Do we have a climate for change? Insights about adaptation planning actions in coastal New England

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DO WE HAVE A CLIMATE FOR CHANGE?
INSIGHTS ABOUT ADAPTATION PLANNING ACTIONS IN COASTAL NEW ENGLAND

A Dissertation Presented
by
ANA MESQUITA EMLINGER

Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

September 2016

Department of Landscape Architecture and Regional Planning
DO WE HAVE A CLIMATE FOR CHANGE?
INSIGHTS ABOUT ADAPTATION PLANNING ACTIONS IN COASTAL NEW ENGLAND

A Dissertation Presented
by
ANA MESQUITA EMLINGER

Approved as to style and content by:

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__________________________
Elisabeth M. Hamin, Department Head
Landscape Architecture and Regional Planning
DEDICATION

To my mother
JUDITH GIMENEZ MESQUITA
for the endless support throughout my life.

To my kids
GABRIEL MESQUITA ZANGIROLANI & LIVIA SUZANNE EMLINGER,
for being my best source of motivation to never give up on the pursuit of this dream.
"Though nobody can go back in time and make a new beginning, anyone can start over and make a new ending."

- Francisco Cândido Xavier
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Dear Elisabeth Hamin, I want you to receive my first and most earnest acknowledgment. I am truly fortunate to have had you as my advisor. I will be eternally thankful to you for the encouragement and support in many decisive moments throughout these years. Your always practical guidance and the experience of working with you were fundamental for my growth as a researcher. All my gratitude for the many hours you dedicated reading my drafts, commenting on my views and deeply enriching my ideas.

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I owe my gratitude to all these people who have made this dissertation possible and because of whom my experience has been one that I will cherish forever.
ABSTRACT

DO WE HAVE A CLIMATE FOR CHANGE? INSIGHTS ABOUT ADAPTATION PLANNING ACTIONS IN COASTAL NEW ENGLAND
SEPTEMBER 2016

ANA MESQUITA EMLINGER, B.ARCH., STATE UNIVERSITY OF LONDRINA M.SC., UNIVERSITY OF SAO PAOLO Ph.D., UNIVERSITY OF MASSACHUSETTS AMHERST

Directed by: Professor Elisabeth Hamin

“I just drink more coffee and stay late” – declared the town planner of a small coastal community in the South of Boston, Massachusetts (MA) referring to the need of extra work to address climate change adaptation in a short-staffed planning department. These words illustrate one of the many common issues faced by planners of small and medium coastal communities in the region.

A systematic incorporation of climate change concerns into formal community planning, management, and infrastructure design is in nascent stage. The challenges of effective adaptation are complex and likely to be politically hard, especially at the local level where the impact of climate change is most likely to be experienced and administered.

Climate science is providing an increasingly sophisticated picture of possible climate alteration in future decades, and for coastal zones in particular, the potential consequences are a cause for mounting concern. The role of planners comes to a new level of importance because they urge to develop creative and innovative responses to adapt the built environment to these challenges. Efforts are needed to guide proactive
adaptation actions that benefit coastal communities for present and future generations.
Overall, there is a pressing need to move beyond vulnerability analysis and into implementation of adaptation action. In the real world, however, planners of small coastal communities are often times alone in their innumerable professional daily struggles and issues related to climate change are frequently placed in the bottom of their list of priorities.
One of the goals of the present research is to examine the status of climate adaptation planning at the local level in the coastal New England. The research also aims to investigate what are the preferred climate actions taken by these municipalities, the main forces behind the challenges faced by planners and city officials trying to deal with these issues and what they need to move forward in the adaptation planning.
The results of this study showed many similarities among these coastal communities in NE. Barriers repeatedly found in the literature such as lack of financial support, staff dedicated to this matter, political support and information were confirmed with high rates in all states. However, despite the challenges encountered, 36 communities were able to break the barriers and advance in the adaptation planning process.
The data collection for this study was divided in two phases: Phase 1 – In-person semi-structured interviews with planners in the coastal Massachusetts (conducted in 2011; n=15); Phase 2: Web-survey with city officials, mostly planners, of small and mid-sized coastal communities in New England, particularly the states of Massachusetts, New Hampshire, Maine, Rhode Island, and Connecticut (Fall 2015, n=121). I focused on coastal areas, as these seemed the most likely to have begun considering climate change due to publicity about sea level rise and existing climate vulnerability.
This study brings a range of benefits to Massachusetts’ smaller coastal towns and cities, as well as to the broader region of New England. First, it generates empirically-based findings on what communities are doing to become better adapted to future climate, and why. This leads to improvements in our ability to advise communities on how to move ahead on this important topic based on their particular situation. These coastal communities constitute a system, like a string of intrinsically interconnected parts. These parts are not impacted alone by the challenges associated with climate change. For this reason the risks to which these communities are subject should be addressed collectively. Perhaps, this knowledge will be an important step to collaborate in the meeting of joint solutions for the region.
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LIST OF SYMBOLS AND ABBREVIATIONS

Symbols

\[ \mu \] Medium or Average
\[ \sigma \] Standard Deviation
\[ \chi^2 \] Chi-square

Abbreviations

APA American Planning Association
CC Climate change
CCA Climate change adaptation
CT Connecticut
GHG Greenhouse Gas
HUD United States Department of Housing and Urban Development
ICLEI Local Governments for Sustainability
IPCC Intergovernmental Panel on Climate Change
IPCC WGII AR5 Intergovernmental Panel on Climate Change - Working Group II – Fifth Assessment Report
LARP Landscape Architecture and Regional Planning
MA Massachusetts
ME Maine
NE New England
NEPA National Environmental Policy Act
NH New Hampshire
NOAA National Oceanic and Atmospheric Administration, an American scientific agency within the United States Department of Commerce
NRC National Research Council
QUAL Qualitative method
QUAN Quantitative method
RI Rhode Island
RR Response Rate
UMass University of Massachusetts
UN-Habitat United Nations Human Settlements Program
USAID United States Agency for International Development
CHAPTER 1

INTRODUCTION

In 2007 the United Nations announced that more people were now living in cities than in rural areas. Considering that the majority of humans reside along coasts, coastal regions have become uniquely important to the wellbeing of society and the need for proactive action to adapt to climate changes is ever more pressing (USAID, 2009). Climate variability and extremes have long been important in many decision-making contexts. Climate-related risks are now evolving over time due to both climate change and development. (IPCC WGII AR5, 2014).

Adaptation to climate change, defined by the Intergovernmental Panel on Climate Change in (Summary for policymakers), is the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate this adjustment (IPCC WGII AR5, 2014, p.5).

Cities throughout the world face the challenge of preparing for climate change impacts. Since urban climate adaptation is an emerging policy domain, however, few institutions exist to guide cities among the first to take action (Carmin, Anguelovski and Roberts, 2012). Minimizing the impacts that climate change will have on cities requires that municipalities make concerted efforts to protect natural systems, the built environment, and human populations. While cities are places where synergies between adaptation and mitigation measures can take root, they differ in orientation and emphasis. Mitigation programs typically focus on developing clean technologies or changing consumer demand. In contrast, urban adaptation casts a wider net. It not only requires that municipal officials
and agencies set policies and performance targets that foster emission reduction but that they engage in comprehensive actions to make their cities more sustainable and resilient (Carmin et al, 2012).

City planning is an ancient activity but a modern profession, as observed by Scott (1969). The profession arose in the United States from the urban reform movements of the 1890s but it was not until the first decade of the 21st century that planning started to be used more deliberately as an instrument of response to climate change. Words like vulnerability, resilience, Greenhouse Gases (GHG), global warming, disaster preparedness, risk management, climate change mitigation and adaptation became more and more frequent in the vocabulary of planners.

Spatial form matters. Urban environments more densely organized can be more efficient in terms of energy usage (e.g. heating) and transportation (e.g. low emissions). In the other hand, a larger green infrastructure can be beneficial to adaptation, because more room for urban greening and storm water management can be provided (Hamin and Gurran, 2012). As the Fourth Assessment of the Intergovernmental Panel on Climate Change (IPCC, 2007) notes, urban centres and the infrastructure they concentrate – and the industries that are a key part of many such centres’ economic bases – are often capable of considerable adaptation in order to reduce risks from the direct and indirect impacts of climate change.

Overall, there is a pressing need to move beyond vulnerability analysis and into implementation of adaptation action (Hamin and Gurran, forthcoming 2015). It would be a mistake to assume, though, as reflects Satterthwaite et al (2009), that a logical, justifiable, fundable process driven by good science provides a viable roadmap for action. The
examples of evolving good practice for adaptation represent exceptions and it is important to understand why this is so. It is easy for national governments to sign declarations at international conferences that recommend all the needed measures – and then ignore them.

Urban areas are pivotal to global adaptation and mitigation efforts thus they are particularly vulnerable to climate hazards due to their high density of people, assets, and infrastructure (Reckien et al, 2014). The terms “adaptation” and “mitigation” are two important terms that are fundamental in the climate change debate. The IPCC (2007) defined adaptation as the initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects. A commonly used definition of mitigation is also found in IPCC report (2007) as implementing policies to reduce greenhouse gas emissions and enhance sinks. In general the more mitigation there is, the less will be the impacts to which we will have to adjust, and the less the risks for which we will have to try and prepare. Adaptation planning, argues Füssel (2007, p. 268) “involves addressing questions such as: How will future climatic and non-climatic conditions differ from those of the past? Do the expected changes matter to current decisions? What is a suitable balance between the risks of acting (too) early and those of acting (too) late? Eventually, adaptation planning is about making recommendations about who should do what more, less, or differently, and with what resources.”

A systematic incorporation of climate change concerns into formal community planning, management, and infrastructure design is in embryonic phase. The causes of climate change are global, but the impacts are experienced locally (IPCC 2011). Most research on climate change has focused on selected big cities in the Global North (Bell & Jayne, 2009). More general planning or urban studies have rarely used small to mid-sized
cities as a focused unit of analysis (Pitt & Bassett, 2013). This is important because most people live in small or mid-sized cities in America. The country’s 25 most populous cities are home to about 10% of the U.S. population. Small and medium-size cities make up a large portion of the municipal governments in the United States. According to U.S. Census data, 80% of U.S. cities have populations of fewer than 10,000 people. We seek to identify how small cities approach climate adaptation, the barriers they face in doing so, and the strategies that such cities develop to overcome those barriers (Hamin et al, 2014).

However, despite the high visibility that adaptation has on the global policy agenda and the imperative for cities to initiate action, relatively few have made concerted efforts to develop dedicated adaptation plans or to set adaptation initiatives in motion (Carmin et al, 2012).

To identify planners’ perspectives on the status of climate change adaptation, I started my research conducting in-person interviews in 15 Massachusetts coastal cities and towns in 2011 plus 3 background interviews with regional planning agencies for the coastal communities. This pilot project had Prof. Elisabeth Hamin as principal investigator and received a small grant from APA – Massachusetts chapter of the American Planning Association1.

Working within one state decreased variation from state-level policy frameworks. We excluded towns that did not have planning staff (approximately 1/3 of municipalities). The state was then divided into three coastal regions to represent regional place identity – North Shore (north of Boston), South Shore (south of Boston but not on Cape Cod) and Cape Cod. We randomly selected five communities in each region for interviews.

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1 The title of the study was: Adapting to Climate Change: Barriers and Opportunities in Massachusetts Towns. Sponsored by the Massachusetts Agricultural Experiment Station – Project # MAS00458.
Qualitative techniques were used to seek a rich understanding of municipal planners’ experiences.

Communities across the New England region and the country are facing challenges from climate change including more extreme storms, hotter and longer-lasting heat waves, more rain in winter and less in summer, as well as the slower but significant effects of sea level rise (Kirshen, Ruth et al. 2004). The interviews with the 15 communities was primarily conceived to elucidate the barriers to climate change adaptation faced by these communities.

The study was designed to follow up on themes that emerged from this previous pilot study, and allow the dedicated exploration of outcomes in a wider geographic range of communities. The second data collection comprised small and medium coastal communities located in the states of Massachusetts, Connecticut, Rhode Island, New Hampshire, and Maine.

My dissertation research is located within the general subject areas of urban planning and climate change adaptation. My specific interest is in the status of climate adaptation efforts in the context of smaller coastal communities of New England, comprising not only the challenges encountered in their climate planning process but particularly investigating the adaptation actions that have been accomplished/are in process by these municipalities.

My goal is to illuminate issues related to barriers and opportunities faced by planners to address climate change adaptation in the daily basis. In my research I investigated what are the main forces behind the struggles faced by planners and city officials trying to deal with the issues related to climate change. I wanted to know what
could be done different in this scenario for them to be able to be more proactive and less reactive to the changes that they have already been experiencing in the coast.

Despite a growing scholarship exploring climate change in local communities, the results of this study were difficult to predict in advance. Planning for climate change adaptation is still in a nascent stage. Adaptation plans are largely under-developed (Preston et al, 2011). The growing urgency associated with responding to climate risk has elevated climate adaptation on policy agendas across a broad array of institutions and governance networks (Swart et al. 2009). But, what does adaptation actions look like? This is a common question among planners, policy-makers, and other professionals charged with the task of developing and implementing adaptation strategies. While adaptation is increasingly recognized as an important climate risk management strategy, and on-the-ground adaptation planning activity is becoming commonplace, there is no clear guidance as to what success would look like, what to aim for, and how to judge progress (Moser & Boykoff, 2013). The study results can bring a range of benefits to Massachusetts’ smaller coastal towns and cities, as well as to the broader region of New England comprising coastal Connecticut, Rhode Island, New Hampshire, and Maine. First, generated empirically-based findings on what communities are doing to become better adapted to future climate, and why. This information can lead to improvements in our ability to advise communities on how to move ahead on this important topic based on their particular situation.
1.1 Research Questions

- How do small and medium coastal communities of New England (NE) perform in terms of climate change response? What level of municipal adaptation action is underway in these communities? How can this status be measured?
- What sorts of barriers and opportunities are city planners in this context experiencing in trying to address climate adaptation? How meaningful is climate change for planners? What are the factors that influence their perception, motivation, communication and effective action regarding climate change?
- How does the size/ demographic variables of the towns influence climate change adaptation in the region? How does having a full-time staff dedicated to climate change influence climate adaptation planning?

1.2 Significance of research and potential contributions to knowledge

Climate change planning accelerated in the mid-to-late 1990s, with jurisdictions adopting more comprehensive plans to reduce emissions (Wheeler, 2008). In the first decade of the 21st century, as pointed by Moser and Ekstrom (2010), adaptation to climate change has risen sharply as a topic of scientific inquiry, in local to international policy and planning, in the media, and in public awareness. The need to track climate change adaptation progress is being increasingly recognized but our ability to do the tracking is constrained...
by the complex nature of adaptation and the absence of measurable outcomes or indicators by which to judge if and how adaptation is occurring (Ford et al, 2013).

In this context, the built environment is directly impacted by the effects of more frequent and powerful storms. Coastal communities are naturally more vulnerable to these impacts. I am trying to build here a bridge to connect this reality of climate change with the role of urban planners and their capacity to address the issue, at the local level. This research was designed also by verifying a lacunae in the literature related to this aspect of the planning profession.

Catastrophic or out of control impacts of climate change are a reality that is becoming more and more frequent for many coastal communities across the world. In the recent years the east coast of the USA has been impacted by three major storms that caused immense material and human loss: Hurricane Sandy in October/November of 2012, Blizzard Nemo in February of 2013 and Blizzard of 2015 in January of 2015. The amount of snow dropped in Boston in February of 2015 was unparalleled to any Boston's past history.

It’s important to make it clear that the discussion about whether climate change exists or not won’t be discussed in this research. Scientific evidence for warming of the climate system is unequivocal (IPCC 2007, IPCC 2013). Since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased (IPCC 2013). The current warming trend is of particular significance because most of it is very likely human-induced and proceeding at a rate that is unprecedented in the past 1,300 years. “Ocean warming
dominates the increase in energy stored in the climate system, accounting for more than 90% of the energy accumulated between 1971 and 2010. It is virtually certain that the upper ocean (0–700 m) warmed from 1971 to 2010, and it likely warmed between the 1870s and 1971.” (IPCC 2013, p. 8).

The NASA Global Climate Change – Vital Signs for the Planet - presents in its main webpage the graph below (Figure 1) and the following information: “The Earth's climate has changed throughout history. Just in the last 650,000 years there have been seven cycles of glacial advance and retreat, with the abrupt end of the last ice age about 7,000 years ago marking the beginning of the modern climate era — and of human civilization. Most of these climate changes are attributed to very small variations in Earth’s orbit that change the amount of solar energy our planet receives.”

Figure 1 - This graph, based on the comparison of atmospheric samples contained in ice cores and more recent direct measurements, provides evidence that atmospheric CO2 has increased since the Industrial Revolution. (Credit: Vostok ice core data/J.R. Petit et al.; NOAA Mauna Loa CO2 record – published in NASA webpage, available at http://climate.nasa.gov/evidence/)

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According to NOAA, the number of record high temperature events in the United States has been increasing since 1950. Levitus (2009) highlights that the oceans have absorbed much of this increased heat, with the top 700 meters (about 2,300 feet) of ocean showing warming of 0.302 degrees Fahrenheit since 1969. The U.S. has also witnessed increasing numbers of intense rainfall events, which directly impacts the coastal communities. Global sea level rose about 17 centimeters (6.7 inches) in the last century. The rate in the last decade, however, is nearly double that of the last century (Church and White, 2006). Figures 2a./2b. show the seal level variation in two different measurements.

A vast amount of scientific data can be easily accessed nowadays, however we still encounter complaints of lack of information about climate change among planners and city officials. Most of today's urban planners are braving unknown lands regarding climate change adaptation. Planners are doing things for which, for the most part, their formal education did not prepare them, reflects Innes (1998). These challenges, she continues, have produced planners who are creating innovative ways of doing planning, taking on new roles. Academic research is just beginning to identify, document, and interpret this range of activities and to suggest how it is changing the basic nature of planning.
Furthermore, there is little guidance of national or transnational diffusion shaping the adaptation initiative in small and medium coastal communities. Although there are here and there a few adaptation planning initiatives in the coast of Massachusetts, it does not seem to exist any formal efforts in place to promote joint learning in the region.

Adaptation planning to cope with future changes in the climate is still confusing for most planners that don’t even know how to start. For this very reason, measuring the success of adaptation to climate change can seem meaningless, as an overly advanced action in a process that is still far from achieving the expected pace. However, in the end of the day, it can become a powerful tool instead. The best practices (even if just a few) can serve as a great motivator to planners, especially if research in the area is disseminated to planners in practice, informing them in a comprehensive way.

The fact is that we seem to have become experts in producing GHG but we are having a hard time to figure out how to fix the problem. Cities are the primary source of GHG emissions, but they also have a big potential to provide GHG reductions (UN-Habitat 2011). While locally devised adaptation responses are needed, to date local authorities have been more engaged in work to reduce greenhouse gas emissions than prepare for climate change impacts already underway (Wheeler 2008). Local authorities, argue Berrang-Ford, Ford, and Paterson (2011), who have begun preparatory work are generally at the stage of assessing overall vulnerability to climate change, and developing strategies intended to build resilience, but that fully implemented strategies are rare. What remains confuse, though is what are the urban centres effectively supposed to do to reduce their vulnerability and how can their actions be evaluated.
Climate mitigation initiatives are taking place in cities around the world, argue Carmin et al (2012). And, to the extent that the literature has progressed, as argued by Hamin and Gurran (forthcoming 2015) a general perspective on the process of adaptation has emerged. However, despite the high visibility that adaptation has on the global policy agenda and the imperative for cities to initiate action, relatively few have made coordinated efforts to develop dedicated adaptation plans or to set adaptation initiatives in motion (Carmin et al, 2012). Ford et al (2011) reinforce that our knowledge about adaptation is still limited.

Climate change planning accelerated in the mid-to-late 1990s, with jurisdictions adopting more comprehensive plans to reduce emissions (Wheeler, 2008). In the first decade of the 21st century, as pointed by Moser and Ekstrom (2010), adaptation to climate change has risen sharply as a topic of scientific inquiry, in local to international policy and planning, in the media, and in public awareness. The need to track climate change adaptation progress is being increasingly recognized but our ability to do the tracking is constrained by the complex nature of adaptation and the absence of measurable outcomes or indicators by which to judge if and how adaptation is occurring (Ford et al, 2013).

Despite there is an emerging scholarship proposing assessment approaches and adaptation options, few studies have systematically examined actual adaptation actions at a national or regional level. “Is adaptation taking place? What types of interventions are being implemented? What factors are motivating adaptation in the communities?” Quite diverse have been the approaches found in the literature in trying to measure the level of climate change adaptation implementation. Some, for example, are looking at the existence of written plans that incorporate climate concerns at least. Others are trying to find
implemented actions already. Others are considering at least the existence of adaptive capacity as an indicator of advancement.

### 1.3 Measuring Climate Change Adaptation implementation

The understanding of “successful” actions is still very variable, despite the vast number of scientific publications and peer reviewed scholarly articles dedicated to the subject. For this reason the approaches to measuring the level of planning adaptation implementation in urban areas are very diverse in the literature. In the table below I try to summarize how some authors have approached the subject:

Table 1 - Brief characterization of approaches to measuring the level of climate change adaptation implementation.

<table>
<thead>
<tr>
<th>Author/ Article (listed in chronological order)</th>
<th>Brief characterization of approaches to measuring the level of climate change adaptation implementation</th>
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<tr>
<td>Smit, B., Burton, I., Klein, R.J.T., Wandel, J., 2000. An anatomy of adaptation to climate change and variability. Climatic Change 45, 223–251.</td>
<td>They argue that the nature of adaptation processes and forms can be distinguished by numerous attributes including: - timing, - purposefulness, and - effect. The paper notes the contribution of conceptual and numerical models and empirical studies to the understanding of adaptation, and outlines approaches to the normative evaluation of adaptation measures and strategies.</td>
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<td>Yohe, G. and Tol, R. (2002) “Indicators for social and economic coping capacity - moving toward a working definition of adaptive capacity” Global Environmental Change 12, 25–40.</td>
<td>Yohe and Tol (2002) argue that these proposed tasks help evaluate the locally specific adaptive capacity that must be enhanced and realized: - Examine the range of available technological options; - Evaluate the availability of resources; - Explore the structure and functionality of critical institutions; - Assess the human and social capital; - Document the system’s (and individuals”) access to risk-spreading processes; - Assess decision-makers’ ability to manage information; and - Calibrate the public’s perceived understanding of the stresses and the population’s readiness to engage in implementing necessary adaptation measures.</td>
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<tr>
<td>Adger, W. N., Arnell, N. W., &amp; Tompkins, E. L. (2005). Successful adaptation to climate change across scales. Global Environmental Change Part A, 15(2), 77-86.</td>
<td>They outline a set of normative evaluative criteria for judging the success of adaptations at different scales, arguing that the following elements are important in judging success in terms of the sustainability of development pathways into an uncertain future: - effectiveness, - efficiency, - equity, and - legitimacy</td>
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- awareness of and concern about the potential impacts of climate change,  
- adaptation strategy,  
- the concept of an adaptation space from which options are selected, and  
- the notion that three groups of factors influence awareness, strategy and option selection:  
  o susceptibility to change,  
  o internal characteristics of the organization, and  
  o regulatory and market context. | |
| Eriksen, S. and Kelly, P. (2007). | Developing credible vulnerability indicators for climate adaptation policy assessment. Mitigation and Adaptation Strategies for Global Change, 12(4), 495-524. | They address the issue of how to develop credible indicators of vulnerability to climate change that can be used to guide the development of adaptation policies. They compare the indicators and measures that five past national-level studies have used and examine how and why their approaches have differed. “Verification has been neglected, yet this process is important both to assess the credibility of any set of measures and to improve our understanding of vulnerability. A fundamental lesson that emerges is the need to enhance our understanding of the causes of vulnerability in order to develop indicators that can effectively aid policy development.” (Eriksen and Kelly, 2007, p.495) | |
- Awareness of the problem;  
- Availability of effective adaptation measures;  
- Information about these measures;  
- Availability of resources for implementing these measures;  
- Cultural acceptability of these measures;  
- Incentives for implementing these measures. | |
| Moser, S., Kasperson, R., Yohe, G. and Agyman, J. (2008). | Adaptation to Climate Change in the Northeast United States: opportunities, processes, constraints. Mitig Adapt Strat Glob Change 13: 643-659. | This paper offers a preliminary qualitative assessment, in which they emphasize the need for:  
- assessing the feasibility and side effects of technological adaptation options,  
- increasing available resources and improving equitable access to them,  
- increasing institutional flexibility, fit, cooperation and decision-making authority,  
- using and enhancing human and social capital,  
- improving access to insurance and other risk-spreading mechanisms, and  
- linking scientific information more effectively to decision-makers while engaging the public. | |
| Tol, R., Klein, R., & Nicholls, R. (2008). | Towards successful adaptation to sea-level rise along Europe’s coasts. Journal of Coastal Research, 24(2), 432–442. | Tol, Klein and Nicholls (2008) argue that there is no concrete and agreed guidance as to how adaptive capacity can be assessed, although a range of indicators have been identified that are assumed to be useful predictors. One possible set of factors consists of the following:  
- Technological options  
- Resources and their distribution  
- Institutional structure  
- Human capital  
- Social capital  
- Risk spreading  
- Information management  
The important point about the adaptive capacity concept is that successful adaptation requires all the necessary elements to be available to sufficient degrees. | |
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<th>Author(s)</th>
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<td>Moser, S. C. and J. A. Ekstrom (2010)</td>
<td>&quot;A framework to diagnose barriers to climate change adaptation.&quot; Proceedings of the National Academy of Sciences 107(51): 22026-22031.</td>
<td>Moser and Ekstrom (2010) use common phases of a rational decision-making process, including understanding the problem, planning adaptation actions, and managing the implementation of the selected option(s). For each one of the sub-phases listed below there are many specific questions related to “barriers”, “actors”, “governance &amp; context”, and System of Concern”. - Understanding (Problem detection and initial framing; Information Gathering and Use; Problem (Re)Definition) - Planning and Decision-Making (Development of Options; Option Assessment; Selection of Options) - Managing the Problem (Implementation; Monitoring; Evaluation) They name “crosscutting issues” the barriers that tend to be of repeated importance throughout the process, such as: Leadership; Resources; Communications and information, and Values and beliefs.</td>
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<td>Susskind, L. (2010)</td>
<td>Policy &amp; Practice: Responding to the risks posed by climate change: Cities have no choice but to adapt. Town Planning Review, 2010.</td>
<td>Susskind argues that ultimately adaptation planning will need to be Action-oriented, adaptive, strategic, and broadly supported. He also argues that one way to think about the steps that cities will need to move through as part of their adaptation planning efforts is summarized below: - Initial situation assessment; - Convene stakeholders group; - Assess the risks of climate change using scenario planning; - Identify vulnerabilities using joint fact finding (JFF); - Identify actions to increase resilience using JFF; - Generate agreement and build public support for actions to reduce vulnerability and increase resilience; and - Monitor changes in local climatic conditions, reassess vulnerability and review the effectiveness of risk management efforts.</td>
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<tr>
<td>Berrang-Ford, L., Ford, J. D., &amp; Paterson, J. (2011). Are we adapting to climate change? Global Environmental Change, 21(1), 25-33.</td>
<td>Berrang-Ford, Ford and Paterson (2011) develop and apply a methodology to track and characterize adaptation action. In this article, they present results that challenge a number of common assumptions about adaptation while supporting others: 1. Considerable research on adaptation has been conducted yet the majority of studies report on vulnerability assessments and natural systems (or intentions to act), not adaptation actions; 2. Climate change is rarely the sole or primary motivator for adaptation action; 3. Extreme events are important adaptation stimuli across regions; 4. Proactive adaptation is the most commonly reported adaptive response, particularly in developed nations; 5. Adaptation action is more frequently reported in developed nations, with middle income countries underrepresented and low-income regions dominated by reports from a small number of countries; and 6. There is limited reporting on adaptations being developed to take advantage of climate change or focusing on women, elderly, or children.</td>
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<td>Ford, J. D., Berrang-Ford, L., &amp; Paterson, J. (2011). A systematic review of observed climate change adaptation in developed nations. Climatic Change, 106(2), 327-336.</td>
<td>In this paper, Ford, Berrang-Ford and Paterson (2011) develop a systematic mixed-methods review methodology to examine if and how adaptation is taking place in developed nations. The methodology advances existing approaches to meta-analysis and allows us to critically examine how adaptation is taking place. The methodology adopted by them includes: - Systematic reviews, - Document selection and review, and - Analysis.</td>
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<td>Measham, T., Preston, B., Smith, T., Brooke, C., Goroddard, R., Withycombe, In considering the case study of three municipalities in Sydney, Australia in 2008, Measham, Preston, Smith, Goddard, Withycombe and Morrison (2011) draw attention to factors thus far under-acknowledged in the climate adaptation literature:</td>
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<td>G., &amp; Morrison, C. (2011).</td>
<td>Adapting to climate change through local municipal planning: barriers and challenges. Mitigation and Adaptation Strategies for Global Change, 16(8), 889-909. These factors, they notice, can serve as constraints or enabling mechanisms for achieving climate adaptation depending upon how they are exploited in any given situation. The paper concludes that, through addressing these issues, local, place-based planning can play a greater role in achieving climate adaptation.</td>
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<tr>
<td>Gurran, N., Norman, B. and Hamin, E. (2012).</td>
<td>“Climate change adaptation in coastal Australia: an audit of planning practice”, Submission for Ocean and Coastal Management Special Issue, Australian Coastal Councils’ Conference. This study examines the state of local practice in planning for climate change adaptation in coastal Australia. Australia’s coastal cities and towns, with over 85 per cent of the nation’s population, are at the frontline of physical risks associated with sea level rise and changed weather patterns; exacerbated by ongoing concentration of public and private assets in potentially vulnerable locations. The results reveal a ladder of adaptation action, whereby communities tend to have to accomplish early steps before they move on to more complex, expensive, or political policies. We connect this ladder to community perceptions of what is supported in state and national frameworks and legislation. Communities in the future may be able to use this ladder to suggest where to start their processes, and directions to undertake as they accomplish their first tasks.</td>
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<tr>
<td>Carmin J, Anguelovski I, and Roberts D (2012)</td>
<td>Urban Climate Adaptation in the Global South: Planning in an Emerging Policy Domain. Journal of Planning Education and Research 32, 18-32. Carmin, Anguelovski, and Roberts (2012) examine the initiation and development of adaptation planning in two cities in the global south: Durban and Quito. The authors highlight two types of forces influencing in climate adaptation agendas: 1. Exogenous, and 2. Endogenous forces. As exogenous they argue that coercive measures such as regulation, the need to attract funding, and the diffusion of best practices and other forms of knowledge and norms originating from sources such as foreign governments, intergovernmental organizations, professional associations, and NGOs influence action. However, these types of exogenous pressures are more likely to be associated with mature policy fields, ones in which institutions have been established, and forces shaping both expectations and behavior are present. In contrast, in emerging domains such as climate adaptation, the expectation is that cities and municipal departments at the frontier of the field will be driven by endogenous goals and objectives rather than exogenous forces.</td>
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<td>Scheckman, J., &amp; Brady, M. (2013). Cost-efficient climate change adaptation in the North Atlantic. National Oceanic and Atmospheric Administration (NOAA), Sea Grant.</td>
<td>The authors visited coastal communities to collect information on low-cost climate change and related coastal hazard management best practices – their purpose was to identify and collate cost-effective adaptation projects implemented at the municipal level, ranging from a community’s efforts to decrease flood risk with: systematic infrastructure designs, local climate adaptation plans, or legal mechanisms to support resilient developments.</td>
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<tr>
<td>Barnett, J., Graham, S., Mortreux, C., Fincher, R., Waters, E., &amp; Hurlimann, A. (September 28, 2014). A local coastal adaptation pathway. Nature Climate Change, 4, 12, 1103-1108.</td>
<td>The authors define “adaptation pathways” as a sequence of linked strategies that are triggered by a change in environmental conditions, and in which initial decisions can have low regrets and preserve options for future generations. They report on a project that sought to empirically test the relevance and feasibility of a local pathway for adapting to sea-level rise. They find that triggers of change that have social impacts are salient to local people, and developing a local adaptation pathway helps build consensus among diverse constituencies. Our results show that adaptation pathways are feasible at the local scale, offering a low-risk, low-cost way to begin the long process of adaptation to sea-level rise.</td>
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- political leadership,  
- institutional organization,  
- adaptation decision making and stakeholder engagement,  
- availability of usable science,  
- funding for adaptation, and  
- public support for adaptation.  
For each readiness factor they identify potential indicators, data sources, and considerations for analysis, outlining approaches for quantitative scoring and qualitative examination. |
- nature of adaptation initiatives being reported,  
- vulnerabilities provoking adaptive responses,  
- stakeholder involvement in policies and programs, and  
- consideration of vulnerable groups.  
Their analysis is aided by the calculation of a basic Adaptation Initiatives Index, which ranks countries based on the range of adaptation actions reported through the national communications. |
| Hamin, E.M. and N. Gurran (2015). "Climbing the Adaptation Planning Ladder: Barriers and Enablers in Municipal Planning” in W. Leal Filho, ed. Handbook of Climate Change Adaptation. London: Springer. | Hamin and Gurran (forthcoming 2015), recognizing different levels of climate preparedness, analyze what steps communities tend to follow when they move forward on climate adaptation, including prerequisites for planning and the selection of policies. They explore the adaptation policy choices communities are making and explain the range of strategies local governments have used to move forward on a ‘ladder’ of climate adaptation, proceeding from:  
- awareness and constituency building activities,  
- through formal risk analyses and strategic planning for climate adaptation,  
- through implementation  
- through specific changes to land use planning and infrastructure investment.  
Factors found to support or hinder these efforts relate to:  
- political will,  
- staff resources,  
- technical information, and  
- training in potential policy responses.  
Significant barriers include:  
- issues of property rights and sunk investment in vulnerable locations (particularly along the coast),  
- shifting community, and  
- political views about the reality of climate change. |
They argue that “overall, progress in municipal climate adaptation planning is patchy, and affected by wider policy frameworks and access to state or national level support” (p. 2).


