South Shore. Brian is motivated to set an example for other local restaurants and show that transitioning towards smart energy choices is also cost-effective.

We learned that a significant portion of Brian's financial costs goes toward heating and cooling the space. Even the restaurant's design, including an open dining room concept, large operational glass windows, and energy efficient appliances, was to create a comfortable and functional space for all the patrons serviced at Galley Kitchen and Bar. Restaurants face unique energy challenges because they require a constant supply of power for kitchen appliances in addition to heating and cooling their business for employees and customers. At Galley Kitchen and Bar, efforts to be more sustainable extend beyond energy, as the business is moving towards getting eliminating plastic straws and drink mixing sticks, and sourcing local food and composting.



Galley Kitchen and Bar in downtown Scituate. A modern gastropub that has faced flooding impacts, and prioritizes mitigation measures. Galley Kitchen is seen as a local business leader, participating in a variety of sustainable practices.  
Photo: CABA Staff

ment. Its aim is to further diversify the state's energy supply, advance commercial and residential programs, especially for low-income residents, improve demand management, and promote zero net energy buildings, among others.<sup>71</sup> Massachusetts has been able to consistently remain vigilant in meeting the energy goals it sets for itself by increasing the share of energy production to renewable sources such as wind and solar, but also through extensive energy efficiency programs. Many of which have been led by the Mass Save program.<sup>72</sup> For small businesses, Mass Save offers facility assessments, help on renovations, and upgrades for equipment. Programs, like Mass Save, can be used as a template to further incentivize businesses to make choices to reduce their greenhouse gas emissions, continuing to help businesses play a major role in meeting our state reduction commitments.

After speaking with small businesses throughout Massachusetts, we found that nearly 72% are actively taking measures to increase their energy efficiency, and 83% are actively working towards reducing demand. It's clear why businesses are taking energy efficiency seriously, as 65% of the businesses we spoke with cited concerns about increasing energy costs. There are a number of viable options that any small business can take to be more energy efficient, our suggestions (which are in all of our Small Business Resilience Guides) include updating building insulation, investing in equipment with passive-air cooling systems, and replacing inefficient climate control systems.



Owners of Ripple on the Water with our Essex Resilience Guide, which details how businesses can become more energy efficient. Photo: CABA Staff



After the storms in the winter of 2018, Manchester Marine has raised up their air conditioning units due to sea-level rise and expected flood conditions. Photo: CABA Staff

### KEY TAKEAWAYS

**MASSACHUSETTS HAS PRIORITIZED ENERGY EFFICIENCY** over the past several years, becoming one of the most efficient states.

**EXTENSIVE ENERGY EFFICIENCY PROGRAMS** that offer incentives, like Mass Save, have been very successful. These incentive programs can be used as a model to further meet our greenhouse gas emissions reductions.

**MANY SMALL BUSINESSES ARE CONCERNED ABOUT THEIR ENERGY USE** and are taking actions such as reducing demand and purchasing energy efficient appliances.

**CONCERNS OVER RISING ENERGY PRICES** are prevalent throughout the state and many would like to see greater grid resiliency.

## SUSTAINABILITY AND SMALL BUSINESS

Sustainability has grown from an issue of little concern to being a top priority for entrepreneurs, even beginning to impact day-to-day practices of small businesses. At a broad level, sustainability's role within an organization is bigger than simply turning off the lights or recycling.<sup>73</sup> Sustainability practices can often result in a positive financial outcome for the organization if methods are incorporated into strategic planning.<sup>74</sup> While the tactics taken by any industry, business, or individual owner may be unique to a given circumstance, investing in resilience can have significant financial returns.

Multiple approaches can be taken towards organizational sustainability, such as recycling programs, employee ridesharing, reducing carbon emissions, ethically sourcing materials, composting, switching to LED lights, and much more. However, having the capacity to participate in any number of practices is dependent on organization size, financial standing, and resource availability.<sup>75</sup> While some businesses are better positioned to weave sustainability practices into their operational fabric than others, there are many different approaches that can be taken when shifting towards sustainability and resiliency.

The businesses we interviewed are incorporating sustainability in a number of ways: removing unnecessary plastic waste, signing up for Mass Save energy audits, participating in recycling programs, using greener transportation, composting, and reducing energy use were some of the examples we encountered.

### BUSINESSES PARTICIPATION IN SUSTAINABILITY PROGRAMS

Over 80% of interviewed businesses participate in plastic waste reduction, energy conservation, and recycling.

