Coastal States' Climate Adaptation Initiatives:
Sea Level Rise and Municipal Engagement

Todd Schenk and Ona Ferguson

Lincoln Institute of Land Policy
Working Paper

The findings and conclusions of this Working Paper reflect the views of the author(s) and
have not been subject to a detailed review by the staff of the
Lincoln Institute of Land Policy.

Contact the Lincoln Institute and the Consensus Building Institute
with questions or requests for permission to reprint this paper.

Lincoln Institute Product Code: WP12TS1

Abstract

Sea level rise (SLR) is expected to become an increasingly prominent challenge for all levels of government as the climate changes. Complicating matters is the multi-jurisdictional nature of coastal zone management in the United States. Many of the potential measures to reduce the impacts of SLR are in the hands of municipalities, including changing building codes and land-use regulations; maintaining critical infrastructure; and protecting communities from flooding and other risks. Despite their autonomy and responsibility, municipalities will typically rely on resources and guidance from higher levels of government, and will also be subject to the restrictions these higher levels impose. Given the increasing importance of addressing SLR across the US, this relationship between states and municipalities is worthy of consideration.

This paper explores how states and municipalities interact to address SLR, providing an overview of the state of practice, some reasons for different levels of action, and some of the needs of municipalities. We conclude with a set of recommendations for states as they attempt to support municipalities:

- Provide funding and material resources;
- Provide downscaled climate data and easy-to-use information;
- Provide process support;
- Coordinate and provide consistency at the state level;
- Raise the profile of SLR adaptation;
- Instigate and support coordination at the most appropriate level; and
- Tailor responses to the context.

About the Authors

Todd Schenk is a graduate associate with the Consensus Building Institute and a PhD candidate in the Environmental Policy and Planning group of the Department of Urban Studies and Planning at the Massachusetts Institute of Technology. Through CBI, Todd provides trainings and works on public engagement processes, particularly in the areas of climate change and environmental management. Recent projects include providing training on climate change negotiations for civil servants participating in the Arab Water Academy and the preparation of a scenario exercise on hydroelectricity planning in the face of climate change for senior civil servants and other stakeholders in Ghana. Todd coordinates CBI's Local Communities Adapting to Climate Change: Managing Risk in Decision Making course and has produced an online version. In his academic work, Todd is looking at multi-stakeholder approaches to infrastructure planning and management in the face of complex uncertainties, like those associated with climate change. Prior to returning to graduate school, Todd spent five years working for the Regional Environmental Center for Central and Eastern Europe.

Todd Schenk
Massachusetts Institute of Technology
77 Massachusetts Ave., Room 9-316
Cambridge, MA 02139
e: tschenk@mit.edu
t: (617)324-5681

Ona Ferguson is a senior associate at the Consensus Building Institute, a nonprofit dispute resolution organization. Ona has worked for eight years as a facilitator, mediator and trainer in the United States helping groups work constructively together on natural resource and public policy issues. She has worked with groups and organizations on stakeholder, community and interagency dialogues, planning processes, public engagement, negotiations and assessments. Her broad experience includes land use, climate change, coastal and estuary management, Superfund, and organizational and strategic planning. Ms Ferguson also conducts training throughout the country in negotiation, communication and collaboration skills. Ona has a masters degree from the Yale School of Forestry and Environmental Studies.

Ona Ferguson
Consensus Building Institute
238 Main Street, Suite 400
Cambridge, MA 02142
e: oferguson@cbuilding.org
t: (617) 492-1414
f: (617) 492-1919

Acknowledgements

Table of Contents

Coastal States' Climate Adaptation Initiatives:
Sea Level Rise and Municipal Engagement

Introduction

Adapting to the risks associated with climate change is largely a local or regional endeavor, as much of the responsibility for planning and infrastructure lies at this level of government, and this is the level at which the impacts will be contiguous and thus may be most effectively addressed. Furthermore, private landowners typically turn to local government first when their property is threatened. The impacts felt in various places around the world will have much in common, but the particulars of how they will manifest, and thus should be addressed, are more local in nature. Impacts are contingent on local geographical, hydrological, biological and socioeconomic conditions. Furthermore, many options for preparing for and responding to these impacts (adaptation options) fall under the areas of responsibility of regional or local rather than national agencies and actors. For example, most land use decisions in the U.S. are solely within local jurisdictions' control under U.S. federalism. Much of the surface and groundwater, while managed differently from water bounty in the east to water scarcity in the West, is often under the control of regional compacts, differing state laws and regulations, and local water supply and management authorities.

Sea level rise (SLR) is likely to be one of the more prominent consequences of climate change that coastal communities face. Aside from higher water levels inundating low-lying areas, SLR will exacerbate storm surges and spring high tides, and accelerate saltwater intrusion. These changes may threaten coastal developments, infrastructure, ecosystems and freshwater availability. While other species might migrate gradually in response to these changes, human socio-cultural connections to particular places, investments in immobile infrastructure, individual investments in shoreline property and lack of access to alternative locations will make migrating gradually difficult. Furthermore, coastal property owners and communities are accustomed to receiving support—including federal flood insurance and assistance post-disaster—that mitigate the consequences they would otherwise have to pay for developing in high-risk locations.

For people to respond effectively, there will need to be changes in how coastal zones are managed, including how land use is regulated, areas are protected and long-term decisions are made. As noted above, coastal zone management has the added complexity of multiple levels of jurisdiction, involving federal, state and local regulations and agencies (National Oceanic and Atmospheric Administration [NOAA] 2012a). The involvement of multiple actors at various levels may complicate matters at times, but also brings benefits, including additional resources and perspectives. While different states exercise different types and levels of regulatory authority in their coastal zones, they generally need local governments to implement appropriate action and enforce regulations. Furthermore, many states are now advocating for SLR adaptation planning beyond their traditional coastal zones, or areas of responsibility, which often increases tension with and requires the cooperation of local governments.

The fact that the adaptation burden falls significantly on local governments does not preclude action by higher levels of government. In fact, given limited municipal budgets, it seems likely that most municipalities will be dependent upon resources and guidance from national and state agencies to implement effective adaptive measures. To date, the SLR adaptation support offered by such higher-level agencies includes providing data on risks (e.g. detailed coastal maps); making recommendations on how local governments might respond (e.g. building code templates); providing direct technical assistance (e.g. staff time to assist in adaptation planning efforts); and enacting direct mandates (e.g. requiring that municipalities take SLR projections into account when reviewing coastal development plans). Given the strong preference for local control in the U.S. (with the exception of some water issues—for example, flooding under the U.S. Army Corps and navigable waterways under U.S. federal jurisdiction), it is highly unlikely that the federal or state governments will seek or be able to reduce, overtake, or overrule municipalities.

Grannis (2011), NOAA (2010) and Wyman et al. (2010) all offer excellent guidance on how state and local coastal zone managers and other decision makers can effectively prepare for SLR. This paper explores how coastal states and local governments are planning for SLR in practice, paying particular attention to how they interact and possible reasons for variation in types of activity. It examines how states are, and can do a better job of, helping municipalities act. Our focus is the critical relationship between the two levels of government.

We begin by providing a quick overview of our research approach. The second section of the report describes what different coastal states are doing vis-à-vis local governments to prepare for SLR and explores the variation in how SLR initiatives are structured. The third section explores what is driving states and municipalities to take action on SLR adaptation. The fourth section identifies some common needs of municipalities as they begin to address SLR. We conclude this report with a set of recommendations to state agencies working with municipalities on how they might make the most of their relationships. In brief, our recommendations are:

- Provide funding and material resources;
- Provide downscaled climate data and easy-to-use information;
- Provide process support;
- Coordinate and provide consistency at the state level;
- Raise the profile of SLR adaptation;
- Instigate and support coordination at the most appropriate level; and
- Tailor responses to the context.

Methods

In order to learn about how states are engaging municipalities on SLR adaptation, in late winter 2011 we reviewed publicly available reports and websites and began making preliminary inquiries. This initial review provided us with an overview of the state of affairs across all 23 states with ocean coasts.[1]

---

[1] This paper excludes Great Lake states because inland water level projections under climate change are much less certain than those for oceans. In fact, experts predict that water levels may decline in the Great Lakes with climate change (Kling and Wuebbles 2005). U.S. territories are also excluded.

We then selected three states to focus on, California, New York and South Carolina, while seeking to stay aware of work underway in other states. We chose these three states because they all have engaged in sea level rise-related adaptation in one form or another, but are at different stages; are in different parts of the country geographically and socio-politically; and have structured their SLR initiatives in very different ways at both the state and local levels. In these three focal states, we conducted more thorough analysis, talking to people involved in SLR at both the state and municipal levels to gain richer qualitative insights into the nature of the relationship between states and municipalities.

Rather than conducting a broad survey of everything happening in all coastal states, we focused on a limited number of in-depth interviews. This is a dynamic time with many SLR-related activity underway, which means that survey-style reports that are fixed in time become quickly outdated. We recommend regularly updated online resources such as Georgetown Climate Center's Adaptation Clearinghouse (http://www.georgetownclimate.org/adaptation/clearinghouse), the Climate Adaptation Knowledge Exchange (http://www.cakex.org), Climate Central's Surging Seas portal (http://sealevel.climatecentral.org/) and StormSmart Coasts (http://www.stormsmartcoasts.org) for current information about climate adaptation activities around the U.S. In this working paper, we focus largely on emerging trends and challenges we believe may be persistent.