The authors draw on responses from 156 U.S. ICLEI cities that participated in a 2011 global survey on local adaptation planning, 60% of which are planning for climate change. They use logistic regression analysis to assess the significance of 13 indicators measuring:
- political leadership,
- fiscal and administrative resources,
- ability to obtain and communicate climate information, and
- state policies in predicting the status of adaptation planning.


The authors argue that few studies have documented the barriers to redressing the drivers of social vulnerability as part of urban local climate change adaptation efforts, or evaluated how emerging adaptation plans impact marginalized groups. In this article, they present a roadmap to reorient research on the social dimensions of urban climate adaptation around four issues of equity and justice:
1. broadening participation in adaptation planning;
2. expanding adaptation to rapidly growing cities and those with low financial or institutional capacity;
3. adopting a multilevel and multi-scalar approach to adaptation planning; and
4. integrating justice into infrastructure and urban design processes.

Responding to these empirical and theoretical research needs is the first step towards identifying pathways to more transformative adaptation policies.

It’s reasonable to think that there are advantages and disadvantages in the different ways of measuring climate change adaptation implementation. The mix of approaches can be seen as an advantage from the point of view that since the question of successful CCA does not have a “right” or “wrong” answer so far, the more different approaches we have, bigger are the chances to get closer to the best ways to measure it. In the same time, the fact that this myriad of approaches can make/keep the situation very confusing and lacking a main direction to be pursued as a safe “theory” supported in the field can be considered one of the disadvantages. Insomuch, it’s understandable that planners, in their turn, proceed without knowing the right way to go in terms of planning a successful adaptation solution for their communities.
Frenchman (2000) argues that from the point of view of a practitioner who reviews hundreds of requests for planning services each year, the profession of planning is not only alive but also increasingly important to shaping urban growth and development. Planners in the United States have never had it easy (Innes, 1998). The challenge for planners, continues Innes, has grown in recent years as organized interests have increasingly become active players in planning decisions and as public trust in government has declined. Innes, however, brings a positive view of the situation, observing that while, of course, there are discouraged planners in many communities and agencies because of the unsupportive, ambiguous environment in which they work, there is much to be learned from those who have taken the challenges head on and who are carving out new ground, whether in the United States or elsewhere.

Professions change. Not only in their ideas, tools and capabilities, or the problems they address and the services they render, but in the controversies that divide them, as well as the images others have of them or they have of themselves (Rodwin 2000). In the case of identity issues of the profession, Rodwin characterizes such a situation as similar to the crisis of the “adolescent human development” arguing that “one way to interpret more specifically the conflicts and moods as this profession evolved is to recall the kinds of highs and lows, of exaltation and depression, associated with identity issues in adolescent human development and to relate those experiences to one of the most difficult tasks of a practitioner in a relatively new profession: understanding what the field is, what it has been and might yet be, and how the practitioner’s role might change in the future.
Planning theory, as points out Innes (1998) tells planners that they may not be able to shape places into the forms they choose, nor predict the specific results of actions; but it does affirm that they are key participants who assist the many other players in urban development to help to ensure that cities are more workable, efficient, livable, sustainable places.

One of the goals of the present study is to examine issues and changes in city planning practice due to the impacts of climate change, looking at the status of climate adaptation efforts in the local level in the context of small and medium coastal communities of New England. It has as main focus the city planners in their day to day experience, overwhelmed by pressing priorities, most of the time very unrelated to the “uncertainties” of climate change. “Some aspects of climate change, such as the timing and extent of climate impacts and policy and technological solutions that will be available, are inherently uncertain”, argue Markowitz et al (2014, p. 80).

Obviously there’s a lot to be done. Better understanding the city planner’s perspectives /issues/challenges/opportunities is just a small slice of a big cake. There’s many other important actors in this play. The engagement of the community, for example, is fundamental for any climate change initiative to be effectively implanted. One next step could focus in a community-based participatory planning process in order to listen and consider the important voice of the citizens, residents… the voice of the common people, the stay-at-home mothers, the youth with their energy and dreams… Leaders vary in their inspirational attributes, but those with high skill levels in communication, solid technical knowledge and clear personal integrity are more likely to be trusted by the public and decision-makers (Moser & Ekstrom, 2010). A climate change adaptation project needs to
expand community leadership and adaptation capacity by strongly involving these people because that’s what the city is made of and should be planned for.

1.4 Hypotheses and research design components

My proposed hypotheses were based, primarily, on the data collection from the set of interviews done in 2011 and in 2014, and from the literature review: Higher public pressure to adapt to climate change is positively related to severe storm impacts in the geographic area. Higher climate change adaptation is positively related to:

- previous experience with storms.
- financial support to climate related initiatives.
- political support to climate related policies and initiatives.
- knowledge, expertise and awareness about climate change reality existing in the community.
- climate perception of the risks and dangers of climate change by the community.
- the existence of federal and/or state climate policies guidelines.
- the leadership of the urban planner/city official dealing with this matter.

Babbie (1979) argues that conventionally, dependent and independent variables must be operationally defined before the research begins. However, it’s sometimes appropriate to make a wide variety of observations during data collection and then determine the most useful operational definitions of variables during later analyses – this seems to be the case of the present study.
INDEPENDENT VARIABLES

CAPACITY
- Staff resources (allocating staff time; dedicated climate staff)
- Training in potential policy responses
- Financial support
- Political support
- Stakeholder/business engagement
- State or national level support

DEPENDENT VARIABLE
STATUS OF CLIMATE CHANGE ADAPTATION IN COASTAL NE
- Not in the radar with no prediction of interest
- Intention to start
- Actions in process
- Implemented plans
- Monitoring/Evaluation of actions

INDEPENDENT VARIABLES

MOTIVATION
- Optimism/willingness to put an effort - Leadership of planners/ city officials
- Number of funded projects
- Presence or lack of will to act

BELIEF
- Acceptance that climate change is real
- Acknowledgement that CC is likely to harm coastal communities
- Cultural acceptability of adaptation measures

INFORMATION
- General Scientific information
- Local information of impacts
- Information management (gathering and use)
- Knowledge of what to do
- Availability of usable science
- State/Federal climate policies guidelines

DEMOGRAPHICS
- Size of the towns (# inhabitants)
- State where towns are located
- Age of the official: better chances of exposure to CC studies x experience in the field

RISK/ AWARENESS
- Perception of vulnerability
- Real impact of storms
- Extreme events as stimuli
- Awareness and formal risk analysis

INFRASTRUCTURE
- Specific changes to land use planning
- Updating coastal infrastructure

CONSTRUCT
MEASURE

Figure 3: Research Diagram showing the relationship between the independent and dependent variables.
The research diagram (Figure 3) formed the framework of the data analysis as we tried to understand the effects of various independent variables and its subsequent influence on the status of climate change adaptation (dependent variable) and compare the scores of the respondents for each category.

In 2010, when we first started organizing the interviews with planners, we were curious to verify the status of climate adaptation efforts in small coastal communities of Massachusetts from the perspective of the city planners. We were willing to hear from them regarding the principal barriers preventing them to address the issues related to climate change in their communities.

We were also looking for the opportunities that, in the opposite, would give them strength and motivation to move forward. What better way to get the answers we were looking for than going to the field and asking the city planners? Starting in a qualitative approach, we conducted in-person interviews with planners along the north, south and Cape Cod coasts of Massachusetts. We were in line with Hitchcock and Newman (2012) when they talk about allowing research questions to guide methodological choices and avoid overemphasizing division between research paradigms.

The next step in the research design was the conduction of a web-survey in coastal New England, expanding the size of the sample in order to get a more precise data about the region. The convenience in terms of time and financial resources demanded for a web-survey in comparison to the common high investment needed for in-person interviews plus the possibility of amplifying the sample were decisive factors in the process of choosing the web-survey method.
1.5 Research methods

Methods should follow from questions and how we do something in research depends on what we are trying to find out (Punch, 2009). Mixed methods research has become increasingly articulated, very connected to practice and being recognized as the third major research approach, along with qualitative and quantitative research methods (Johnson, Onwuegbuzie & Turner, 2007). Nevertheless, it was not without bumps that the mixed methods idea was established in the social and behavioral sciences. There was a paradigm war being fought across several battlefields, examine Tashakkori & Teddlie (1998, p. 7): “during the past three decades, several debates or “wars” have raged in the social and behavioral sciences regarding the superiority of one or the other of the two major social science paradigms or models. These two models are known alternately as the positivist/empiricist approach or the constructivist/phenomenological orientation.”

In recent years, however, evaluators of educational and social programs have expanded their methodological repertoire with designs that include the use of both qualitative and quantitative methods (Greene et al, 1989). Rossman and Wilson (1985) identified three reasons for combining quantitative and qualitative research. First, combinations are used to enable confirmation or corroboration of each other through triangulation. Second, combinations are used to enable or to develop analysis in order to provide richer data. Third, combinations are used to initiate new modes of thinking by attending to paradoxes that emerge from the two data sources.
This research integrates both quantitative and qualitative methods in a mixed methods approach. When we illuminate a complex issue through multiple lenses, we see more facets than when only one is used – qualitative and quantitative methods can be combined to better address research questions (Rossman and Wilson, 1994).

A critical part of social research is deciding what to observe and what not (Babbie, 2009). Sampling, the process of selecting the population or the units of observation to be studied, whether in traditional qualitative or quantitative methods, whether in mixed methods, can be a challenge (Teddlie & Yu, 2006; Plano Clark & Creswell, 2008).

In general, sampling procedures in social and behavioral sciences are often characterized into two distinct groups: probability sampling and purposive or nonprobability sampling (Babbie, 2009; Teddie & Yu, 2007). Despite the fact that probability sampling remains the primary method of selecting large samples for social research, this type of sampling can be inappropriate in a number of research situations (Babbie, 2009) which is specifically our case.

The first phase of the data collection, as mentioned before, was done by conducting 15 semi-structure interviews in the coast of MA (list of questions asked in Appendix A). More details on the interviews are presented in chapter 2. The second phase expanded from coastal MA to coastal NE, comprising the states that have Atlantic Ocean shoreline: CT, RI, MA, NH and ME. My intent was to individually contact all the small and medium communities possible along the coast for the web-survey (n=248) to ameliorate chances of response. However, only 226 of them have email information available. All of them were contacted, 140 answered at least one session; 121 completed the survey, thus considered
valid responses, for a response rate of 54%. More details about the web-survey are presented in chapters 3 and 4.

1.6 Choosing the Exploratory Design

As in all research, the choice of a design in a mixed methods study should be governed by the inherent logic of the research project, by the way the research problem is framed and set up for research, and especially by the way its research questions are asked and phrased - in mixed methods research, ‘question–method’ fit is crucial (Punch, 2009). Creswell (2015) also refers to what he calls “Integration” - how the researcher puts together the qualitative and quantitative results in a mixed methods study. “The way the researcher combines the data needs to relate to the type of mixed methods design used.” (p.75)

The one-on-one interviews conducted in 2011 (Phase I) was followed by the web-based-survey conducted in 2015 (Phase II). Data collected from interviews and the web-surveys were connected by generating hypotheses based on qualitative results and using the quantitative data to test the extent to which the qualitative results generalized to the larger sample, followed the suggestion presented by Plano Clark & Creswell (2008).

The general logic of the exploratory design is that quantitative investigation is inappropriate until exploratory qualitative methods have built a better foundation of understanding (Punch, 2009). In line with the literature, my two-phase mixed methods design, qualitative data (interviews) were collected in the first phase, and quantitative data (web-survey) in the second.
“In qualitative research, a small sample is studied in order to build individual perspectives; in quantitative research, a large sample is collected so that the results can be generalized from the sample to the population” Creswell (2015, p. 46). In an exploratory sequential design, the sample for the quantitative follow-up may be different from the sample for the initial qualitative strand of the study. According to the literature, the qualitative data collection needs to be purposeful and the quantitative sample as randomly selected as possible. As possible or desired, I guess. In my design all data collections will be purposeful. However, because the first phase is exploratory, the sample drawn is based on a small number of individuals intentionally selected to help explore the problem. Creswell (2015) argues that a quantitative element can be developed (in my case the web survey) in order to test the qualitative data collected now with a larger sample, with the main objective of generalization of findings to a larger sample. Figure 4 is an attempt to graphically exemplify this explanation:

![Diagram](image)

Figure 4 - Graphically exemplification of the Exploratory Sequential Design framework presented by Creswell, 2015.

Attempting to also graphically demonstrate my sequential exploratory mixed method design with instrument development, I present the table below. In this table I also intend to address the methodology used in the different phases of the study, data analysis techniques, the procedures and related products.
Table 2 - Visual diagram of my sequential exploratory mixed method design with instrument development

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>QUAL</strong>&lt;br&gt;Data collection Phase 1 (2011)</td>
<td><strong>Diverse sample (n=15);</strong>&lt;br&gt;Audio recordings.</td>
</tr>
<tr>
<td>▪ Purposeful sampling for maximum variation (Tp=64; n=15);</td>
<td></td>
</tr>
<tr>
<td>▪ One-on-one semi-structured interviews.</td>
<td></td>
</tr>
<tr>
<td>▪ Full transcription of the interviews</td>
<td><strong>Selection of quotes;</strong>&lt;br&gt;Preliminary analysis.</td>
</tr>
<tr>
<td>▪ Coding using the software <em>Dedoose</em></td>
<td></td>
</tr>
<tr>
<td>▪ Identify categories with supporting quotes;</td>
<td><strong>Factors/indicators that show adaptation readiness;</strong></td>
</tr>
<tr>
<td>▪ Develop web-survey instrument based on qualitative findings;</td>
<td></td>
</tr>
<tr>
<td>▪ Pilot-test web-survey instrument.</td>
<td><strong>Table of survey items and supporting quotes;</strong></td>
</tr>
<tr>
<td>▪ Select expanded sample <em>(P and TP)</em>;</td>
<td><strong>Survey instrument (16 items and 1 open-ended questions)</strong></td>
</tr>
<tr>
<td>▪ Administer survey instrument electronically.</td>
<td></td>
</tr>
<tr>
<td>▪ Descriptive simple statistics <em>(look at the patterns that will emerge)</em></td>
<td><strong>Means, standard deviations, and internal consistency</strong></td>
</tr>
<tr>
<td>▪ Code responses to open ended questions</td>
<td><strong>Quotes describing themes</strong></td>
</tr>
<tr>
<td>▪ Report basic statistical results</td>
<td></td>
</tr>
<tr>
<td>▪ Discuss and interpret what was learned overall;</td>
<td><strong>Summary tables;</strong></td>
</tr>
<tr>
<td>▪ Use qualitative quotes to validate and illustrate quantitative results.</td>
<td><strong>Chi-square, means and standard deviation</strong></td>
</tr>
<tr>
<td><strong>INSTRUMENT DEVELOPMENT</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Quan (+ qual)</strong>&lt;br&gt;Data collection</td>
<td></td>
</tr>
<tr>
<td>▪ Table of survey items and supporting quotes;</td>
<td></td>
</tr>
<tr>
<td>▪ Survey instrument <em>(16 items and 1 open-ended questions)</em></td>
<td></td>
</tr>
<tr>
<td><strong>Quan (+ qual)</strong>&lt;br&gt;Data analysis</td>
<td></td>
</tr>
<tr>
<td><strong>Quan</strong>&lt;br&gt;Results</td>
<td></td>
</tr>
<tr>
<td><strong>Interpretation</strong>&lt;br&gt;QUAL + quan Results</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Discussion;</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Evaluation of the qualitative results as a helper to generalize</strong></td>
</tr>
<tr>
<td></td>
<td><strong>the large sample, providing</strong></td>
</tr>
<tr>
<td></td>
<td><strong>validity and reliability to the</strong></td>
</tr>
<tr>
<td></td>
<td><strong>new instrument (web-survey).</strong></td>
</tr>
</tbody>
</table>
1.7 Study Area

The survey was administered to urban planners and other municipal officials in the Atlantic coastal communities of New England: Connecticut, Rhode Island, Massachusetts, New Hampshire, and Maine.

In the first phase of the study, working within one state (Massachusetts) minimized variation from state-level policy frameworks, as mentioned before. Now, for the web survey, five states were involved. Upon a preliminary analysis, we found that these states have similar governance and land use planning systems. Planning law is defined by the states but implemented by municipalities who show varying levels of heterogeneity in their policy approaches and priorities (Hamin and Gurran, 2015). This means that even when strong state policy exists, very different local planning frameworks and outcomes are typical in the region.

In 1969, the National Environmental Policy Act - NEPA was one of the first laws ever written that establishes a broad national framework for protecting the environment. NEPA's basic policy is to assure that all branches of government give proper consideration to the environment prior to undertaking any major federal action that could significantly affect the environment. Born in the wake
of elevated concern about environmental pollution, the United States Environmental Protection Agency – EPA was established on December 2, 1970 to consolidate in one agency a variety of federal research, monitoring, standard-setting and enforcement activities to ensure environmental protection. EPA has ten Regional offices, each of which is responsible for the execution of environmental programs within several states and territories. At EPA New England, the region's Office of Environmental Review is responsible for NEPA. EPA Region 1 (New England) serves Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and 10 Tribal Nations.

In an interactive and very user-friendly website, EPA presents the following question linked to the map (Fig. 6): “What are the impacts of climate change where I live?” For the Northeast region the answer is: “More frequent heat waves in the Northeast are expected to increasingly threaten human health through heat stress and by affecting air pollution. As temperatures rise, farms and fisheries will likely face increasing problems with productivity, potentially damaging livelihoods and the regional economy. More frequent heavy rains and sea level rise are likely to increase flooding in the Northeast.”

Figure 6 - EPA regional offices. Source: http://www.epa.gov/climatechange/
In May, 2015 EPA launched an online training module to help local governments take actions to increase their communities' resiliency to climate change. The training provides links to federal and state resources that help communities assess their unique climate-related risks. The participation or not in this training could contribute in the assessment of indications of leadership.

1.8 Criteria for selecting the target population

For the first phase of data collection, criteria used were:

1. Geographic position of the municipality in the State of Massachusetts: Atlantic Ocean coastal towns;
2. Number of inhabitants: cities and towns between 10,000 and 100,000 inhabitants;
3. Geographic position of the town related to Boston: North of Boston, South of Boston and those located in Cape Cod.

3 More information can be found in http://yosemite.epa.gov/opa/admpress.nsf/bd4379a92ceceea8525735900400c27/53fb49077845158f85257e3d0057c71f!OpenDocument
Despite criteria determining the number of inhabitants for the sample selection, there was one exception: communities located in Cape Cod. Cape Cod is a geographic cape and peninsula south of Boston that juts out into the Atlantic Ocean in the state of Massachusetts (Fig. 7). Due to its vulnerable wetlands and coastal habitats, coastal flooding and other impacts have become more common in the area when extreme weather such as nor’easters and ice storms occur. This method for choosing the sampling is characterized as purposive because it has nothing of random. Thus, 15 communities were selected: 5 in Northshore, 5 in the Southshore and 5 in the Cape.

Now, for the second phase of data collection, the geographic area was expanded beyond the state of Massachusetts. Criteria used were:

2. Number of inhabitants: cities and towns up to 150,000 inhabitants.

For the second data collection we expanded the geographic area and also the range of size of communities. Concerned about how fairly the data collected would reflect the reality of the small and medium coastal communities in NE, I randomly picked a few very small communities and visited their official websites. Interestingly I started finding some good indications that these small towns could also serve as a relevant source of

Figure 7 - Cape Cod, a geographic cape and peninsula in Massachusetts, south of Boston. (Source: Google maps)
information for the study, despite the possible absence of a planner in the staff. For example, Damariscotta in Lincoln County, Maine, a town of a little more than 2,000 habitants, has a planning department directed by an urban planner. He works only two days a week in Damariscotta Town Hall, but it is nonetheless an interesting finding. In addition to the Planning department, Damariscotta has also an Emergency Management department. One other good example that deserves to be cited here is Rye, a town of 5,298 habitants in New Hampshire. The first thing that called my attention when visiting the town’s official website was a banner, posted in the cover page: “Preparing for Climate Change”. The link leads to a planning and zoning administrator – for sure the ideal figure to be contacted for the web-survey.

Continuing my quick search I noted that the majority of these small coastal communities have an Emergency Management department, a Conservation Commission, or at least a Planning Board. In the lack of all these commissions, the town administrator was contacted and engaged in the research. Besides the possibility of enriching the study by including other officials involved in discussions and possible actions regarding CCA, the inclusion of these other city officials presents one other advantage for the web survey: the number of target population is significantly increased, enhancing the chances of better response rates and representativeness of the population.

Even though Teddlie & Yu (2007) argue that probability sampling techniques are primarily used in quantitatively oriented studies while purposive sampling techniques are primarily used in qualitative studies, the sampling technique adopted in my study in both approaches - qualitative (in-person interviews) and quantitative (web-surveys) - is the purposive one, which involves selecting certain units of sampling based on a specific
purpose rather than randomly. Moreover, I believe that I can also characterize the population chosen for the interviews (qualitative side of the study) and for the web-surveys (quantitative side of the study) as “Convenience sampling”. In a simple way to explain, we have “convenience sampling” when choosing samples that are willing to participate because they have interest in the subject and also that are easily accessible (Teddlie & Yu, 2007).

The natural differences between qualitative and quantitative methods does not mean that one is better or worse than the other – each method should be evaluated considering its strengths and limitations (Duffy, 1987), without mentioning that the individual power of one method offsets the other method’s weaknesses (Jick, 1979). Qualitative and quantitative methods in this study functioned iteratively, deriving a more complete understanding of the phenomenon under study; and don’t necessarily need to take precedence over the other (Rossman & Wilson, 1985).

1.9 The two Phases of the Study

1.9.1 Phase 1: Interviews in 2011

In-person unstructured interviews were conducted in 2011 with planners of 15 coastal communities in Massachusetts + 3 background interviews with regional planning agencies for the coastal communities. The main goal of these interviews was to verify the barriers and opportunities to address climate change adaptation at the local level. The Massachusetts Office of Coastal Zone Management (CZM) maintains 5 regional offices that serve 78 coastal communities. Table 3 shows similar division was adopted in this study:
Table 3 - List of interviews done in 2011, including North of Boston, South of Boston, and Cape Cod.

<table>
<thead>
<tr>
<th>North Shore</th>
<th>Boston Harbor</th>
<th>South shore</th>
<th>Cape Cod and Islands</th>
<th>South Coastal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newburyport</td>
<td>Quincy</td>
<td>Plymouth</td>
<td>Mashpee</td>
<td>New Bedford</td>
</tr>
<tr>
<td>Gloucester</td>
<td>Marshfield</td>
<td></td>
<td>Brewer</td>
<td></td>
</tr>
<tr>
<td>Salem</td>
<td>Duxbury</td>
<td></td>
<td>Falmouth</td>
<td></td>
</tr>
<tr>
<td>Swampscott</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marblehead</td>
<td></td>
<td></td>
<td></td>
<td>Eastham</td>
</tr>
</tbody>
</table>

Sub-total: 5 Sub-total: 1 Sub-total: 3 Sub-total: 5 Sub-total: 1
Total of communities interviewed in 2011: 15

Besides the interview with planners, three background interviews were conducted:

Cape Cod Commission (Barnstable, Cape Cod), Metropolitan Area Planning Council - MAPC (Boston) and Waquoit Bay National Estuarine Research Reserve (Waquoit Village, MA).

1.9.2 Phase 2: Web-survey in 2015

The web-based survey was conducted with small and medium communities along the coast of New England. Five out of the six states were part of the study: Connecticut, Rhode Island, Massachusetts, New Hampshire, and Maine. Vermont is the only New England state that does not have an Atlantic coastline and for this reason was out of the survey.

One of the interesting possibilities of the web-survey is to quantify the factors that most affect the response to climate adaptation planning at the community level. The overall result of the web survey reveals data that improve the understanding about the status of climate adaptation efforts of these communities. By the end of Phase 2, we had both quantitative and qualitative data collected. I am confident that they, together, provided a better understanding of the research problem than either type by itself. The list of all the cities and towns for the survey are displayed in Appendix C.
1.9.2.1 The web survey method

Until the introduction of the use of Web-based surveys in the late 1990s, “a paper-and-pencil format, often distributed and collected through the postal system, was the typical method of conducting a self-administered survey” (Shropshire, Hawdon & Witte, 2009, p. 344). Due to a series of advantages, web-based surveys rapidly spread. Internet surveys can be effective data collection tools. The use of internet survey eliminates the need for paper and waiting for the mail, is not geographically constrained, and can provide immediate feedback (Dillman, 2000).

Couper & Miller (2008, p. 831) argue that “despite their relatively short history, Web surveys have already had a profound effect on survey research. The first graphic browser (NCSA Mosaic) was released in 1992, with Netscape Navigator following in 1994 and Internet Explorer in 1995. The first published papers on web-surveys appeared in 1996”. Since then, there has been a virtual explosion of interest in the Internet as a tool for collection of survey data. Today, web-based surveys “are ubiquitous, although they are often of questionable quality (…) Along with telephone surveys and face-to-face interviews, self-administered surveys have been the predominant means to solicit data from individuals across a variety of disciplines”, highlight Shropshire et al, 2009.

In this context, it’s important to differentiate web surveys from e-mail surveys, in which the survey instrument is put in the body of an e-mail or is sent as an attachment. “E-mail surveys lack the interactive element that is characteristic of Web surveys”, noted Shropshire et al, 2009.