Alternate Transit (walk, bike, subway, bus)	48%
Energy Efficient Appliances	72%
Plastic Waste Reduction	81%
Energy Conservation	83%
Recycling	85%

### BEAN AND LEAF CAFÉ ROCKPORT

After their experiences with extreme weather over the past few years, the owners at Bean and Leaf Cafe in Rockport knew that something needed to be done. Rockport is no stranger to extreme winter storms, located right at the tip of Cape Ann, the region is regularly pounded on by nor'easters, blizzards, and other storms. A common experience throughout coastal communities in Massachusetts is that of storm surges and flooding. The owners of Bean and Leaf Cafe also own and manage The Ice Cream Shop, a white-washed gingerbread cottage the size of a shed, right along the peninsula. Over the past winter, the force from waves coming onto the property during high tide were so powerful that they shifted the Ice Cream Shop off its foundation. While they were able to shift it back for the coming season and redo the landscaping, these events can have serious implications for small businesses. The owners of Bean and Leaf understand that by engaging in more sustainable practices, they are helping to reduce greenhouse gas emissions, and therefore, any commitment made towards sustainability is also a contribution to lessening the future effects of extreme weather caused by climate change.

Composting is still relatively new in terms of being municipally regulated like trash and recycling pickups, so it can take a lot of individual initiative from businesses to commit. Large scale municipal composting has only been implemented in a few cities across the country, Cambridge, MA launched their curbside composting service in April of 2018, for example. At the Bean and Leaf Cafe they are aware of the issues surrounding the waste they generate; to reduce their plastic waste and ensure that the packaging they hand out is less harmful, they have switched to compostable containers. Everything from drink lids, silverware, and to-go containers are all either compostable plastics, like corn and starch derivatives, or paper. Bean and Leaf Cafe understands its effects on environmental well-being and has incorporated it into its business strategy.

## CHELSEA STATION CHELSEA

The Chelsea Station Restaurant Bar and Lounge is a cornerstone operation within its neighborhood. Located within walking distance of residential streets and public transportation, Chelsea Station is easily accessible by its employees and customers. Many of them choose these alternative modes of transportation rather than using a personal vehicle. We had the chance to sit down with a key stakeholder and manager, Mark, to talk about their climate risk, sustainability practices, and community.

At Chelsea Station, they have taken a strong commitment towards reducing their environmental footprint in a number of innovative and creative ways. Of all the businesses we spoke with, over 30% were in the restaurant and food industry, yet Chelsea Station was the only one to consider the end-life of the cooking oil they use. Currently, they are in the

process of interviewing different bio-waste companies to take their waste and use it for energy production: an expensive endeavor, but one that shows an unwavering commitment towards sustainability.

To help cut down on plastic waste and control what flows into our oceans, customers at Chelsea Station have to specifically ask for a straw when ordering a drink. The restaurant also installed dual flush toilets to cut down on how much wastewater they produce.

In the kitchen, all of the appliances are Energy Star certified, which reduces their energy demand in what is an energy-intensive industry. The Chelsea Station Restaurant Bar and Lounge can serve as an example of what steps restaurants can take to be more sustainable in what can be a challenging industry.



Mark, Manager at Chelsea Station highlights the Chelsea shoreline and shares about Chelsea's environmental justice concerns along the Mystic River and Chelsea Creek.

Photo: CABA Staff

The 2016 BARS Campaign found that throughout Massachusetts at least 99% of businesses engaged in at least one sustainability practice, with recycling being the most common with 85% of participants, a trend we encountered in the 2018 BARS Campaign with the same level of recycling at 85%.

When it comes to sea level rise and sustainability, we found that geographic scale and personal connections are the most influential factors in one's own risk determination, and this helps businesses make the connection between climate change and sustainable practices. Having direct experiences with weather and climate-related events also increases one's perception of these issues, and this helps them relate to the global need for sustainable practices. These connections lead to greater awareness and understanding about such issues as sea level rise and the impact of being aware of using natural resources, and preventing environmental harm.<sup>76</sup>

Resilience in organizations can be thought of in two ways, short and operational or long and strategic.<sup>77</sup> Long term planning is crucial to the success of small businesses, and extreme weather events have a tendency to knock them out. Losses, on average, can be as much as \$3,000 per day.<sup>78</sup> Understanding the long and short term implications of sustainability programs can be hard for small businesses. High costs, lack of information, or not knowing where to start has caused many to defer taking action. Understanding resilience, from a business perspective, as a way to save money and better position oneself for unplanned disruptions, can be a greater driver for businesses than the benefits of undertaking such initiatives. It is true that it pays to prepare, and incorporating resilience and sustainable thinking into business operations can make these abstract ideas more concrete and actionable.

Compostable cups make it easier for commercial kitchens to engage in sustainable practices and serve beverages without damaging the earth's environment.  
Photo: CABA Staff



## KEY TAKEAWAYS

**SUSTAINABILITY IS NOW VERY MUCH INTEGRATED IN SOME WAY IN BUSINESS OPERATIONS.** Recycling is the most common, with 85% of interviewed businesses participating.