We do not separate out our findings by municipality or state as we have worked to identify crosscutting themes and trends, but we did hold discussions with stakeholders in at least two municipalities or regions within each focal state, plus several in other states. We spoke to people in the San Diego Bay and San Francisco Bay areas in California; East Hampton and Yonkers in New York; and Charleston and Hilton Head Island in South Carolina. In the end, we interviewed 24 people in state and local government, and other related stakeholder groups. The observations, examples and recommendations in this paper are drawn from these interviews, and from the literature review of documents and activities in many coastal states.

II. Status of SLR Activities in Coastal States

Looking across all 23 coastal states, there is substantial heterogeneity in terms of how each is responding to the threat of sea level rise. We postulate that this is because sea level rise is such a new issue on the policy agendas of state and municipal governments. While interesting, this variety makes comparisons difficult. States and municipalities vary on a variety of axes, including:

- What types of action they are undertaking;
- How much they are doing;
- The degree and nature of state–local collaboration;
- How SLR activities are being organized;
- How SLR is being framed as an issue; and
- How states and municipalities are funding their initiatives.

We consider each of these variables as we explore the current status of SLR activities across coastal states. The unique particulars of each jurisdiction's response are important, and it can be difficult to learn what exactly each is doing. For example, if a state does not have an explicit SLR or adaptation program, it would be easy to conclude that that state is doing little, while in fact a great deal could be underway within various agencies. Furthermore, the pace of change in the field of addressing SLR is rapid; many interviewees said their states have reports currently underway or plans to be announced in the coming weeks.

Types of Action

States are engaging in a variety of different activities to both address SLR directly and to support local governments in their adaptation efforts. In some cases, these reflect different priorities identified by municipalities, but for the most part the nature of the support appears to reflect the varied capacities and preferences of state agencies. This may change as states increase their own capacities and have more opportunities to assess needs in partnership with municipalities. Table 1 provides a list of common types of state level activities, and examples of each.

Table 1: State-Level SLR Adaptation Activities

Adaptation Activity	Examples
Collect and provide high-resolution SLR data	Maryland has invested significantly in mapping its coastal environment and makes the data easily accessible to decision makers via an online *Coastal Atlas* tool (http://www.dnr.state.md.us/ccp/coastalatlas).
Provide grants to municipalities for pilot projects	Delaware Coastal Programs is funding the development of coastal resiliency plans in the Town of Bowers Beach and the City of New Castle. Maryland is providing grants to various municipalities for pilot projects.
Provide staff support	In California, San Francisco Bay Conservation and Development Commission (BCDC) staff (state employees) are working intensively with municipal partners to understand the potential impacts of SLR and assess possible response options.
Develop guidance documents and other templates	Massachusetts StormSmart Coasts program provides easy-to-use guidelines, templates and examples for municipal decision makers in different positions, including planning boards, building departments, departments of public works and conservation commissions. For example, it provides planning board members with guidance on how to incorporate SLR adaptation into master planning processes.
Direct regulatory change	California is working to incorporate SLR concerns into its regulatory processes, including the Strategic Growth Council's requirement for planning grant applicants to "Plan for Sea Level Rise, where appropriate, consistent with [the] Ocean Protection Council Resolution on Sea Level Rise and related guidance" (State of California Strategic Growth Council 2011: 25).
Coordinate	The BCDC has played a coordination role in the San Francisco Bay area, bringing together various actors including municipalities. The New York State Sea Level Rise Task Force brought together

	representatives from the range of relevant state agencies and other stakeholder groups, including municipalities, to collaboratively evaluate SLR risks and possible responses.

Municipalities across coastal states are also engaged in a range of activities to address SLR. Table 2 enumerates common activities at the municipal level and examples of each.

Table 2: Municipal-Level SLR Adaptation Activities

Adaptation Activity	Examples
Changing land-use and building codes	East Hampton, New York and Hilton Head Island, South Carolina have both established more stringent setback requirements than required under state and federal law. The Cape Cod Commission's Model Bylaw for Effectively Managing Coastal Floodplain Development provides member municipalities in Massachusetts with an easy-to-adopt regulatory tool (http://nsgl.gso.uri.edu/hawau/hawaut09001.pdf).
Incorporating SLR into planning processes and documents	Chula Vista, California is currently finalizing a Bayfront Master Plan that would, among other things, require coastal development proposals to take 50-year sea level rise projections into account (http://www.portofsandiego.org/chula-vista-bayfront-master-plan.html). Garden City, Georgia is accounting for the more intense storms expected under climate change in their hazard mitigation plans.
Defending shorelines from SLR	Hilton Head Island, South Carolina has an active beach nourishment program to counteract coastal erosion. While this may not be a sustainable solution in the long run, for the time being it prevents or delays the loss of valuable coastal land.
Assessing the vulnerability of infrastructure and taking SLR into account when carrying out projects	The City of Olympia, Washington took SLR projections into account when deciding where to site its new municipal building. Charleston, South Carolina is intentionally elevating roads and other infrastructure in vulnerable areas when they are due for renewal.
Advising citizens and other stakeholders on how to prepare for SLR, and encouraging deliberate action	A storm surge visualization tool is available via Google Earth to residents and other stakeholders in Hull, Massachusetts. Furthermore, the municipality provides a $500 freeboard incentive credit to developers and residents that elevate their homes at least two feet above the highest state or federal requirement (http://www.mass.gov/czm/stormsmart/pilots/hull.htm).

Tables 1 and 2 depict an overview of the types of action underway today. In the rest of this section, we provide more descriptive examples.

Maryland is investing significant resources into providing technical data on the projected impacts of SLR. They are generating high-resolution Light Detection And Ranging (LIDAR) maps to help communities identify coastal hazards, providing training and technical assistance to help communities use this information and address risks, and making grants available so communities have the resources to successfully implement their plans (Maryland Department of Natural Resources 2012). The implicit assumption behind Maryland's focus on providing high-resolution and easy-to-use coastal data is that more precise scientific information will engender better responses on the part of municipalities. Worcester County Maryland used the data to generate a coastal inundation model that is helping the county make wiser planning decisions and informing their comprehensive planning efforts. The county has proposed response options ranging from *rolling easements* to *elevating and floodproofing* vulnerable infrastructure (Worcester County, Maryland 2008).

In California, CalAdapt (http://www.cal-adapt.org) serves a similar role as a one-stop clearinghouse for climate change data, including easy-to-use SLR maps. The North Carolina Office of Geospatial and Technology Management Floodplain Mapping Program is also focusing on data collection and is currently engaged in a technical Sea Level Rise Impact Study (http://www.ncsealevelrise.com). In this case, the emphasis is on providing better data to state coastal managers, with coastal communities identified as a secondary audience.

Many states are operating grants programs with selected pilot communities. Maryland has given grants to eight coastal communities and counties, including Worcester County, to support SLR-related work, and another round of granting is currently underway (Maryland Department of Natural Resources 2012). The Delaware Coastal Programs office has been working intensively with the Town of Bowers Beach and City of New Castle (Delaware Coastal Programs 2011). Funding has been made available to California communities via the Strategic Growth Council's Sustainable Communities Planning Grants program. For example, Hermosa Beach received support to revise and integrate its General and Coastal Land Use Plans with the goal of "advance[ing] sustainability and build[ing] resiliency into a tourism-dependent coastal city that can serve as a model for others" (Strategic Growth Council 2012: 5). These pilots both assist the communities directly involved and provide useful insights to both the state and other communities as states scale up their efforts and more municipalities tackle SLR-related challenges.

Some coastal states activities include the provision of guidelines and templates. Massachusetts is focused on providing local government officials with the regulatory and planning tools they need to prepare for SLR. The Office of Coastal Zone Management tailors the information if offers—which ranges from to zoning overlay recommendations to guidance on how to retrofit critical infrastructure—to various groups, including elected officials, conservation commissioners, members of boards of health and public works department employees (Massachusetts Office of Coastal Zone Management 2012). They also provide case studies profiling Massachusetts communities. An Adaptation Policy Guide for local and regional stakeholders is also under development in California (California Resources Agency 2011).

While few jurisdictions have implemented policy changes to address SLR to date, this is becoming an increasingly common form of action. The San Francisco Bay Conservation and

Development Commission (BCDC) modified their policies so shoreline projects are required to conduct engineering analyses that take not only current flood risks into account, but also potential future (increased) risk with SLR (San Francisco Bay Conservation and Development Commission 2011). This is a policy imposed by this state agency in the narrow 100-foot band of coast over which it has jurisdiction. Some have proposed the formal incorporation of SLR into the California Environmental Quality Act (CEQA) project review process, but this would certainly face legal challenges, as have previous ad hoc attempts to incorporate SLR into project review. For example, in Ballona Wetlands Land Trust v. City of Los Angeles, the courts ruled that CEQA is intended to assess the impacts of projects on the environment and not the other way around (Abbott 2011).

At the municipal level, Chula Vista, California, is institutionalizing SLR into their bayfront planning process, requiring coastal development proposals to take 50-year sea level rise projections into account. This is not dissimilar to traditional requirements that 100-year floodplains be accounted for in various aspects of planning. Other municipalities are incorporating SLR issues into their hazard mitigation and disaster response planning. Garden City, Georgia, for example, is planning for category 5 hurricanes rather than the traditional category 3 in light of climate change and SLR. New York State is helping municipalities to incorporate climate change adaptation into their comprehensive planning efforts rather than championing stand-alone adaptation planning processes.