There are two aspects of response patterns that have been intensively compared between the traditional mail surveys and electronic surveys, including web-based surveys
– response rate (RR) and response speed (Kwak & Radler, 2002). These authors inform that past studies have generally reported that electronic survey produced a lower RR than traditional mail surveys. Recent studies, however, that compared web-surveys with traditional mail surveys reported higher RR for web-based surveys. They also highlight that studies reported that the response speed in web-surveys is fare better that mail surveys, as expected. Aspects such as transmission time required to deliver and return a web-survey is “virtually eliminated, which should decrease the turnaround time” (Dillman, 2000).

Despite all the advantages, there are some challenges in using the internet. As respondents visually scan the options available to them on the screen, their fingers are usually ready to click and move quickly on the next item. This kind of fast reaction can potentially cause measurement error by obtaining responses that are not accurate or that don’t represent the reality concerning that specific respondent in that particular matter. Dillman (2000) argues that subjects on-line read faster, are more impatient, and are more discriminating compared to the off-line readers.

Some efforts can be taken in order to try to increase the number of usable responses. Simple steps as the contrast of the letters with the background can provide an “easy-to-read” screen. One other feature uses was that the survey was set-up so that respondents were notified of missing answers. Answering the questions was not mandatory, with the exception of the consent form one.

There are a good number of online survey development sites available that simplifies the survey process considerably. One of the leading providers of web-based survey solutions highlights the possibility of “responses in real time, slice and dice data to
reveal insights, and easily share presentation-ready charts and reports”. These useful and interesting features, obviously, don’t take away the tremendous responsibility of the researcher when designing the survey and analyzing the data. According to Shropshire et al (2009), the literature about survey research has long indicated that design factors such as question wording and question ordering can influence response tendencies in survey instruments. All self-administered questionnaires share the common characteristic of being written in two distinct languages: the word and the graphical language (Dillman, 2000).

In addition to the typical advantages of self-administered surveys, Shropshire et al (2009) note that web-based surveys offer further benefits:

- 1st: Designers of Web surveys are able to take advantage of computer technology to construct complex skip patterns that transparently guide respondents past questions that prior responses indicate do not apply to them. The overall effect is to reduce response burden and perhaps increase response rates;
- 2nd: Web surveys permit various design effects, such as image prompts, to create a potentially more engaging survey to reduce nonresponse and incomplete surveys;
- 3rd: Web-based surveys introduce the prospect of monitoring respondents’ progress throughout the instruments. That is, the exact number of questions answered and the time spent on a survey instrument can be determined even if a respondent terminates the survey.

In traditional mailed questionnaires, failure to deliver due to wrong address is the first cause of low response rate (RR) and the lack of willingness of people to answer is the
second (Baruck & Boltom, 2008). Similar situation can be considered for the web-based survey: wrong email address and also the lack of motivation for answering the survey. Other important issue highlighted by them is what they call “over-surveying” by describing the situation of the respondent being flooded by an enormous number of questionnaires. They argue that the result is a large number of target individuals who are fatigued and therefore refuse to respond to non-essential questionnaires. Similar situation, again, can be perfectly reported to web-survey.

Regarding the factors that are believed to influence the RR to surveys like, for example, the use of incentives, such as promise of money or a gift, follow-up, personalization, among others, the literature suggests differential effectiveness for traditional RR enhancement techniques depending on the target (Baruck & Boltom, 2008). For this reason they defend that the use of incentives and reminders will result in a higher RR in studies of individuals than in studies of organizations. I will not use incentives in terms of promise of money or gifts, however I will inform them about the fact that the data result of the study will be shared with all the participants as a form of incentive. I am assuming this will serve as a good motivation because several planners, in the in-person interviews, declared that this is a data highly valued by them and that they are eager to get this information. I will definitely use reminders as well to help keeping the survey in their radar.

Baruck & Boltom (2008) present a “response rate review checklist” for traditional questionnaires in their article. Table 4 presents their input in the column on the left and the data that I find is transferable as a response rate review checklist for web-based survey:
### Table 4 - Response rate review checklist, based on Baruck & Boltom, 2008 with insertion of transference for response rate for web-based survey.

<table>
<thead>
<tr>
<th>QUESTIONNAIRES</th>
<th>WEB-BASED SURVEY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Information about the sample</strong></td>
<td><strong>Information about the sample</strong></td>
</tr>
<tr>
<td>- How many people was the questionnaire sent to?</td>
<td>- How many people was the web-survey sent to?</td>
</tr>
<tr>
<td>- How was it distributed? (e.g. traditional mail, internal mail, email, web, in person)</td>
<td>- How was it delivered? (e.g. work e-mail, personal e-mail, web, social media)</td>
</tr>
<tr>
<td>- Was it sent to people who volunteered for the study (prior consent)?</td>
<td>- Was e-mail used as a cover letter?</td>
</tr>
<tr>
<td>- Was it sent to people who volunteered for the study (prior consent)?</td>
<td>- Was it sent to people who volunteered for the study (prior consent)?</td>
</tr>
</tbody>
</table>

**Questionnaires returned**
- How many questionnaires were returned?
- Of those that were returned, how many were usable?
- Was there a typical reason for receiving unusable questionnaires? If so, explain.

**Web-surveys completed**
- How many web-surveys were returned?
- Of those that were returned, how many were usable?
- Was there a typical reason for receiving unusable responses? If so, explain.

If several populations are involved (e.g. rank and file vs managers), was there a difference in the RR across the populations?

What response facilitation approaches were used by the researcher to increase RR (e.g. pre-notification, publicity, incentives, reminders, survey feedback)?

What response facilitation approaches were used by the researcher to increase RR (e.g. pre-notification, publicity, incentives, reminders, survey feedback)?

If the RR is an extreme case, either below or above acceptable norms, the researcher(s) should briefly explain the reason for such a deviation.

1.9.2.2 Web-survey design

Many of the questions for the planners and other local government officials on the survey were tailored for each of the respective groups to better understand their attitudes toward planning for climate change adaptation.

Respondents were asked about the factors that influence their decision to plan for adapting the town/city to cope with climate change challenges. They were also asked to

---

4 Specifically about this abnormal rate in responsiveness, Baruck & Boltom (2008) suggest that an RR exceeding the boundaries of one standard deviation should be discussed. If it is above, was it really voluntary for the respondents to reply and what are the possible explanations (e.g. use of specific approach in design or an effective promotion)? If below, why is it still justifiable to use the sample (e.g. population is difficult to access, strong evidence that many questionnaires have not reached the target population)? As an example, when Tsui et al. (1995) had 90 percent and 95 percent RR they indicated it is an excellent RR but did not try to explain the unique circumstances or possible reasons for such a result.

rate the strategies found in the literature to measure the status of CCA, to express their experience, attitudes and motivations for adapting to climate change.

The web survey questionnaire was roughly divided into six main sections:

1. Location characteristics/basic demography
2. Professional experience/perception of climate impacts
3. Support for and influences on planning - leadership assessment
4. Challenges/barriers and benefits/actions and opportunities
5. Groups and organizations for information and guidance
6. What’s needed to move forward

The most frequent issues result of the interviews conducted in 2011 with planners of small and mid-sized coastal communities in Massachusetts were addressed in the survey, such as lack of staff. For the most part, the interviewees did not reflect resistance to adaptation planning. Most often, limited interest and action were based on the fact that many departments in these small towns are coping with overloads, lack of funding to complete mandated tasks, and diminished capacity because of decreasing levels of staff.

The questionnaire was reviewed by members of my dissertation committee for content and clarity before being sent out. Once the instrument was ready, sample communities were sent an introductory email announcing the study and asking for collaboration. The email provided the link to the web survey and appropriate consent form. Reminders were sent two weeks, plus 72 and 24 hours before survey portal was closed.

A key choice in the design of Web surveys is whether to place the survey questions in a multitude of short pages or in long scrollable pages. There are advantages and
disadvantages of each approach, but little empirical evidence to guide the choice. (Peytchev, Couper, McCabe and Crawford, 2006). In 2003 Peytchev et al conducted a survey of over 21,000 undergraduate students. Ten percent of the 10,000 respondents were directed to the scrollable version of the survey, containing a single form for each of the major sections. Overall, they affirm, “few differences were found between the paging and scrolling designs. Contrary to several earlier studies and prevailing belief, the paging design did not take longer to complete—in fact, it took slightly less time.” (Peytchev et al, 2006, p. 604).

Various kinds of rating scales that can be used in web-survey design have been developed to measure attitudes directly. The most widely used is the Likert Scale. Likert-type or frequency scales use fixed choice response formats and are designed to measure attitudes or opinions (Bowling, 1997). These ordinal scales measure levels of agreement/disagreement. Respondents were offered a choice of five to seven pre-coded responses with the neutral point being neither agree nor disagree, or other type of agreement measure.

For example:

**Statement:** I believe that climate change impacts are the most important issues urban planners are facing today.

**Options of answer:** Strongly agree / agree / don’t know / disagree / strongly disagree.

In this case, each of the five responses have a numerical value which is used to measure the attitude under investigation. In this example, mean scores would be based on
a 5-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = don’t know, 4 = agree, 5 = strongly agree. Some Likert Scale examples are presented in table 5:

Table 5 - Examples of 5-point Likert Scale

<table>
<thead>
<tr>
<th>AGREEMENT</th>
<th>Strongly Agree / Agree / Undecided / Disagree / Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>FREQUENCY</td>
<td>Very Frequently / Frequently / Occasionally / Rarely / Never</td>
</tr>
<tr>
<td>IMPORTANCE</td>
<td>Very Important / Important / Moderately Important / Of Little Importance / Unimportant</td>
</tr>
<tr>
<td>LIKELIHOOD</td>
<td>Almost Always True / Usually True / Occasionally True / Usually Not True / Almost Never True</td>
</tr>
</tbody>
</table>

Likert Scales have the advantage that they do not expect a simple yes / no answer from the respondent, but rather allow for degrees of opinion, and even no opinion at all (Mcleod, 2008). Therefore quantitative data is obtained, which means that the data can be analyzed with relative ease. However, like all surveys, argues Mcleod (2008), the validity of Likert Scale attitude measurement can be compromised due social desirability. This means that individuals may lie to put themselves in a positive light. For example, if a Likert scale was measuring discrimination, who would admit to being racist? Or being totally inactive if asked about concrete actions in planning for climate change adaptation?

Offering anonymity on self-administered questionnaires should further reduce social pressure, and thus may likewise reduce social desirability bias. Paulhus (1984) found that more desirable personality characteristics were reported when people were asked to write their names, addresses and telephone numbers on their questionnaire than when they told not to put identifying information on the questionnaire.
To give a sense of what sorts of adaptation actions are possible at the municipal level, Hamin and Gurran (2015) identify the policies and practices that first-adopter communities are undertaking. Their study compares practice in two nations – the US and Australia, which both have similar governance and land use planning systems. Both nations have three tier federal, state, and local governments, with planning law defined by the states but implemented by municipalities. Following that, they focus on the process that these communities are using to reach those policies, and the conditions and actions that enable or disable progress particularly in relation to land use planning for climate adaptation. Their empirical data suggests that the steps undertaken by communities lie along an adaptation ‘ladder’ (Fig. 8). The adaptation ladder proposed by Hamin and Gurran identified what typical actions are, and the steps through which communities tend to move.

These 5 steps described in the adaptation ladder helped in the elaboration of the questionnaire for the web-survey. The ladder served as a guide for the survey design, in the attempt to verify if the steps undertaken by the communities are in accordance to the ladder or not. Hamin and Gurran (2015) explore the adaptation policy choices communities are making and explains the range of strategies local governments have used to move forward on a ‘ladder’ of climate adaptation, proceeding from awareness and constituency building activities through formal risk analyses and strategic planning for...
climate adaptation, through implementation through specific changes to land use planning and infrastructure investment. Factors found to support or hinder these efforts relate to political will, staff resources, technical information, and training in potential policy responses and significant barriers include issues of property rights and sunk investment in vulnerable locations (particularly along the coast), as well as shifting community and political views about the reality of climate change (Hamin and Gurran, 2015).

The process of elaborating the questions for the web-survey were also informed by a global survey developed and conducted by Carmin, Nadkarni and Rhie in 2012. Despite all the differences in the sample basic characteristics, Carmin et al’s research in 2012, found a similar situation to those observed here on the coast of Massachusetts in the interviews of 2011. To gain insight into the status of adaptation planning globally, approaches cities around the world are taking, and challenges they are encountering, a survey was sent to communities that are members of ICLEI-Local Governments for Sustainability.

The adaptation ladder together with Carmin et al’s study seem to have been an appropriate model to inform our approach through the web survey, facilitating the understanding of a process that can function as a route to future research in other geographical coastal areas of US and abroad.

1.10 Dissertation Organization

This dissertation consists of four main chapters and a conclusion. The first chapter is composed by a general literature review, research questions, discussion about the methods adopted and a brief explanation about the two phases of data collection. The remaining three chapters are different investigations, however closely linked to form a coherent
intellectual whole. This wholeness was demonstrated by the shared introductory chapter that clearly and broadly placed the investigations into the existing scholarship on the general topic, and by concluding chapter (Chapter 5) that identifies the intersecting findings of the investigations and their importance to policy or scholarship. The chapters within the body of this document stand each on their own as coherent articles including literature review, methods, and findings, in a format that is readily submittable to a scholarly planning or related journal. The references from each article were merged into one bibliography, located after Chapter 5.
CHAPTER 2

BARRIERS TO MUNICIPAL CLIMATE ADAPTATION:
EXAMPLES FROM COASTAL MASSACHUSETTS’ SMALLER CITIES AND TOWNS

(article 1)

2.1 Problem, research strategy, and findings:

Many global cities are making good progress on climate adaptation. There is less information, however, on climate adaptation among smaller cities and towns: Are their approaches similar when undertaking adaptation? Do the barriers they face mirror those of large cities? In this study, we undertake fine-grained empirical research on the perceptions of 18 municipal planners in 14 coastal cities and towns in Massachusetts; our findings are thus limited to planners’ perceptions of efforts and barriers in one region of the United States. These communities are very early in the uptake of climate adaptation policies and use a range of approaches when they do begin adaptation, including planning, mainstreaming, or addressing current hazards. The planners interviewed reported that barriers to adaptation actions tend to be interconnected; for example, the strength of private property interests often limits local political leadership on the issue. Without such leadership, it is difficult for planners to allocate time and/or money to adaptation activities. It is also challenging to gain support from local residents for climate adaptation action, while a lack of accepted technical data complicates efforts.
2.2 Takeaway for practice:

In coastal Massachusetts, and perhaps elsewhere, local residents, planners, and their municipal bodies, as well as the states, must act in multiple ways (take multiple actions such as preparing plans, raising awareness, etc.) to encourage the development of meaningful climate adaptation action in smaller cities and towns.

2.3 Keywords: land use planning, climate change, adaptation, municipal, qualitative research

2.4 Introduction

Climate change adaptation is defined by the National Research Council (NRC; 2010) as “adjustments in the natural or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects” (p. 19). Adaptation seeks to adjust the built and social environments to minimize the negative outcomes of climate change (Intergovernmental Panel on Climate Change [IPCC], 2007); mitigation planning, by contrast, seeks to reduce current and future greenhouse gas emissions, including those generated through the built environment and transportation sectors. Although adaptation to climate change challenges local decision makers to face a complex decision-making arena and a novel topic, municipal-level efforts to plan for greenhouse gas reduction and adaptation are increasingly common (Bedsworth & Hanak, 2010).

Most research on climate change has focused on selected big cities in the Global North (Bell & Jayne, 2009). More general planning or urban studies have rarely used small to mid-sized cities as a focused unit of analysis (Pitt & Bassett, 2013). We seek to identify
how small cities approach climate adaptation, the barriers they face in doing so, and the
strategies that such cities develop to overcome those barriers. For this study, we undertake
fine-grained empirical research on a sample of small communities.

We explore two specific questions:

• What types of municipal adaptation action are occurring in smaller coastal communities
  in a region with minimal state guidance on climate change?

• What sorts of barriers are planners experiencing in addressing climate adaptation in these
towns and cities?

Smaller, often less-researched places offer insights on how policy ideas in general,
and specific climate adaptation practices in particular, may travel and implant across a
region (Pitt & Bassett, 2013). Although we focus on municipal planners, we recognize that
adaptation involves collaboration across a variety of governmental and nongovernmental
actors (Drummond, 2010).

We find that smaller communities in this region have only attempted very limited
adaptation efforts. While the literature suggests that there are discrete barriers to adopting
climate adaptation policies or activities, most respondents stress that these barriers are
extremely interconnected. For example, private property interests often limits local
political leadership on the issue and reduce the resources available to planners to address
climate adaptation. As argues Babie (2011, p. 19), ‘climate change is a private property
problem’ and what is really being conferred by private property is what Duncan Kennedy
calls the legal ground rules giving “permissions to injure” others, to cause legalized injury
(Kennedy, 1993). This makes it difficult for planners to develop useful data, overcome
technical barriers, or help educate their communities. Equity questions about who should
pay for adaptation improvements also cloud the issue. Local planners need help from all levels of government to develop meaningful and effective climate adaptation approaches and policies. While our findings are specific to coastal communities in Massachusetts, they may have implications or scalable lessons for other small or coastal communities.

The following section reviews the literature on typical adaptation policies at the local level, the extent of current municipal adaptation efforts, and previously identified barriers to action. The second section introduces the study area and research techniques, and the third describes our findings. The final section discusses implications of our work for the diffusion of climate adaptation learning and practice more widely.

2.5 Research Literature Framework

Global awareness about the implications of anthropogenic - or human-induced -climate change has grown dramatically in the past decade. The range and uncertainty of potential future climate impacts suggest that we need more than static historical information to inform existing planning frameworks, building codes, and infrastructure standards (Berkes, 2007; Betts et al., 2011; Hamin & Gurran, 2009; Intergovernmental Panel on Climate Change, 2007; Quay, 2010). Some U.S. municipalities and regions are making progress in adaptation planning and policy (Crucce, 2009; Wheeler, 2008), particularly those with state-level leadership (Bedsworth & Hanak, 2012). For example, more than 20% of the local jurisdictions in California have policies or programs addressing climate adaptation (Governor’s Office of Planning and Research & State of California, 2012). But aside from states such as California and parts of Europe, the extent of progress in second-tier and smaller cities and towns is less clear (Australian Government, 2010; Baker, Peterson,
Brown, & McAlpine, 2012; Bierbaum et al., 2013; Carmin, Nadkarni, & Rhie, 2012; Gurran, Norman, & Hamin, 2012; Measham et al., 2011; Norman, 2009).

To prepare for climate change, communities must begin by projecting future climate scenarios and identifying the neighborhoods, populations, and infrastructure systems of greatest vulnerability to potential climate hazards (Füssel, 2007). Addressing these vulnerabilities might involve developing policies to respond to the increased frequency or intensity of natural hazards and the consequent implications for public health, coastal zone management, building codes, water and sewer supply, stormwater management, and biodiversity conservation (Burby et al., 1999; Rosenzweig, Solecki, Hammer, & Mehrotra, 2011). Preparing for climate change requires more interagency coordination and wider geographical spheres for planning (Bedsworth & Hanak, 2010; Castán Broto & Bulkeley, 2013; Zimmerman & Faris, 2011). For example, communities can prevent development in vulnerable locations, use structures and materials able to withstand storm events at future projected intensities, and increase provisions for onsite water retention in regions where rainfall patterns are likely to become more volatile (Gurran, Hamin, & Norman, 2008; Gurran et al., 2012; Harvey & Woodroffe, 2008). The impact of intense heat days can also be reduced (Stone, 2012).

In practice, many communities follow a process or pattern: They develop community awareness of the need for adaptation, analyze climate risk and vulnerability, change local regulations, and then modify infrastructure. However, few communities have progressed through all of these steps (Hamin & Gurran, in press). Adaptation is similar to other policy innovations: It requires managing the framing of the issue while raising
awareness, generating sanctions and incentives, developing feasible options, and institutionalizing the selected policies (Tabara et al., 2010).

Municipalities can prepare for future climate in one of three ways:

• planning, preparing specific plans to prepare for various scenarios and possibilities;
• mainstreaming, changing technical specifications and regulations to reflect projected climate conditions without going through a full planning process; and
• addressing current hazards, which typically makes a community better adapted to future hazards as well.

Cities adopting the planning approach generally prepare a comprehensive strategic adaptation framework based on climate forecasts and vulnerability analyses (Adger, Arnell, & Tompkins, 2005). This can be a standalone adaptation plan or a chapter in a sustainability plan, comprehensive plan, or master plan (Laukkonen et al., 2009). Such plans or plan elements often include recommendations on how to integrate climate issues into other plans or regulations, showing how to assimilate climate concerns into a broad range of policies.

Cities using the mainstreaming approach move directly from climate forecasts to changing relevant technical specifications and regulations, focusing largely on internal coordination (see Klein, Schipper, & Dessai, 2005; Sharma & Tomar, 2010); that is, cities adopting this approach use some projection of future climate and directly incorporate responses to those projections into key aspects of related government policies (Adger et al., 2007). This enables them to integrate their policies horizontally using mechanisms such as strategic assessment, reforming planning regimes, inserting climate considerations into the mandates of government agencies, or revising rules of liability regarding extreme
events (Dovers & Hezri, 2010). Other examples include changing the requirements for temperature tolerance in paving materials with the awareness of increased heat projections under climate change or changing building codes to accommodate more flooding based on climate projections. Using the mainstreaming approach, planners still make specific reference to climate change as a motivating factor for policy changes, but move directly to incorporate climate adaptation elements into other processes rather than first preparing a standalone plan. Mainstreaming can be an important way to implement climate adaptation provided that local authorities have access to sufficient technical data and expertise (Kok & deConinck, 2007). Typically, these sorts of actions do not require engaging the public as is expected in a planning process because the issues are more technical and internal to municipal management.

The third approach, addressing current hazards, is based on the observation that becoming more resilient to current climate hazards has substantial benefit for preparing for projected climate. Adaptation as defined by the IPCC (2007, 2012, 2014) and others is built on projections of future climate (Ford, Berrang-Ford, & Paterson, 2011). However, it may be more politically acceptable to discuss addressing current hazards than discussing climate change (Berrang-Ford, Ford, & Paterson, 2011; Ruthe & Coelho, 2007). Adaptation benefits can also accrue directly or indirectly from other more established or politically acceptable initiatives such as public health initiatives, urban greening, rural development and diversifying agriculture, disaster management, energy security, or improved air quality (Kok & deConinck, 2007; Preston, Westaway, & Yuen, 2011).
Each of these approaches (planning, mainstreaming, and addressing current hazards) is appropriate in different situations and achieves different goals; yet, the clear divisions suggested by the definitions will be messier in practice. Moreover, they are not mutually exclusive: Cities and towns might start by focusing on improving resilience to current hazards while they undertake a planning process and work to change their building code. The literature has not explored fully the question of when it is better to choose one approach over the others (Moser & Ekstrom, 2010).

The barriers to adopting any of these climate change adaptation approaches include a complex range of institutional, informational, technological, financial, and sociocultural factors (Fuenfgeld, 2010; Measham et al., 2011; Mozumder, Flugman, & Randhir, 2011; Uittenbroek, Janssen-Jansen, & Runhaar, 2013). For example, climate projections are often seen as subjective, the public perceives that it will be a long time before actual impacts are seen, and cities have difficulty in identifying appropriate climate projections to use in developing or modifying regulations (Quay, 2010). Local values can provide an atmosphere of support for climate change adaptation or, alternately, act as a barrier to that process (Wolf, Allice, & Bell, 2013). We know that local leadership makes a difference; there is a direct and positive correlation between the frequency of local planning offices taking leadership roles and the number of times policy action is taken in a survey of city officials and planners in more than 100 U.S. cities (Jepson, 2004). Thus, it is not surprising that the absence of local political leadership creates many barriers to climate adaptation measures; these include lack of resources assigned to adaptation planning and failure to overcome interdepartmental conflict when some departments do not share the goals of
adaptation or have concerns over changes in the distribution of power that may come with policy change (Burch, 2010; Storbjork, 2007).

Given that few planners have had formal training in climate adaptation planning, it is not surprising that climate issues are rarely embedded within local practice. Australian research has found that planners express uncertainty about how to implement climate adaptation policies, despite evident awareness and conviction about the need for action (Baker et al., 2012; Gurrnan et al., 2012; Measham et al., 2011). As Measham et al. (2011) suggest, climate change adaptation is easily displaced by the context of routine demands because it is not typically embedded within local planning frameworks.

The lack of regulatory authority or mandates creates significant barriers to the climate adaptation policies and programs in local cities and towns (Barbour & Deakin, 2012). As early as 2007, Few, Brown, and Tompkins (2007) reported that in UK communities without a regulatory authority or mandate to support adaptation, planners were unable to overcome barriers arising from insufficient information and capacity constraints. As a result, other priorities prevailed (see also Dymen & Langlais, 2013). State mandates, while sometimes viewed by local officials as obtrusive, can provide a basis for policy coordination and the political cover needed when facing opposition from constituents (Bedsworth & Hanak, 2010; Dalton & Burby, 1994).

Moser and Eckstrom (2010) characterize barriers as arising from deficits of leadership, resources, and values and beliefs based on review of a wide range of municipal adaptation barriers literature; that is, whether in the government or grassroots-level activism, leadership is particularly essential when there is no regulatory mandate or local public demand for action. The lack of resources, staff time, and expertise creates barriers
to adaptation. Poor communication with the public and an inadequate flow of communication among those responsible for action create additional barriers. Finally, differences in values and beliefs about the problems at heart, especially beliefs regarding risk and how it should be managed, as well as which substantive concerns have standing, create yet other barriers to cities addressing climate change (Moser & Ekstrom, 2010).

2.6 Regional Setting and Research Method
Coastal Massachusetts, on the northeastern seaboard of the United States, is highly vulnerable to anticipated climate change. Under a high emissions scenario, the state will likely experience increased winter precipitation as well as a 3–5 °C increase in average ambient temperature resulting in up to 28 days above 38 °C (100 °F) a year compared with up to 2 days a year today (Hayhoe et al., 2006; Frumhoff, McCarthy, Melillo, Moser, & Wuebbles, 2007; Frumhoff et al., 2008). Because the coast is naturally subsiding, the net sea-level rise is expected to be about 0.3 meters (12 inches) by the end of the century, not factoring effects of thermal ocean expansion or ice melt in the Arctic. The dense settlement patterns and high property values of the region mean that assets at risk are substantial: Lenton, Footitt, and Dlugolecki (2009) found that a sea-level rise of 0.65 meters (26 inches) in Boston could bring long-term damages of $463 billion.

The City of Boston has been a national leader in climate planning, having prepared a combined mitigation and adaptation plan in 2010 (Climate Action Leadership Committee & the Community Advisory Committee on Climate Action [Boston], 2010) as well as climate action plans that are regularly updated. However, the state has no mandate or official position on climate change adaptation (1).
Land use is controlled locally in Massachusetts; neither the state nor regional bodies has meaningful land use regulatory power. The state has no legal requirement for master plan updates, nor are communities required to update zoning to match an updated comprehensive plan. Therefore, cities and towns update their master (comprehensive) plans only when they want to. To identify the perspectives of local planners on the status of climate adaptation measures in their cities and towns, we conducted interviews in 14 cities and towns in 2011, as shown in Figure 9.

![Figure 9 - Regional Locator (Source: E. Gong and A. Emlinger)](image)

We focused on coastal areas, as they seemed the most likely to have considered climate change in response to publicity about sea-level rise and existing climate vulnerability. We excluded towns that did not have planning staff (approximately a third of the municipalities in the area). We then divided the state into three coastal regions to represent regional place identity: North Shore (north of Boston), South Shore (south of
Boston but not on Cape Cod), and Cape Cod. We randomly selected five communities in each region for interviews, as shown in Figure 2. All but one community planner agreed to be interviewed. The sample of 14 communities thus represents 24% of 62 coastal communities distributed evenly along the coast (2). Multiple staff personnel came to some interviews, so we interviewed a total of 18 local planners.

The socioeconomic character of the cities and towns varies widely; total populations vary from more than 90,000 to less than 2,000. The median 10-year population change averages just 2%, from overall declines to gains of 18% over the decade (3). The density of settlement ranges from under 400 persons per square mile to more than 5,000 (for comparison, Boston has about 13,300 persons per square mile). Median 2009 household income in our sample municipalities ranged between $30,000 and $100,000; median home values ranged from roughly $230,000 to $950,000. Between 11% and 70% of the residents had completed higher education. Overall, the data suggest that many of the communities have relatively high levels of social capacity, or the norms and relationship networks that enable people to act collectively (Woolcock & Narayan, 2000). Our research method follows a grounded theory approach (Glaser & Strauss, 1967). Grounded theory methods use systematic yet flexible guidelines for collecting and analyzing qualitative data in an effort to construct theories that arise from the data themselves (Charmaz, 2006). The researcher does not formulate the hypotheses in advance when applying the grounded theory method, since preconceived hypotheses result in a theory that is not based in the data (Glaser & Strauss, 1967). Instead, data analysis is conducted on codes that emerge from the data itself, which allows theory building. Once theory is built, it can be compared with existing literature for support and interpretation to build the next stage of theory,
essentially forming a dialog with previous research. We recorded the interviews, fully transcribed them, and coded the results into a qualitative data analysis program (DeDoose). Three interviews were dual-coded to ensure intercoder reliability. We based the initial coding of the interviews on the interviewee’s native language, as is appropriate in grounded theory. Once we completed the coding using the patterns we found in the data, we reclassified the coded data based on findings from the literature review. This made our findings more comparable with other research on climate adaptation implementation, particularly the Moser and Eckstrom (2010) typology described here. A particularly thorny issue in coding was differentiating among the adaptation approaches that the planners report using. The lines differentiating one approach from another are not firm within the

Figure 10 - Coding flowchart for adaptation actions.
literature or empirically. Over time in any particular place, planners might make efforts across all three categories. Nevertheless, categorization was necessary to illuminate the range of local approaches. In coding the responses to this question, we used the decision tree shown in Figure 10.