**WEATHER AND CLIMATE-RELATED IMPACTS ON BUSINESSES ARE COSTLY,** and it results in 1 in 4 small businesses permanently closing.

**GEOGRAPHIC PROXIMITY TO AND PERSONAL EXPERIENCES WITH EXTREME WEATHER HELPS DRIVE** perceptions of risk, vulnerability to climate change, and **THE TRANSITION TO SUSTAINABLE PRACTICES.**



HOW TO MAKE A GREATER IMPACT



Boston's Chinatown. Photo: CABA Staff

**GRID RESILIENCE**

For businesses to flourish and local economies to thrive, reliable, affordable, and accessible energy sources are essential. Small businesses face losses associated with the impacts of climate change and extreme weather, as these can in many cases result in costly power outages. The U.S. Department of Energy (DOE) found that approximately 78% of all power outages from 1992 to 2010 were due to weather-related events.<sup>79</sup> Exposure to these risks disproportionately affects coastal and low-income communities, as they threaten business operations and can result in expensive losses.

We need to adapt and act together to “incorporate lessons learned from past events to improve resilience.”<sup>80</sup> After recent storms, utilities and communities are re-evaluating their emergency practices, business continuity plans, and system design. Looking to the future, this opens the doors for new technologies and innovation to update infrastructure in order to be able to keep the power and the heat on when the traditional grid is unable to operate.

The rise of renewables, like wind turbines and solar panels, now allows businesses to choose to get their electricity from sustainable sources. This coupled with the falling cost of batteries can help businesses cut costs and lower their electric bills. Battery storage technology is key when managing the variable generation of renewable sources, and it serves as an aid in regions with aging grids. Renewable energy sources can also be much more localized than traditional fossil fuels, therefore shortening the distance between generation and consumption and in turn, reducing vulnerabilities in its delivery.<sup>81</sup> The

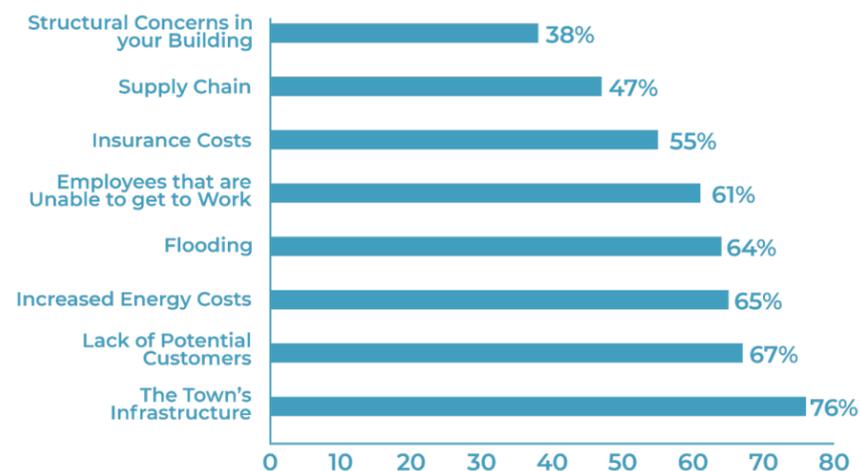
adoption of renewable energy sources is therefore as much a function of greenhouse gas reduction as it is of resilience building in our communities. Furthermore, this transition can help meet state and global goals for greenhouse gas emission reductions.

The current power system in the Northeast is interconnected with ISO-NE. It spans six states, and power sources can travel thousands of miles across the high voltage power lines. ISO-NE controls the dispatch of power to meet consumption needs, determining the availability of power, hourly demand (often weather dependent), and the consequences of power failures.<sup>82</sup>

Microgrids have the power to keep the lights on when the larger grid goes dark. These energy systems can minimize the scale of the impact of power outages by sourcing power from multiple streams and using energy storage technologies. With a microgrid, a neighborhood or even a few blocks can utilize a localized power system that is independent from larger regional grids.

The U.S. Department of Energy defines microgrids as “a group of interconnected loads and distributed energy resources (DERs)...that acts as a single, controllable entity and can connect and disconnect from the grid to operate in both grid-connected or island mode (when the microgrid generates power independently).” It can function autonomously by disconnecting from the traditional grid with a manual or automatic switch. Microgrids also offer communities the opportunity to cut costs and rely on cleaner sources of energy. They can reduce greenhouse gas emissions by integrating renewables, modernizing the grid, and providing a more localized resilient

**CLIMATE VULNERABILITIES**  
76% of businesses interviewed found their town's infrastructure to be a source of vulnerability in the face of extreme weather.



power network that is “designed to operate closer to customers on the electricity grid.”<sup>83</sup>