State agencies can play an important role in coordinating both state and municipal-level activities to address SLR. Beyond institutionalizing regulatory changes within its legal jurisdiction via the 2011 update to the Bay Plan, the BCDC is working with municipalities in the San Francisco Bay area to plan for an uncertain future. Progress requires action at the regional level, and the BCDC has led the way by coordinating meetings, compiling data and managing multi-stakeholder processes. An example of this is the ongoing Adapting to Rising Tides (ART) project, which is working with agencies and organizations along the Alameda County shoreline to help them understand how SLR and storm events may affect the assets that they plan for and manage. This is a nonregulatory, collaborative effort that BCDC has convened and continues to shepherd.

New York's Climate Smart Communities program (http://www.dec.ny.gov/energy/50845.html) is a partnership coordinating action among local communities and five state agencies that includes a SLR adaptation component. The New York State SLR Task Force and the interagency work group on adaptation were two other venues in which agencies and other stakeholders coordinated and jointly planned SLR adaptation activities.

Some municipalities are already taking concrete measures to address SLR and protect their shorelines out of necessity. Hilton Head Island, South Carolina has an ongoing beach nourishment program to counteract significant coastal erosion. Charleston, South Carolina is relocating drainage channels and elevating infrastructure when it has the opportunity. Many Gulf Coast communities have freeboard requirements in their building codes, meaning that new homes must be elevated above ground to prepare for future flooding. Olympia, Washington took SLR projections into account when it constructed its new municipal building.

Degree of Action

In addition to the wide variety in the types of action taken by state and municipal bodies, different states and municipalities are engaged in SLR adaptation to significantly varying degrees of intensity. Some states and local governments are engaged in very elaborate processes generating tangible policy change. Other governments' activities are more general or aspirational in nature, identifying SLR as a potential problem that will need to be addressed at some point. Others continue to ignore the problem all together.

Of the three states we focused on, California is farthest along with impressive efforts underway along the coast, particularly in the San Francisco, San Diego and Los Angeles areas. All three regional efforts involve various actors from state government agencies, local municipalities and other stakeholder groups. These multi-scale efforts feed off of and make action at other levels possible. For example, the San Diego Bay effort has produced higher resolution maps of coastal areas and wetlands than were previously available, giving municipalities both the technical information to make more precise decisions, and the political cover they need to do so. As mentioned previously, Chula Vista, California used this information and the momentum from the San Diego Bay effort to substantially change how they regulate development along the coast.

While SLR adaptation actions have not coalesced in New York State and South Carolina to the same level as those in California, extensive sea level rise adaptation initiatives are underway, with people in each state working on data collection and analysis, developing guidance documents, and considering regulatory changes. An example of the robust foundations being laid is the ClimAID Integrated Assessment for Effective Climate Change Adaptation in New York (Rosenzweig et al. 2011a). An impressive group of researchers from different fields, including coastal zone management, public health, transportation energy and agriculture, explored the likely consequences of climate change on the state in various areas and identified potential adaptive measures to address these challenges. For example, the project developed maps to illustrate potential changes in flood zones for portions of the New York coastline under climate change. A variety of strategies, including land buyouts or swaps to encourage movement out of flood-prone areas, are proposed as solutions.

Municipalities in New York and South Carolina are also engaged in different levels of activity. Hilton Head Island, South Carolina has implemented more stringent setbacks than required under federal and state law. Charleston, South Carolina is implementing various measures to mitigate the impacts of flooding, including encouraging more creative design standards in at-risk areas. New York City is a world leader in the climate change adaptation arena, including on sea level rise; a great deal of research has been conducted and tangible planning changes are underway (Rosenzweig et al. 2011b). The state seeks to learn from and coordinate closely with the City's efforts. More than one interviewee noted the difficulties other municipalities in the state will face in trying to match New York City, given its significant wealth, access to top-level academics and other professionals, and supportive mayor (who has made adaptation planning a priority).

Other states and municipalities across the country are at various stages in taking up the sea level rise challenge. Leaders beyond those in New York, California and South Carolina include

Maryland, Hawaii, Washington State, King County (Washington), Miami-Dade (Florida) and Broward County (Florida).

Some states that are not promoting their SLR adaptation activities widely may none-the-less have substantial work underway, as is the case in Georgia. We conclude from our research that despite being quite vulnerable to sea level rise and storm surge-related disasters, Alabama and Mississippi are the only states with virtually no sea level rise-related work at the state level, and there is very little activity underway in Texas and Louisiana (Center for Climate and Energy Solutions 2011; Schutze 2012; Twilley et al. 2001).[2]

An important factor associated with the degree of action a state is taking is the length of time over which it has focused on SLR. Maryland's efforts have been underway for more than a decade, with a Sea Level Response Strategy released in 2000. Worcester County modeled its SLR inundation in 2006. Georgia's programs are, on the other hand, in their infancy and thus little information or concrete outcomes are available at this time. That being said, there are other key factors associated with the degree of action, and we should not assume that all states are on a trajectory of ever increasing SLR adaptation activity. The reasons why states are more or less active are explored in more detail in the next section of this report, but include the degree to which they are already feeling the impacts, leadership, the political and legal environment, and the availability of financial and technical resources.

Action at Various Levels of Government

Another axis along which SLR adaptation efforts can be considered is the degree of state involvement vis-à-vis the degree of local government action. In other words, to the degree that there is action within a state, which level of government is leading or ahead in addressing SLR? At one end are states with agencies directly implementing SLR adaptation measures that impact local decision making, and at the other are local governments acting in the absence of state involvement.

Connecticut's efforts include engaging municipalities as partners, but focus on how state-level regulations can be changed to foster more robust adaptation. Towards the same end of the spectrum, state agencies in California, including the BCDC and the California Coastal Commission, are exerting their regulatory oversight mandates to advance SLR adaptation planning and have clearly taken a leadership role.

In contrast are states in which municipalities rather than state governments are at the forefront of SLR adaptation. In Florida, for example, though state efforts are underway, they are less comprehensive than those of many of their coastal municipalities. The Southeast Florida Regional Climate Change Compact, a partnership between five counties, generated its own technical Unified Sea Level Rise Projection for the region and recently released a draft Regional Climate Change Action Plan (Southeast Florida Regional Climate Change Compact 2011; 2012). The Action Plan provides concrete recommendations about how partner municipalities can

---

[2] While there appears to be a dearth of action at the state level, it is important to note that federal (US Army Corps of Engineers 2012), local (City of Biloxi 2008), and research/academic (Yoskowitz, Gibeaut and McKenzie 2009) activities are underway in these states.

respond to SLR, including the identification of "adaptation action areas" and strategies for mitigating risks and losses. Virginia is in a similar situation, with little state-level action, but a group of coastal communities proceeding with the support of local universities (through Sea Grant) and Federal agencies.

The scale at which SLR adaptation measures are being implemented also varies. Louisiana is focused primarily on site-level planning, providing recommendations on how building codes can set standards like minimum elevation (i.e., freeboard) to provide more protection from SLR, and on what developers can do in the absence of regulation. (See http://coastal.cpex.org/.) This reflects the assumption that most efforts in Louisiana will be voluntary in nature, given the lack of a strong SLR program in the state and predisposition to give private landowners maximum choice in land use decisions.

Organizational Alignment

A single dominant format or mode of organization has not yet emerged for the management of SLR. In other words, there is significant heterogeneity in how different states, regions and municipalities are integrating adaptation efforts into their planning and decision making, and how they are funding these programs. The ways in which different governments approach other environmental problems are not always the same, but there is typically more consistency across jurisdictional lines than we see for the management of SLR, perhaps because agencies have had more time to figure out their approaches to handle those other topics while SLR is still such a new challenge.

 At the state level, adaptation efforts are being driven by and funded through different types of agencies, which influences the actions being taken and their efficacy. In New York State, the prime actor in the SLR adaptation realm is the Office of Climate Change within the Department of Environmental Conservation (DEC). While other agencies—particularly the Department of State, which administers the Coastal Zone Management Program and works on land use-related activities—might have been equally logical homes, this placement in the DEC was based on DEC's pioneering efforts on greenhouse gas mitigation. The DEC is subsequently partnering with other agencies actively working on SLR, including the Department of State, the State Office of Emergency Management, and NYSERDA. The DEC has made significant efforts to engage these agencies, and other actors, including municipalities, to coordinate efforts that are happening across the board via the New York State SLR Task Force (2008–2010) and the interagency work group on adaptation. In California, the Governor's Office of Planning and Research (OPR) is a key player in climate change adaptation planning, sharing information with municipalities and working with other state departments and agencies. This is valuable, as OPR is used to working with other agencies to advance policy and practice in municipalities. It also signals that this is an important issue to the governor himself.

There may be a risk that placing SLR in one department leaves other agencies with a sense that adapting to SLR is someone else's responsibility. SLR can, for example, be marginalized as a purely environmental issue. Local transportation infrastructure managers might not instinctively go to an environmental agency when wrestling with SLR-related problems. That being said, the effectiveness of a state SLR adaptation program depends in part on how influential and

connected the coordinating department is, and how much others are involved. As mentioned previously, the DEC in New York is working hard to involve other relevant agencies.