2.7 Adaptation Efforts in Coastal Massachusetts

Our first research question seeks to identify the status of the climate adaptation efforts of the 14 municipalities in terms of the three main categories of local adaptation actions: planning, mainstreaming, and addressing current hazards. We were interested in whether they had actually undertaken specific actions or had only expressed intentions and hopes to do so, or if there was not even that level of interest. As Figure 11 shows, progress on climate adaptation is not widespread. None of the communities had an adaptation plan in place or in progress; only three communities were preparing to do either plans or mainstreaming. Thus, even with the generous interpretation including intentions to prepare a plan, only one-fifth of sampled communities were addressing climate change. One-third had either fairly vague intentions for policy action of some sort, or none at all (4). The third approach, addressing current hazards, was the most common approach reported.

The two communities in the planning category (5) were preparing to add climate adaptation chapters in their master plans. These planners had recently secured grant

![Figure 11 - Status of Adaptation Action.](image)
money for a sea-level rise study; they then sought state funding to prepare new comprehensive plans that will include an adaptation chapter. The planners reported feeling politically supported in their efforts even though their town managers did not allocate funding or resources to these efforts. Another town was working on the second approach, mainstreaming climate projections into vulnerability analyses for new, mandatory multi-hazard mitigation plans. The Cape Cod Commission regional planning agency provided training, technical support, and climate projections to inform these hazard plans. There were no other initiatives with an explicit focus on future climate conditions. Data collection is incredibly important. We used interviews to discover this information about this small subset of communities. A face-to-face interview method provides advantages over other data collection methods. Different than directly exploring each community’s website, for example, the advantage of using this method is big. Wise (2014) argues that face-to-face interviews help with more accurate screening, will capture verbal and non-verbal cues, will help keep the interviewee focused by the presence of the interviewer and capture emotions and behaviors. Other advantage is that, in comparison with research in the website is the updated aspect of the data collected because frequently websites are be out of date.

To address current hazards, communities had changed wetland bylaws to protect foreshores and minimize new saltwater incursions of septic systems, and had integrated sea-level rise projections into their plans. What they had not done was actually discuss climate change per se.

The other planners in our sample communities expressed the intention, sometimes more accurately described as a desire, to begin adaptation. They told us variants of the following statement: “We’re actually looking at doing that, we’re hopeful to be able to get
going.” One respondent was reviewing adaptation plans to see what other communities had done, while another was focusing on sewer regulations. So the intentions discussed will likely lead them to attempt both the planning and mainstreaming approaches.

### 2.8 Barriers to Adaptation in Coastal Massachusetts

Respondents reported a range of challenges to incorporating climate change adaptation into municipal practices, many of which are consistent with the typology suggested by Moser and Eckstrom (2010). Figure 12 summarizes what planners indicated was the primary barrier they faced, while Figure 13 shows all the barriers mentioned in the interviews (6). None of our respondents commented on communication as a barrier per se, which was a category expected by Moser and Eckstrom (2010). While those authors included lack of technical data in the resources category, our respondents discussed limited resources as a barrier because they lacked staff time or money. Thus, we expand on the Moser and Eckstrom typology to create a new category: the lack of technical information. Otherwise, the Moser and Eckstom typology of barriers to climate adaptation fits our data.
well. Each category of barrier to local action on climate adaptation reported by the planners we interviewed is further discussed later in this study.

2.8.1 Lack of Local and State Leadership

Much of the literature positions inadequate “leadership” as a major barrier to local climate adaptation actions; this is one of our findings as well. Every planner felt that there was limited political support for adaptation; for some it was the major barrier, while for others it was a contributing factor. As the planners discussed, the politics of creating change can be daunting:

*We’ve got to convince the town manager that it’s a good idea; he’s got to convince the board of selectmen that it’s worthwhile having his staff spending time doing this. Then once we have…centered on the [idea that] it’s a good use of the planner’s time and [gotten] all of the other department heads to move in this direction, then we need to take that message out to the public and then we have to say “this is why.” I mean, I can’t imagine that any of them have any idea what adaptation planning is.*

For some activities, such as the provision of water infrastructure, specific state regulations guide local enforcement, so any change needs to start at the state level. Other municipal departments control important policies related to infrastructure as well. This raised problems in dealing with other government departments internal to the city and at the state level:

*Our biggest issue...is, we’ve submitted material out of this department to the other pieces of the government, whether it’s DPW, [sewer commissioner]’s office, executive branch, and it just disappears. So, you know, it’s difficult for a planning department to influence other city functions on the importance of this stuff.*
2.8.2 Conflicting Values and Beliefs

Conflicting values and beliefs were the primary barriers to action according to our respondents. Respondents mean many things by this phrase, including a sense that the timeframe of change is too distant to act now, that private property interests are too strongly opposed to action, that there is a general lack of public knowledge and support, and that the science remains uncertain. Overall, the planners we interviewed perceive the majority of their public is not very interested in climate adaptation, with climate concern limited to a “do-gooder” few. Many of our respondents faced specific challenges operating in the radical democracy of town meetings, where zoning changes need approval by a two-thirds majority of those attending, and there is little appetite for changes that reduce property values or rights:

*It is really difficult to get people to raise their hand at town meetings for something that directly impacts their property in a way they might not be all that happy about.... If you are telling 100 people that you are going to start impacting how they can use their property, the ability to actually pass regulations starts to drop a little (sarcasm).... It is a question whether or not we could get enough people to back it.*

The connections here with the discussion of politics are strong:

*There’s still a lot of lack of belief in climate change.... Nothing’s happening, nothing serious is coming down from the federal government other than these occasional training programs to the believers already.... But in terms of the general population there isn’t a lot of education out there, there’s not a lot of emphasis on it. You know a municipality and especially bosses are political creatures that respond to the citizens’ concerns. There’s not a big concern so obviously there’s not a lot of effort put in.... Somebody’s gotta get out there and do some more educating.*
Of course, this comment begs the question of who will educate whom. The planners we interviewed did not feel they have time or the mandate to do this sort of advocacy. But they also knew that without additional citizen education, their ability to move forward is limited. Wealthy coastal owners evince the least concern about or belief in climate change at least as reported by the planners:

_They want to live on the water and they don’t care if it’s there in 10 years, 20 years, 40 years, 50 years, they don’t care, they want to live there today._

_It’s not going to happen overnight, there is too much investment.... [O]ver 72 miles of coast and all these houses and all these businesses are developed here... they are worth big dollars. The last thing anyone is going to say is that you need to take your house and move it back 50 feet. See you in court._

The high cost of actually implementing change also brings on complex equity questions related to property interests and local power:

_Whether it is paying for replacing the culvert or flood proofing our wastewater treatment plant, moving a parking lot back or a road, whatever, how are we going to pay for it? Right now we have two ways. We can go to the voters and ask them to spend money from the town’s general fund...or the betterment thing [taxing property owners in only the affected area, who benefit from the protective works], which causes a great deal of divisiveness amongst neighborhood residents.... Why should we have to pay for the seawall protecting that guy’s house down there and what am I going to get out of it?_
2.8.3 Lack of Resources (Staff, Money, and Time)

Our respondents explained resource barriers in terms of time and money to do planning and to implement plans:

*The short answer (is)...staffing, money, and resources. At our level of population of 25,000, our planning department is me and a full-time secretary...and under state law, when someone brings in a subdivision plan...there are mandatory, statutory deadlines and if (these are not met)...it gets approved by default and so, I have little control in managing my time.... We don’t do much planning here at the local level and I can say that’s [true] for most of the communities in the Commonwealth.*

*I think that’s the challenge.... [T]here’s a lot of infrastructure, and if these things [climate impacts] are realized, there’s going to be pretty big price tags on trying to come up with solutions for them. So I think with it has to come some form of...assistance in implementing it.*

2.8.4 Lack of Information

The lack of information was not the primary barrier for most respondents, but rather a contributing issue. Respondents were often apologetic about their own level of knowledge:

“I haven’t studied it. I know the principle behind it, but I haven’t studied it.”

At the time of our interviews, there were no state-approved climate change projections of any sort. The result is that if planners in a town or city wanted to analyze that city’s vulnerability to future climate they have to decide on their own what climate numbers to use (7) :

*We just constructed a harbor walk. Should we have built it higher, because the sea level’s going to rise? But, if that’s true, how much higher should we have built it? What’s the information on which to base that? We don’t have any of those facts. So*
we built it based on current conditions, figuring if it is sometimes underwater, people wouldn't use it that day! . . . Some guidance...would be really helpful.

The complexity of attempting to choose benchmarks, even at the state level, is highlighted in comments by one of our interviewees who was part of the group then writing what became the State Adaptation Plan (Executive Office of Energy and Environment et al., 2011).

I was in a group [writing the state plan] that was talking about…the coastal zone and potential impacts…and I think we probably had about eight sessions and they were completely dominated by trying to pick the number [i.e., sea-level rise threshold] of what we should plan to. And I think that’s probably one of the biggest impediments right now.

Planners do not doubt the reality of climate change; instead, the smaller cities and towns in which they work do not have the capacity to develop their own climate forecasts. At the same time, the available forecasts are not considered sufficiently detailed or with enough regulatory heft to form the basis for planning decisions. In some regions, universities are providing locally relevant climate projections. But in university-rich Massachusetts, none of these communities were using projections prepared by a university in their plans (8).

2.9 Overcoming Barriers and Connecting to Approaches
We asked our respondents why they chose their particular approach to climate adaptation at the local level: planning, mainstreaming, or addressing current hazards. The two communities using the planning approach—developing adaptation chapters for their
master plans—reported that their motivation was to generate public engagement and political support as part of the wider comprehensive planning process, thus encouraging implementation. Planners who report choosing a mainstreaming approach do so when they faced political barriers, need to focus on benefits in the near term, and lacked resources to do a plan. Planners who choose to address current hazards seem to prefer this approach when they need to address political challenges, whether those arise from the lack of elected or upper-level government leadership or insufficient local recognition of the problem.

We analyze the reported barriers by the locus of decision, grouping together those that can be addressed by the public, local official and administrative leadership, or federal and state leadership. Barriers created by the public include lack of public knowledge of the problems caused by climate change (and thus the lack of public support for adaptation planning), the fact that there had been no recent problems (which means the timeframe was too distant to capture public interest), and very strong private property interests. Barriers created by local official and administrative leadership include problems in engaging other departments in adaptation efforts, lack of staff time and money, lack of mayoral and council support, and perceived limitations created by already built-out or existing land use patterns.

The third type of barrier to adaptation arises from the failure of leadership at higher governmental levels, including the lack of regional planning and a legal basis for adaptation
plans or policy. This type of barrier also includes the need for a state or federal mandate for climate adaptation planning as well as the need for more certain science and projections.

As Figure 14 shows, the barriers reported by the respondents do not fall neatly into one category. Planners face barriers posed at and by multiple levels of government and from multiple actors and roles. For small communities to move forward in adaptation planning, many institutions at different levels of government need to take action to help change community values through education and outreach, strengthen municipal leadership by offering political cover through climate adaptation planning mandates, provide better technical knowledge and information, and provide and energize state leadership by putting climate adaptation more squarely onto the political (voters’) agenda.

2.10 Summary and Conclusions

In this study, we first question whether, and how, our sample of smaller cities are moving forward on climate change adaptation. We find that there has been little uptake of adaptation planning among these municipalities, despite the fact that these communities are likely to experience significant sea-level rises in the coming years and the strong example set by the City of Boston. While most of our sample of small cities are not addressing future climate change at all, those few that are doing so are split among two of the three major approaches: planning and mainstreaming approaches. Most commonly,
these towns avoid discussion of future climate altogether, and instead focus on improving the community’s ability to address current hazards. These empirical findings suggest that there likely is not a single most effective way to achieve climate adaptation in the face of multiple constraints. Instead, planners match their approach to the specifics of their communities’ politics, needs, and barriers.

Our research highlights the interconnections among the separate barriers to climate adaptation commonly recognized in the literature. We find that the strength of private property interests tends to limit local political leadership on the issue; without that leadership, it is difficult for planners to allocate time and money to the issue. The most common form of land-use regulation is zoning. Broadly speaking, this suggests that planning for climate change might be easier where there are stronger restrictions on private property already in place. Zoning regulations and restrictions are used by municipalities to control and direct the development of property within their borders. Since New York City adopted the first zoning ordinance in 1916, zoning regulations have been adopted by virtually every major urban area in the United States. As explains Grant (2005, p.1), private property in the United States arose out of a tradition that emphasized the individual freedom to control holdings without interference from governmental influences. Property ownership attitudes are central to issues that often divide environmentalists and landowners. Land itself as a type of property should be considered ethically distinct from other forms of property because of the interdependencies of human and nonhuman interests that the science of ecology has revealed (Grant, 2005, p. 1). The lack of resources means that planners find it hard to overcome technical barriers and to provide the kind of education that would develop local resident support. The co-occurrence of high property values and
increasingly vulnerable properties creates a challenging political situation. Concerns about property rights complicate local adaptation decision making, even while areas with lower property values remain quite vulnerable. These issues are further complicated by equity questions about who should pay for adaptation improvements and which downstream costs are acceptable. Addressing the complexity of these barriers and their interrelations will increase uptake of adaptation among these smaller cities and towns.

2.11 Directions for Future Research

The findings here are limited to one state within one U.S. region, and smaller cities and towns rather than global cities. In addition, our focus is on the perceptions of the local planners on the state of climate adaptation in their towns and the barriers that they face in addressing climate adaptation. We do not offer an external evaluation of their perceptions; moreover, the small sample size of our qualitative work reduces the generalizability of our findings. Although we focus on planners, climate adaptation can be addressed by many actors, including other local municipal departments, grassroots leaders, elected officials, and higher levels of administration.

Our efforts suggest many fruitful future research topics. It will be helpful to seek a quantitative correlation between specific barriers and municipal approaches to adaptation, as well as quantifiable findings on the connections between different approaches to climate adaptation and actual policy action. Modeling adaptation uptake based on local socio-spatial and economic variables also has descriptive and inferential potential. Future qualitative work should broaden the respondent pool to include local elected officials and other stakeholders. Testing municipal adaptation uptake across states with different
policies (e.g., California’s stronger technical guidance) will help determine the effectiveness of different state roles and strategies on local climate adaptation activities.

Comparative analyses of adaptation policies and strategies in Canada and across Australia and Europe, as well as provincial or state or regional policies in other countries, will also be enlightening. Such analyses can provide important information on alternatives to U.S. approaches, particularly as experienced by smaller cities and towns. Finally, there is a presumption inherent in the way we categorize possible approaches to climate adaptation that better preparation for the current climate will yield improved adaptation to future climate. It seems likely that this is true only under some conditions; better information on when this connection is true and when it is not could provide very important research and policy guidance for planners.

Overall, our research suggests that planners have an important role to play in climate adaptation even in smaller cities. But to help overcome the many barriers planners face in developing meaningful climate adaptation action, those planners, the local residents they support, the administrative units within which they operate, the elected officials with whom they work, and higher levels of government must act together in multiple ways.

Notes
1. The Commonwealth’s policy report on climate adaptation was completed in late 2011 (Executive Office of Energy and Environment, Adaptation Advisory Committee, & Commonwealth of Massachusetts, 2011). This is an advisory-only plan, with no requirements or mandates from the state to its municipalities. Our interviews were in mid-2011, before the plan had come out, and thus our interviewees did not have it for reference for technical information such as projected sea-level rise.

2. For more on town meetings and the various forms of municipal governance in the Commonwealth of Massachusetts, see the state website: http://www.sec.state.ma.us/cis/cistwn/twnidx.htm

3. Data on demographics, income, and wealth come from www.city-data.com

4. Note that there was likely some respondent bias in that interviewees may have wanted to appear more sophisticated or advanced in climate change actions than if we were asking about a wide range of actions: There is always the desire to please the interviewer. For this reason, we encourage some skepticism,
particularly in the category of expressed intention, which is about what the planners think they may do at some point in time; the other categories require more explicit back-up in terms of actual policies or plans, so they may be more reliable.

5. There was a third community involved in this same adaptation planning process, but that community was not part of our sample.

6. In Moser and Eckstrom (2010), this includes technical information such as regional climate forecasts as well as staff time and expertise, but our coding suggests that staff time and money is one issue, while data is another. As a result, we coded technical information in the next group.

7. Note that we coded responses here that had to do with the planners’ concern over climate uncertainties; local belief in climate change is discussed in the section on local values.

8. One community had undertaken a workshop run by a Boston-area faculty member to increase public awareness of climate change, but not to develop science. After the study, one of the authors worked with one of the communities to draft an adaptation chapter for their master plan, but that was a result of contact made through the interviews and had not taken place at the time of the interviews.
CHAPTER 3

DO WE HAVE A CLIMATE FOR CHANGE? INSIGHTS ABOUT ADAPTATION PLANNING ACTIONS IN COASTAL NEW ENGLAND

(Article 2)

3.1 Abstract

Coastal communities all over the world are experiencing unprecedented alterations from climate change. We surveyed 121 city officials in small and mid-sized coastal communities of New England, mostly planners, to identify the status of planning for climate change adaptation, the obstacles encountered by them along the way and what they actually want to do about it. While the majority of the communities are still in a very nascent stage of adaptation initiatives, a smaller number is already taking actions. The results of the survey showed many similarities among these small coastal communities in terms of challenges experienced, needs to move forward and reliable sources of information and guidance. We found that 36 communities (26% of respondents) report the existence of adaptation actions that they have already accomplished, combined with the actions in process and those they are willing to take. This result indicates that there is a climate for change in the region. With this article we suggest that a better understanding of these preferred steps in adaptation can help in future climate change policy design and implementation at the local level.

3.2 Keywords: climate change, adaptation, urban planning, coastal communities
3.3 Introduction

Climate science is providing an increasingly sophisticated picture of possible climate alteration in future decades, and for coastal zones in particular, the potential consequences are a cause for mounting concern.

Anthropogenic or human-driven climate change is now fully established in the scientific literature, as well as adaptation to these impacts as necessary and complementary to mitigation efforts (IPCC, 2007; Holdren, 2008; Moser and Boykoff, 2013). However, planning for climate change adaptation efforts, in practice, is still in a relatively nascent stage (Adger et al., 2005; Preston et al., 2011; Measham et al., 2011 Bierbaum et al., 2012; Moser and Boykoff, 2013, Schectman and Brady, 2013). Climate initiatives and adaptation plans are still in early phases of development (Preston et al, 2011; Carmin et al, 2012; Carmin and Dodman, 2013). The growing urgency associated with responding to climate risk has elevated climate adaptation on policy agendas across a broad array of institutions and governance networks (Swart et al. 2009). But, what does successful adaptation look like? This is a common question among planners, policy-makers, and other professionals charged with the task of developing and implementing adaptation strategies. Defining successful adaptation, however, is a very hard task. Barnett, O’Neil, Waller and Rogers (2013, p. 37) argue that it is difficult because “whether an adaptation is successful or not is ultimately determined by whether or not it has reduced the amount of loss or damage that may have arisen from climate change in the absence of adaptation. While adaptation is increasingly recognized as an important climate risk management strategy, and “on-the-ground adaptation planning activity is becoming commonplace”, local officials from
coastal communities lack guidance on what to aim for, and how to judge if their initiatives were successful or not (Moser & Boykoff, 2013).

The role of planners, particularly at the local level, comes to a new order of importance because they urge to develop creative and innovative responses to adapt the built environment to the challenges posed by the changing climate. Efforts are needed to guide proactive adaptation actions that benefit coastal communities for present and future generations. Overall, there is a pressing need to move beyond vulnerability analysis and into implementation of adaptation action.

Despite the emerging scholarship proposing assessment approaches and adaptation options, few studies have systematically examined actual adaptation actions at a national or regional level. “Is adaptation taking place? What types of interventions are being implemented? What factors are motivating adaptation in the communities?”

This study examines how small and mid-sized communities in coastal Connecticut, Rhode Island, Massachusetts, New Hampshire and Maine have addressed climatic impacts in their local planning, the types of initiatives they have taken and what are they willing to do to start moving forward.

Climate change planning accelerated in the mid-to-late 1990s, with jurisdictions adopting more comprehensive plans to reduce emissions (Wheeler, 2008). In the first decade of the 21st century, as pointed by Moser and Ekstrom (2010), adaptation to climate change has risen sharply as a topic of scientific inquiry, in local to international policy and planning, in the media, and in public awareness. We agree with Berrang-Ford, Ford and Paterson (2010) that the understanding of the significance of the adaptation challenge is still incomplete. How much do we know if adaptation is already taking place, who is
adapting and how? The need to track climate change adaptation progress is being increasingly recognized but our ability to do the tracking is constrained by the complex nature of adaptation and the absence of measurable outcomes or indicators by which to judge if and how adaptation is occurring (Ford et al, 2013). Local municipal governments have a crucial role in helping communities adapt to climate change.

Uncertainty pervades adaptation and presents assessors and policy networks with difficulties (Dovers and Hezri, 2010; IPCC - Summary for Police makers, 4th assessment). We do not have a clear picture of the limits to adaptation, or the cost, partly because effective adaptation measures are highly dependent on specific, geographical and climate risk factors as well as institutional, political and financial constraints. Creating a feasible adaptation planning process is difficult given the uncertainties inherent in the physical manifestations of climate change, as well as modelling uncertainty in the timing and magnitude of the change (Abunnasr, Hamin and Brabec, 2013).

The truth is that adaptation to climate change is complex and hard to be implemented, regardless the geographical area or the income of the country. However, there is a prevalent idea that low-income nations tend to react to climatic events while high income countries are characterized by being proactive and implementing long-term adaptation strategies. This idea even finds support in the literature, as can be observed in L. Berrang-Ford et al (2010) when they affirm that there are distinct profiles of low and high income countries reporting on adaptation. They argue that low income countries are characterized by reactive adaptations in response to short-term motivations, while high income countries are characterized by more proactive or anticipatory adaptations stimulated by longer-term climatic changes such as temperature and sea level rise. In a
previous study by the authors (Hamin, Gurran and Emlinger, 2014) done in 2011 by interviewing planners of small coastal Massachusetts communities, we identified a different reality. We found that smaller communities in this region have only attempted very limited adaptation efforts. While the literature suggests that there are discrete barriers to adopting climate adaptation policies or activities, most respondents stress that these barriers are extremely interconnected (Hamin et al, 2014).

Adaptation researchers have generally assumed lower vulnerability and greater adaptive capacity in developed countries than in developing countries and thus have focused more research in the latter (Moser and Ekstrom, 2010; Adger at al., 2007). However, climatic events of recent years striking high income nations have led to a questioning of the real ability of these nations to adapt to climate change (Moser and Ekstrom, 2010).

Despite the high visibility that adaptation has on the global policy agenda and the imperative for cities to initiate action, relatively few have made concerted efforts to develop dedicated adaptation plans or to set adaptation initiatives in motion (Carmin et al, 2012). In summary, advancing an adaptation agenda requires shifts in the values and goals guiding city priorities. It also requires adjustments in the institutional frameworks related to decisions and actions (Healey 1999).

In the following section we review characteristics of the region, existing knowledge on the impacts and challenges posed by climate change in municipalities, and a few similar studies on the subject. We also explore some state initiatives in climate policies and Federal efforts to address adaptation and resiliency, adopting Hurricane Sandy as a temporal reference. In the third section we present our research design and methodology, introducing
the survey in which we base our analyses. In the fourth session we present our results, looking for state-level differences in the variables explored and in the final section we discuss our findings and conclude.

3.4 Background

New England is a northeasterly region of the United States comprising the states of Maine, Vermont, New Hampshire, Massachusetts, Connecticut and Rhode Island. Coastal New England, formed by all the States, but Vermont, on the Atlantic seaboard, is highly vulnerable to anticipated climate change. In 2008, a group of researchers from 7 American universities published a study about regional climate change projections for the Northeast USA. Their results provide guidance on the direction of many regional climate trends, and highlight the fundamental role of future emissions in determining the potential magnitude of changes we can expect over the coming century. The projections show increases in temperature that are larger at higher latitudes and inland, as well as the potential for changing precipitation patterns, particularly along the coast. While the absolute magnitude of change expected over the coming century depends on the sensitivity of the climate system to human forcing, significantly higher increases in temperature and in winter precipitation are expected under a higher as compared to lower scenario of future emissions from human activities. The study also indicates a significant intensification of rainfall rates over the coastal regions (Hayhoe et al, 2008). Moser, Kasperson, Yoho and Agyeman (2008) make the point that scientific evidence accumulating over the past decade documents that climate change impacts are already being experienced in the region.
One of the greatest concerns of future climate change is its potential impacts at the local to regional scale. Global changes in the climate system will interact with the distinctive geographic characteristics of individual regions to produce a climate change signal unique to that region (Hayhoe et al, 2008, p.78). Certainly, the built environment is directly impacted by the effects of more frequent and powerful storms and coastal communities are naturally more vulnerable to these impacts.

This region of the country has been explored in other relevant studies in climate adaptation, and examined in very diverse aspects (For example: Schechtman & Brady, 2013; Carmin et al, 2012; Moser et al, 2008; Shi, Chu & Debats, 2015). Schechtman & Brady (2013) developed a research on community-level coastal flood management and climate change adaptation best practices throughout the North Atlantic region (from Virginia to Maine). The purpose of their work was to identify and collate cost-effective adaptation projects implemented at the municipal level, providing best practice information to assist with ongoing adaptation outreach.

Carmin’s research program was designed to advance knowledge of what motivates cities to pursue new policy agendas and to advance policy and professional understanding of urban climate adaptation planning and implementation. Their study was based on four data collection methods: case studies of upper, upper middle, and lower middle income countries, in-depth, comparative analysis of cities in the US and Japan, focus groups and interviews with urban adaptation leaders and a global survey conducted in partnership with ICLEI – Local Governments for Sustainability. Some New England coastal communities were included in the study.
One other study, based on the review of basic adaptation strategies and the cursory treatment of a few selected sectoral examples, suggest several principles for prioritizing future adaptation actions and point to research needs that can help increase the adaptive capacity of the Northeast (see Moser et al., 2008). After a preliminary assessment of the region’s adaptive capacity, they suggest that the Northeast is potentially quite vulnerable to experiencing negative impacts from climate variability and change. At the same time, they highlight that it is important to recognize that vulnerability and adaptive capacity are not uniform. Both vary across the region’s economic sectors, ecological environments, and subsections of the population (Moser et al, 2008). In their study, Shi, L., Chu, E. & Debats, J. (2015) demonstrated the degree to which strong political leadership, high municipal expenditures, and perceptions that the climate is already changing are associated with adaptation planning among environmentally progressive cities. Their survey used ICLEI’s network of 1,200 municipalities in 86 countries as a sampling frame to describe global urban adaptation trends. Among them, we can find a few coastal communities of New England. It’s is very important to highlight the fact that their sample represent ICLEI members, which are considered “early adopters” because they commit to addressing climate change and sustainability. Existing research has also found that little pressure on local governments on adaptation planning due to a lack of federal and state policies end up also contributing for the slow advancement in climate adaptation planning (Amudsen et al., 2010; Measham et al., 2011). Cities ability to plan for climate adaptation seems to depend on the existence and enforcement of state policies. Although some earlier adopter cities have initiated adaptation planning without state mandates, less progressive cities are unlikely to do so (Bedsworth and Hanak, 2010; Shi et al., 2015)
Most adaptation plans and policies developed in a number of states in U.S. do not mandate local action, instead, they simply recommend that state and local agencies consider climate impacts in their planning process. A few exceptions exist. In New England, for example, Massachusetts and Maine’s mandates that new construction projects greater than a certain size account for sea level rise, and Rhode Island’s mandate that local comprehensive plans integrate climate hazards (Schectman and Brady, 2013). Now we will provide a brief overview of the plans and policies New England states have proposed to prepare for the impacts of climate change. To facilitate the visualization and display data in summary form, a timeline for each state is presented. Most of the information regarding each state listed below, including all dates in the timeline were provided by the Georgetown Climate Center (n.d.).

3.4.1 Massachusetts

Massachusetts first completed a Climate Action Plan in 2004 to address climate mitigation goals. In 2008 the Secretary of Energy and Environmental Affairs was directed to convene an advisory committee to develop strategies for adapting to predicted changes in the climate and impacts on Massachusetts (Global Warming Solutions Act; Section 9).

In 2007, Preparing for the Storm: Recommendations for Management of Risk from Coastal Hazards in Massachusetts was released. The most recent extreme weather events impacting the state (and the region) were Hurricane Sandy in October of 2012 and Blizzard Nemo in February of 2013.

The year of 2013 was remarkable for being very fruitful in terms of climate policies nationwide, as observed in Figure 6. It is also noticeable the concentration of action in the
States, especially Connecticut and Massachusetts. As ironic as can be, the reality is that storms can serve as good levers, at least, for policies to be proposed. The timeline below shows the main actions to support climate planning in the State up to 2015 (Fig. 15).

**Figure 15 - Timeline showing the State Laws and Policies, State Agency Plans, Local and Regional Plans and other featured resources for climate adaptation actions in Massachusetts. Source: adapted from data published by the Georgetown Climate Center.**

### 3.4.2 Connecticut

Connecticut established a Governor’s Steering Committee on Climate Change in 2002. Connecticut’s focus on climate impacts was catalyzed by impacts caused by two major storms: Tropical Storm Irene in August 2011 and a major snowstorm in October 2011. In response, a Two Storm Panel was convened. In January 2012, the Panel released the Report of the Two Storm Panel detailing recommendations to reduce the state’s vulnerability to extreme weather events. In addition, the Connecticut legislature convened a Shoreline Preservation Task Force to study the effects of sea-level rise, coastal flooding, and extreme weather events on the state’s shoreline. That Task Force released The Report of the Shoreline Preservation Task Force in January 2013 including recommendations to
rebuild and recover from the 2011 storms and better plan and prepare for future storms. Despite all these efforts, in October of 2012 Hurricane Sandy severely impacted Connecticut’s shoreline.