With natural disasters, like hurricanes and nor'easters, the delicate nature of centralized grids has come into question; microgrids can provide grid resiliency and increase energy reliability. Major distribution lines and poles can be disrupted or destroyed by falling trees, affecting not only local communities, but entire regions.<sup>84</sup> In 2017, recovery in Puerto Rico was slow after Hurricane Maria, as 80% of residents were still without power a month after the storm. Cities like San Juan in the Northwest were powered by plants in the Southeast, and when power lines were ruined in the storm, recovery was stunted.<sup>85</sup> Recent natural disasters have highlighted the fragility of a centralized grid architecture. As we expect weather events, like hurricanes, to become more frequent, we need to look to decentralized solutions like microgrids to safeguard our power systems.<sup>86</sup> Synapse Energy executed a study on the Puerto Rico Electric Power Authority and discovered that “power

lines were cracking corroding and collapsing.”<sup>87</sup> With the Governor’s Coalition calling for electric grid improvements, microgrids are a means to provide stability where infrastructure may be weak.

Energy storage in microgrids can be used to maximize renewable generation and minimize peak load, while at the same time ensuring greater stability for the system. Microgrid systems can also bid their capacity into the electric marketplace to “to absorb or discharge power” needed in the grid at any given time.<sup>88</sup> This action can sell electricity back to the grid and earn revenue based on the amount of energy dispatched, providing lower-cost electricity and savings to microgrid users, making energy more fair and accessible, promoting greater equity. As microgrids become more well-known, financial investors are noticing the potential for profit in microgrid investment projects. With this comes a greater sense of stability in the development of future projects, further expediting growth, markets, and affordable financing opportunities.<sup>89</sup>



Robust social networks in Boston's Chinatown coordinated by groups like the Chinese Progressive Association and the Chinatown Main Street Program were key allies during the BARS Campaign, helping to distribute the Small Business Resilience Guides in English, Cantonese, and Mandarin.  
Photo: CABA Staff

## RESILIENT URBAN NEIGHBORHOODS GREEN JUSTICE COALITION CHELSEA AND BOSTON'S CHINATOWN

CABA is working with the Resilient Urban Neighborhoods Green Justice Coalition (RUN GJC) to engage with business leaders and local advocates in the communities of Chelsea and Chinatown to present the benefits of microgrids and complete a microgrid feasibility study.

We found that increasing awareness about the benefits of microgrids can have a major impact in lifting up communities that may be underserved. While speaking with businesses, we highlighted how microgrids can be designed to make electricity more resilient and sustainable. By providing communities with grid configurations that are designed to withstand more frequent weather events they can better adapt, a finding that is also echoed in a recent NECEC and BU study.<sup>90</sup>

Each of these projects has been largely driven by the community and its members. The RUN GJC coalition works closely with grassroots nonprofits, Chinese Progressive Association (CPA) and GreenRoots in Chelsea. The cooperative nature of these projects is unlike that of the other microgrid studies happening in the state by allowing for greater participation from residents.

Chinatown and Chelsea are both communities with minority-majority populations, historically low-incomes, and prone to the effects of climate change. While the solar industry in Massachusetts has grown to become one of the best in the country, it has catered to upper and middle classes, with individuals who earn less being almost entirely left out. Compounded with a lack of financial capital, more often than not, low-income residents also face a greater deal of necessary building upgrades to be eligible for solar access, only further exacerbating such issues.

Both microgrid projects are neighborhood-oriented and their inclusive nature gives constituents a chance to be involved in their own energy procurement. 85% of businesses leaders we spoke with during our Businesses Acting on Rising Seas Campaign were interested in learning more about microgrids and how they could benefit the community. Each of the microgrid feasibility projects are exploring what services and local buildings are essential when there is a larger grid outage and the microgrid

goes into island mode. These can include affordable housing complexes, community centers, food distribution centers, hospitals, and education centers. By ensuring critical services and community centers have power, vulnerable communities can be better protected. Furthermore, due to the highly collaborative approach and design process of this microgrid, interpersonal ties are forged and strengthened, leading to better communication within the community, building the community fabric and encouraging emergency planning. Ultimately, we expect for each neighborhood to produce a comprehensive emergency plan that all residents will be familiar with. Part of this plan will include where they can go for emergency shelter and services. This is something we've found is lacking right now, which makes these communities even more vulnerable and isolated in an emergency.

Microgrids have the potential to become a cornerstone piece of infrastructure for any community. Grid modernization, cloud-based connectivity, storage capabilities, and the protection of critical facilities are just some of the ways in which microgrids can increase a community's resilience. With electricity generation happening locally, from within the grid, those who buy into the microgrid could experience overall energy costs lower than what utilities are charging consumers today. For low-income residents and cash-strapped small businesses, reduced energy bills alone could serve as a major asset to their safety and resiliency. Low-income and vulnerable communities are particularly positioned to receive the greatest share of benefits from the development of community-based microgrids.