Success also depends on how connected the coordinating agency is to other actors beyond state government, including municipalities, and how it is perceived by them. The DEC in New York is a relatively powerful agency with regional offices that often have strong relationships with local planning staff, which makes it comparatively easy for them to provide support. One interviewee noted that while he is unfamiliar with the official SLR work underway by the State, the local DEC office has been helpful in providing his community with tangible advice on SLR issues.

At the municipal level, different departments are tackling sea level rise, although planning departments are the most common home. This is logical given the strong relationship between land use-related decisions and sea level rise. It is less clear how many municipal experts and decision makers in other areas are wrestling with SLR; we think it is possible that there is much room for learning in areas like wastewater treatment that may also be impacted by SLR.

Three of the most successful sea level rise adaptation efforts, all in California, occur at the regional level (in the San Francisco Bay, San Diego Bay and Los Angeles areas). Addressing sea level rise at the regional level is seen as appropriate because most of the impacts will be regional in scope, and most of the solutions will require cooperation across political boundaries. Regional cooperation also allows for the sharing of resources, which is particularly important for small municipalities and those that might not otherwise act due to resource or political constraints. It is notable that regional rather than statewide cooperation is particularly appropriate in a state as large and geographically diverse as California.

Interestingly, the group driving the process in each of these three California cases is unique. In the San Francisco Bay area, the BCDC, a regional state agency, has taken the lead in advancing adaptation policy, working closely with a variety of actors including municipalities. In San Diego Bay, the effort has been coordinated and supported by the San Diego Foundation, a private community foundation. In the Los Angeles area, UCLA has played this role. Each approach brings advantages and disadvantages. For example, while the BCDC brings conventionally legitimate power and state-level resources to the table, their Bay Plan policy update caused fear among some municipalities that the Commission was attempting to seize more regulatory authority.[3] In contrast, no one is concerned that the San Diego Foundation is attempting to assume any official control, and the Foundation provides private resources at a time when all levels of government are fiscally constrained. Academic institutions can also play an important role. Aside from UCLA's efforts in Los Angeles, the University of Washington has been a linchpin in climate change adaptation efforts in that state, collaborating with both state-level agencies and municipalities.

---

[3] It is notable that this fear is no longer an issue in subsequent efforts, including the ART project, which are voluntary in nature, supporting municipalities and other stakeholders rather than focusing on regulatory change.

Framing the SLR Issue

Another variation across states is how the issue of SLR is framed and described. Some deliberately avoid the word *climate* in their work. Instead, SLR initiatives are framed as hazard mitigation, or as means to address current challenges. Many southeastern states, like Georgia and North Carolina, are couching the issue in hazard mitigation terms and addressing SLR through Emergency Management offices. This framing allows professionals to proceed with the work that needs to be done, but may be potentially restrictive when it neglects future but as yet unfamiliar threats or levels of risk. For example, SLR may be a long-term phenomenon that emergency managers take into account, but avoiding the climate change element may exclude scenarios in which SLR accelerates due to, for example, glacial melting. Focusing on SLR as a current hazard may also downplay long-term threats that are not yet significant.

While hazard mitigation is an inherent part of managing SLR, this explicit emergency management framing is not consistent across all states. Others, including Maryland, New York and Massachusetts, are explicitly recognizing SLR—and the uncertainties associated with it over the medium and longer terms—as an issue and are framing their responses in terms of coastal zone management. These states typically place primary responsibility for action under natural resource management departments.

Sources of Funding

There is also significant heterogeneity in how SLR initiatives are funded. Sources include state government budgets, existing state granting programs, the federal government (primarily via NOAA), municipal budgets and private foundations and organizations. Funding for New York's program comes in part from the New York State Energy Research and Development Authority (NYSERDA), a public benefit corporation engaged in research and development, education and other projects in the areas of energy efficiency, renewables and environmental protection. NYSERDA is relatively well funded via, among other sources, levies on utility bills and Regional Greenhouse Gas Initiative (RGGI) funds. The organization's climate research is mostly funded from the latter source. This gives them stable funding while other agencies are forced to cut their budgets. However, NYSERDA-funded adaptation initiatives are dependent on project-by-project grants from the organization, awarded in cooperation with the state's Department of Environmental Conservation (DEC) and other partners, which may be less stable than more direct funding from the state budget over the long run.

In most states, SLR adaptation programs are funded at least in part through National Oceanic and Atmospheric Administration (NOAA) coastal zone management program grants. For example, the BCDC's ART project received a $140,000 NOAA Coastal Services Center grant. A related pilot project examining the vulnerability of the sub-region's transportation network received a $300,000 grant from the Federal Highway Administration. Overall, many states depend on grants from the federal government to fund their state-level programs. Again, this is a viable funding source but does involve uncertainty as money is awarded through time-limited grants.

In a few cases, private foundations are funding initiatives. The San Diego Bay effort, which is being supported by the San Diego Foundation, is a prominent example. Universities and research

institutions are also putting resources into supporting efforts, as is the case in Los Angeles, with UCLA taking a major role.

III. Why States and Municipalities are Taking Action

Some interviewees marveled at how fast things are changing on the SLR adaptation front. One stated that she is optimistic after seeing what has happened in California in the last five years. Others are more guarded, noting that very few places—none in already hard-hit South Carolina, for example—have actually made really difficult decisions like mandating planned retreat from the coast. They say that once action like that becomes necessary, opposition to SLR adaptation activities is bound to become much more significant. In that sense, this period may be the *calm before the storm*, as SLR adaptation options like stricter building codes and zoning changes emerge but have rarely been implemented thus far so have not instigated significant opposition.

Another interviewee put the current state of affairs in perspective by noting that many changes, even in his forward-looking municipality, need not be made today. The goal instead is to institutionalize the SLR issue so that as new developments are approved and infrastructure built, SLR is taken into account. No one is going to demolish existing buildings to build foundations two feet higher, but new construction may be built higher at relatively little cost. Because the pace of change in the urban environment is slow, decision makers need to start taking SLR projections into account today, so that the pace of response can match.

Given this context of varied levels of response described above, we asked: What is driving SLR onto the agenda in some places and holding it back in others? Four drivers seem to largely explain why some states and municipalities are progressing with SLR adaptation while others are not: The presence of events or impacts that may be associated with climate change; the presence of strong leadership from above; conducive political and legal environments; and the availability of resources.

Feeling the Impacts Today

Not surprisingly, communities and states that are already experiencing the impacts of SLR are typically taking some sort of action. South Carolina is already facing many sea level-rise related threats, whether or not they are directly related to climate change, including significant coastal erosion in barrier island communities like Hilton Head Island; subsidence, rising water levels and associated flooding in some areas, most notably Charleston; and severe tropical storms. Most interviewees in the state emphasized that they are focusing on addressing problems already being felt by their communities, which makes action not only easier politically but also necessary. Those focused on these issues are aware that future climate change may exacerbate their challenges and make the solutions currently being applied insufficient, but their point of departure is managing today's problems.

In this paradigm, the challenge for those managing SLR adaptation is to adequately reflect on and make decisions about when to change strategies in light of changing conditions. For example, Hilton Head Island must replenish its beaches more and more frequently; at what point

should decision makers consider alternatives like planned retreat? Similarly, people in East Hampton, New York are acutely aware that the town is in a vulnerable spot at the end of Long Island, and thus they may have to make hard decisions in the long run about what to protect and what to let go. The question of who is feeling the impacts versus who will pay for adaptive measures is also important here. One interviewee noted that it is easier for communities to proactively advocate for more expensive SLR adaptation options when they will be paid for in large part by higher levels of government.

Even if coastal communities are not feeling the impacts of SLR directly, the indirect impacts of changes in insurance maps and rates can be substantial. Many communities on barrier islands and in South Florida, for example, have seen the number of companies willing to insure landowners decline or raise their rates substantially in recent years. Conversely, achieving a better rating in the Federal Emergency Management Agency Community Rating System is a major driver of activity for many municipalities, as it can lead to substantial National Flood Insurance Program premium reductions (FEMA 2006). Better ratings are achieved by implementing some or all of the public information and floodplain management activities proposed by FEMA.

In contrast, places not yet feeling the impacts of SLR are generally less motivated to take action. Much of coastal New York, for example, has not experienced a major storm in decades and thus SLR is typically not an issue high on many stakeholders' agendas. Hurricane Irene threatened the area in 2011, disrupting life and briefly reminding citizens and decision makers of the region's vulnerability to SLR, but left coastal New York largely unscathed.[4] However, history is not a good predictor of current or future risk, particularly in light of the dynamic and uncertain nature of climate change. Forward-thinking New Yorkers realize this and are advancing SLR adaptation planning efforts, but getting important decision makers and others behind such efforts takes more work than if the risks were immediately apparent. Many interviewees reflected grimly that there is nothing like a natural disaster to draw attention to an issue, while acknowledging that ideally planning would anticipate both disaster events and gradual SLR rather than waiting for crisis and reacting.

Strong Leadership

Leadership from the highest levels of state and local government is often seen as integral to the initiation and subsequent success of adaptation efforts. Various interviewees in California cited the strong vocal leadership of both Governors Schwarzenegger and Brown as a key reason for the initiation and support of their adaptation efforts. Given the resource constraints many states and municipalities are facing, it can be problematic when there is limited or no gubernatorial or legislative leadership. Raising the profile of SLR requires getting the voluntary attention of civil servants across various government agencies at both the state and local levels that are already strapped for time and resources handling other issues. To get their attention often requires some high level signals about the need to prioritize this issue.