The effects of Sandy in New England were spread as far north as Maine, though by far the most significant damage in the region was in Connecticut. The National Climatic Data Center (n.d.) reported that throughout the state, four people, including a firefighter, were killed, and damage amounted to at least $360 million.

Figure 16 shows the main policies and plans in the state in the past 8 years.

Figure 16 - Timeline showing the State Laws and Policies, State Agency Plans, Local and Regional Plans and other featured resources for climate adaptation actions in Connecticut. Source: adapted from the Georgetown Climate Center.
### 3.4.3 Rhode Island

In 2008 the State of Rhode Island Coastal Resources Management Program was launched. According to the 2012 Progress Report released by the Rhode Island Climate Change Commission, the impacts of climate change upon Rhode Island’s built and natural environment are wide-ranging and, in many instances, growing in severity. This report was published in May, 2012. In October, RI was badly affected by Hurricane Sandy. Most of the damage in Rhode Island was along the coastline and in southern towns, including deep into Narragansett Bay.

The storm surge washed away large sections of the Newport Cliff Walk. Reports from the National Climatic Data Center (n.d.) showed that the walk was closed through June 2014, when it reopened after a $5.2 million restoration and the damage across Rhode Island amounted to $11.2 million. A series of policy initiatives from 2008 to 2015 are displayed in the timeline below (Fig. 17).

Figure 17 - Timeline showing the State Laws and Policies, State Agency Plans, Local and Regional Plans and other featured resources for climate adaptation actions in Rhode Island. Source: adapted from the Georgetown Climate Center.
3.4.4 New Hampshire

In December 2007, a Climate Change Policy Task Force was established to develop a Climate Action Plan for the state (Executive Order 2007-3), after the New Hampshire Wildlife Action Plan of 2006. According to New Hampshire Department of Environmental Services (n.d.), the Task Force is composed of members representing a broad range of interests and are based around the state. This diverse group of regulators, scientists, business leaders, utilities, and environmental groups has been charged with recommending quantified goals for reductions of NH greenhouse gas given the inventory of NH greenhouse gas emissions and emission projections.

Similar to the rest of New England, Sandy produced widespread gusty winds across New Hampshire. The National Climatic Data Center (n.d.) reported that across New Hampshire, one person was killed and damage amounted to $1.8 million. The main state policies and plans are summarized in the timeline below (Fig. 18).

![Timeline of State Laws and Policies](image)

Figure 18 - Timeline showing the State Laws and Policies, State Agency Plans, Local and Regional Plans and other featured resources for climate adaptation actions in NH. Source: adapted from the Georgetown Climate Center.
3.4.5 Maine

In 2003, the Maine Legislature charged the Department of Environmental Protection (DEP) with developing a mitigation plan to reduce greenhouse gas emissions (HP 622, An Act to Provide Leadership in Addressing the Threat of Climate Change). This directive led to the development of the 2004 Maine Climate Action Plan. In 2006 ‘Maine Sand Dune Rules’ was established.

The state was slightly impacted by Sandy. According to a report by the National Climatic Data Center, damage across Maine amounted to $284,500. The timeline below shows some other policies developed in that state up to 2015 (Fig. 19).

From 1980 to 2013, the United States experienced 151 natural disasters that incurred at least $1 billion in damages, according to the National Climactic Data Center (n.d.). The federal government has repeatedly marshaled considerable financial and technical resources to help affected communities recover. In October 2012 Hurricane

Because Hurricane Sandy in 2012 was the most recent major weather event impacting the coast of New England we will look at some policies established around it. Thus, the year of 2013 was indeed productive in terms of state policies as observed in the timelines just presented: 7 in CT, 4 in NH and MA, and 2 in RI. In the months that followed Sandy, the federal government arranged significant financial and technical resources to help communities to recover and rebuilt (Pirani and Tolkoff, 2014). Figure 20 shows a timeline with the principal federal climate related actions in 2013, mainly as a response to the impacts caused by Hurricane Sandy.

Figure 20 - Timeline showing the Federal actions in 2013 as a response to the impacts caused by Hurricane Sandy. Source: adapted from Pirani and Tolkoff, 2014.
Existing research points to barriers to adaptation, having reported that cities’ ability to plan for climate adaptation depends on local government staff and funding for implementation, state policies and incentives for action, leadership from local elected officials, competition with other cities for investments and development, the availability of scientific climate data, and levels of public support (Shi et al, 2015; Hamin et al, 2015). However, these studies do not consistently use similar methods and metrics to evaluate difficulties to adaptation planning. This happens in part because city-level data related to climate are scarce all over the nation. Scholars of climate adaptation have also found it challenging to identify quantitative measures of successful adaptation, as mentioned before in this study (Adger, Arnell, & Tompkins, 2005; Kates, Travis, & Wilbanks, 2012; Moser et al, 2008; Shi et al, 2015). As a result, we are not aware of any study that has systematically evaluated whether the indicators identified by the literature are relevant across small, less studied coastal communities and what they are willing to do or getting ready for.

This study contributes to the literature on adaptive capacity by quantitatively comparing the responses of planning staff from 140 cities to a survey on climate adaptation. In summary, the biggest contribution of the study is in reporting on what communities actually want to do, identifying their preferred steps on climate adaptation planning.

3.5 Research Design and Methodology
Our research in New England small and mid-sized coastal communities began with a web-based survey of NE local government representatives conducted in November of 2015. Despite being a confidential survey, where neither the name of participants nor the
communities they were representing was requested or identified in any moment, the identification of the State where the community was located was asked right in the beginning. In general, they were asked to identify the biggest challenges in the attempt to address climatic impacts in their local planning, the types of initiatives they are planning to start or that they have taken so far and what do they need to start moving forward.

Some of the survey questions were inspired in a web-survey conducted by JoAnn Carmin (1957 – 2014), Associate Professor of Environmental Policy and Planning in the Department of Urban Studies and Planning at the Massachusetts Institute of Technology. Her sample was composed by ICLEI member communities and the representatives from the cities from all around the world, surveyed in the Spring of 2011. While undoubtedly presenting relevant findings, it is important to consider that there’s a natural bias in the results of the mentioned survey for the simple reason that the engagement of communities surveyed in climate issues was, to a certain extent, expected.

Local planning units in New England, as in many parts of the United States, possess considerable power in making the day-to-day land use decisions (Ryan, 2006). Planners were targeted as first priority as respondents for the web survey. In the absence of a planner, we tried to identify the employee in each municipality most qualified to answer questions about planning for climate change adaptation. In general, after planners, they were contacted in this order: members of the planning board, conservation commission agents, and last town administrators/managers, under the assumption that these officials should have a general understanding of a wide range of local policies and initiatives done by their municipalities. All recipients were contacted by email or through a “contact us” form
available in many websites that did not inform the email address of their employees. They were then provided a link to complete the survey online.

Prior to distribution, the survey questionnaire was reviewed for content and clarity by the dissertation committee and tested with 6 planners. Based on this input, the questions were refined and additional questions incorporated into the instrument. In general, its final version was formed by questions with multiple-choice answers, 3 point and 5 point Likert-scale, two multiple-choice with a partially open-ended item and one open-ended question. The two questions that had the partially open-ended item were questions that included a few restricted answer options and then a last one that allowed participants to respond in their own words in case the few restricted options did not fit with the answer they wanted to give.

In research, we often study a sample of participants with the objective of generalizing from the sample to the population from which the sample was drawn (Evans, 2014). Naturally concerned about the external validity of our findings, we were extremely diligent with our sample selection. Even though we know that one way of increasing the likelihood that the sample is representative of a population is to randomly select the participants to be included in the sample (Evans, 2014; Babbie, 2007; Trochim, 2000), we did not use this technique. Using the terminology explored by Teddlie & Yu (2007), we characterize the sample chosen for the web-survey as “Convenience sampling”. Simply explained, “convenience sampling” refers to choosing samples that are willing to participate because they have interest in the subject and that are easily accessible. Controversies apart, we are very confident that we created a sampling strategy that was appropriate and perfectly useful for the context (more in item 3.2). Overall, we agree with
Evans (2014) when she says that the research design itself provides the best opportunity for increasing validity.

Urban planners were the focus in our study and the majority of our sample, despite acknowledging that planners are far from being the sole decision makers in their communities, especially when it comes to climate change adaptation implementation. We know that individual adaptation actions are not autonomous: they are constrained by institutional processes such as regulatory structures, property rights and social norms associated with rules in use (Adger, Arnell and Tompkins, 2005). However, professional planners bring the expertise to develop planning and zoning recommendations for public approval, as well as review new development proposals for compliance with local planning regulations (Ryan, 2006).

Unsurprisingly, low response rate and low completion rate can compromise the validity of the collected data. For this reason, we were very cautious about the preliminary steps of the research design and later stages of population sampling, seeking to aim the highest response rate possible. We also persuaded respondents that their responses would be useful. Two other measures were taken: Participants’ name and town were cited in the subject line of the email and in the body message as well, and the access to the survey was made easy by providing them with the survey URL in all emails sent.

Since regional trends can mask the unique challenges faced within states, chi-square tests of independence for two-way tables were conducted on some items to investigate whether distributions of categorical variables such as actions already taken by the communities or actions that they intend to start, major challenges encountered by them, status of climate adaptation and other variables differ from one another regarding the State
Communities are located, their number of habitants, etc. We will infer that the chi-square result is statistically significant when \( p < 0.05 \). In these cases, we understand that the differences found in the survey results did not occur by random chance. Or, for example, the chi-square will determine the probability that the discovered discrepancy could have resulted from sampling error alone (Babbie, 2007). In this context, it is important to observe data presented in table 06, showing the high representativeness of our sample, thus reinforcing that, as explains Babbie (2007, p. 469): ‘sampling error is an inverse function of sample size - the larger the sample, the smaller the expected error’.

**3. 5.1 Study area**

The study involved 5 States of New England: Maine, New Hampshire, Massachusetts, Rhode Island and Connecticut (Fig. 21), which in total have 250 coastal communities. All the 250 Atlantic Ocean coastal communities in the region were initially selected, named here as population. Than the number of habitants was verified. Since we were intending to focus in small and mid-sized communities, the cities with more than 150,000 habitants - Boston (MA) and Providence (RI) - were excluded.

We gain confidence and precision in our estimates when the sample captures a larger fraction of the total population (known as the “sampling fraction”). Thus, our sampling fraction, also called here as the target population, was of 248 communities to whom the web survey was sent. The State with the larger number of small and mid-sized...
coastal communities was Maine: 108. New Hampshire was the State with the smaller number: 7. Massachusetts, including the towns located in Cape Cod and the Islands, has 77 small and medium coastal communities; Connecticut has 36 and Rhode Island 20.

### 3.5.2 Response Rate

Overall response rate is one guide to the representativeness of the sample respondents. However, high and low response rate can be relative. Babbie (2006), upon a review of published social research literature, presents some general rough guidelines for this judgement. He suggests that a response rate of 50 percent is considered adequate for analysis and reporting; a response of 60 percent is good, and of 70 is very good. Our overall response rate was of 61.95%.

Off the 226 emails with the link for the survey, 155 respondents opened the survey, 153 accepted the conditions expressed in the Consent form, 140 answered survey questions, and 121 number of responses were considered valid. Of valid responses, 45% of respondents from Massachusetts, 29% from Maine, 12% from Connecticut, 11% from Rhode Island and 3% from New Hampshire (table 2). Now, in order to understand the real response rate by state, it’s important to consider that the number of coastal communities naturally differs from one state to the other, thus the number of communities contacted was also different in each state.

As mentioned before, New England small and medium-sized coastal communities were, for the purpose of this study, identified as our “target population”. Massachusetts has 77 communities in the target population, however, one of these communities does not have a website. So, the sample in MA was reduced to 76 communities. A total of 63 answered
this question, for a response rate in MA of 82.89%. From the 108 categorized as our target population in Maine, 21 did not have a website or did not include any email contact in the website. Sample in Maine was then of 87 communities. A total of 40 answered this question out of the 87, for a response rate in ME of 45.98%. The 36 target population in Connecticut have websites providing email contact of their personnel. A total of 17 answered this question out of the 36, for a response rate in CT of 47.22%. For Rhode Island we also found information about the 20 communities considered our population in that state. A total of 16 answered this question out of the 20, for a response rate in RI of 80%. And finally New Hampshire, the state with the smallest shore line, has only 7 communities in the range of our population, all of them provide websites with complete information about their communities. A total of 4 answered this question out of the 7, for a response rate in NH of 57.14% (Table 6).

Table 6 - Sampling and response rate.

<table>
<thead>
<tr>
<th>State</th>
<th>Target Population (TP)</th>
<th>Surveys sent (sample)</th>
<th>Total Surveys returned</th>
<th>Total Surveys returned by planners</th>
<th>% of sampling completed (Response Rate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecticut</td>
<td>36</td>
<td>36</td>
<td>17</td>
<td>14</td>
<td>47.22</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>20</td>
<td>20</td>
<td>16</td>
<td>11</td>
<td>80</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>77</td>
<td>76</td>
<td>63</td>
<td>41</td>
<td>82.89</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>7</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>57.14</td>
</tr>
<tr>
<td>Maine</td>
<td>108</td>
<td>87</td>
<td>40</td>
<td>18</td>
<td>45.98</td>
</tr>
<tr>
<td>Total</td>
<td>248</td>
<td>226</td>
<td>140</td>
<td>87</td>
<td>61.95</td>
</tr>
</tbody>
</table>

To identify the appropriate contact person, we undertook a detailed, one by one, internet search with the use of Google search engine to find the official website of each of the 248 communities (population). We discovered that 22 of them did not have a website or had a very simple one without any email contact listed. These 22 were, then, excluded of the study; he remaining 226 communities (sample) were then contacted via email. In a very personalized method, we sent individual emails, and took the time to cite the name of
the specific community being contacted in the subject line, and the name of the professional in the body of the message. The survey accessible sample ended up being of 214, despite the total size of our target population being of 248 and our deep desire and effort to contact every single community. The link for the survey was provided in this first email. Reminder emails were sent at one and three week intervals. Appendix D shows survey questions in the sequence they were presented to participants and the RR per question.
3.5.3 Participants

In the end, we received 89 responses from planners, 6 from members of the planning board, 11 from conservation commission agents, 21 town administrators/managers and 12 responses from professional that occupy other professional roles in the municipality.

A total of 155 started the survey (72.42%) and 121 completed it, for a response rate of 56.54%, as illustrates Fig. 22. In the course of the three weeks while the survey was open we received all sorts of feedback. Emails of participants declaring their interest in the study started to pop up, as well as 8 undelivered emails due to incorrect address. One official refused to answer the survey because he does not believe in climate change. One
did not feel confident to answer the survey due to the very small size of his community and 2 gave up trying to open the survey because their computer system would not support that type of link. Regarding the latter, we immediately contacted them offering a paper version of the survey. They did not answer to our offer. This way, we had an effective distribution of 214 surveys.

The survey results showed that most communities in the sample have less than 10,000 habitants - 42% were representing communities in a range of population going from 1,001 to 10,000 habitants (Fig. 23). Arranging these communities in 3 big groups of size population, we find that almost 70% of the coastal communities that participated in the study have less than 20,000 habitants, 20% have more than 20,001 habitants and less than 50,000, and 11% of them have more than 50,001 habitants.

The vast majority of the survey participants (64.03%) were planners, 15.12% were

![Figure 23–Population of communities that completed the survey.](image)

5 Only two cities were excluded of this study due to their elevated number of habitants - Boston, MA, with an estimated population of 655,884 in 2014 and Providence, RI, with an estimated population of 179,154 habitants. Providence is the third largest city in the New England region after Boston and Worcester, MA (the latter is not coastal).
town administrators/managers (21 respondents), 7.91% conservation commission agents (11 respondents), 4.32% were members of the planning board (6 respondents) and 8.62% played a different professional role in the town/city hall. It is important to notice that this elevated rate of planners can get even higher and this result more significant, if we look at the total number of planners in our target population and compare with the numbers in our sample. In our target population, 130 of the professionals were planners. A total of 89 answered this question out of the 130, for a response rate of almost 70% (Fig. 24).

Critical theory perspectives are concerned with empowering human beings to transcend the constraints placed on them by race, class, and gender (Fay, 1987 in Creswell, 2013). Other users may face difficulties in pursuing particular adaptation options by a lack of access to or control over assets or social status, which further constrains their control over assets. Gender, in particular, is one user characteristic that may have profound impacts on individuals’ ability to cope with climate change (Bryan and Behrman, 2013). Oftentimes, though, we’ve found that the reason people ask for gender in surveys is simply because they always have. In fact, gender is not truly a relevant and necessary factor in this survey. However, because it would bring some information about diversity in our data, it
was included. We were careful with the response options, making sure to have not only “male” and “female” classic options, but “other” option. Furthermore, although it was clear that any of the questions in the survey were mandatory, a “prefer not to say” option was also included in this specific question. Out of a group of 128 respondents for this question, 81 were male (63%), 45 were female (35%), 1 respondent chose “other” (1%) and 1 respondent made the option for “prefer not to say” (1%).

The survey was answered by a mature and experienced population: 31% of respondents were between 51 and 60 years old, two age groups were rated by 24% of them: those between 41-50 and 61-70, and one respondent were between 71-80 years old. Almost 20% were between 31 and 40 years old and 4% were between 20-30 years old. Professionals were also asked to indicate the number of years they have worked in this profession (including jobs in other communities) and in this current position. The average of number of years in this profession was 17.87 years ($\sigma=11.02; n=119$), having 45 years as the maximum value. For the question regarding the number of years working in this particular community, the average of years was 9.18 ($\sigma= 8.13; n=120$) and the maximum value was 36 years. The minimum in both cases was less than one year.

### 3.5.4 Survey Instrument

The main goal of the survey was to assess the sample communities, attempting to find out if and how adaptation is occurring at a local level. The web survey instrument was developed using Qualtrics. Online Survey software and included 15 closed ended questions and 1 open ended question. Because poor questionnaire design can be a source

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6 Qualtrics is a private research software company founded in 2002, based in Provo, Utah, USA.
of significant frustration in web survey respondents (Dillman, 2000), we tried to make the survey questionnaire to look motivating. We made answering the questions a clear and simple process, and accessible to everyone in the target population. We used a few strategies to facilitate the answering task:

a) The first questions were intentionally of easy answer, requiring no more than a few seconds of respondent’s time;

b) Questions related to the same topic were kept together;

c) We identified the percentage of the survey that has been completed by using a progress bar. This type of resource usually works as a good anxiety reducer for the respondent.

d) We kept it short. The average time taken by participants to fill out the survey was 10 minutes.

3.5.4.1 Format of Response Options

After reading the Consent Form and accepting it, participants were directed to the first question of the survey. This was the only mandatory part in the survey. If consent was not granted, a thank you message appeared.

The main content of the questions, rating scale, format of response options, and the number of statements presented for each question are described in table 7.

Table 7 - Format of the response option of the web survey.

<table>
<thead>
<tr>
<th>Q</th>
<th>Main content / Rating Scale</th>
<th>Format of Response Options</th>
<th># of Statem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qa</td>
<td>Informed Consent Form + Two options of answer: I accept / I do not accept</td>
<td>Multiple choice, single answer (mandatory)</td>
<td>2</td>
</tr>
<tr>
<td>Q1</td>
<td>Drop-down menu with the list of the States: Massachusetts, Connecticut</td>
<td>Text box with a drop-down</td>
<td>5</td>
</tr>
<tr>
<td>Q1</td>
<td>Rhode Island, New Hampshire and Maine menu</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q2</td>
<td>Windows of number of habitants (from “less than 1.000 to “more than 50.001”)</td>
<td>Multiple choice, single answer</td>
<td></td>
</tr>
<tr>
<td>Q3</td>
<td>Professional role in the department</td>
<td>Multiple choice, single answer with partially open-ended item</td>
<td></td>
</tr>
<tr>
<td>Q4</td>
<td>Question only for those that chose “planner” as his/her professional role asking how knowledgeable they feel about planning for Climate Change</td>
<td>Skip logic for planners: Smiley rating scale</td>
<td></td>
</tr>
<tr>
<td>Q5</td>
<td>Windows of age (from “20-30” to “71-80”)</td>
<td>Multiple choice, single answer</td>
<td></td>
</tr>
<tr>
<td>Q6</td>
<td>Professional role in the department</td>
<td>Multiple choice, single answer</td>
<td></td>
</tr>
<tr>
<td>Q7</td>
<td>Number of years of profession and years working in that particular community</td>
<td>Slider in the format of a draggable bar</td>
<td></td>
</tr>
<tr>
<td>Q8</td>
<td>Inquire if the community has a full-time staff dedicated to climate change (mitigation, adaptation or both) - Yes/No answer</td>
<td>Multiple Choice, single answer</td>
<td></td>
</tr>
<tr>
<td>Q9</td>
<td>How much have they thought about climate change</td>
<td>Multiple choice, single answer</td>
<td></td>
</tr>
<tr>
<td>Q10</td>
<td>Importance of planning for climate change in the community and neighboring communities/</td>
<td>5 point Likert Scale</td>
<td></td>
</tr>
<tr>
<td>Q11</td>
<td>Statements about motivation</td>
<td>5 point Likert Scale</td>
<td></td>
</tr>
<tr>
<td>Q12</td>
<td>Rating scale: Not at all – a lot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q13</td>
<td>Question about challenges when trying to address planning for climate change in the community</td>
<td>3 point Likert-like Scale</td>
<td></td>
</tr>
<tr>
<td>Q14</td>
<td>Rating scale: Strongly agree – Strongly disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q15</td>
<td>Question about challenges when trying to address planning for climate change in the community</td>
<td>3 point Likert-like Scale</td>
<td></td>
</tr>
<tr>
<td>Q16</td>
<td>Rating scale: I won’t need this – I already have this – I need this</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q17</td>
<td>In what stage of the “adaptation ladder” communities place themselves:</td>
<td>Diagram symbolizing a ladder of adaptation planning / multiple choice – single answer</td>
<td></td>
</tr>
<tr>
<td>Q18</td>
<td>1. Develop awareness of climate change adaptation need</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q19</td>
<td>2. Analyze climate risk and vulnerability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q20</td>
<td>3. Prepare climate change adaptation plan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q21</td>
<td>4. Change local regulations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q22</td>
<td>5. Change infrastructure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q23</td>
<td>Indication of the actions that they have been taking as part of their adaptation planning process</td>
<td>Matrix table – 4 point answer options</td>
<td></td>
</tr>
<tr>
<td>Q24</td>
<td>Rating scale: No action – Intend to start – In process – Action done</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q25</td>
<td>Respondents were asked to what extent they rely on specific groups and organizations for guidance about adaptation planning activities</td>
<td>4 point Likert-like Scale</td>
<td></td>
</tr>
<tr>
<td>Q26</td>
<td>Rating scale: Never - Always</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q27</td>
<td>Respondents were invited to describe some issue that was not addressed in the survey.</td>
<td>Open-ended question</td>
<td></td>
</tr>
<tr>
<td>Q28</td>
<td>Inquire about what are their needs to move forward in one adaptation planning</td>
<td>Matrix table – statements + partially open-ended item</td>
<td></td>
</tr>
<tr>
<td>Q29</td>
<td>Rating scale: I won’t need this – I already have this – I need this</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Q10  | Rating scale: Not a challenge – Major challenge |
| Q11  | Rating scale: I won’t need this – I already have this – I need this |
| Q12  | Rating scale:  Not at all – a lot |
| Q13  | Rating scale: Strongly agree – Strongly disagree |
| Q14  | Rating scale: I won’t need this – I already have this – I need this |
| Q15  | Rating scale: I won’t need this – I already have this – I need this |
| Q16  | Rating scale: I won’t need this – I already have this – I need this |

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3.5.4. 2 Web survey procedures

The survey was available to those that received the email invitation with the link. If acceptance was granted, participants would be conducted to a sequence of 17 questions. The six first questions focused on collecting demographic data (State where the community was located, population size of the community, professional role of the respondent, age and gender, number of years in the profession). Those that indicated the option “planner” in the professional role question where lead to an exclusive question via “skip logic” feature. The question was asking how knowledgeable they felt as planners about planning for climate change. They were presented a 5-point smiley face scale. The slight majority of the planners (57%) feel that they have a good or very good level of knowledge about planning for climate change (Fig. 25; μ=3.60; σ=0.96; n=80).

Each question of the survey presented specific instructions for completion. The survey took about 10 minutes to complete and, at the end, respondents were thanked for their time. The survey and secure database are hosted by Qualtrics. Neither Internet Protocol (IP) addresses linked to the device used to complete the survey nor any other identifying information about the respondents were collected. The survey was posted during November of 2015. All research procedures were approved by IRB – Institution
Review Board at the University of Massachusetts Amherst. The data analysis involved grouping the questions that were more relevant to illustrate the focus adopted in this article. Not all the survey questions were directly relevant to the focus of this paper, so some tangential themes have been removed.

3.6 Results

Figure 26 summarizes the main combined findings of the survey. It shows the major challenges these smaller coastal NE communities experience in their adaptation planning, preferred and less preferred steps for actions, what they need to move forward in their climate planning and source for information and guidance considered reliable.

The high rates of responses emerge from the graphic. The three main challenges, for instance, are encountered by more than 90% of communities. These rates indicate that,
in general, problems faced by these small and medium coastal communities are identical, despite the state communities are located, their size of population or even presence or lack of particular state policies.

Cities around the world are increasingly aware of the need to prepare for the harmful impacts of greater variability in temperature, precipitation, and natural disasters result as climate change (Carmin et al, 2012; Moser, 2010). All of the respondents to our survey indicated that they have thought about climate change before the day that they were taking the survey. They were presented a scale going from “never” to “all the time”. The rates were as follow: 10% all the time, 51% often, 30% sometimes, 9% rarely and 0% never.

Again, 100% of the respondents also believe that climate change is likely to harm coastal communities in general and their communities in particular. Hurricane Katrina caused disastrous flooding of New Orleans in 2005, Super-storm Sandy caused extensive damage to east coastal areas of the United States in 2012, as well as Blizzard Nemo in February of 2013. The devastation caused by these catastrophes is a warning to coastal cities to incorporate climate change concerns in their radar. Future dangers that could come from rising sea levels and more frequent and severe flood surges are the main reasons to justify this inclusion, as both are the likely consequences of climate change (Barnett, 2016).

### 3.6.1 Major challenges

Figure 27 summarizes communities’ three major challenges, minor challenges and not a challenge when trying to address climate adaptation in their communities. Participants were presented the 13 most common challenges usually faced by communities according
to previous study by the authors (see Hamin et al., 2014) and extensive search in the literature.

![Bar chart listing three major challenges, minor challenges and not a challenge when trying to address climate adaptation in their communities.](image)

Figure 27 - Bar chart listing three major challenges, minor challenges and not a challenge when trying to address climate adaptation in their communities.

Open ended responses reported⁷ a range of challenges to incorporating climate change adaptation into municipal practices, many of which are consistent with the literature by Moser (2010), Carmin et al. (2012) and Hamin et al. (2014):

Staff is so limited in this community, and there are very vocal climate deniers in the community and on the Town Council. It is very hard to implement a work plan with no sense of urgency from those setting the budget and determining priorities. The only avenue forward that I see at this time is to attack the issue from a fiscal standpoint, i.e. protecting public investments through planning. The other viable tie-in is through assessment

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⁷ The last question of the survey was open-ended, giving participants the opportunity to share their thoughts.
of storm impacts and planning related to storm resiliency, which is much more politically palatable. (planner, RI)\(^8\)

In a tight fiscal climate it’s very easy to postpone action on climate change adaptation. (Planner, ME)

It’s remarkable that almost 100% of respondents in all states reported finding funding, as seen in Figure 28.

![Figure 28](image)

Communities report many challenges as they pursue adaptation planning. Because adaptation can still be considered a new policy arena, many local governments are trying to take actions with limited resources (Carmin et al, 2012). Consistent in the literature, lack

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\(^8\) It is worth noting that this respondent, despite all the difficulties mentioned, declared to be willing to put a lot of effort to overcome barriers to address climate change in his/her community. In a different question, when asked what is needed to start moving forward to address climate change adaptation in the local planning, the same respondent again used the box for open-ended answers and wrote: “A sense of urgency from the public”.
of financial support appears to be the most common obstacle that make adaptation less efficient and less effective (Tribbia and Moser, 2008; Moser and Eckstron, 2010; Carmin et al, 2012; Clar et al, 2013; Hamin and Gurran, 2014; Eisenack et al, 2014; Hamin et al, 2014; Shi et al, 2016). Not surprisingly, among our survey respondents finding funding to pay for adaptation action was rated the top major challenge when trying to address climate adaptation, at 82.5% of the communities (99 indications; n=120). Allocating staff time to work on adaptation was rated as the second major challenge (66.4%, n=122).

We expected that there would be some relationship between communities’ ability to find funding for adaptation and the State in which they are located (case 1) or their size of population (case 2). To test this, we ran a chi-square test. In both cases 1 and 2, the non-significant p-values mean that the Chi-square test was not able to detect an effect of one variable (state or population size) on the other variable (finding funding), and the results obtained could be due to random chance⁹. It is important to acknowledge that we can still interpret the descriptive results (the percentages), but since the result was non-significant, there is no statistical evidence that the two variables are related. Again, this could be because: a) there really is no relationship between the two variables in the population or b) the small counts in some cells makes the Chi-square test less able to detect a difference.

