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Barriers to Municipal Climate Adaptation: Examples From Coastal Massachusetts' Smaller Cities and Towns

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Barriers to Municipal Climate Adaptation

Examples From Coastal Massachusetts' Smaller Cities and Towns

Elisabeth M. Hamin, Nicole Gurran, and Ana Mesquita Emlinger

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.

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 to encourage the development of meaningful climate adaptation action in smaller cities and towns.

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

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 in coastal Massachusetts by interviewing community planners. This approach allows us to assess these issues within different geopolitical contexts but similar legal and governance conditions.

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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 limit local political leadership on the issue and reduce the resources available to planners to address climate adaptation. 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.

Research Literature Framework

Global awareness about the implications of anthropomorphic—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 (Cruce, 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). Adaption 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 adaption 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; Gurran 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 adaption 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).

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 1. Working within one state minimized variation that might be created by state-level policy frameworks. 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

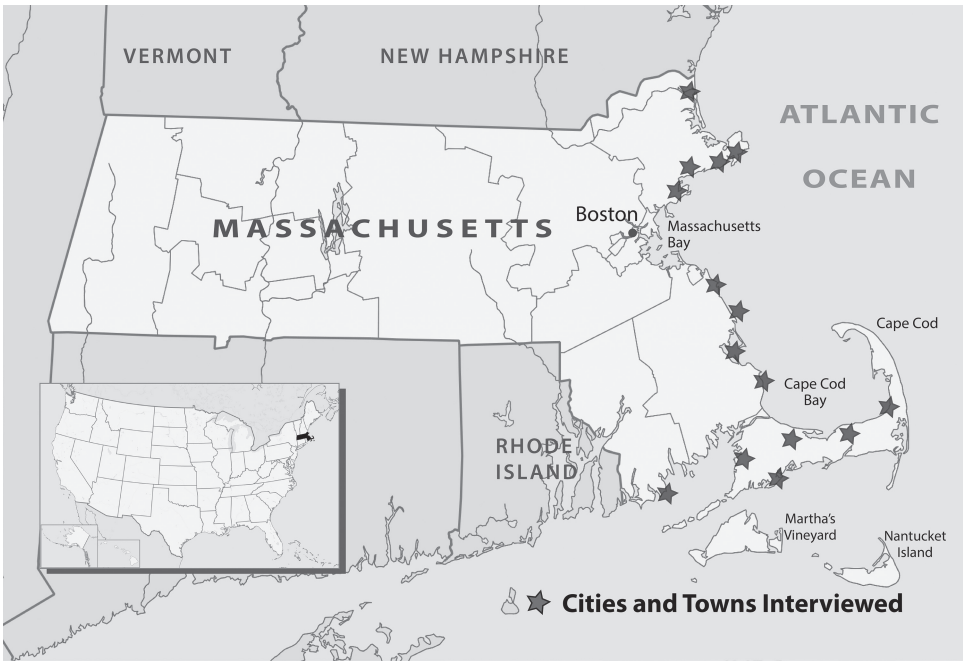

Figure 1. Regional locator.
Source: E. Gong and A. Emlinger.

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,

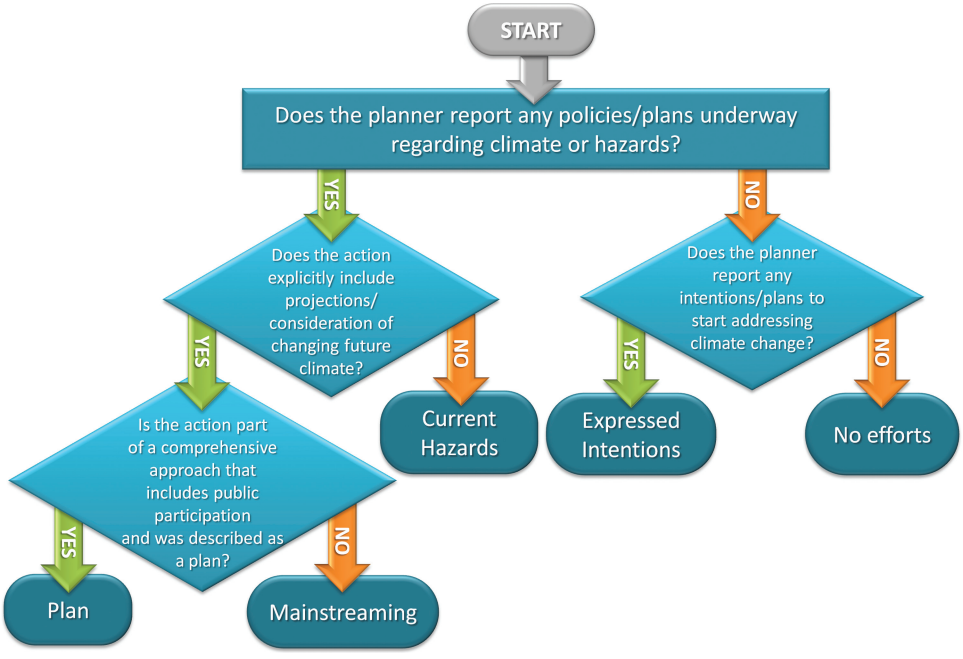

Figure 2. Coding flowchart for adaptation actions.