## SMART PLANNING

Increasing resilience for any system, at any scale, requires adaptability, flexibility, and the ability to deal with uncertainty while protecting valuable assets. Resilience building has positive ripple effects, particularly in the relationships between towns, small businesses, and residents. Smart planning methods adopted by state and local governments can play a key role in fostering resilient building measures as well as helping to mitigate climate impacts at the local level.

We recommend that cities and towns use various planning methods as tools to increase climate resiliency in their communities, such as incorporating the principles of smart growth, changes in zoning permits, and revising building codes. Smart growth encourages the preservation of open space and critical environmental areas.<sup>91</sup> Strengthening the review process, and the conversation on community preparedness for development in areas subject to increasing weather impacts, like flooding, is critical to make business districts more resilient.<sup>92</sup>

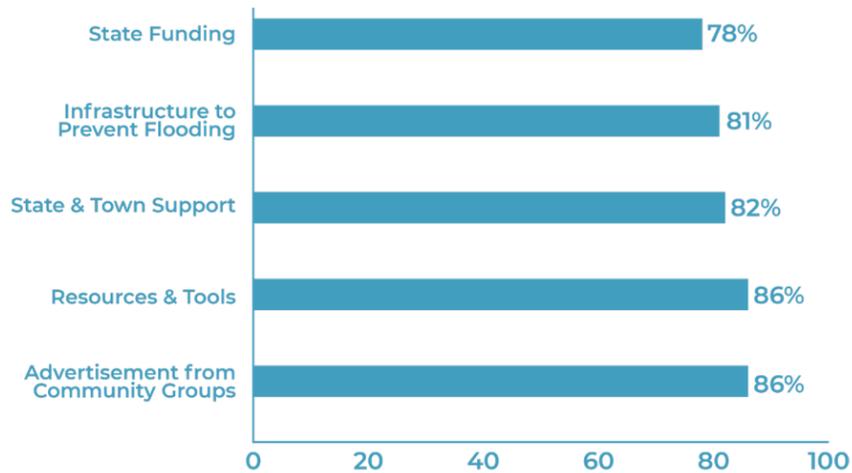
Our fieldwork focused heavily on small businesses along main streets that are key regions supporting local economic vitality. When speaking with business owners and managers, we continually heard stories about how their storefronts were stunted over the past winter from infrastructure concerns, including lack of foot traffic for retail stores, and physical damage to their workplace. Businesses are spending money out-of-pocket or calling in insurance claims to recover after severe winter storms. As businesses

finish renovations from flood damage incurred over the past winter, they're witnessing new buildings under construction in equally flood-prone areas of their neighborhood. During our conversations, business owners repeatedly asked, how is this possible?

To protect communities from weather events, and ensure business districts are expanding into regions that are easy to repair and recover, Massachusetts municipalities are adapting regulations for rising tides and climate change impacts in lieu of changing the state building code. As written the code states, "all buildings in the state of Massachusetts are subject to the Massachusetts State Building Code."<sup>93</sup> An 11 member board known as Board of Building Regulations and Standards, (BBRS) appointed by the Governor, are tasked with adopting and administering the state building code.<sup>94</sup> The law has a provision for municipalities to amend the state code where, "The board of selectmen in a town or the mayor in a city may recommend to the board the adoption of rules and regulations imposing more restrictive standards than those established by the state building code for construction, alteration, repair, demolition, and removal in such a city or town."<sup>95</sup> Even though this provision exists, after reaching out to each of the 10 municipalities we engaged with, and hearing from countless urban planners and town building inspectors, along with environmental lawyers and leaders at other environmental nonprofits, we could not find a community that had actually made recommendations to the BBRS. Instead, communities across Massachusetts are finding some pretty ingenious round-

### INTERVIEW QUESTION: WHAT WOULD HELP YOUR BUSINESS PREPARE FOR CLIMATE CHANGE?

Over 75% of businesses interviewed pointed to support from the state and their town in addition resources and better infrastructure as means to increasing their resilience.



**ABOVE:** Images after a storm in 1950 on Plum Island Massachusetts. While eroding sand dunes are not uncommon on Plum Island, many oceanside structures (in the past and present) have not been built to withstand high moving flood water. Photos: Courtesy of Surfland

**BELOW:** Surfland Bait and Tackle Shop on Plum Island. Photo: CABA Staff

### SURFLAND BAIT AND TACKLE SHOP PLUM ISLAND

In our fieldwork, we found business owners to be key community members, many of them running family businesses that have been in their respective towns for generations.