---

[4] While Hurricane Irene was one of the worst natural disasters in New York state history, its impacts were, largely inland rather than coastal.

Stakeholders across government are far more likely to engage and devote limited resources to this issue when encouraged by top leaders, like governors, to do so. In contrast, negative signals like the restrictions on explicitly using SLR projections in planning recently proposed in the North Carolina state legislature put a damper on adaptation activities (Ross 2012). Similarly, when more climate-skeptic Governor Rick Scott succeeded Charlie Crist in Florida, there was a steep decline in SLR work at the state level. That being said, many municipalities, counties and regions in Florida are proceeding with SLR adaptation planning in the absence of state support because they are already feeling the consequences of climate change and want to take action before conditions get worse (Southeast Florida Regional Climate Change Compact 2012).

Leadership on this issue does not have to come from the very top to be effective. The BCDC effort in the San Francisco area is an example of the powerful role a regional state agency can play in instigating action on the part of municipalities and other local actors. While many bay-area communities are now advancing on their own and in other cooperative arrangements, several are still benefitting from the BCDC's leadership and coordination. Interestingly, many engaged with the BCDC initially out of fear that the organization was attempting to expand its authority via its Bay Plan update. The BCDC had to defend their objectives and clarify that they had no plans to expand their jurisdiction, but these interactions started dialogue and motivated some municipalities to proactively engage out of fear that they could lose authority to the BCDC later. The BCDC has now stepped back from focusing on regulatory change, but is still a critical leader in the region in terms of data provision, technical support and thought leadership. For example, the BCDC is working with agencies and organizations from a portion of the Bay shoreline on SLR and storm event vulnerability and risk assessment, which includes taking an in-depth look at governance and equity in the context of SLR.

Supportive Political and Legal Environments

Political dynamics also influence the extent and nature of state and municipal efforts to address SLR. A cursory examination of the state of SLR planning suggests that more politically conservative states are less active in addressing SLR than more liberal states, possibly because of widespread skepticism about the existence of climate change. Political affiliation and belief in climate change correlate highly in America (Borick and Rabe 2012). Alabama, Mississippi, Texas and Louisiana are the only coastal states with essentially no SLR adaptation activities and are also among the most politically conservative states (Jones 2010). As mentioned above, Florida's SLR efforts were greatly reduced when more conservative Governor Rick Scott succeeded fellow Republican but more moderate Charlie Crist. Similarly, Virginia's state-level efforts were pared back after Republican Bob McDonnell succeeded Democrat Tim Kaine as governor in 2010.

The inverse correlation between how conservative a state government is and how much attention it is paying to climate change is not absolute. South Carolina, for example, is one of the most politically conservative states and yet has a relatively advanced SLR program (Jones 2010). This is in stark contrast to the aforementioned legislative attempts to restrict work on SLR in neighboring North Carolina, which is generally less conservative (Ross 2012).

Many states in which explicit talk of anthropogenic climate change is less politically palatable get around this challenge by couching SLR threats in the language of hazard mitigation and disaster preparedness, as noted above in the framing discussion. Georgia, for example, is actively working with municipalities on "long-term hazards planning." These states often avoid talking about the likely causes of SLR while addressing the issue, featuring current trends rather than long-term climate projections to indicate the need for action. That being said, in its nascent planning efforts, Georgia is using maps with explicit SLR projections. Georgia is also focusing on voluntary efforts and preparedness rather than regulatory change under the belief that municipalities and individual landowners should be provided with the best possible data and advice so they can make good decisions. While the political will is absent for strong state mandates, "post-disaster redevelopment planning" processes are underway so that if and when the status quo is disturbed, municipalities and individual landowners will have the scientific data and regulatory ammunition necessary to make better decisions about where and how to rebuild.

Legally, many states and municipalities are advancing their SLR efforts under the auspices of their coastal zone management programs, which give them authority over their coastal zones.[5] An example is the aforementioned new requirement that future flooding risks under SLR be taken into account at the project level in the coastal zone under the BCDC's authority. Similar requirements are being institutionalized in Maine and Rode Island. States are typically limited in how much they can do under the coastal zone management regulations, as their zones are often narrow and home rule, aversion to conflict with local municipal governments and the need to work at a local scale (because of the particularly local nature of impacts and potential responses) prevents them from going further.

Legal precedence can also restrict the types and degree of action taken to prepare for SLR. South Carolina has implemented some regulations around building in the coastal zone, but some doubt the strength of these regulations. One interviewee identified fear of further lawsuits and drawn-out legal challenges as a hurdle after the state lost a seminal case over their right to restrict development in the coastal zone (Lucas vs. South Carolina Coastal Council 1992). Similar legal challenges have restricted progress in other states, including Delaware. Further complicating matters, interviewees noted that the property rights movement has been growing in recent years, and that it can be daunting for small municipalities to face off against politically organized opponents, particularly in wealthy communities in which the landowners have lots of resources.

Decision making authority is another key parameter within which adaptation decisions are made. Municipal planners face the challenge of generally not being decision makers. Professional staff may foresee SLR-related problems and make certain recommendations, but getting volunteer planning boards made up of local citizens to take these warnings seriously and make difficult decisions such as denying building requests in vulnerable zones can be difficult. One planner lamented that it can actually be hard to get the planning board to deny approval of inappropriate applications. Planning board decisions are made in the face of local politics and the reality that in small communities people may not want to say no to their neighbors' proposals. Planning boards

---

[5] Each state defines its coastal zone differently (see NOAA 2012b). Some, like California, only include narrow strips of land along the ocean. Others, like Delaware, include the entire state. Georgia uses existing political boundaries, including "the 11 counties that border tidally-influenced waters or have economies that are closely tied to coastal resources".

also may not want to hurt their near term tax base by discouraging development. Some communities are also concerned that SLR initiatives—whether new hard infrastructure like seawalls, soft responses like organized retreat, or simply requiring new structures to be elevated—will change the historical nature and appearance of communities. For better or worse, these political, social and economic realities are influential factors in decisions affecting the exposure of development to coastal hazards and SLR impacts.

Despite these challenges, some municipalities are voluntarily going beyond state regulations. Hilton Head Island South Carolina has, for example, set stricter setback requirements. In San Francisco Bay, the BCDC and its municipal partners have been wrestling with what will happen as coastal zone boundaries shift under SLR; the areas over which they have regulatory authority may change as the coast moves.

Availability of Financial and Technical Resources

Financial and staffing levels also influence governments' inclination and ability to address SLR. In today's economic climate, resource constraints are a significant challenge restricting progress. Municipalities are already strained under the weight of managing their day-to-day operations and so have very limited staff capacity to start thinking about SLR. Communities that might otherwise take up SLR but do not have the resources to do so are in a bind and often cannot proceed effectively.

In other places, the availability of new resources has served as an incentive for taking up the SLR issue. For example, many San Francisco Bay area communities got involved when the BCDC started its ART Project (a pilot effort to work collaboratively with cities to conduct a SLR vulnerability and risk assessment) and provided a structure for them to participate, along with technical support and staff time. East Hampton, New York, is building its SLR activities on a strong foundation of a well-funded and well-managed natural resource management program at the municipal level. As mentioned previously, Maryland has provided grants to eight coastal communities and counties to support SLR-related work, helping these communities to advance their adaptation agendas (Maryland Department of Natural Resources 2012).

<div align="center">

IV. Needs of Municipalities

</div>

In our research, we identified a range of things municipalities need for effective action on SLR at the local level, most of which emerged numerous times throughout the interview and literature review process. While this paper revolves around the state-municipality relationship, we acknowledge that the federal government, foundations, academic institutions and other organizations also can and do play significant roles in meeting these municipal needs.

a. Funding and Material Resources

One of the most significant needs identified is funding and resources. Municipalities report that they are extremely stretched these days—with revenues falling in light of the recession while costs rise—and need financial and/or technical assistance if they are expected to take up any

additional activities beyond the ones currently on their plate in order to address SLR. Municipalities fear new "unfunded mandates" from states.

From the state side, there is concern that there are insufficient funds to allocate in these fiscally challenging times. Many would like to see available funding go into pilot projects to fund those communities most likely to implement successful and groundbreaking projects. These pilot projects then offer lessons to state agencies developing guidelines and to other municipalities. As mentioned previously, Maryland has funded a set of sea level rise adaptation-related projects at the municipal level that are intended to provide examples of what other municipalities might do. Similarly, New York State is awarding funds to municipalities via a competitive granting process. The risk with pilot projects is that they occur only because of the extraordinary resources made available and so other municipalities could be unable to replicate their success. On the other hand, it will likely be easier for others to follow the clear and effective paths identified by first movers through trial and error, making external support less necessary.

Evidently, some states and municipalities are finding money for this work even in austere times. As mentioned previously, funding for New York State's program is coming through its energy research and development agency (NYSERDA), which is getting funds from the Regional Greenhouse Gas Initiative. Many other states, including South Carolina, are using NOAA (i.e., federal) funding.

Many SLR efforts are being taken up by ad hoc groups and funded through limited-time grants rather than being institutionalized into state and local governments and funded as ongoing budget line items. This situation may be desirable in these early stages as cross-agency coordination is necessary and budgets are stretched, but could prove challenging in the long run should SLR initiatives fail to be fully integrated into ongoing planning, decision-making and funding regimes. Stable long-term funding is a major need.