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). One of the authors and a research assistant dual-coded three interviews 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 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 2.

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 3 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 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.

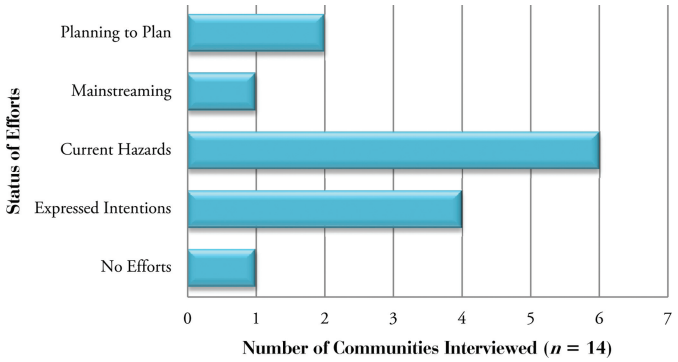

Figure 3. Status of adaptation action.

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.

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

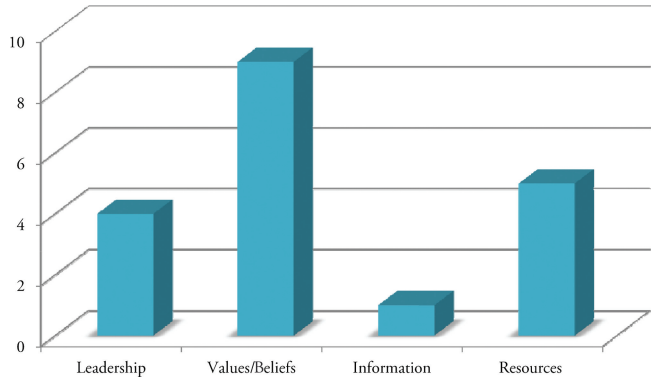

Figure 4. Primary barriers ($n = 14$).

suggested by Moser and Eckstrom (2010). Figure 4 summarizes what planners indicated was the primary barrier they faced, while Figure 5 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.

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.

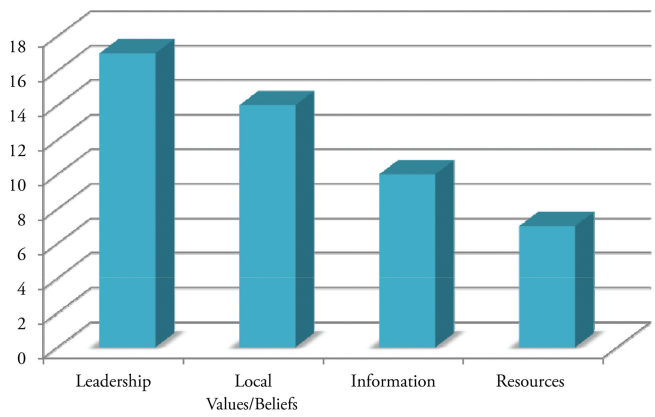

Figure 5. All barriers mentioned by interviewed planners ($n = 14$).

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…. [N]othing'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?

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.

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! . . .[S]ome 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]

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 6 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.

Summary and Conclusions

In this study, we first question whether, and how, our sample of smaller cities are moving forward on climate

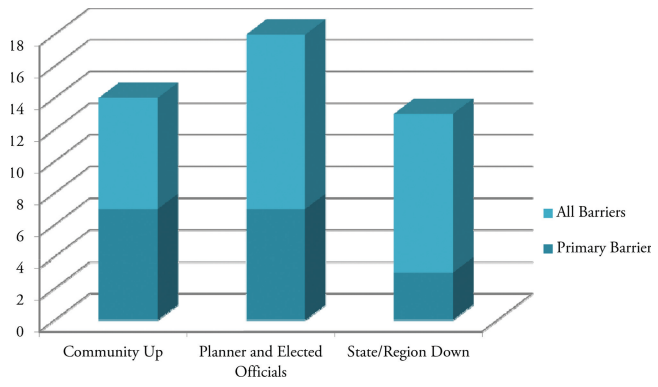

Figure 6. Barriers by institutional locus ($n = 14$).

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 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.

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 sociospatial 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.

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