Fishing is one of the main forms of entertainment on Plum Island, and Surfland Bait and Tackle Shop is one of the hubs of information. The shop has been owned by the same family for more than 60 years on Plum Island. They have an archive of how the island has changed, and what has stayed the same. We were shown a thick binder filled with old photographs, news articles, and personal stories of erosion and weather events. This family-run business is resilient, setting up shop on an island known for severe storm events. They knew where the island was most vulnerable, how the tides come in, and what businesses are most at risk, citing pictures to prove their stories. Business owners often have institutional knowledge that can help identify and prepare for threats that affect the community. Including them in workshops where they can share their expertise, as well as incorporating new businesses that are not as assimilated, will better help the community as a whole in their preparedness efforts.



The Main Street bridge in Essex is often inaccessible during storm events due to flooding from the Essex River. Photo: CABA Staff

abouts to ensure more resilient communities and business districts.

Cities and towns can take advantage of zoning bylaws by installing stricter regulations than those imposed by state legislation. Creating higher building safety and environmental quality standards for areas that are high risk, along with incentives, can encourage building on better-suited locations. Article 25 of the City of Boston's zoning codes covers Flood Hazard and Flood Resilience Overlay Districts, which can help protect the long-term viability of coastal communities.<sup>96</sup> With greater knowledge of flood hazard districts, plans like the recent Climate Ready South Boston Report, are addressing sea-level rise by proposing the addition of 67 acres of green

space to Boston's 47 mile shoreline that will protect properties, businesses and families.<sup>97</sup>

Other innovative initiatives include the town of Chatham,<sup>98</sup> where they prohibit any expansion of structures in special flood areas in the VE zone, or 1% flood zone as determined by FEMA, and the town of Orleans<sup>99</sup> completely prohibits construction within that zone. Towns are incentivizing smart building practices: in 2009 Hull's Board of Selectmen enacted a freeboard incentive where the town building department offers a \$500 credit toward permitting fees to buildings that elevate and renovate "structures at least two feet above the highest federal or state requirement."<sup>100</sup> Further encouraging incentives and zoning changes such as these across coastal towns in Massachusetts will encourage the expansion of business districts in areas that are less at risk, lower insurance rates, and further reduce recovery time in key economic regions after a storm.

Climate change and sea level rise pose compounding challenges in our communities, and the science and experience of dealing with these issues is limited,<sup>101</sup> but

any measure is more likely to be adapted if there are positive payouts.

We found growing public awareness of green solutions to protect shorelines and prepare for climate impacts. Private and public entities are turning to natural means to address and mitigate sea level rise. Traditional gray infrastructure uses cement and metal, requiring constant maintenance and escalating costs. Solutions that incorporate green storm water infrastructure take advantage of natural solutions where storm water and soil is drawn towards permeable surfaces, leading to multiple benefits like providing a home for plants, developing new habitats, using less energy, and bene-

fitting public health by remediating the heat island effect. Local municipalities are also creating hazard mitigation and emergency plans that incorporate green solutions, like living shorelines, "shoreline erosion control that incorporates native vegetation and preserves native habitats"<sup>102</sup> into their plans to better prepare for flooding.<sup>103</sup>

Hazard mitigation and emergency plans create critical resources for community development and preparedness efforts. They are often found on a town's website, but are not always distributed to the local business community. We incorporated these plans and resources in our tailored resilience guides for each of the 10 at-risk communities in our campaign.

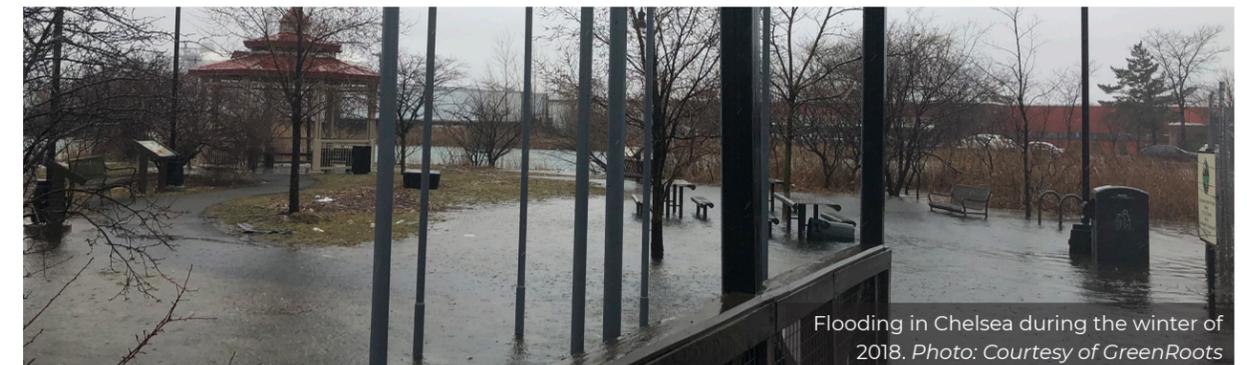
We found that towns are incorporating smart planning into their hazard mitigation plans. Scituate outlined a series of mitigation goals that address a number of issues including zoning regulations and enforcement, educational outreach and engagement, protection of existing infrastructure, and encouraging development in low-risk areas.<sup>104</sup> The city of Gloucester also laid out a number of different approaches that aim to improve resilience and mitigation. Some of the measures include replacing and maintaining critical infrastructure, ensuring that the public is educated on climate issues, identifying funding measures, and encouraging participation from businesses and residents to consult on any future projects.<sup>105</sup> While municipalities are identifying concerns and solutions to become more resilient, these projects are unlikely to be implemented and come to fruition unless there's funding for them, which is why we also recommend the development of a Green Infrastructure Fund through the collection of a fee on carbon pollution (see How Do We Pay For This? Carbon Pricing)