Flooding and storm damage can have very real impacts on communities, financial and otherwise, including higher emergency management and infrastructure provision costs, depressed real estate values and poor environmental quality. Emphasizing coastal resilience has multiple benefits to communities that can be leveraged both to find funding and justify expenditures. SLR adaptation can be integrated with other programs, including regional economic development, hazard mitigation and Smart Growth Act programs.

b. Locally-Specific Climate Data

Global climate change models are not very useful to municipalities as they grapple with the local impacts of SLR. Municipal officials want localized (i.e., downscaled) climate data relevant to their communities that they can understand and use. Some states, like Maryland, New York and California, are making substantial investments to develop and provide easily accessible and highly accurate sea level rise data. This often takes the form of high-resolution LIDAR maps, which can typically show elevations at an accuracy of 30 centimeters or better with 95% confidence (NOAA Coastal Services Center 2012). Academic institutions can and do also play a role in providing data. For example, San Diego State University and the Scripps Institution of Oceanography at UC San Diego have been major sources of data for the adaptation planning

process in that region. Similarly, the New York City Panel on Climate Change is comprised largely of representatives from local universities. Many interviewees spoke of the benefits of capitalizing on local expertise when it is available. It would be interesting to delve more deeply in the future into the question of the degree to which local advances in SLR adaptation are dependent on relationships with trusted academic institutions or individuals within a region or area.

c. Templates and Easy-to-Apply Models

Many municipalities lack the technical capacity internally or the resources to hire external experts to translate SLR issues into regulations from scratch. Those that would like to implement policies indicated that having model regulations and ordinances would be helpful. The creation and implementation of new policies seems far more likely if municipalities are given easy-to-use guidelines that they can adopt more or less as is. Municipalities also need assistance identifying opportunities to include SLR into existing planning processes. For example, Yonkers, New York is currently redoing its hazard mitigation and disaster preparedness plan. Such an occasion provides an opportune time for a state agency or local partner to bring up the SLR issue. The FEMA-approved 2011 New York State Multi-Hazard Mitigation Plan clearly calls on municipalities to take SLR into account during the planning process, and planners are provided with data and procedural recommendations to make this easier. It is not clear that municipalities are always aware of such guidance and resources, and are therefore making the best use of them, nor does better planning always lead to concrete changes in practice, but this support and guidance is a critical step.

As mentioned previously, the Massachusetts Office of Coastal Zone Management is focused on providing templates and other easy-to-apply models for use by various municipal entities, including planning offices and elected officials. A comprehensive *Model Sea-Level Rise Overlay Zone For Maryland Local Governments* is currently under development, along with advice on how it can be legally incorporated into floodplain and coastal regulations (Grannis et al., forthcoming). Other states are working on similar easy-to-use templates and guidelines.

d. Consistency and Attention Across State Guidelines and Regulations

Dozens of different regulations and programs from a variety of state agencies influence municipalities. These are complex and sometimes contradictory. One of the most powerful things state agencies could do would be to standardize these guidelines and regulations so they support one another and provide consistent, strong messages about how municipalities should address SLR. In the words of one interviewee in California, "nothing would get SLR on the radar of municipalities more than explicitly incorporating it into both California Environmental Quality Act procedures and into all grants—be they for housing development, new schools or wetlands protection." While not tackling CEQA, OPR is explicitly focusing on providing standardized guidance to municipal and regional agencies and other stakeholders. One important step in their ongoing engagement was the recent Confronting Climate Change: A Focus on Local Government Impacts, Actions and Resources conference that OPR hosted (Governor's Office of Planning and Research 2012). Similarly, New York State has an inter-agency task force

considering, among other things, how to harmonize the guidelines various state agencies provide to municipalities.

Unified messaging from state governments to municipalities would also make it more likely that municipalities clearly receive the message. Some interviewees were entirely unaware of activity in their respective states at the state level, suggesting that there is significant room for improvement on this front. Guidelines and other forms of support are only useful if municipalities are aware of their existence and understand how they can be applied and why they would be useful.

e. Leadership and Coordination

Leadership was identified above as an important reason some states and municipalities take up SLR issues. Municipal interviewees indicated that high-level leadership on climate change issues helps municipal leaders and civil servants to advance agendas related to climate change. Sometimes this leadership comes from the Governor, sometimes from a regional effort, sometimes from local politicians or highly regarded individuals. Regardless of its source, leadership is important as staff and politicians at the local level look for ways to justify and advance initiatives to help their communities prepare for SLR.

One interviewee emphasized that leadership on an issue like SLR is most effective when it is disseminated through well respected bodies perceived as balanced or neutral, rather than coming from environmental groups. He noted that many committees set up at the local level to address environmental issues are marginalized because their members are exceedingly passionate but seen as one-sided. Instead, SLR champions seen as legitimate by all must be found throughout municipal governments and the wider community.

A great deal of SLR adaptation will happen most appropriately at the regional level, requiring cooperation across municipal boundaries. In the absence of strong regional institutions, municipalities often need assistance forming partnerships and devising effective ways to share resources and make complementary rather than conflicting decisions.

f. Process Support for the Management of Stakeholders

Political and legal opposition is challenging SLR efforts, and may worsen as the solutions proposed become increasingly restrictive or interventionist in the eyes of some stakeholders. Proponents of SLR adaptation planning must recognize the opposition they will face and prepare for it by ameliorating the harmful side effects of their efforts and adequately justifying the importance of action. Municipalities need help in identifying less threatening ways to engage people while still introducing the challenges that may lie ahead. That is, they need process support in devising ways to work effectively with stakeholders. None of this will be easy, particularly given the stakes involved. A map showing that a multi-million dollar property is at risk is an uncomfortable proposition for the owner, even if they will be forced to deal with the consequences of SLR in the long run.

g. Flexibility: Voluntary Rather Than Mandatory Measures

While desirous of leadership, coordination, financial and technical support and consistency in regulations, many interviewees at the municipal level said they do not want mandates or stringent regulations. They said that municipalities should be able to maintain flexibility and the ability to adapt as they see appropriate locally, particularly given their limited resources.

Those we spoke with at the state level concurred by and large, expressing no interest in challenging municipalities' authority and shying away from suggesting new regulations. State-level interviewees emphasized the need to work *with* municipalities, giving them tools and resources rather than unfunded mandates. Even if they wanted to, most coastal states are limited in how much they can intervene in local activities due to the emphasis on local decision making present under home rule.

While all favor voluntary measures, one interviewee noted that communities will choose different adaptation options depending on who is paying and what external sources will pay for. State and federal agencies and other sources of support thus have leverage to encourage sustainable and appropriate land use adaptation. This leverage can also be wielded to encourage regional solutions, rather than leaving each municipality to address SLR on its own and potentially at cross-purposes with its neighbors.

V. Recommendations and Conclusion

Our research was designed to provide an overview of the current state of activity in addressing SLR in U.S. coastal states and communities. Rather than providing a comprehensive review of the state of practice, we have focused on highlighting some of the activities in selected places, exploring why SLR is (or is not) being addressed in various jurisdictions. We have paid particular attention to the relationship between state and local governments. We believe this link is critical as communities make inherently local decisions to address SLR, but require state resources to do so effectively.

In the previous section, we outlined a set of needs municipalities have as they take up the SLR challenge. We conclude now with a set of recommendations for coastal states as they aim to support municipalities in their efforts to address SLR. We provide these recommendations while recognizing that communities will face significant hurdles as they move forward. However, we believe they can be overcome if municipalities are given the tools and support they need to make effective decisions.

Recommendations for States Supporting Municipalities

A variety of themes have emerged throughout this paper, each worthy of more attention as stakeholders grapple with how to address SLR at the state and local levels. We provide this list of initial recommendations for states supporting municipalities, based on our conversations with state and local officials and other stakeholders and our review of the literature. Many of these

recommendations respond to the needs identified in the previous section of this paper, while others are more procedural or organizational in nature. We recommend that states:

1. ***Provide funding and material resources:*** Most states are extremely strained financially, making the provision of additional funding difficult. Nonetheless, providing support to local governments is critical as they often have even less budgetary leeway. One option is to find existing granting programs that may be adapted or redirected to address SLR, as NYSERDA has done in New York. Similarly, many states are using NOAA funds to support local initiatives. Private dollars may also be leveraged to pay for SLR adaptation work, partnering with relevant stakeholders, including the insurance industry and large local employers or landowners, including Federal agencies, in the given region. Adequate funding may not be available to support all coastal communities, but pilot projects provide opportunities to test options and develop knowledge that can be applied elsewhere. It may also be necessary to find support for coastal landowners to ease what will sometimes be extremely unpopular and expensive transitions or land use changes.

2. ***Provide downscaled climate data and easy-to-use information:*** Municipalities also identified both high-resolution SLR data and information and templates they can easily adapt and adopt into their existing regulations as major needs. State agencies are uniquely situated to provide these things, as most municipalities do not have the capacity to generate their own SLR models, nor to effectively revise their codes in response. Municipal regulations are typically similar across states, allowing for economies of scale when state agencies devise templates or recommendations that communities can adopt.