In combining the responses for major challenges and minor challenges we observe that finding funding severely impacts all municipalities in the region (100% in Rhode Island and New Hampshire) or almost all of them (96% in Massachusetts, 94% in Maine and 93% in Connecticut). Lack of resources and limited appreciation by local officials

⁹ This is a big "could" since the non-significant result might also have been due to the small number of counts in some cells of the table. In other words, there might be an effect, but the Chi-square test just was not able to detect it because there were not enough cases for each cell of the table (the usual recommendation is at least 5 cases per cell).
make it difficult for cities to generate significant improvements in adaptation (Carmin et al., 2012), as explains this respondent:

Climate change adaptation strategies have only been acknowledged by some of the departments necessary to have meaningful discussion. In addition, modifying bylaws in any significant manner can be very difficult particularly if the citizenship feels that it might result in a taking or confining their rights to utilize their property as they see fit. The town is not in a financial position to purchase property that might be required to effect change in the more vulnerable areas. (Planning Board Member, MA)

When looking at this big barrier and the population size, results show that it impacts all of the communities with less than 1,000 habitants and those between 10,001 and 20,000, 95.6% of those with more than 1,001 and less than 10,000, 92.31% of communities with more than 50,000 habitants and 87.5% of those between 30,001 and 50,000 habitants. These numbers show a clear trend here – the smaller the community, the more likely there is a financial problem.

Figure 29 - a. Towns experiencing allocating staff time as a challenge by state and b. by size of population.
Summarizing, we could infer that the p-value results (0.95 in case 1 and 0.83 in case 2) are very reflective of the reality, because combined with this analysis, they show that finding funding for adaptation is generalized among these municipalities, regardless their size or location. Communities in the area not only lack funding. Allocating staff time to work on adaptation, as mentioned before, was rated as the second biggest challenge faced by them. All the communities in Massachusetts (n=53) and in New Hampshire (n=4) that answered this question suffer the challenge of assigning staff time to dedicate to this matter. In the three other states the situation appears that it might be somewhat better: 93.3% in Connecticut, 92.9% in Rhode Island, and 91.7% in Maine.

To test this question, the null hypothesis states that there is no influence of the state communities are located in the existence of this challenge. After running a chi-square test, the P-value obtained doesn’t find evidence to reject the null hypothesis, just as in the previous cases. Furthermore, figure 14 shows clearly that this challenge is spread in practically all the communities that answered the question. In other words, there is no significant relationship based on the state communities are located and the difficulties to allocate staff time to work on adaptation.

One question seems reasonable regarding the size of the community: is it harder for the smallest ones to allocate staff time to work on adaptation? We were curious to know if our sample provided strong evidence of a relationship here. This could certainly be a possibility, but, again, the P value is way beyond 0.05, which means that such relationship does not exist, as summarized in figure 29b. Results are, somewhat, concerning: 100% of communities with less than 1.000 habitants, between 10.001 to 20.000 and those in the range from 30.001 to 50.000 struggle with allocating staff time to work on adaptation, and
more than 90% in the rest of population ranges also reported this challenge. Indeed, the non-significant P value (0.48) makes sense, once almost all the communities in every single population range of the survey sample reported struggling with this barrier that is likely to be delaying their local adaptation process.

Previous study by the authors reported that planning officials do not doubt the reality of climate change; instead, the smaller cities and towns in which they work do not have the capacity to develop their own climate forecast (Hamin et al, 2015). The lack of adaptation by communities with fewer resources represents a fundamental form of spatial injustice, as future resilience to climate impacts will exacerbate existing developmental gaps between large, wealthy cities and “the rest” (Shi et al, 2016, p. 133). These gaps point to the important challenges reported by study respondents, such as funding for implementation and short-staffed departments:

*Having the data in place (for example drainage system as-builts) and added to a maintainable GIS is key. Many towns do not have the capacity to do this work in-house and funding for consultants to complete the work is limited (Planner, CT).*

*For us, a small community with limited resources, it happens much more piecemeal as part of our short-range (i.e zoning/bylaw amendments) and long-range (comprehensive plan) planning efforts. The problem is that change happens more slowly than may be needed to actually adapt. Additional resources would be required for local communities to both plan and implement adaptation strategies more aggressively and effectively (Planner, MA).*
The third barrier that appear to deeply impact these communities is the lack of ability in generating interest in adaptation among business. We already know that the state communities are located and their size of population do not seem to exert any influence in finding funding for adaptation (the top challenge) nor in allocating staff time to work on adaptation. We found similar results here as well. Upon running the chi-square test, the result was non-significant, indicating that there is no statistical evidence that the ability to generate interest in adaptation among business and the state they are located are related. Figure 29a illustrates the amount of towns that struggle in generating interest among business in each state, in comparison with the number of communities that answered this specific question.

Figure 30a and 30b clearly illustrate, again, the similarity of these communities in terms of the barriers that hinder their adaptation planning process. Figure 29b shows how this challenge is well distributed among the different sizes of coastal communities in NE.
Summarizing, in the cases of the three major challenges mentioned – finding funding, allocating staff time, and generating interest among business – survey results demonstrated that the state or the size of the population did not exert absolutely any influence in increasing or decreasing those challenges. A simple observation of this fact provides basic findings that may be useful to promote understanding of the region. At least, from the analysis of the three top challenges, we come to a conclusion that small and medium coastal communities in New England strive together to fight these roadblocks that hinder their ability to be more proactive in planning for climate change adaptation.

The results of a global survey suggest that without the commitment of local political officials and the acknowledgement of this agenda by national governments, it will be difficult to make rapid advances in planning and, most importantly, to move from planning to implementation (Carmin et al., 2012). Our survey findings confirm these results, adding to it the difficulties of organizational infrastructure in small towns, as one respondent explains:

\begin{quote}
There is no professional planner as a member of town government. There is no group charged with the responsibility of planning for climate change effects on the town. There is no long-range planning process which exists in town. In small towns like this, the Board of Selectmen is the group which needs to decide that planning for climate change is a priority; it must then assign the task to some other group. I would suggest the problem is not general awareness of the need, but that small towns have no organizational infrastructure to accept responsibility for planning. (Planner, ME)
\end{quote}

Getting climate change adaptation issues on the political agenda is usually hampered by the challenges mentioned. Policymakers tend to focus their awareness on
highly relevant, urgent problems that require immediate responses (Storbjork, 2010). Since adaptation issues rarely match this profile – of course this can change quickly, with extreme weather events directly attributed to climate change – they often fail to gain political commitment and are therefore often excluded from political agendas (Clar et al., 2013). Moreover, people have a hard time thinking about or acting on events that are psychologically distant - events that are perceived as far in the future, physically distant, or happening to other people (Markowitz et al., 2014), as reflects this respondent:

_Climate adaptation issues with a 20-50 year plus time horizon are not as readily dealt with or planned for when we are responding to coastal change (new inlets, migrating barrier beaches, water level changes, storm impacts) that can happen overnight. (Coastal management, MA)_

### 3.6.2 What Communities are currently doing

Figure 31 shows the top three actions communities have already taken as part of their adaptation planning process. Respondents were presented 24 common actions indicated in the literature and asked to rate the actions already done, in process, the ones they intend to start and no action. The actions listed ranged from the earliest stages of planning, such as

![Figure 31](figure31.png)
as searching in the internet or the literature for information, having informal discussions and meetings to the more advanced actions such as updating coastal infrastructure to address climate change or improve resiliency or moving houses or business out of vulnerable areas.

Even though our findings show a considerable number of ‘highly concerned and willing-to-act coastal officers’ (Tribbia and Moser, 2008), the majority of these small and mid-sized coastal communities in New England are still at the earliest stages of climate planning. This situation can be easily verified by the top two actions accomplished by them: “held public meetings” and “met with regional government department” (31.4%). Having met with local government department was the second more common action taken (30.6%) (Fig. 31a. and b.) and having searched the web or literature for information on adaptation was the action chosen by 26.4% of them (n=121) (Fig. 32a. and b.)

Figure 32 - a. Towns that have met with Local Government department by state and b. by size of population.
Figure 32a shows the number of communities in each state that have met with Local Government department; in 32b we can see these choices by different size of population. P-value for 32a and b are >0.05.

Searching the web or literature for information on adaptation was also popular among the actions that are “in process” by them (32.2%, n=121). Figure 33a shows how many in each state have searched the web for information and 18d the distribution of this response by range of population. The p-values for all responses illustrated in figures 33 (a,b) are >0.05.

Similarly as done with the challenges, we ran chi-square tests to try to detect an effect of state or number of inhabitants in the actions accomplished by these communities, as well as those in process, action they intend to start and the action they have not taken.
yet. Figures 33a and 33b show the distribution of the top two actions more frequently taken by these municipalities, holding public meetings and meeting with Regional Government department, in the states and by number of inhabitants. Having met with local government department was the second more frequent action in process (26.4%). The distribution of this action by state and by size of population is illustrated in the figures 34a and 34b. P-values for all these responses illustrated in figures 33a and b and 34a and b are >0.05.

These results are very aligned with those presented by Carmin in her global survey on the subject: “in keeping with this nascent stage of planning, the most common adaptation planning activities are formative measures such as meeting with local government departments and doing online research.” (Carmin et al, 2012, p. 25).

<table>
<thead>
<tr>
<th>State</th>
<th>Number of Towns</th>
</tr>
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<tbody>
<tr>
<td>Massachusetts</td>
<td>13</td>
</tr>
<tr>
<td>Connecticut</td>
<td>6</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>5</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>4</td>
</tr>
<tr>
<td>Maine</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Population Size</th>
<th>Number of Towns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1,000</td>
<td>13</td>
</tr>
<tr>
<td>1,001 - 10,000</td>
<td>11</td>
</tr>
<tr>
<td>10,001 - 20,000</td>
<td>17</td>
</tr>
<tr>
<td>20,001 - 50,000</td>
<td>11</td>
</tr>
<tr>
<td>More than 50,000</td>
<td>4</td>
</tr>
</tbody>
</table>

Figure 34 - a. Number of towns that have held public meetings by state, and b. by number of inhabitants.
Up to this point, the responses were keeping these communities in the very first stages of the adaptation planning. However, the third most common action in process raised them one step further: the results show a tie between preparing vulnerability analysis and updating coastal infrastructure to address climate change or improve resiliency (25.2%, n=123). The fact that 25% of these communities were able to overcome so many challenges common in their contexts, as mentioned before, and are now in process of updating infrastructure is indeed positive because it changes the status of adaptation actions in the region (Fig. 36a and b).

Figure 35 - a. Number of towns that met with Regional Government Department by state and d. by number of inhabitants.
What communities are willing to do

Equally important in the process of investigating communities’ preferred steps in adaptation includes focusing not only on what they have already accomplished or are in process of, but also on the actions they intend to start. Despite having not received extensive coverage in the literature, generating a robust understanding of what cities are doing to address climate impacts is critical to improving our knowledge of adaptation planning and implementation (Carmin et al, 2012).

Figure 36 - a. Towns that are in process of updating coastal infrastructure by state; b. by range of population.

Figure 37 - Adaptation actions communities are willing to start.
In an attempt to predict the subsequent approaches these communities will pursue, we also asked about the actions they intend to start. Figure 36 shows that almost 30% of study respondents are willing to start integrating adaptation and climate projections into existing regulations and into existing municipal plans. These communities are also interested in updating zoning codes to address climate change or improve resiliency (24.4%) and in updating coastal infrastructure to address climate change or improve resiliency (21.1%, n=123)(Fig. 37).

Interestingly is that updating coastal infrastructure to address climate change or improve resiliency was again a popular response, not only among those who are in the process of performing these actions, but also now among those who wish to start them. If we combine the number of communities where this action is in process with the ones that intend to start, we get a rate of almost 50%. It is, perhaps, an indication that implementing some more advanced climate adaptation actions might be a rising trend in the region.

Actions in process, to a certain extent, are equally relevant in comparison to those already done. In fact, they demonstrate that communities were able to break the barriers and at least start.
Thus one other way to try to have a better understanding of this context is the combination of action in process with those already accomplished by study communities. Figure 38 summarizes the results of this combination, indicating three actions reported by more than 50%: Searched the web or literature for information on adaptation (58.2%, n=122), Met with local government department (58%, n=119), and Met with regional government department (52.1%, n=121). In attempting to understand what steps communities really want to do, we added the actions they also intent to start to this combination. The overall results after these combinations confirm initial stage of climate planning as their preferred steps are still ‘non-structural interventions’ (Ford et al, 2011) that involve developing management strategies, plans, policies, regulations, guidelines, or operating frameworks to guide current and/or future planning.

Again, in the process of trying to understand who is doing what, we ran some cross tabulations and chi-square tests. It’s important to know the rates in terms percentages, however, the data becomes even more interesting if we know in which state of the regions these actions are more frequent. Same with size of communities.

Despite being the most common action done or in process, as seen in Fig. 38, searching the web or literature is such a simple and affordable way of gathering information that does little influence in our analysis. For this reason, we will not display the graphics resulted from the cross-tabulation here, however, they are available in appendices E and F. Now, having met or being in the process of meeting local government departments or Regional Government departments are steps that demand a little more investment of time and effort.
Regarding the combination of actions taken by these municipalities, actions in process and actions they are willing to start, searching the web appears very popular for 70% of them. Meeting with local government was rated in second place by 68%. Because these two actions have been already explored, results for the cross-tabulation can be found in the appendices F and G. The third action rated by 66% of them was preparing vulnerability analysis.

![Figure 39](image)

Climate vulnerability analysis are a means through which cities can move from general perceptions of change to systematic evaluation of the types of climate risks and vulnerabilities they may face (Carmin et al. 2012). They are a step forward in comparison
with a searching the web or the literature for information or meeting with local/regional government departments.

![Figure 40](image)

Figure 40 - a. Number of towns that have met with Regional government department or are in process of taking this action by state; b. by number of inhabitants.

![Figure 41](image)

Figure 41 - a. Towns that have prepared vulnerability analysis, are in process or intend to start this action by state; b. by size of communities
Figure 41a shows the number of towns in each state that are have already prepared vulnerability analysis, are in process or intend to start these important assessments. Interestingly, almost all communities in Connecticut, Rhode Island and New Hampshire are in this stage. Fig. 40b illustrates these preferences by size of communities.

### 3.6.4 Less Preferred Steps

Still one other way to grasp the context of actions these communities are immersed is looking at the actions they are definitely not taking.

Survey results show that almost 90% have not formed commission as part of the adaptation planning process (108 votes, n=121); it may be that this is not viewed as an important step in the process. As expected, a large number of respondents stated that they have not moved houses or business out of vulnerable areas yet (106 votes, n=123) (Fig. 42). Given the expense of these actions and the financial constraints faced by these municipalities, it is indeed not surprising that this is not an initiative they would be taking so far.

Not forming partnership with business was also highly rated by respondents, occupying the third place in the “no action” rank, with 81.8% (99 respondents, n=121). These high rates of no action involving business confirms results explored previously in this article regarding possible difficulties in effective communication and engagement of
this sector in climate adaptation discussions. Graphics for the three top no action results of cross-tabulation are available in the appendices H, I and J.

It is important to acknowledge that a large number of survey respondents also reported that they did not take any action forming partnership with NGOs thus far (76%, n=121) and 71.5% did not create a task force. Many initiatives presented in the literature (see Anguelovski et al, 2014; Carmin et al, 2013) recognize the importance of including residents, non-governmental organizations and other civil society actors in adaptation planning processes (Chu et al, 2015). Also, creating a task force could be one of the options in trying to implement some changes.

In general, what can we learn from these actions not taken, fancy called “less preferred steps” in this article? Graphically, if we observe an average of the top three actions isolated (only the actions taken or only those in process or yet the ones they intend to start), in comparison with the average of the top less preferred actions (no action), the result is almost chocking (Fig. 43a). The difference in rating for ‘no action’ is enormous, making it highly evident that there’s much more actions not taken than actions taken. Obviously, considering the general results of this survey, strongly supported by the literature in status of efforts to address climate change in planning, there’s not much surprise in this finding. However, our perception changes completely once we combine the average of the actions done with the actions in process (Fig. 42b). This results shows that there is a climate for change in the region, despite the very large 84% with no action.
Leadership and Optimism

Leadership can serve as a lever to help initiatives to happen. Leadership can be critical at any stage in the adaptation process but maybe most important in initiating the process and sustaining momentum over time (Moser and Ekstron, 2010).

Leadership and motivation were measured in our survey by a number of questions. The study results show that the great majority of these small and mid-sized coastal communities (65%) are willing to put a lot of efforts to overcome barriers to address climate change in their municipalities, while 28% is neutral, and 7% are not (n=131; mean=3.73 in a 5 point Likert-like scale where 1 = strongly agree… 5 = strongly disagree). Even combining here neutral with not willing, the number of those that want to strive to surpass difficulties in addressing climate in their planning is still superior. Desire to change is somewhat underrated element that must be in place for change to occur. As argue Rochecouste and Pearson (2014), without desire nothing will happen.

Figure 43 - a. Average of the three top no actions rated by communities in comparison with the average of the top three intend to start, in process and actions done; b. Average of the top three no actions in comparison with a combination of action done and in process.
In the context of our survey, we also found that there is a significant relationship between the professional role played by the respondent in their community and their motivation to overcome barriers (p-value = 0.02). Just to illustrate, the majority of urban planners that reported being very satisfied with their level of knowledge to address climate change in their communities (n=14) also reported being optimistic and motivated to overcome barriers in their communities. As expected, similar responses were given by those local governments that have one or more full-time staff member who works solely on climate adaptation (n=4), mitigation, or both (Fig. 44).

Success in adaptation, reflect Moser and Boykoff (2013, p. 300), is also “the ability to hold on to or create a positive vision of the future and being engaged in shaping it, rather than standing helpless and unheard on the side lines, watching an imposed future unfolds”. In The Leadership Advantage, Warren Bennis argues that optimism is one of the key things people need from their leaders in order to achieve positive results. Every "exemplary leader
that I have met," writes Bennis, "has what seems to be an unwarranted degree of optimism – and that helps generate the energy and commitment necessary to achieve results" (Bennis, 1999, p. 21).

As we briefly embark on these questions of leadership, motivation and willingness to put an effort to overcome barriers, we must caution that these rates don’t necessarily infer status of planning adaptation. In other words, we must not assume there is a direct correlation in the stage of climate actions one community achieved with the level of motivation or leadership of its professionals. It’s understandable, though, that the ability to walk the extra mile to surpass the roadblocks of climate adaptation implementation at the local level depends on several other factors, deserving further research.

Although a number of studies of local government action have indicated that action at higher levels of government have significant impact on local capacity to manage climate change adaptation (Urwin & Jordan, 2008), Rosenzweig et al. (2011) highlight that perhaps a necessary component of successful implementation of sustainability efforts is strong leadership from local planning offices. As reflect Markowitz and Shariff (2012, p. 246): ‘understanding how to connect the very global and abstract issue of climate change to our very local and human moral intuitions may play a critical role in rallying first our hearts, and then our hands, to action’.

Thus, in acknowledging that personal passion and motivation can inspire action, the high rates of motivation observed in the survey results are, perhaps, a preliminary evidence for more climate concrete initiatives to happen in the region. Further study is needed to explore this conjecture more in depth in order to verify if it is, in fact, related to the actions being taken by communities.
3.6.6 What’s needed to move forward

Not surprising, financial support is what almost 90% of these small and mid-sized coastal municipalities need the most (n=117), followed by more staff dedicated to this matter (79.1%) and political support from elected officials (71.6%). Because the top two responses were, to a certain extent, expected, we incorporated a few other highly rated responses. We then found that clear legal basis is what 69% of them need and two responses were rated by 67% of respondents: Scientific information about climate change in their community and Zoning tools (Fig. 45).

Difficulties associated with obtaining, interpreting, and communicating scientific information about climate change is a real barrier to advancing local adaptation planning (Tribbia and Moser, 2008; Shi et al., 2015). The high rates reveal a significant agreement among them, leading to a conclusion that, as with the challenges, their needs are also very similar.

Survey participants were presented 8 statements and asked to rate them in ‘I won’t need this’, ‘I already have this’ and ‘I need this’. This specific question offered a partially open-ended item in case participant wanted to list their needs with their own words. Table 8 shows the complete list written by them, presented here due to its variety and relevance. Again, further study could explore each one of these requests.

Figure 45 - Top answers regarding what communities need to start moving forward to address climate change adaptation in their local planning.
Table 8 - Complete list of responses with participants own words about what they need to move forward in the adaptation planning in their communities.

<table>
<thead>
<tr>
<th>Response Description</th>
<th>Need for Information and Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A sense of urgency from the public.</td>
<td>- grants for prof. engineering</td>
</tr>
<tr>
<td>Recommendations</td>
<td>- mediation and conflict resolution resources</td>
</tr>
<tr>
<td>Political Will</td>
<td>- estimates and maps of projected sea level rise</td>
</tr>
<tr>
<td>Political consensus on change</td>
<td>- Universities need to get more involved with communities, more funding, tool box for communities</td>
</tr>
<tr>
<td></td>
<td>- buy in from all departments</td>
</tr>
<tr>
<td></td>
<td>- None</td>
</tr>
<tr>
<td></td>
<td>- Money and time</td>
</tr>
</tbody>
</table>

### 3.6.7 Information and Guidance

Finally, survey participants were asked to indicate the extent to which they rely on groups and organizations for information and guidance with their climate adaptation planning activities. The question presented a list of the 12 most common options for information and guidance found in the literature, including previous study from the authors (see Hamin et al, 2014).

Figure 46 shows that the role of Regional and State agencies is very relevant: it is the most reliable source of information and guidance for almost 50% of respondents. Local government departments or agencies are also appreciated by them, chosen by 38%.

Frequently, cities are able to gain insights by engaging peer networks and take action through trial and error (Carmin et al., 2012). Pirani and Tolkoff (2014) argue that municipalities need to work together to address the environmental and social consequences of climate change. Figure 45 shows that 39% of these small and mid-size New England coastal communities always or very often rely on professional colleagues and 58% on networks with other communities occasionally.

Perhaps a good initiative for the region would be what the department of Housing and Urban Development (HUD) directs grantees to use: ‘a regional and cross-jurisdictional approach to resilience, in which neighboring communities and states come together to
identify interdependencies among and across geography and infrastructure systems, compound individual investments toward shared goals, foster leadership, build capacity, and share information and best practices on infrastructure resilience’ (Pirani and Tolkoff, 2014, p. 37).

In addition to highlighting the importance of regional agencies in this context, survey results also revealed that International Consultants is never a source for information and guidance by 90% of respondents, making totally sense with their preferences as reliable sources. If we combine the top three answers for always, often and occasionally, this predilection becomes even more evident: 89% rely on Regional and State Agencies, 88% on networks with other communities, and 58% in Local Government department or agencies. These numbers bring the role of these regional agencies to a new level of importance, providing motivation for regional governments to, not only play a stronger...
leadership role in coastal risk reduction and climate adaptation preparedness for the region, but also foster climate leadership in these communities.

3.7 Discussion and Conclusion

Climate change is among the most important issues of our time. Many cities around the world are aware of the potential impact climate change can have on their operations, assets, and residents (Carmin et al, 2012). Coastal areas in particular are increasingly vulnerable to extreme weather events, as those experienced in the Northeast of the U.S., including the recent Tropical Storm Irene in 2011, Superstorm Sandy in 2012, Blizzard Nemo in 2013, flooding in 2014 and historical winter storm in 2015, highlighting the region’s vulnerability and need for more sustainable infrastructures.

While hundreds of cities around the world are working on mitigation actions, fewer local governments have developed adaptation plans, making climate adaptation planning still a novelty in many places (Blanco et al, 2011). The examination of developed nations’ adaptive capacity, and the persistent “adaptation deficit” in developing nations has led to focused research on barriers and limits to adaptation (Moser and Ekstrom, 2011). For this article, we focused our attention in the status of actions communities have taken in the coast of New England as part of their adaptation planning process, as well as their biggest challenges and what these small and mid-sized coastal communities are willing to take on to move forward. We propose identifying the status of actions as a primary mechanism by which future strategies for the area can be proposed.

Funding and staffing constraints were evident in the study results, representing the two main challenges experienced by these coastal communities. These barriers are highly recognized in the adaptation literature (Tribbia and Moser, 2008; Moser, 2010; Measham

The present study showed very similar responses among these communities about their needs to start moving forward. Identical situation was found in the global survey mentioned before, where communities all over the world express the need of financial resources to support staff time, hire consultants to conduct research, purchase data, and promote outreach (Carmin et al, 2012). Respondents presented considerable agreement also among the biggest challenges experienced by them. Because finding funding to pay for adaptation actions was indicated as the top challenge faced by the vast majority of communities, it was not surprising that financial support was rated as what they need the most to start moving forward. Only four communities surveyed have a full-time staff member dedicated to the issues of climate adaptation planning, and yet 2 of them pointed “Allocating staff time to work on adaptation” as a challenge when trying to address climate adaptation in their local government.

The results of this study revealed one feature that seems to be central to these small coastal communities: their conservative, narrow-minded posture concerning preferences for reliable climate adaptation information and guidance. We found that there’s mood for collaborative actions to achieve a more climate resilient region because these local leaders have been working together, sharing their knowledge and resources. This ability could be, then, systematized, avoiding duplication of efforts, and increasing their capacity to communicate regional needs to state and federal government in a unified voice. Like many other environmental, social, and economic challenges, climate planning cannot be solved by independent governments acting isolated. The fragmentation of responsibility
manifested in the multitude of local governments and special authorities in the United States, as argue Pirani and Tolkoff (2014), gives rise to development patterns that make it difficult to address the needs of shared regional systems in the face of climate change.

Therefore, rather than a purely top-down or bottom-up approach, adaptation requires collective action and coordination between multiple scales, from the local to the international, with significant linkages between institutions at the various levels (Wilbanks and Kates 1999; Adger 2003; Agrawal and Perrin 2008; Bryan and Behrman, 2013).

The results of this study showed that the majority of climate actions taken so far in the region demonstrate initial stage of climate planning and their preferred steps are still “non-structural interventions” (Ford et al, 2011) that involve developing management strategies, plans, policies, regulations, guidelines, or operating frameworks to guide current and/or future planning. It is important to emphasize that there is vulnerability analysis being undertaken, but less physical structural actions to date, likely because these are much more expensive and will require more political buy-in. Despite all the difficulties endured by these less researched and less resourced municipalities, they have found the means to implement, at least, some kind of adaptation initiatives. The alternative found was to focus on non-structural measures such as policies and communication. Almost 60% are still experiencing the embryonic stage of searching the web or literature for information on adaptation or meeting with local/regional government departments. In terms of actions that they are or will be taking, about 50% of them have already prepared or are in the process of preparing vulnerability analysis. Almost 30% reported the intention to integrate adaptation and climate projections into existing regulations or municipal plans, and about 25% want to update zoning codes and coastal infrastructure to address climate change or
improve their resiliency. This shows signs of willingness to move from planning to implementation. While past approaches in the literature frequently privileged barriers to impede climate initiatives, this research agenda highlighted the actions that they have already taken, actions that they are actually doing and the ones they intend to start. In here we believe lies the best contribution of this research.

Studies like this can help us grasp what we know, don’t know and need to know (Ford et al., 2011). We naturally do not argue that the study captures all adaptation actions being implemented in coastal New England. What the work does offer is an indicator of adaptation action in the region – a snapshot of what is going on – that can be used to monitor adaptation overtime. Importantly, examining how adaptation is and is not taking place offers guide for future research.

We recognize some limitations in the study. Respondents are almost all planners, and thus we are looking at a small slice of a big group of stakeholders. Nevertheless, we believe that information collected in this survey can still inform future initiatives. We understand that the results presented are far from being a singular case. Thus, we cautiously view our findings as broadly applicable outside New England, USA, even if the specifics are likely to differ from location to location.

Above all, we conclude that, although financial, institutional and human resources are in short supply among these communities and can slow their progress, such constraints are not preventing them from initiating adaptation action. Despite all the challenges commonly experienced by these municipalities, there are not only concrete adaptation actions in place, but there is also the intention to incorporate new initiatives in their planning process. Hence, the present study showed that the willingness to take the next
step in adaptation planning, together with the actions already accomplished and in process, do characterize the climate for change in these small New England coastal communities.
4.1 Abstract

Scientists all over the world are increasingly positive of being right about climate change. In the field of adaptation to climate change research, common barriers to adaptation have intensely emerged in the recent years. However, current discussions put little emphasis on explaining what are the steps communities tend to follow in the process of adaptation and on how early adopters have overcome those roadblocks that tend to hinder the adaptation process. These gaps present an opportunity for scholarship to increase understanding on what are the factors that, in practice, can contribute to adaptation and how they could be measured. This article presents some of the findings of a web-survey conducted in November 2015 with 121 small and mid-sized coastal communities in New England, in order to examine the status of climate adaptation planning at the local level. The central goals of the paper are: (1) to explore the characteristics of 36 early-adopter communities; (2) to investigate the ways these characteristics influence their capacity to accelerate in the adaptation planning process; and (3) to elucidate these evidences as a significant opportunity to advance the understanding of on-the-ground adaptation planning in smaller municipalities. The study results suggest that the advancement of adaptation action in these early-adopter small coastal communities occurred despite the severe
presence of challenges, perhaps motivated by city officials’ declared willingness to put a lot of efforts to overcome barriers to address climate change in their communities.

4.2 Keywords: climate change, adaptation, early-adopter, urban planning, small coastal communities

4.3 Introduction

Scientists all over the world are tasting a bittersweet flavor of being right about climate change. It is becoming more evident than ever that the alterations in climate will not be experienced as a smooth change in mean conditions, but as a series of extreme weather events, possibly leading to crisis in policy and planning (Adger, Quinn, Lorenzoni, Murphy and Sweeney, 2012). As the climate changes, individual and societal adaptation to new climatic and environmental conditions becomes ever more important (Clar, Prutsch and Steurer, 2013). Thus, adaptation has become a core element of climate policy and research (Ford and King, 2015).