Adaptation measures can be broken down into 3 overarching strategies: planned retreat, accommo-

dation, and protection.<sup>106</sup> Routinely, when a coastal region becomes damaged in an event of extreme weather, the immediate reaction is to rebuild 'stronger than the storm,' a phrase coined during the reconstruction from Hurricane Sandy in New Jersey.<sup>107</sup> Due to the complicated nature of reconstruction, and the complexities of climate adaptation, much of the drive for resiliency will need to come from legislation. Business leaders can be at the forefront of change, encouraging legislative solutions that can help recovery and increase overall resilience.<sup>108</sup>

We found that 76% of businesses with have concerns about their city/town's infrastructure, and 82% report that state and town support (financial and legislative) would be helpful for businesses to do more for extreme weather preparation. Damaged bridges, frequent power outages, or long-term closures due to reconstruction can create a loss of business confidence in regions that are negatively affected.<sup>109</sup> Involvement from the local business community ensures that any planning process will be more equitable, and better suited to the needs of the community.

For the coastal communities we visited, and any other that is vulnerable to climate change, we recommend smart planning measures such as those laid out by the concepts of smart growth, revising building codes to be more strict than mandated by state regulations, changing zoning regulations to meet the future needs of communities subject to sea level rise and flooding, engaging with the local business community, and the creation of hazard mitigation and emergency management plans that incorporate green infrastructure. Understanding how decisions made today can affect decision-making in the future is critical for the protection of our communities in the face of climate change.



Flooding in Chelsea during the winter of 2018. Photo: Courtesy of GreenRoots

## HOW DO WE PAY FOR THIS? CARBON PRICING

Carbon pricing has significant co-benefits that can reverberate across the state and the economy. Resilience efforts can be funded from a direct carbon fee.

A basic economic principle is that the price of goods reflects their costs. However, the market has failed to account for the very significant and overarching costs of fossil fuels and the carbon pollution that results from burning them. Those costs have been hidden behind massive subsidies, making us over consume fossil fuels without addressing the environmental and health challenges of burning them.

Carbon pricing can be the solution to fix our economic and climate woes; it is a policy that uses market forces to shift consumers away from fossil fuels and towards renewables. A state or country can put a price per-ton on carbon emissions that can generate vital funds for resilience and green investment, while stimulating job growth and clean innovation. Carbon pricing keeps money invested in local economies while encouraging investment in locally-sourced and renewable energy increases.

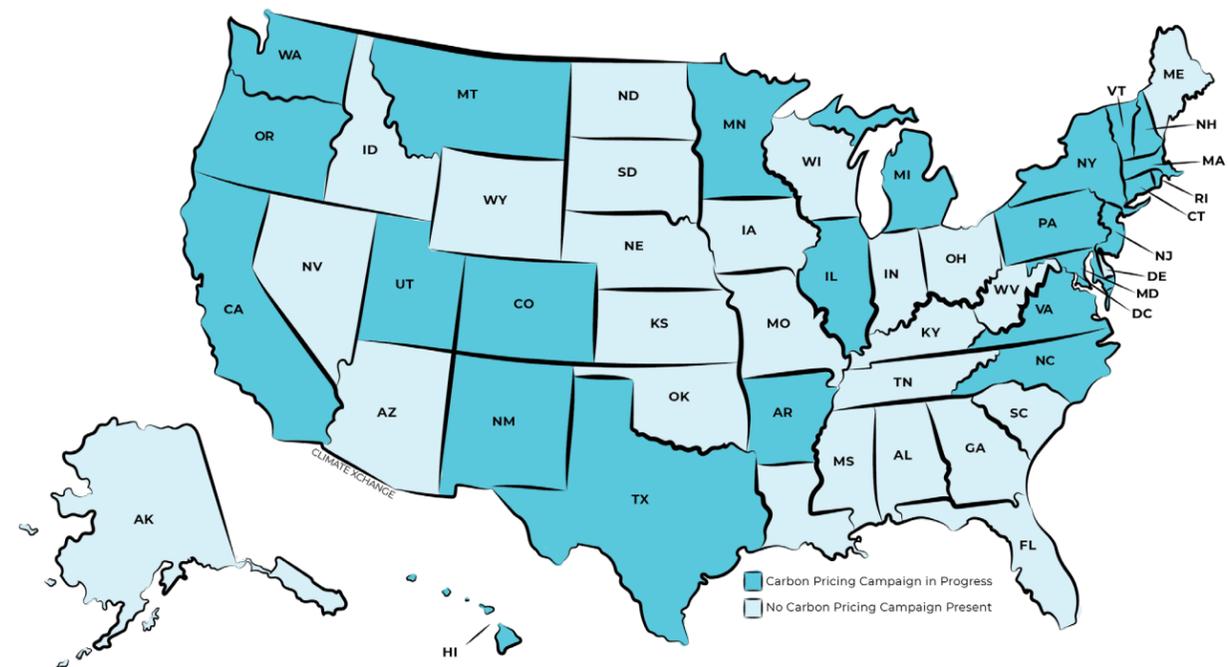
Massachusetts is sending billions of dollars out of state to import its natural gas and oil on a yearly basis. A carbon fee and rebate system in the state has