3. ***Provide process support:*** The engagement of multiple stakeholders at various levels of government and from outside constituencies, including private citizens, has been a recurring theme throughout this paper. Effective stakeholder engagement is integral to success and is often underappreciated as a key consideration as processes are devised. Fortunately, we have a wealth of expertise and experience to draw from on how to effectively engage parties to explore the various interests and account for them in the quest for mutual gains and thus consensus (Innes and Booher 2010; Susskind and Crump 2009). Role-play simulation exercises and other interactive tools can help stakeholders to inexpensively and more easily grapple with the decisions before them and gain greater appreciation for the interests on the table (Plumb, Fierman and Schenk 2011). Gaining a clearer sense of the options before them and the costs and benefits of each can help stakeholders work together to adapt to SLR as it becomes increasingly necessary. States can play a critical role in bringing critical process support to municipalities.

4. ***Coordinate and provide consistency at the state level:*** Inconsistency across state regulations and agencies can lead to confusion and undermine efforts to address SLR. Processes that bring together representatives from various agencies, like the New York State SLR Task Force and interagency work group on adaptation, can do a lot to support consistency and advance a coordinated response. Critically, the New York SLR Task Force also involved representatives from local governments and other stakeholder groups to draw additional expertise and perspectives. The effort currently being undertaken by the California Natural Resources Agency to produce a 2012 Climate Adaptation Strategy,

which will help coordinate adaptation efforts and messaging, is another example of what can be done to provide municipalities with consistent guidance and encouragement.

5. ***Raise the profile of SLR adaptation:*** While eager to maintain their autonomy, many interviewees acknowledged that they look to the state for guidance on how important an issue is and how they can best approach it. They also want to stay ahead of state mandates they suspect are coming. Strong and vocal leadership from political leaders and state agencies can set the tone and raise the profile of SLR on local agendas. Governors and other leaders can send supportive signals by emphasizing the need for adaptation in their statements, giving it prominence in their own policy agendas, and devoting resources to it. State agencies can do the same, providing local officials with guidance documents and support to make SLR adaptation easier. The emphasis should be on both the imperative to adapt over time and on the ease with which SLR adaptation can be integrated into ongoing planning and decision making.

6. ***Instigate and support coordination at the most appropriate level:*** States can play a critical role in initiating and supporting collaborative efforts at the most appropriate scale, which may be state-wide in some cases while focused on a particular metro area in others. Many of the appropriate responses to SLR fit neither at the state nor at the local level, but somewhere in between. Unfortunately, regional bodies and coordination are typically weak in the United States. State agencies and regional offices should look for opportunities to fill this void by strengthening existing regional institutions and coordinating regional initiatives, bringing together municipalities and other stakeholders to collaborate on effective responses to SLR. Again, municipalities are not going to give up autonomy but often need assistance and support as they find new ways to work together. Given the predilection to local autonomy, regional efforts will be most successful when municipalities are engaged from the beginning and see the need for and benefits of regional coordination. For example, the financial benefits of sharing resources and problems associated with managing different parts of the same coast in different ways need to be illustrated. The BCDC's efforts in the San Francisco Bay area are exemplar in this regard, bringing together a range of actors to address a challenge shared by the entire Bay. Entities like the Cape Cod Commission in Massachusetts could play a similar role.

7. ***Tailor responses to the context:*** State officials must be able take into consideration the unique opportunities and challenges presented by their particular situations. For example, some more conservative states are framing SLR activities as hazard mitigation as it makes it more politically palatable. Others are presenting SLR as an issue directly. Some states are advancing legislative or procedural changes to address SLR, while others are focusing on providing nonbinding advice. There are many ways to approach the SLR issue, and the most appropriate one will depend on the particular state or local environment. Those advancing SLR adaptation initiatives should also consider who their likely allies and opponents are, and how they can work with (or around) them effectively. Sometimes the identity of the organization or agency leading the effort matters, so agencies must think strategically about how they present efforts and who makes the initial overtures. In South Carolina, a Blue Ribbon Committee comprised of distinguished

individuals from various constituencies, including the development and environmental communities, is devising regulatory recommendations around how the state could better manage the coastal environment. In other places, SLR efforts are led solely by state agency staff.

Conclusion

Our review of the different approaches to SLR adaptation in different parts of the country and at different scales leads us to conclude that there is significant heterogeneity in both the types and degree of action being taken. What is clear is that SLR adaptation is a nascent and quickly evolving area of work. Best practices are emerging and being emulated, yet significant barriers to action exist, including resource deficits and insufficient information on the specific risks communities face. We look forward to seeing how practices at the state, regional and local levels evolve over time. We know this is challenging and important work, and hope that some of the practices and recommendations in this report is useful for people trying to take positive action to address SLR today.

In addition to the needs and best practices described in this report, we see a few other topics likely to need attention. First, while we have focused largely on the relationship between state and local governments, emphasizing public policy, we believe municipalities can and should also engage private citizens and businesses within their communities. Like states working to help municipalities, municipalities can help their residents, businesses and community organizations understand the risks they face and the things they could do to ameliorate them, particularly as people make individual decisions around such things as where and how to build. State or local decision makers may need to make difficult decisions in the longer-term, like mandating managed retreat from the coast, but in many places a good start to effective adaptation will involve providing guidance to help private landowners make relatively easy and informed decisions voluntarily. Many of the early adaptations that private actors can make, like elevating structures and increasing setbacks, can be no-regrets actions, or even bring tertiary benefits like cheaper flood insurance.

Another ongoing challenge that decision makers working on adaptation planning are likely to face is the potential for maladaptation. That is, since perfect coordination across all entities is impossible and different parties have different interests, it is likely that measures taken by one entity to address SLR will be inappropriate or ineffectual from others' perspectives. For example, while armoring coastlines is one way to protect adjacent land, it also has negative consequences on ecosystem health and access to the shore. There is likely to be tension between those municipalities that want to protect their built environments and communities as they look today by building seawalls and other hard infrastructure, while some state agencies might argue that allowing flooding to occur and changing land use accordingly is the appropriate response to gradual SLR, given the negative environmental impacts associated with engineered solutions. We expect that these tensions will need to be reconciled. Stakeholders will need to develop clear standards and procedures for evaluating the efficacy and appropriateness of individual adaptation options.

These are two of the many challenges not featured in this paper that we see on the horizon. We anticipate that early adopters—states, pilot communities and individual actors—will continue to lead the way, showing the rest of the country through trial and error effective approaches to planning for SLR adaptation. The need for ongoing cooperation and support across levels of government, and with private stakeholders, is apparent and worthy of ongoing attention.

Works Cited

Abbott, W.W. (2011). 2nd Appellate District Again Holds That For The Purposes Of CEQA, It Is The Impact Of The Project On The Environment, Not The Other Way Around. *Abbott & Kindermann Land Use Law Blog*. Sacramento, CA: Abbott & Kindermann, LLP. http://blog.aklandlaw.com/2011/12/articles/ceqa/2nd-appellate-district-again-holds-that-for-the-purposes-of-ceqa-it-is-the-impact-of-the-project-on-the-environment-not-the-other-way-around/ (Last accessed: July 27, 2012).

Borick, C. and B. Rabe (2012). Fall 2011 National Survey of American Public Opinion on Climate Change. *Issues in Governance Studies,* 45. Brookings Institution.

California Resources Agency (2011). *Climate Adaptation—Adaptation Policy Guide.* http://resources.ca.gov/climate_adaptation/local_government/adaptation_policy_guide.html (Last accessed: July 27, 2012).

Center for Climate and Energy Solutions (2011). *Climate Change 101: Adaptation.* http://www.c2es.org/docUploads/climate101-adaptation.pdf (Last accessed: July 1, 2012).

City of Biloxi, MS (2008). *Comprehensive Plan—Existing Conditions, Issues, and Trends Report*. http://www.biloxi.ms.us/PDF/existconditionstrendsissues.pdf (Last accessed: July 29, 2012).

Delaware Coastal Programs (2011). *Sea Level Rise Adaptation.* http://www.dnrec.delaware.gov/coastal/Pages/SeaLevelRiseAdaptation.aspx (Last accessed: July 1, 2012).

FEMA (2006). *National Flood Insurance Program Community Rating System: A Local Official's Guide to Saving Lives, Preventing Property Damage and Reducing the Cost of Flood Insurance*. FEMA 573. http://www.fema.gov/library/viewRecord.do?id=3655 (Last accessed: July 17, 2012).

Governor's Office of Planning and Research (2012). *Impacts and Adaptation Local Government Conference.* http://www.opr.ca.gov/s_climateconference.php (Last accessed: July 27, 2012).

Grannis, J. (2011). *Adaptation Tool Kit: Sea-Level Rise and Coastal Land Use.* Washington, DC: Georgetown Climate Center.

Granis, J., E. Swanson, C. Wyman, J. Shoaf and M. Singer (forthcoming). *A Model Sea-Level Rise Overlay Zone For Maryland Local Governments*. Washington, DC: Georgetown Climate Center.

Innes, J.E. and D.E. Booher (2010). *Planning With Complexity: An introduction to collaborative rationality for public policy*. New York, Routledge.

Jones, J.M. (2010, February 3). Ideology: Three Deep South States Are the Most Conservative. *State of the States*. Princeton, NJ: Gallup Politics. http://www.gallup.com/poll/125480/Ideology-Three-Deep-South-States-Conservative.aspx (Last accessed: July 1, 2012).

Kling, G.W. and D.J. Wuebbles (2005). *Confronting Climate Change in the Great Lakes Region: Impacts on Our Comunities and Ecosystems—Updated Executive Summary*. Cambridge, MA: Union of Concerned Scientists; and Washington, DC: Ecological Society of America.