This article presents some of the findings of a web-survey conducted in November 2015 with 121 small and mid-sized coastal communities in Massachusetts, Connecticut, Rhode Island, New Hampshire and Maine. The survey aimed to examine the status of climate adaptation planning at the local level in coastal New England. The central goals of this paper are: (1) to explore the characteristics of 36 early-adopter communities; (2) to investigate the ways these characteristics influence their capacity to accelerate in the adaptation planning process, enabling them to start planning at an early stage; and (3) to elucidate these evidences as a significant opportunity to advance the understanding of on-the-ground adaptation planning in smaller municipalities.
City planning is an ancient activity but a modern profession, as observed by Scott (1969). The profession arose in the United States from the urban reform movements of the 1890s. One hundred years passed until planning started to be used more deliberately as an instrument of response to climate change. It was not until the mid-to-late 1990s that climate change planning accelerated, with jurisdictions adopting more comprehensive plans to reduce emissions (Wheeler, 2008; Castan Broto and Bulkeley, 2013). In the first decade of the 21st century, though, as pointed by Moser and Ekstrom (2010), adaptation to climate change rised sharply as a topic of scientific inquiry, in local to international policy and planning, in the media, and in public awareness.

As the Fourth Assessment of the Intergovernmental Panel on Climate Change (IPCC, 2007) notes, urban centres and the infrastructure they concentrate – and the industries that are a key part of many such centres' economic bases – are often capable of considerable adaptation in order to reduce risks from the direct and indirect impacts of climate change. Urban environments more densely organized can be more efficient in terms of energy usage (e.g. heating) and transportation (e.g. low emissions). However, a larger green infrastructure can be beneficial to adaptation, because more room for urban greening, storm water management can be provided (Hamin and Gurran, 2012).

Examples of evolving good practice for adaptation still represent exceptions in the scholarship. As stressed in the literature, planning for climate change adaptation is still in a nascent stage, our understanding of the magnitude of the adaptation challenge remains in its infancy, and plans are largely under-developed (see: Adger et al., 2007; Preston et al., 2011; Measham et al., 2011 Bierbaun et al., 2012; Moser and Boykoff, 2013; Carmin et al, 2012b; Carmin and Dodman, 2013; Ford and King, 2015; Emlinger and Hamin, 2016). The
growing urgency associated with responding to climate risk has elevated climate adaptation on policy agendas across a broad array of institutions and governance networks (Swart et al. 2009). But, what does successful adaptation look like? This is a common question among planners, policy-makers, and other professionals charged with the task of developing and implementing adaptation strategies.

While adaptation is increasingly recognized as an important climate risk management strategy, and on-the-ground adaptation planning activity is becoming commonplace, there is not yet a model of what success would look like, and how to judge progress (Moser & Boykoff, 2013). This so far lack of a clear guidance supports a question: what are the specific nature of the factors that intervene in the translation of existing local capacity into action?

The northeast Atlantic coast of the United States is particularly vulnerable to sea level rise and extreme weather events. The region already experiences floods, coastal erosion, wildfires and droughts. From Connecticut to Maine, such threats have implications for economic, social, and environmental policy.

By focusing on what is actually being done to plan and prepare for adaptation, this study can provide a measure of the likelihood of adaptation taking place. In contrast to extensive research on barriers to address climate change or on adaptive capacity, however, there have been few attempts to conceptualize the determinants of adaptation planning or identify indicators by which it can be measured and tracked over time. This constrains our ability to identify and prioritize needs for adaptation support, identify what has to be done to enhance the ability of human systems to adapt, and monitor and evaluate adaptation progress (Ford and King, 2015).
With some degree of climate change now inevitable, climate policy is shifting away from its once exclusive focus on mitigating climate change to preparing and adapting for the impacts to come (Porter, Demeritt and Dessai, 2015). However, while mitigation reporting already consists of well-developed methodologies for inventorying emissions across sectors and countries, tools to permit similar levels of tracking across adaptation are lacking (Lesnikowski et al, 2015). It is important to acknowledge that, despite our ability to do the tracking still being constrained by the complex nature of adaptation, the need to track its progress is being increasingly recognized in the scholarship, as discussed in the next session of this article.

4.4 Background

To the extent that the literature has progressed, a general perspective on the process of adaptation has emerged (Hamin and Gurran, 2015). However, despite the high visibility that adaptation has on the global policy agenda and the imperative for cities to initiate action, relatively few have made coordinated efforts to develop dedicated adaptation plans or to set adaptation initiatives in motion (Carmin et al, 2012).

It would be a mistake to assume, though, that a logical, justifiable, fundable process driven by good science provides a viable roadmap for action (Satterthwaite et al., 2009). This is strongly reinforced by Porter, Demeritt and Dessai (2015), after presenting the results of a decade long study of British local government. Despite having received considerable investment for climate science and their staff engaged in the kind of information they were seeking throughout that period, better knowledge has not translated into tangible adaptation actions. They concluded that in their current political environment, adaptation officers need information about the economic costs of weather impacts to local
authority services if they are to build the business case for adaptation. What was presented by IPCC in 2007 remains current because we still do not have a clear picture of the limits to adaptation, or the cost, partly because effective adaptation measures are highly dependent on specific, geographical and climate risk factors as well as institutional, political and financial constraint.

Regardless of the recognition that cities are places where cooperation between adaptation and mitigation measures can be established, in general, municipal actions have given more emphasis to climate change mitigation, rather than adaptation (Measham et al., 2011, Castan Broto and Bulkeley, 2013, Hamin and Gurran, 2015). Mitigation programs typically focus on developing green technologies or trying to change consumer demand while adaptation initiatives engage in comprehensive actions to make cities more sustainable and resilient" Carmin et al (2012).

At least from the vantage point of the United States, it appears that the 'pendulum has swung' from an initial emphasis on mitigation, to one focusing on adaptation, as cities begin to prepare for the attack of climate-related impacts (Carbonell and Blakely, 2012). Overall, there is a pressing need to move beyond vulnerability analysis and into implementation of adaptation action (Hamin and Gurran, 2015). Despite measuring adaptation having been a late-comer to climate change debates, attention to it is increasing.

This article bridges some gaps in the literature, examining the experience of early adopters in coastal New England. The flowchart below (Fig. 47) is an attempt to show the role of the article in this context, summarizing the flow of the scholarship production in climate change since when it started to be incorporated in the scientific inquiry, based on extensive literature review. While mitigation (emission reduction) is well established in the
literature due to its nature - cost-effectiveness can be easily determined and compared, adaptation to climate change process is still not fully understood. The idea of what a successful adaptation initiative looks like is still not consistent. The recent (and almost exhaustive) focus on barriers that hinder the process is shifting to a current tendency to a pursuit of measuring if and how adaptation is taking place. However, climate change adaptation implementation is still a very under-developed area.

Planned adaptation to climate change means the use of information about present and future climate change to review the suitability of current and planned practices, policies, and infrastructure (Füssel, 2007). Ultimately, adaptation planning will need to be, as argue Susskind (2010): 'Action-oriented' (i.e. risks need to be assessed, vulnerabilities need to be addressed and investments need to be made that will enhance resilience); 'Adaptive' (i.e. intelligence gathering and recalibration of both risks and risk management options need to be on-going); 'Strategic' (i.e. cities should start with least-cost, no-regrets

Figure 47 - Flowchart attempting to document the flow of the scholarship in climate change, status of mitigation and adaptation approaches in the scientific inquiry, current tendency, gaps and the role of this paper.

Planned adaptation to climate change means the use of information about present and future climate change to review the suitability of current and planned practices, policies, and infrastructure (Füssel, 2007). Ultimately, adaptation planning will need to be, as argue Susskind (2010): 'Action-oriented' (i.e. risks need to be assessed, vulnerabilities need to be addressed and investments need to be made that will enhance resilience); 'Adaptive' (i.e. intelligence gathering and recalibration of both risks and risk management options need to be on-going); 'Strategic' (i.e. cities should start with least-cost, no-regrets
measures that are widely supported because they can accomplish a variety of important objectives at the same time, and 'Broadly supported' (i.e. risk management choices need to be collective choices that reflect the input and support of all relevant stakeholders).

Assuming that a climate change-related problem either exists now or will exist in the future (Füssel, 2007) effective planned adaptation is much needed. In the emerging scholarship proposing assessment approaches and adaptation options, some studies have systematically examined actual adaptation actions at a regional or local level. Not surprisingly, quite diverse have been the approaches found in the literature in trying to investigate possible policies to respond to climate change at the municipal level and/or measure climate change adaptation implementation. Figure 48 demonstrates, in summary, the most common indicators found in the literature for this non-linear list of approaches that can indicate some level of climate adaptation.

In a study developed throughout the North Atlantic coastal region (Virginia to Maine) by Schechtman and Brady (2013), best practices were defined as innovative initiatives aimed at increasing resilience to coastal flooding and storm-related hazards.
These best practices, they argue, range from a community's efforts to decrease flood risk with systematic infrastructure designs, local climate adaptation plans, or legal mechanisms that support resilient development. Qualifying practices had to be voluntarily adopted by a local government and either not required or more stringent than state or federal law. In their criteria of measurement, practices could explicitly incorporate climate change or sea level rise concerns or not. Those that did not explicitly incorporate climate change had to include coastal flooding or hazards exacerbated by climate change.

The readiness framework proposed by Ford and King (2015) provides the basis for developing indicators, which synthesize complexity into simple terms readily communicated to policy makers and the public. In their paper, they develop a framework that captures the overarching factors critical for developing, implementing, and monitoring adaptation interventions, without which, according to them, adaptation is unlikely to happen. Adaptation readiness is proposed as a complimentary concept to adaptive capacity that captures the strength and existence of governance structures and policy processes which determine whether adaptation takes place. As such, adaptation readiness is concerned with examining actual experiences with planning for adaptation and seeks to characterize whether human systems are prepared and ready to 'do adaptation.'

Barnett et al. (2014) report on a project that sought to empirically test the relevance and feasibility of a local pathway for adapting to sea-level rise. They explain that 'adaptation pathways are a sequence of linked strategies that are triggered by a change in environmental conditions, and in which initial decisions can have low regrets and preserve options for future generations' (p. 1103). Local governments are not adapting to sea-level rise, they argue, because it is difficult to build consensus on the need for change and the
best way to implement it, defending the idea that adaptation pathways can resolve this impasse. They found that triggers of change that have social impacts are salient to local people, and developing a local adaptation pathway helps build consensus among diverse constituencies. Their results show that adaptation pathways are feasible at the local scale, offering a low-risk, low-cost way to begin the long process of adaptation to sea-level rise.

In keeping with the literature, previous qualitative research on local adaptation planning has found that the lack of policy mandates from state governments as well as the lack of resources, ability to access and communicate climate information, leadership, and supportive cultural values among local governments all inhibit adaptation planning at the local level (Hamin et al., 2014; Moser & Ekstrem, 2010; Carmin et al., 2012; Shi et al., 2015). Shi et al. (2015), drawing on responses from 156 U.S. ICLEI member cities that participated in a 2011 global survey on local adaptation planning, assessed the significance of 13 indicators measuring political leadership, fiscal and administrative resources, ability to obtain and communicate climate information, and state policies in predicting the status of adaptation planning. However, it is important to acknowledge the fact that these 156 American cities surveyed by Shi et al. (2015) are members of ICLEI. By definition, these communities commit to addressing climate change and sustainability and are likely to include many early adopters of adaptation planning. This characteristic, together with the facts that ICLEI surveyed communities were located inland and in the coast and there was not restriction in the number of their population make all the difference between their study compared to mine, with a sample of 140 small and mid-sized coastal communities.

Due to its uncertainty and frequent unexpected outcomes, adaptation is considered to be fundamentally dependent on new forms of learning (Collins and Ison, 2009) and local
municipal governments have a crucial role in this process. Recognizing different levels of climate preparedness in the region, as demonstrated in the literature and by previous research, and willing to find measurable indicators by which to judge if and how adaptation was occurring, we adopted the 'adaptation planning ladder' proposed by Hamin and Gurran (2015) as a framework (as previously seen in Fig. 8).

In practice, many communities seem to follow a process or pattern: first they develop community awareness of the need for adaptation, in the sequence they analyze climate risk and vulnerability, next they change local regulations, and then modify infrastructure. However, few communities have progressed through all of these steps (Hamin et al, 2014; Hamin & Gurran, 2015).

As noted, scholars have already used a variety of resource indicators to predict local capacity to plan for climate adaptation. While some cities have established climate change officers and funded dedicated climate staff (Carmin et al., 2013), others have integrated climate considerations into ongoing planning processes by reallocating the time of existing staff (Klein, 2011; Shi et al., 2015). So far, efforts to promote urban adaptation planning have deeply focused on the municipal level (Preston, Mustelin and Maloney, 2015; Shi et al. 2016).

Very recent literature, though, has started to question if adaptation is a local responsibility. Placing the burden of responsibility on local communities without strengthening their financial and technical capacity accentuates the differences between the ability of different cities to adapt (Nalau, Preston and Maloney, 2015). Shi et al. 2016 (p. 131) advise that 'focusing on the municipal scale hinders the systematic evaluation of how variations in socio-economic conditions, political voice and governance capacity across
cities affect the cumulative adaptation of urban regions’. While this is certainly a valuable approach, in practice, we believe that, in order to understand a region, it is crucial to understand each part individually. That’s what we did in this study with 140 small and medium coastal communities in Massachusetts, Connecticut, Rhode Island, New Hampshire and Maine, in order to understand the status of climate planning adaptation in coastal New England.

Below we describe the research methodology and data sources; next we report the findings. Subsequently we discuss the findings and their implications for current and future research and decision-making related to planning for climate adaptation at the local level, and present the conclusions.

### 4.5 Data and Methods

The construction of the database involved surveying coastal communities using a web-based instrument and application of basic statistics to facilitate the analysis. The process included selection of communities, survey design, data collection and analysis, as well as review of key literature.

The web-survey was initially piloted in September of 2015 with planners outside the sample universe, and officially conducted in November 2015. It was addressed to local city officials, mostly urban planners, from small and mid-sized coastal communities in New England. In pursuing representativeness of the population, it is essential that the sampling frame include all (or nearly all) members of the population (Babbie, 2007). Following this idea, I contacted all coastal communities in the region that had an email address listed or, at least, provided a text box for contact in their website (except Boston.
and Providence due to their size of population). Thus, 226 out of the total 250 coastal communities in the 5 States, became my sample universe, because they were accessible to receive the invitation to participate in the web survey. From these 226 municipalities, 140 completed at least one session of the questionnaire for a 62% response rate, and 121 completed the survey (considered valid responses) for a response rate of 56.54%. Of valid responses, 45% were from Massachusetts, 29% from Maine, 12% from Connecticut, 11% from Rhode Island and 3% from New Hampshire.

Preliminary analysis of two datasets collected from semi-structured interviews with planners in coastal Massachusetts in 2011 (n=14) and 2014 (n=34) by the authors, as well as literature review in the subject, informed the selection of questions for the survey. A large-scale global survey conducted by Joann Carmin in 2011 with ICLEI - Local Governments for Sustainability especially inspired the construction of the questions and response options.

The survey instrument presented 14 closed-ended questions, 01 blended (close-ended and open-ended) and 01 open-ended question and took 10 minutes in average to be completed. Several researchers have suggested that expertise is a significant variable in influencing attitudes toward planning and management decisions (Kaplan and Kaplan, 1989 in Ryan, 2006). Participants were invited on the basis of their professional role in the municipality. Planners were the focus of the study, thus the first ones contacted. As a profession, planners can play an important role in the adaptation process, helping to establish new rules and regulations to support climate preparedness (Bedsworth and Hanak, 2010). In the absence of a planner in the municipality, members of the planning board, conservation commission agents, town administrators/managers/mayors or employees
occupying a position in the organizational structure that pertains directly to aspects of climate change (even if not involved directly in climate change policy development), in this order, were asked to participate.

4.5.1 Study Area and Selection of Communities

New England is an area which comprises six states of the northeastern United States: Massachusetts, Connecticut, Rhode Island, New Hampshire, Maine, and Vermont. It is bordered by the state of New York to the west and the Canadian provinces of New Brunswick and Quebec to the northeast and north, respectively. The Atlantic Ocean is to the east and southeast, and Long Island Sound is to the south.

This study selects small and mid-sized (up to 150,000 habitants) coastal New England communities on the Atlantic seaboard, which includes the states of Massachusetts, Connecticut, Rhode Island, New Hampshire, and Maine. Vermont, the only New England State not bordered by the Atlantic Ocean, was not included in the study.

Despite some recent criticism in the literature regarding placing the climate adaptation burden on local communities (see Shi et al. 2016), as mentioned in the 'background' session of this article, we focus on adaptation by local governments because of the crucial role they play in both delivering adaptation strategies conceived from above and in coordinating bottom-up action (Adger et al. 2005; Porter et al. 2015).

It's stressed in the literature that larger cities tend to be more engaged in adaptation planning. As mentioned before, the only large coastal cities in the region are Boston (MA) and Providence (RI) - excluded of this study due to their size. All the other 226 Atlantic
Ocean coastal municipalities in the region invited for this study have population of less than 150,000 habitants – 84% of them with less than 30,000.

4.5.2 Identifying early-adopters

Exclusively for this article, the survey respondents were stratified into early-adopters and non-early adopters, based on the information on adaptation actions already accomplished or in process in these communities. Upon this analysis we found that 36 coastal communities in our sample are considered early adopters because they are in the process of/or have already changed infrastructure to address climate change or improve resiliency and/or are in the process of/or have already moved houses or business out of vulnerable areas. This information raises them to the top stage on the adaptation ladder proposed by Hamin and Gurran (2015).

The majority of the 36 early-adopters are towns of less than 20,000 inhabitants (65%), as shown in figure 49b. This rate jumps to 84% when adding towns up to 30,000 inhabitants.
In order to examine the differences between groups (e.g. locations, size of population), we conducted non-parametric tests including Chi-squared ($\chi^2$). The significance of all results was assessed at the 0.05 level.

4.6 Report of Findings

Many communities follow the steps presented in the adaptation ladder as they move forward on climate adaptation initiatives. As if using a magnifying glass, we narrowed from the 121 valid responses in the survey to give a closely look at these 36 early-adopter communities.

![Figure 50 - Summary of the demographic data about the 36 early-adopters: a. State where early-adopter communities are located; b. number of inhabitants in these communities; c. age of respondents, and d. professional role of respondents in the community.](image-url)
communities, attempting to investigate what makes them special and what they might be
doing different from the others to be getting a different outcome. Figure 49 summarizes
the main demographic data collected from our sample, including the state where they are
located, population, age and professional role of respondents in their community.

Survey results show that early adopters are located in four out of the five New
England states studied: 58% in Massachusetts, 19% in Maine, 14% in Rhode Island and
8% in Connecticut (Fig. 50a). Towns with less than 20.000 inhabitants are 65% of them -
34% less than 10.000 + 31% from 10.001 to 20.000 (Fig. 50b).

More experienced professionals were majority among the respondents: 63% of
them have more than 50 years old, 20 years on average working in this profession (mean
= 19.68) and almost 10 years working in the current position in the community (mean =
9.88). Considering those with more than 40 years old, this rate rises to 80% (Fig. 50c).
Regarding their professional role, planners were majority – almost 60% (Fig. 50d)

4.6.1 Awareness and Motivation

Respondents were asked if they have thought about climate change before the day of the
survey: 69% have thought about it often or all the time (Table 9, statement a).

They were also asked if they think that climate change is likely to harm coastal
communities in general and their communities in particular. Survey results showed that
they are very positive about both statements (Table 9, statements b and c).

Table 9 - Attitudes towards climate change impacts.
<table>
<thead>
<tr>
<th>Statement / Question</th>
<th>μ</th>
<th>σ</th>
<th>P value</th>
<th>Variance</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Thought about climate change before the day of the survey</td>
<td>3.92</td>
<td>0.72</td>
<td>0.05</td>
<td>0.52</td>
<td>36</td>
</tr>
<tr>
<td>b. Think that climate change is likely to harm coastal communities in general</td>
<td>4.67</td>
<td>0.53</td>
<td>&gt; 0.05</td>
<td>0.28</td>
<td>36</td>
</tr>
<tr>
<td>c. Think that climate change is likely to harm your community in particular</td>
<td>4.47</td>
<td>0.67</td>
<td>&gt; 0.05</td>
<td>0.42</td>
<td>36</td>
</tr>
<tr>
<td>d. Feel optimistic when I think about the planning possibilities that come along with the challenges of Climate Change.</td>
<td>3.44</td>
<td>0.76</td>
<td>0.03</td>
<td>0.58</td>
<td>36</td>
</tr>
<tr>
<td>e. Willing to put a lot of efforts to overcome barriers to address Climate Change in my community.</td>
<td>4.03</td>
<td>0.83</td>
<td>&gt; 0.05</td>
<td>0.69</td>
<td>36</td>
</tr>
</tbody>
</table>

Mean scores based on a 5-point Likert scale: for statement a. 1 = never… 5 = all the time; for statements c. and c. 1 = not at all… 5 = a lot; for statements d. and e. 1 = strongly agree… 5 = strongly disagree.

While 50% of survey participants feel optimistic when they think about the planning possibilities that come along with the challenges of climate change (18 out of 36), a much better rate (78%) declared be willing to put a lot of efforts to overcome barriers to address climate change in their communities (28 out of 36).

4.6.2 Challenges

Similar to previous findings by the author (please see Emlinger and Hamin, 2016) finding funding to pay for adaptation actions was reported by these early-adopters as the major challenge when trying to address climate adaptation in their planning (83%). Five other respondents pointed this barrier as of minor challenge. In combining both responses, results show that finding funding is a significant concern for 97% of these early-adopter communities, despite their ability to act.

Blending the answers for minor and major challenges is important in this context because it shows the existence of a challenge, independently of its intensity. In keeping this combination, survey results show that the high rate of 97% is also found for ‘Allocating staff time to work on adaptation’, and ‘Communicating the need for adaptation to the
public”; also one other highly rated barrier assumes, now, the top challenge among them: ‘generating interest in adaptation among business’ – rated by 100%. (n=36) (Fig. 51).

In this attempt to understand the barriers that tend to hinder the adaptation process at the local level, the ones that have already been overcome by these communities are also important. Figure 52 shows the top three issues that were not considered a challenge by respondents: Learning from other communities working on adaptation (39%), Learning how to conduct a risk or vulnerability assessment (31%), and Generating interest in adaptation among local government staff (25%).

It’s notable that any one of the 13 barriers listed in the question – extracted from the literature, confirmed by previous work by the authors (see Hamin et al, 2015) - has been overcome by the majority of these communities. For the top ‘no action’, for example, although 14 respondents indicated that learning from other communities working on
adaptation is not a challenge anymore, 16 claimed that it is a minor challenge for them and still a major challenge for 5 of them.

Respondents were also asked if they have one or more full-time staff members who work solely on climate issues (adaptation, mitigation, or both). Only 3 out of these 36 early adopters (8%) answered positive to this question.

4.6.3 Actions

From a list of 24 options, respondents were asked to indicate the actions that they have already done, are in process of taking, intend to start, or have not taken any action so far, as part of their adaptation planning process.

The options ranged from the most rudimentary actions, common when communities begin to develop institutional awareness of climate change adaptation needs passing through the stages of analyzing climate risk and vulnerability, preparing climate change adaptation plans, changing local regulations and reaching the top stage of changing
infrastructure. Taken together, these series of actions suggest a ladder of adaptation that communities tend to follow (Hamin and Gurran, 2015). This sequence is, by any means, static in practice. Actions can, and often do, happen in a different order. However, the top stage is the aim and also considered the most complex to be implemented.

Figure 52 shows the survey results for all the 24 adaptation options presented to respondents, rated by them as ‘no action’ (red), ‘intend to start’ (dark blue), ‘in process’ (light blue), and ‘action done’ (green).

The most popular actions taken by these communities (47%) are holding public meetings (option n) and meeting with local government department (option a) are, immediately followed by meeting with regional government department (option b) (46%).

Knowing the actions that have already been accomplished by these 36 communities is obviously relevant, however the actions in process are, to a certain extent, equally important. The ability to break the barriers and start an action requires some effort, in some cases significant effort, given the number of barriers that impact these small municipalities. This combination of both ratings result in valuable information because it ultimately indicates the actions that are possible to be taken at the local level by small communities in this region to advance their climate adaptation planning.

It was by blending ‘action done’ with ‘action in process’ that we found these 36 communities, subject of this article. They reported having accomplished or being in process of doing two of the actions that place them on the top of the adaptation ladder: updating coastal infrastructure to address climate change or improve resiliency (92%) and/or moving houses or business out of vulnerable areas (31%).
Figure 53 - List of the 24 actions rated by respondents as 'no action', 'intend to start', 'in process', and 'action done'.

a. Met with local government
b. Met with regional government department
c. Met with state government department
d. Met with national government agencies
e. Searched the web or literature for information on adaptation
f. Formed advisory group
g. Formed commission
h. Reviewed progress
i. Wrote grant proposals
j. Formed partnerships with other cities
k. Formed partnership with business
l. Formed partnerships with community groups.
m. Formed partnerships with NGOs
n. Held public meetings
o. Created inventory of current adaptation initiatives
p. Prepared vulnerability analysis
q. Integrated adaptation and climate projections into existing regulation
r. Integrated adaptation and climate projections into existing municipal plans
s. Did stand-alone adaptation plans or chapter in other plan
t. Updated zoning codes to address climate change or improve resiliency
u. Updated coastal infrastructure to address climate change or improve resiliency
v. Moved houses or business out of vulnerable areas
w. Changed specifications for municipal projects to address climate or improve resilience
x. Created a task force.
Other popular actions among these municipalities, keeping these combination action done + in process, are: meeting with local government department (77%), followed by meeting with regional government department (74%), searching the web or literature for information on adaptation (70%), and holding public meetings and preparing vulnerability analysis rated by 69% of them. In terms of actions accomplished or in process, what makes these communities “early adopter” is the fact that they were able to reach the top stage of the adaptation ladder: updating coastal infrastructure or moving houses out of the vulnerable zones. Now, in trying to understand how these 36 communities became “early adopters” and what makes them different, unique, we found that it will be necessary a deeper investigation because in practically all the other aspects they are very similar. Now, 78% declared that they agree or strongly agree with the following statement: “I am willing to put a lot of efforts to overcome barriers to address Climate Change in my community”. Perhaps, this is the key. Further research will be necessary to confirm this conjecture.

Respondents were also asked to rate the actions that they intend to start, as observed in Figure 52 (dark blue). About 33% of respondents are willing to start integrating adaptation and climate projections into existing regulations; 28% want to integrate adaptation and climate projections into municipal plans and 22% intend to start doing stand-alone adaptation plans or chapter in other plan and updating zoning codes to address climate change or improve resiliency. Forming partnership with business was rated by 19%, as a possible indication of willingness to overcome one of the main barriers faced by them: to generate interest in adaptation among business.
Now, following the same idea of blending response options, we combined responses for ‘no action’ and ‘intend to start’ because they indicate the actions still not taken. Forming commission was the most popular ‘still not taken’ action by 92% of participants, followed by forming partnership with business (81%) and forming partnership with NGOs (72%). Moving houses or business out of vulnerable areas have not been done by 69% of respondents.

Figure 53 shows graphically the mean value (µ) for each of the 24 options rated by respondents. They were presented 4 different alternatives: ‘no action’, ‘intend to start’, ‘action in process’, and ‘action done’. Table 10 shows the numeric value of each mean (µ) in descending order and the value of the standard deviation (σ).

<table>
<thead>
<tr>
<th>Action</th>
<th>µ</th>
<th>σ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Met with local government department</td>
<td>3.12</td>
<td>1.11</td>
</tr>
<tr>
<td>g. Updated zoning codes to address cc or improve resiliency</td>
<td>2.19</td>
<td>1.08</td>
</tr>
<tr>
<td>m. Met with regional government depart.</td>
<td>2.97</td>
<td>1.18</td>
</tr>
<tr>
<td>j. Changed specifications for municipal projects to address climate or improve resiliency</td>
<td>2.19</td>
<td>1.10</td>
</tr>
<tr>
<td>h. Updated coastal infrastructure to address climate change or improve resiliency</td>
<td>2.92</td>
<td>0.55</td>
</tr>
<tr>
<td>d. Integrated adaptation and climate projections into existing regulations</td>
<td>2.17</td>
<td>1.33</td>
</tr>
</tbody>
</table>

Figure 54 - Graphic showing the mean for each of the 24 actions communities have taken as part of their adaptation planning process. 4-point scale: no action – intend to start – in process – action done.
<table>
<thead>
<tr>
<th>Source of Information</th>
<th>2.89</th>
<th>1.17</th>
<th>2.11</th>
<th>1.24</th>
</tr>
</thead>
<tbody>
<tr>
<td>p. Searched the web or literature for information on</td>
<td>2.89</td>
<td>1.17</td>
<td>2.11</td>
<td>1.24</td>
</tr>
<tr>
<td>adaptation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Held public meeting(s)</td>
<td>2.81</td>
<td>1.33</td>
<td>2.11</td>
<td>1.33</td>
</tr>
<tr>
<td>c. Prepared vulnerability analysis</td>
<td>2.81</td>
<td>1.15</td>
<td>2.09</td>
<td>1.12</td>
</tr>
<tr>
<td>n. Met with state government department</td>
<td>2.71</td>
<td>1.26</td>
<td>2.06</td>
<td>1.26</td>
</tr>
<tr>
<td>b. Created inventory of current adaptation initiatives</td>
<td>2.64</td>
<td>1.11</td>
<td>1.89</td>
<td>1.17</td>
</tr>
<tr>
<td>t. Wrote grant proposals</td>
<td>2.54</td>
<td>1.29</td>
<td>1.81</td>
<td>1.05</td>
</tr>
<tr>
<td>e. Integrated adaptation and climate projections into</td>
<td>2.53</td>
<td>1.01</td>
<td>1.66</td>
<td>1.04</td>
</tr>
<tr>
<td>existing municipal plans</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Did stand-alone adaptation plans or chapter in other</td>
<td>2.25</td>
<td>1.14</td>
<td>1.60</td>
<td>0.9</td>
</tr>
<tr>
<td>planning activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>w. Formed partnership w/ community groups</td>
<td>2.23</td>
<td>1.10</td>
<td>1.17</td>
<td>1.36</td>
</tr>
</tbody>
</table>

### 4.6.4 Source of Information

Survey participants were asked to indicate, among 12 groups and organizations, the extent to which they rely on them for information and guidance with their climate adaptation planning activities.
For 61% of respondents, professional colleagues (µ=2.61; σ=0.83) and Regional or state agencies (µ=2.67; σ=0.75) are the main sources of information and guidance; 52% of them rely on networking with other communities (µ=2.47; σ=0.69), on professional associations (µ=2.42; σ=0.68) and on local government departments or agencies (µ=2.61; σ=0.92) (Fig.54).