the potential to create upwards of 12,000 jobs and increase the Gross State Product by over \$600 million, with prices starting at \$20 per ton and increasing annually until they reach \$40.<sup>110</sup> With one-fifth of global emissions covered by current or planned carbon pricing programs, we now have overwhelming evidence of their success.

Sweden introduced a fee on carbon pollution in 1991 at \$33 per ton. The price has since risen to \$160, making it the highest carbon tax rate in the world. The country has since experienced GDP growth of 60% while reducing its emissions by 25%.<sup>111</sup> British Columbia became the first place in North America to adopt a carbon fee and rebate system, which resulted in a drop in emissions 3.5 times faster than the national average, while at the same time boasting one of the highest economic growth rates in Canada.<sup>112</sup> A transition into a low-carbon economy also means a transition towards a healthier community. A carbon price is a policy that business can also support, as it provides them with the flexibility to choose alternatives on their own terms while having future certainty on energy prices.

In the United States, 6 Northeastern states proposed carbon pricing legislation in 2017 and at least 3 more are expected to do so in 2018. Campaigns for

**STATE-LEVEL CARBON PRICING CAMPAIGNS IN THE U.S.** Active carbon pricing campaigns as of January 2019.  
Map: Climate XChange State Carbon Pricing Network



Chelsea Produce Center, Chelsea  
Produce Center Flooding in the Winter of 2018.  
Photo: Courtesy of GreenRoots

Carbon Pricing legislation are also active in at least 20 states and the District of Columbia.<sup>113</sup> Progressive action needs to be taken to substantially reduce greenhouse gas emissions to meet the predicted need to cut 80% of emissions by 2050 in Massachusetts. We have begun this effort in the Northeast with the Regional Greenhouse Gas Initiative (RGGI). It has put a price on carbon in the electricity sector for 10 years through a cap and trade system.<sup>114</sup>

The revenue generated from a direct carbon fee in Massachusetts can be invested in resiliency efforts and green infrastructure projects throughout our local communities. Many of the businesses engaged during the BARS campaign agreed that funding and other support from the commonwealth would help them in their resilience efforts. They were especially interested in funds that could be used to improve critical infrastructure such as storm water management systems and structural concerns in buildings. After the winter of 2018, businesses saw the effects of bridges collapsing and drains overflowing, diverted traffic, closed streets, and halted commerce. A study commissioned by the Federal Highway Administration found that in Massachusetts 4,178 bridges, or 9%, are classified as ‘in need of repair.’<sup>115</sup>

Curt, the owner of Essex River Marina, was impacted by infrastructure concerns within the town of Essex, as well as costs from sea-level rise that negatively impacted his own businesses.

“These are funds that come out of people’s pockets that don’t necessarily have the money to do that, but you gotta do what you gotta do to keep the busi-

ness going. You can have all kinds of ideas to prepare, but it always comes down to money. That’s where again it would be nice to get some assistance to help with this rising tide situation.”

Money from a Green Infrastructure Fund would create programs where businesses could apply for resources. California directs funds from their cap and trade programs into resilience planning, urban greening, and weatherization programs,<sup>116</sup> as well as funding for communities that are the most impacted by pollution to choose their own goals, strategies, and projects to reduce greenhouse gas emissions and local air pollution.<sup>117</sup> During our campaign we found that business owners seek to make their stores and communities more resilient, but costs often get in the way. We need an approach that will bring funds to support our main streets and increase the economic vitality of communities. Investing in carbon pricing revenue into projects that benefit and sustain our communities is the best approach to ensure an economically efficient response to climate change.

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