Lucas V. South Carolina Coastal Council, 505 U.S. 1003 (1992). U.S. Supreme Court. http://caselaw.lp.findlaw.com/scripts/getcase.pl?navby=CASE&court=US&vol=505&page=1003 (Last accessed: July 1, 2012).

Maryland Department of Natural Resources (2012). *CoastSmart Communities*. http://www.dnr.state.md.us/CoastSmart/ (Last accessed: June 30, 2012).

Massachusetts Office of Coastal Zone Management (2012). *Storm Smart Coasts*. http://www.mass.gov/czm/stormsmart/ (Last accessed: June 30, 2012).

National Oceanic and Atmospheric Administration [NOAA] (2010). *Adapting to Climate Change: A Planning Guide for State Coastal Managers*. Silver Spring, MD: NOAA Office of Ocean and Coastal Resource Management. http://coastalmanagement.noaa.gov/climate/adaptation.html (Last accessed: July 1, 2012).

NOAA (2012a). *Coastal Programs: Partnering with States to Manage Our Coastline*. http://coastalmanagement.noaa.gov/programs/czm.html (Last accessed: June 30, 2012).

NOAA (2012b). *State Coastal Zone Boundaries*. http://coastalmanagement.noaa.gov/mystate/docs/StateCZBoundaries.pdf (Last accessed: July 1, 2012).

NOAA Coastal Services Center (2012). *Digital Coast—Coastal Lidar*. http://www.csc.noaa.gov/digitalcoast/data/coastallidar/download.html (Last accessed: July 1, 2012).

Plumb, D., E. Fierman and T. Schenk (2011). Role-Play Simulations and Managing Climate Change Risks. *Tools: Best Practice Lesson.* Cambridge, MA: Consensus Building Institute. http://www.cbuilding.org/tools/bpcs/roleplay-simulations-and-managing-climate-change-risks (Last accessed: July 3, 2012).

Rosenzweig, C., W. Solecki, A. DeGaetano, M. O'Grady, S. Hassol and P. Grabhorn, Eds. (2011a). *Responding to Climate Change in New York State: The ClimAID Integrated Assessment for Effective Climate Change Adaptation.* Technical Report. Albany, NY: New York State Energy Research and Development Authority (NYSERDA).

Rosenzweig, C., W.D. Solecki, R. Blake, M. Bowman, C. Faris, V. Gornitz, R. Horton, K. Jacob, A. LeBlanc, R. Leichenko, M. Linkin, D. Major, M. O'Grady, L. Patrick, E. Sussman, G. Yohe

and R. Zimmerman (2011b). Developing Coastal Adaptation to Climate Change in the New York City Infrastructure-Shed: Process, approach, tools, and strategies. *Climatic Change*, 106: 93–127.

Ross, K. (2012, May 15). *Sea-Level Rise Debate May Move to Raleigh*. North Carolina Coastal Federation. http://www.nccoast.org/Article.aspx?k=b965eb03-1d87-4284-9bfb-46d8b3eb67fb (Last accessed: July 1, 2012).

San Francisco Bay Conservation and Development Commission (2011). *Resolution No. 11-08: Adoption of Bay Plan Amendment No. 1-08 Adding New Climate Change Findings and Policies to the Bay Plan; And Revising the Bay Plan Tidal Marsh and Tidal Flats; Safety of Fills; Protection of the Shoreline; and Public Access Findings and Policies* http://www.bcdc.ca.gov/proposed_bay_plan/10-01Resolution.pdf (Last accessed: July 1, 2012).

Schutze, J. (2012, March 14). Texas' Plan for Rising Sea Levels: Wait Till God Tells Us to Build an Ark. *Dallas Observer Blog—Unfair Park: Get Off My Lawn.* http://blogs.dallasobserver.com/unfairpark/2012/03/texas_plan_for_rising_sea_leve.php (Last accessed: July 1, 2012).

Southeast Florida Regional Climate Change Compact (2011). *A Unified Sea Level Rise Projection for Southeast Florida*. http://www.southeastfloridaclimatecompact.org/documents/SLR.pdf (Last accessed: July 1, 2012).

Southeast Florida Regional Climate Change Compact (2012). *Draft Regional Climate Action Plan*. http://www.southeastfloridaclimatecompact.org/index_files/Page648.htm (Last accessed: July 1, 2012).

State of California Strategic Growth Council (2011, November). *2011 Solicitation—Sustainable Communities Planning Grant And Incentive Program*. Funded by the Safe Drinking Water, Water Quality And Supply, Flood Control, River And Coastal Protection Bond Act Of 2006, Proposition 84, Chapter 9. http://www.sgc.ca.gov/meetings/20111102/pgip-guidelines-2011.pdf (Last accessed: July 27, 2012).

Strategic Growth Council (2012). *Sustainable Communities Planning Grants—Round 2 Funding Recommendations*. http://www.sgc.ca.gov/meetings/20120510/PlanningGrantsRound2-corrected.pdf (Last accessed: July 27, 2012).

Susskind, L. and L. Crump (2009). *Multiparty Negotiations* (Four-Volume Set). Thousand Oaks, CA: Sage.

Twilley, R.R., E.J. Barron, H.L. Gholz, M.A. Harwell, R.L. Miller, D.J. Reed, J.B. Rose, E.H. Siemann, R.G. Wetzel and R.J. Zimmerman (2001). *Confronting Climate Change in the Gulf Coast Region: Prospects for Sustaining Our Ecological Heritage*. Cambridge, MA: Union of Concerned Scientists; and Washington, DC: Ecological Society of America.

US Army Corps of Engineers (2012). *Louisiana Coastal Area Ecosystem Restoration Study*. http://www.mvn.usace.army.mil/environmental/lca.asp (Last accessed: July 29, 2012).

Worcester County, Maryland (2008). *Sea Level Rise Response Strategy*. Snow Hill, MD: Department of Comprehensive Planning. Prepared by CSA International, Inc. http://www.dnr.state.md.us/CoastSmart/pdfs/SeaLevel_Worcester.pdf (Last accessed: June 30, 2012).

Wyman, J., D. Carter, J. Weber, J. Andrews, R. Bates, C. Byron, T. Calnan, B. Davis, S. Dickson, E. Fisher, S. Goldbeck, S. Hansch, T. Howey, Z. Johnson, M. Jesperson, L. Kellner, J. Kline, J. Knisel, G. Lytton, T. Miller, T. Pratt, R. Roth, G. Schultz and P. Wellenberger (2010). *The Faces of Climate Change Adaptation: The Need for Proactive Protection of the Nation's Coasts*. Washington, DC: Coastal States Organization—Climate Change Work Group.

Yoskowitz, D.W., J. Gibeaut and A. McKenzie (2009). *The Socio-Economic Impact of Sea Level Rise in the Galveston Bay Region*. A Report for Environmental Defense Fund. Harte Research Institute for Gulf of Mexico Studies, Texas A&M University-Corpus Christi. http://www.edf.org/sites/default/files/9901_EDF_Sea_Level_Rise_Report.pdf (Last accessed: July 29, 2012).

Appendix 1: Interviewees and Reviewers

California

- Nancy Bragado, Principal Planner, City of San Diego
- Wendy Goodfriend, Senior Planner, San Francisco Bay Conservation and Development Commission
- Nicola Hedge, Manager of the Climate Initiative, San Diego Foundation
- Michael McCormick, Local and Regional Affairs Policy Advisor and Senior Planner, Governor's Office of Planning and Research
- Sara Polgar, Coastal Planner, San Francisco Bay Conservation and Development Commission
- Brendan Reed, Environmental Resource Manager, City of Chula Vista
- Ben Rubin, Associate Planner, Governor's Office of Planning and Research
- Will Travis, former Executive Director, San Francisco Bay Conservation and Development Commission; Senior Advisor at Bay Area Joint Policy Committee
- Emily Young, Senior Director of Environment Analysis & Strategy, San Diego Foundation

New York

- Lee Ellman, Director, Planning Bureau, City of Yonkers
- Brian Frank, Chief Environmental Analyst, City of East Hampton
- Richard Lord, Chief of Mitigation Programs & Agency Preservation Officer, NYS Division of Homeland Security & Emergency Services, Office of Emergency Management
- Mark Lowery, Climate Policy Analyst, Office of Climate Change, Department of Environmental Conservation
- Fred Nuffer, Public Assistance Liaison, Mitigation Programs, Office of Emergency Management
- Berry Pendergrass, Coastal Resource Specialist, Office of Coastal, Local Government and Community Sustainability, Department of State
- Amanda Stevens, Environmental Research Program, New York State Energy Research & Development Authority
- Mark Watson, Environmental Research Program, New York State Energy Research & Development Authority
- Marguerite Wolffsohn, Town Planning Director, City of East Hampton

South Carolina

- Barbara Neale, Senior Program Analyst, Ocean and Coastal Resource Management
- Jill Foster, Deputy Director of Community Development, Town of Hilton Head Island
- Laura Cabiness, Director, Department of Public Service, City of Charleston

Other

- Hedia Adelsman, Senior Policy Advisor, Department of Ecology, State of Washington
- Jeffrey Allenby, Chesapeake and Coastal Service, Maryland Department of Natural Resources
- Jessica Grannis, Georgetown Climate Center, Georgetown University Law Center
- Jennifer Kline, Coastal Hazards Specialist, Georgia Department of Natural Resources Coastal Resources Division