International consultants are never considered an option for information and guidance on adaptation for 85% of these small and medium coastal New England communities (µ=1.31; σ=0.66). More than 40% of them don’t rely on local nonprofits
(µ=1.81; σ=0.78) and 36% on research institutes (µ=1.81; σ=0.66). Figure 55 presents the mean for all the 12 options rated by survey respondents.

Figure 56 - Graphic showing the mean for each of the 12 options communities rely as a source of information and guidance, ordered from highest to lowest. 4-point scale: never – occasionally – very often – always.

4.6.5 Resources needed to move forward

Survey respondents were asked what they needed to start moving forward to address climate change adaptation in their local planning.

Not surprisingly, financial support affects 91% of these communities (µ=2.81; σ=0.46). More staff dedicated to this matter is needed by 84% (µ=2.66; σ=0.67) and clear legal basis 78% of them (µ=2.60; σ=0.68) (Fig. 56).
This was a blended question, offering respondents the chance to use their own words to express their needs. In response to this opportunity, participants recognized the importance of ‘Money and time’, ‘buy in from all departments’, ‘Universities need to get more involved with communities, more funding, tool box for communities’, ‘mediation and conflict resolution resources’, ‘Recommendations’, and ‘A sense of urgency from the public’.

4.6.6 Statistical Significance

Table 11 - List of statistical significance found in cross-tabulations.

<table>
<thead>
<tr>
<th>Significance</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. State x Update coastal infrastructure to address climate change or improve resiliency</td>
<td>0.05</td>
</tr>
<tr>
<td>b. Number of inhabitants x Update coastal infrastructure to address climate change or improve resiliency</td>
<td>0.01</td>
</tr>
<tr>
<td>C. Number of inhabitants x Move houses or business out of vulnerable areas</td>
<td>0.01</td>
</tr>
<tr>
<td>d. Feel optimistic when think about the planning possibilities that come along with the challenges of climate change x Update coastal infrastructure to address climate change or improve resiliency</td>
<td>0.03</td>
</tr>
<tr>
<td>e. How much have thought about climate change before the survey x Update coastal infrastructure to address climate change or improve resiliency</td>
<td>0.05</td>
</tr>
</tbody>
</table>
Table 3 presents the list of characteristics found in the survey results that have some statistical significance. By Statistical significance we refer to whether any differences observed between groups being studied are "real" or whether they are simply due to chance.

Figures 57a and 57b graphically illustrates the statistical significances listed in table 11, items a and b. Figure 58a shows that the vast majority of communities updating coastal infrastructure to address climate change or improve resiliency are located in the state of Massachusetts (n=19, out of the 31). The P value of 0.05 indicates that there’s statistical significance in this context, meaning the state communities are located and being in process of these actions is not due by chance.

Same with Fig. 57b, where we can observe that these actions are much more popular among communities with less than 20,000 inhabitants, possibly explaining P value = 0.01.
In terms of being in process of moving houses or business out of vulnerable areas, Fig. 58 shows that the majority of active communities in this context have less than 30,000 habitants. P value = 0.01 indicates a strong probability that this result is not due by chance, as illustrated in Figure 58.

Statistical significance was also observed in two other survey results, as listed in table 11, items d and e. Figure 59a illustrates the results of the cross-tabulation among the degree of optimism respondents feel when they think about the planning possibilities that come along with the challenges of climate change x Updating coastal infrastructure to address climate change or improve resiliency (in process or done) - P value = 0.03.

Figure 15b illustrates results of the cross-tabulation of the amount respondents have thought about climate change before the survey x Update coastal infrastructure to address climate change or improve resiliency – P value = 0.05. It sounds obvious, but the statistical significance just confirms that the more one thinks about a subject, the more he/she tends to put an effort to accomplish the intent.
While locally devised adaptation responses are much needed, fully implemented strategies are still rare. What seems to remain unresolved in the literature is what are the urban centres effectively supposed to do to reduce their vulnerability and how can their actions be evaluated. More recently, scholarship has begun to examine the actual experience of adaptation. Research has been driven by the need to track real progress in adaptation, which could help us better understand opportunities for intervention (Ford and King, 2015).

Previous study by the authors (Hamin, Gurran and Emlinger, 2014) showed that, in practice, adaptation planning to cope with future changes in the climate is still confusing for many planners that don't even know how to get started. However, it can become a powerful tool instead. Some good practices (even if just a few) can serve as a motivator to planners, especially if research in the area is disseminated in a comprehensive way. Many local governments, as Shi, Chu and Debats (2015) point out, find it difficult to understand
climate science or to alter historic development and planning practices in response to projected impacts (Cutter et al., 2014; Shi et al., 2015).

The survey reported in this paper characterizes one of the first attempts – if not the first and only so far - to capture the experiences of these smaller, less represented coastal communities in New England. A narrow look, identifying early-adopters and capturing their main characteristics, biggest barriers encountered in the process, actions accomplished, reliable sources of information and guidance and what’s needed to move forward was presented.

What do these findings tell us? What have we learned about early-adopter communities? What makes them unique, besides the fact that they are already doing more to adapt to climate change? This is the heart of this study’s contribution, however, the answer is much less bold that we expected so far. It’s crucial to recognize that the beauty of scientific research is that, after a study is completed, we find out what the reality is, and not what we would like or expected it to be. In fact remarkable differences is these communities were expected. This did not happen. The only point that raised a flag is that 78% declared that they agree or strongly agree with the following statement: “I am willing to put a lot of efforts to overcome barriers to address Climate Change in my community”. Maybe this was the key.

Despite there must be an inherent bias towards those staff who had a particular interest in climate change adaptation and were, therefore, more motivated to respond to the survey, we believe that responses collected may be representative of the entire group surveyed. Due to considerable high response rate of the big survey from where this analysis was based, which was cautiously distributed in all the states involved and the establishment
of the highest sample population possible, we propose that the findings of this study may be usefully considered as offering insights into climate change adaptation planning made possible by small coastal communities.

New England has three out of the 10 wealthiest states in the country, according to the U.S. Census Bureau’s 2014 American Community Survey (ACS): Connecticut ranked 4th place, Massachusetts 6th and New Hampshire 7th. Despite being geographically widespread, 58% of them are agglomerated in Massachusetts.

Also, one could expect that these early adopters would, perhaps, be concentrated in the largest communities of the region. Instead, and the majority of them do not have more than 20,000 inhabitants. This information confirms Shi's suspicion that their findings about bigger towns being more advanced in adaptation processes for the survey with 156 communities were of 'borderline statistical significance' and may have been due to an oversampling of larger and more progressive ICLEI cities in their study (Shi et al. 2015).

Because planners and planning departments should take the lead in adaptation planning due to their already knowledge on how to work cross-sectorally, think long-term, worry about balancing science and politics and are committed to public learning and public engagement (Susskind, 2010), this rate of almost 60% of planners is relevant in this context, qualifying the findings. Planners aren’t trained as climate change experts, so they have to learn on the job. There is an opportunity for further research to focus on the factors that help planners implement adaptation plans, as more cities begin to plan and progress along the adaptation planning process (Shi et al. 2015). Eisenack et al. (2014) explain that individuals and collectives, their actions and how decisions are made are taken as starting points for analysis in actor-centered adaptation research. This does not imply an exclusive
focus on single actors or disregard of the institutional systems in which they are embedded, but simply puts actors at the center of the analysis. In this article, we were mostly focusing on the perceptions of planners - absolute majority in our sample population.

Success in adaptation, explains Moser and Boykoff (2013, p. 300), is also the ability to hold on to or create a positive vision of the future and being engaged in shaping it, rather than standing helpless and unheard on the side lines, watching an imposed future unfold. True to the literature, the vast majority of this early-adopter respondents think that climate change is likely to harm coastal communities in general (97%) and their communities in particular (91%). Other high rate, 70% of them stated that they have thought about climate change often or all the time before the survey. Thus, survey results show that respondents identify climate change as a morally relevant issue at present.

Converging with previous study by the authors and the literature, lack of staff resources is still among the factors that can hinder the efforts related to climate adaptation (see Carmin et al. 2012; Moser and Ekstrom, 2012; Hamin, Gurran and Emlinger, 2014; Hamin and Gurran, 2015; Emlinger and Hamin, 2016). As reported in the findings, 3 out of these 36 early adopters (8%) have one or more full-time staff members who work solely on climate issues (adaptation, mitigation, or both). It is important to acknowledge, though, that this is a much better rate than the bigger sample in the region, presented in Emlinger (2016), when only 4 in 132 respondents attested having this "luxury".

Barriers can be defined as obstacles that make adaptation less efficient, less effective or may require changes that lead to missed opportunities or higher costs (Moser and Ekstrom, 2010). One of the top main barriers recognized in the literature - lack of financial resources - was clearly evident in the 36 studied communities. Discussion about
barriers is important because the data shows that, despite being the communities that are doing something, they face similar barriers compared to the non-adopter communities.

Generating interest in adaptation among business was an absolute barrier among these early-adopters, being rated as major or minor challenge by 100% of the respondents. Also, 97% of these municipalities find strong difficulties in communicating the need for adaptation to the public. Upon such common and substantial barriers, the deeper question, perhaps, is why communication about climate topics has not been effective. How have climate change issues been presented to the public? What level of stress, fear, even guilty have been instilled in the message? More effective communication of climate change's urgency - which derives from the uncertainty in potential climatic changes and the significant risks involved in some of them - can help bring about this highly desirable engagement. To increase the likelihood that threatening information leads not to denial and apathy but to action, a 'focus-in' tone and 'content-on' empowerment should be the highest priority in communication (Moser and Dilling, 2004). Connecting action on climate change to positive moral emotions like pride and the sentiment of well-being may help battle what Markowitz and Shariff (2012, p. 245) call the 'guilty-bias challenge by decreasing defensive processing of what can, at times, be very dire, frightening information about the world'.

Carmin et al (2012) address the issue of leadership and beliefs in their research in Dubai, reflecting that generating ideas internally, experimenting, and innovating were key elements that, even in the absence of mandates, standards, and models to follow, helped them to move from assessment to strategy to plan in Durban. Survey results seems to find similar situation with these early-adopter communities in New England. From all the
connections they are used to make among themselves for information and guidance, we would assume that their reality led them to creatively bind together existing initiatives, and avail themselves of opportunities in order to ensure that adaptation planning took root. Rather than conforming to national, regional, or global norms, the result is that these cities not only are acting independently but are in the process of identifying approaches (Carmin et al., 2012).

Obtaining accurate scientific data, interestingly, is a challenge for 79% of them. Despite being framed as a key barrier for adaptation by local government in policy circles by extensive literature in the past years (Adger et al., 2005; Hamlin et al. 2014; Porter et al., 2015), recent literature has started to indicate the opposite. Study over a decade in British local government concluded that better knowledge has not translated into tangible adaptation actions, showing evidences that adaptation barriers are not fixed and change over time (see Porter et al., 2015).

Despite the relevance of these results, it is important to consider that the circumstances in Britain may be different. The scientific information as created in the U.S. is not always geographically specific at the town-scale. In addition, planners are not climate scientists or geo-science experts to interpret data that is available.

The interesting point in this analysis of the barriers is that, nevertheless, overwhelmed with all those challenges, these early adopters were able to step up the adaptation ladder and move forward. Severe similar barriers stated by nearly all of these 36 communities apparently did not stop them from acting. What is their secret? What is special about them?
So far, there are only a few studies that explicitly investigate how barriers perceived as problematic might be overcome (Eisenack et al. 2014). Yet some studies of instances where adaptation is already occurring provide insights on enabling factors that either prevent barriers from emerging or that help actors to deal with them (Berrang-Ford et al, 2011; Moser and Ekstrom, 2012). Eisenack et al (2014) reflects that reported observations of 'early adopters' indicate that there are no one-size-fits-all solutions, probably reflecting the multiple and context-specific origins of barriers. Adaptation planning processes require substantial technical capacity, financial resources, and political support (National Research Council, 2010). The lack of resources is one of the most cited barriers to adaptation (Carmin et al. 2012, Hamin et al., 2014, Shi et al., 2015).

Past approaches to climate adaptation planning often privileged barriers that hinder the adaptation process. Moving forward, we found necessary to understand the actions taking place. In this study we explored the initiatives planners of these early-adopter communities have chosen as part of their adaptation planning process. In this context we looked at the actions they have already accomplished, actions in process and actions they declare intention to start.

Perhaps expected, these 36 communities have much more actions done and in process than actions not taken or that they intend to start, different than the whole sample population of the study (see Emlinger and Hamin, 2016). This fact shows that these communities are indeed more proactive compared with the whole group. The adaptation ladder was an important tool in this study. It was a visible way of identifying the status of climate change adaptation in these communities.
The present study found significant contrast with earlier study by Shi et al., 2016, in which some early adopter cities made a concerted effort to develop representational and participatory processes with non-governmental organizations and urban residents. For 72% of these 36 communities, forming partnership with NGOs has not been a priority so far.

The disaster recovery process is a set of actions undertaken to repair and restore communities affected by a disaster. Although response is key, scholars argue that effective disaster recovery should take place before, during, and after a disaster through planning, response and relief, and long-term rebuilding, respectively (Smith 2011). In the United States, disaster recovery policy tends to focus on response and relief. Without appropriate planning before a disaster, however, tension can arise between the urge to return to normal and the desire to transform communities to become more resilient. The manner in which these 36 communities addressed these existing concerns is insightful for other locations. Interestingly, many more communities are in the process of changing infrastructure (top of the ladder) before doing vulnerability analysis (second step), showing that the steps of the ladder in between the start and the end are not linearly taken. The ladder for adaptation planning may possibly oversimplify a more nuanced continuum of approaches and accomplishments - room for future research. We recognize, though, that the identification of the steps adopted by them, particularly in blending the actions done with those in process, can assist in decision-making in other coastal communities facing similar situation.

This study does not offer a single answer for the different levels of climate preparedness that all communities might be taking. Instead, it attempts to identify the steps these local governments tend to follow when they move forward on climate adaptation.
Although we recognize that these steps can be context-specific, some of the findings may be applicable beyond small and mid-sized coastal New England communities, USA.

It is good to remember that most of today's urban planners are braving unknown lands regarding climate change adaptation. These challenges, points Innes (1998), have produced planners who are creating innovative ways of doing planning, taking on new roles. They are doing things for which, for the most part, their formal education did not prepare them. Academic research is just beginning to identify, document, and interpret this range of activities and to suggest how it is changing the basic nature of planning. Furthermore, there is little guidance of national or transnational diffusion shaping the adaptation initiative in small and medium coastal communities.

Despite the initiatives of these 36 communities, it does not seem to exist any formal efforts in place to promote joint learning in the region. As this study made clear, reaffirmed by the scholarship, the majority of these early-adopter coastal New England municipalities still face several impediments or constraints, in spite of their ability to reach the top stage of the adaptation ladder. The popular adage "where there's a will, there's a way" could, perhaps, fit here. These 36 communities found the way, even though they clearly still struggle with lack of financial support and staff - barriers frequently found in the literature. So, what was the secret? Even though it would be premature to affirm for sure that the set of actions or attitudes these communities have taken have led them to the top of the ladder, one fact seems significant: 78% declared that they agree or strongly agree with the following statement: “I am willing to put a lot of efforts to overcome barriers to address Climate Change in my community”. Maybe this was the key. Further research is needed to confirm this assumption.
CHAPTER 5

SUMMARY

5.1 How the three articles fit together

This dissertation consists of one field – climate adaptation planning in coastal communities, but multiple investigations. The three articles present three different investigations, however, as illustrated in figure 60, they are closely linked to form a coherent intellectual whole.

The interviews conducted in 2011 were our first attempt to investigate the context of climate adaptation planning in the region. We started within one state, Massachusetts. Apart from the easy location of the cities and towns in coastal Massachusetts, working on one state decreased variation from state-level policy frameworks. The results of these interviews, reported in Article 1, in addition to findings from extensive literature review, informed the elaboration of questions for the web-survey – subsequent phase of data collection.
For this new phase we expanded the geographical area, including four other states of New England with Atlantic Ocean shoreline: Connecticut, Rhode Island, New Hampshire and Maine. Because our main goal was to investigate the status of climate change adaptation planning in small and mid-sized coastal communities in the region, this increase in the size of our population was necessary. Article 2 reports the main findings of the 121 communities that completed the survey, for a response rate of 56.54%.

5.2 Contribution to Knowledge

This study brings a range of benefits to Massachusetts’ smaller coastal towns and cities, to the broader region of New England, as well as to scholarship. First, it generates empirically-based findings on what communities are doing to become better adapted to future climate. This leads to improvements in our ability to advise communities on how to move ahead on this important topic based on their particular situation and experience.

New England coastal communities constitute a system, like a string of intrinsically interconnected parts. These parts are not impacted alone by the challenges associated with climate change. For this reason the risks to which these communities are subject should be addressed collectively. This knowledge is an important step to collaborate in the meeting of future joint solutions for the region.

The data collected for this dissertation characterizes one of the first attempts to capture the experiences of these smaller, less represented coastal communities in the state of Massachusetts initially and the whole New England later. After reporting the findings from the interviews in article 1, we presented the main results of the 121 New England communities that completed the web-survey in article 2. Finally, article 3 consists of a
narrow look, identifying early-adopters and capturing their main characteristics, biggest barriers encountered in the process, actions accomplished and in process of, reliable sources of information and guidance and what’s needed to move forward.

The number of scientific publications available for assessing climate-change impacts, adaptation, and vulnerability more than doubled between 2005 and 2010, with especially rapid increases in publications related to adaptation (IPCC 2014). However there’s still room to explore these small, often times less researched, coastal communities, engaging them in the process of building a better place to live and cope with future changes in the climate.

Despite the fact that New England comprises three of the 10 richest states of the country, lack of financial support or need of financial support are the most popular issues reported by planners and other city officials of small and mid-sized coastal communities in the region, confirming what’s repeatedly found in the literature.

More importantly, we were interested in finding out what were the typical adaptation actions in place. The most common actions taken or in process are ‘search the web or literature for information’, ‘meet with local government’, and ‘meet with regional government’. Despite the majority of actions still indicating a nascent stage of adaptation planning, initiatives that they have already accomplished, blended with the actions in process and those they are willing to take indicate that there is a climate for change in the region. With this dissertation we suggest that a better understanding of these preferred steps in adaptation can help in future climate change policy design and implementation at the local level.
Study results showed great interest of planners and other city officials for a more specific data directly related to their communities. They recognize the vast general data about climate change available in the internet. They report that it’s easy to find lots of experiences from all over the world that are, in one hand, undoubtedly valuable, but in the other hand, totally distant from their particular situation most of the time. In this context, the result of these interviews and survey can bring a potential benefit from the study in two main aspects:

1. Contribution to local planners or other officials: Reporting on the status of climate adaptation planning in the region by exploring experiences from neighboring communities has the potential to serve as a lever for planners to get motivated and raise their actions to a new level of engagement with climate adaptation measures. These results will get into people’s hands via publication in website (Ex. Climate Action Tool), summary of results will be sent to all communities contacted for the survey and data will also be presented in regional and national conferences.

2. Contribution to generalized scholarship: Climate adaptation implementation is still not fully understood. Literature in the field has mostly focused on barriers that tend to hinder the adaptation process, whether than exploring the actions communities are taking to promote adaptation implementation. This study tries to address the gap in the literature on how planners and other city officials respond to emerging challenges for which their schooling, most of the time, did not train them. We found that they rely on regional agencies and particularly on each other
and neighboring communities for information and guidance. Regarding the applicability of this study, we can highlight, for instance, that funding is always an issue. In these communities specifically the funding might be needed for hiring full-time staff that would be dedicated to climate issues. The regional planning agencies in Massachusetts, for example, provide a major technical support to communities – this fact shows in the results, when relying on regional agencies for information and guidance is highly rated among these communities. While this study is not intended for an international audience, some of its findings may be applicable beyond the coastal communities of New England, United States.

It seems that the early-adopters explored in article 3 are the illustration of the “Learning by doing” idea. In the absence of mandates, standards, and models, they are finding the way to move from plans to implementation. Similar to results presented in the literature (see Carmin et al, 2012), this study reveals how planners and public officials can be innovative when seeking to initiate an agenda in an emerging policy domain. Rather than being pressured by mandates or influenced by external parties, these early-adopters were driven by internal goals and aims. For instance, in comparing these communities with the other respondents, we found that almost 80% of the early-adopter communities declared be willing to put a lot of efforts to overcome barriers to address climate change in their communities (28 out of 36) against only 39% among the non-adopters (33 out of 85). At that same time, the absence of guidelines led them to avail themselves of opportunities in order to ensure that adaptation planning took root (Carmin et al., 2012). The result is that, rather than conforming to national, regional, or global norms, these 36 small coastal
New England communities are in the process of updating coastal infrastructure and a few already moving houses and business out of vulnerable areas, thus advancing protocols that others may be able to follow. I believe that this is not only a great contribution of this study to knowledge, but also a source of motivation to practice.

5.3 Future Directions

Climate planning initiatives are expected to be a forever changing status situation. Climate change has been scientifically established, in addition to the simple observation of more frequent and intense impacts to life on Earth. These facts leave no doubt that communities in general, and coastal ones in particular, need to strive, more than ever, to improve their capacity to deal with climate change impacts.

In this context, there’s a lot of room for future studies focusing on these small and medium coastal communities. Not only because they are less researched, but because in this specific geographical area they are the absolute majority. Only two cities - Boston and Providence- in about 250 coastal communities in CT, RI, MA, NH and ME are big centers. Due to the totally different reality of these big cities in terms of social and financial capacity, they would work as perfect outliers if they not excluded of the study, deeply impacting the final results.

‘Unfortunately – or perhaps fortunately – social life is so complex’, as argues Babbie (2007, p. 457). The data from the web-survey present a myriad of possibilities for analysis and space for many other explorations. For article 3 we decided to take a closer look in the characteristics of the communities that are stepping up the adaptation ladder presented by Hamin and Gurran (2015). These communities are called early-adopters
because they are in the process or have already updated coastal infrastructure to address climate change or improve resiliency or are in the process or have already moved houses or business out of vulnerable areas.

In the midst of all these possibilities, there’s a very likely path to be pursued immediately. In between the first round of interviews conducted in 2011 and the web-survey in 2015, we conducted a series of follow up interviews with most of the same planners interviewed in 2011 (14 out of the 15) and included 20 new communities (complete list of towns available in appendix B). The interviews were conducted after two major climatic events had impacted the region: Hurricane Sandy in 2012 and Blizzard Nemo in February 2013. One of our goals was to verify if storms can serve as a lever, if the experience with storms could have raised awareness and created a sense of imperative for addressing climate impacts.

These 34 interviews have already been transcribed and are in the process of being coded to identify themes / patterns in the discourse of the planners. As seen in article 3, web-survey results show that the vast majority of early-adopters are located in Massachusetts. For this reason, the next step is to examine the results of the follow-up interviews conducted in 2014 with planners in coastal MA in comparison with data from the survey. These approach will certainly add an important layer in the understanding of the findings from the web-survey.
### APPENDIX A

**INTERVIEW GUIDE QUESTIONS USED IN 2011 (FIRST PHASE OF DATA COLLECTION)**

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<td>1.</td>
<td>Has there been much discussion of Climate Change (CC) in the city/town?</td>
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<tr>
<td>2.</td>
<td>What is the most likely negative outcome from CC for your town?</td>
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</table>
| 3. | What sorts of town policies or issues need to consider CC?  
(prompt: like infrastructure, zoning, etc.?) |
| 4. | What would you say is the principal barrier to you addressing Climate Change Adaptation in your town (CCA)? |
| 5. | If you were going to try to address CCA in your community, how would you start?  
(prompt: do you think the best way here would be through a stand-alone adaptation plan, through changing zoning or other technical specifications, or is it better not to talk about it at all?) |
| 6. | Do you need political support from elected officials to move forward? |
| 7. | What would you need to be able to start to address CCA in your planning?  
(prompt: such as more information, zoning tools, political support, state direction, something else?) |
| 8. | Who would be the best source of training and information about CCA?  
(prompt: would it be the state, your RPA, the APA, a university, or another group?) |
APPENDIX B
LIST OF TOWNS INTERVIEWED IN 2014

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Sub-total: 13  Sub-total: 2  Sub-total: 8  Sub-total: 8  Sub-total: 3

Total of communities interviewed in 2014: 36

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* Same towns of 2011
APPENDIX C

LIST OF ALL COASTAL COMMUNITIES IN NE AND NUMBER OF INHABITANTS
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</table>
| Mattapoisett | 6.045 |}

**TP Option 1:**
- 19 communities in CT
- 16 communities in RI
- 64 communities in MA
- 2 communities in NH
- 9 communities total in ME

**TP Option 2:**
- 24 communities in CT
- 20 communities in RI
- 77 communities in MA
- 7 communities in NH
- 108 communities in ME

**Total TP adopting Option 1 criteria:** 110 communities

**Total TP adopting Option 2 criteria:** 236 communities
### APPENDIX D

#### QUESTIONS ASKED IN THE WEB-SURVEY/ RESPONSE RATE PER QUESTION

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<th>Question</th>
<th>Responses</th>
<th>Rate</th>
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<td>Online Survey Consent</td>
<td>155</td>
<td>100%</td>
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<tr>
<td>In what state is your community located?</td>
<td>144</td>
<td>92.9%</td>
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<tr>
<td>What is the population in your community?</td>
<td>144</td>
<td>92.9%</td>
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<tr>
<td>What best describes your professional role in this community?</td>
<td>144</td>
<td>92.9%</td>
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<tr>
<td>How knowledgeable do you feel as a planner about planning for climate change? (EXCLUSIVE FOR PLANNERS – use of the feature “skip logic”)</td>
<td>81</td>
<td>52.26%</td>
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<tr>
<td>What is your age?</td>
<td>138</td>
<td>89.03%</td>
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<tr>
<td>What is your gender?</td>
<td>138</td>
<td>89.03%</td>
</tr>
<tr>
<td>Click below to indicate the number of years that you have worked in:</td>
<td>138</td>
<td>89.03%</td>
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<tr>
<td>Does your local government have one or more full-time staff members who work solely on climate issues (adaptation, mitigation, or both)</td>
<td>135</td>
<td>87.1%</td>
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<tr>
<td>How much have you thought about climate change (CC) before today?</td>
<td>135</td>
<td>87.1%</td>
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<tr>
<td>How much do you think Climate Change is likely to harm coastal communities in general and yours in particular?</td>
<td>135</td>
<td>87.1%</td>
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<tr>
<td>Please indicate how much you agree or disagree with the following statements:</td>
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<td>85.81%</td>
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<tr>
<td>Have the following been challenges when trying to address climate adaptation in your community?</td>
<td>127</td>
<td>81.94%</td>
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<tr>
<td>Many communities follow the steps below as they move forward on a ‘ladder’ of climate adaptation. In what stage of the ladder would you place your community?</td>
<td>127</td>
<td>81.94%</td>
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<td>Please indicate the actions that you have taken as part of your adaptation planning process.</td>
<td>125</td>
<td>80.65%</td>
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<tr>
<td>(continuation of the previous question)</td>
<td>124</td>
<td>80%</td>
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<tr>
<td>Please indicate the extent to which you rely on each of the following groups and organizations for information and guidance with your climate adaptation planning activities.</td>
<td>120</td>
<td>77.42%</td>
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<tr>
<td>What do you need to start moving forward to address climate change adaptation in your local planning?</td>
<td>120</td>
<td>77.42%</td>
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<tr>
<td>(Open ended question) Please, use the space below to briefly describe any issues or opportunities we have not addressed.</td>
<td>25</td>
<td>16.13%</td>
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APPENDIX E

SEARCH THE WEB OR THE LITERATURE FOR INFORMATION (IN PROCESS OR DONE)

Graphics by state and number of inhabitants.
APPENDIX F

SEARCH THE WEB OR THE LITERATURE FOR INFORMATION (IN PROCESS OR DONE) B

In process of doing that or intend to start, by state and size of population.

![Bar chart showing the number of states and size categories for searching web/literature and answering questions.]

- **Massachusetts**: 34 in process, 53 answered
- **Connecticut**: 12 in process, 15 answered
- **Rhode Island**: 12 in process, 13 answered
- **New Hampshire**: 4 in process, 4 answered
- **Maine**: 23 in process, 37 answered

Legend:
- Green: Have searched the web/literature, are in process or intend to start
- White: Answered this question
APPENDIX G

MET WITH LOCAL GOVERNMENT DEPARTMENT
In process of doing that or intend to start - By state and size of population.

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- □ Have met with Local Gov. Dept., are in process or intend to start
- □ Answered this question
APPENDIX H

HAVE NOT FORMED COMMISSION (BY STATE AND SIZE OF POPULATION)

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APPENDIX I

HAVE NOT MOVED HOUSES OR BUSINESS OUT OF VULNERABLE AREAS

Towns separated by state and size of population.
APPENDIX J

HAVE NOT FORMED PARTNERSHIP WITH BUSINESS

Towns by state and size of population.
BIBLIOGRAPHY


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