

Exploration of Local Sea Level Rise Planning Public Perceptions

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Sea level rise (SLR) is a potentially destructive phenomenon to coastal communities, despite uncertainties surrounding its extent, timing, and impacts. Forces driving SLR include climate change and geologic factors, globally and locally. Information available to communities preparing for SLR will likely never be perfect, given the difficulty of planning through uncertain global projections and assessing local conditions. Communities will need to develop SLR plans despite uncertainties, balancing factors such as determining the scope of a plan, assessing funding options, and identifying conflict resolution methods. This study describes a survey assessing the range of public preferences on these three planning factors. Key findings include that public engagement may be effective for overcoming local conflict, that too much focus on government intervention could be divisive, and that there are a wide variety of palatable methods to fund planning and implementation of those plans. This research informs local planning to reduce SLR risks.

Keywords: sea level rise, planning, climate change, flooding, preparedness, resilience

INTRODUCTION

Disasters like Superstorm Sandy and hurricanes Harvey, Irma, and Maria have helped to bring climate risk into the national spotlight. Sea level rise (SLR), one of many potential climate-related impacts, has the potential to increase the damage caused by storms and harm ecosystems, structures, and the way of life of coastal communities (Melillo, Richmond, & Yohe, 2014). With sea level already advancing and likely to increase more rapidly in the future, communities will

need to prioritize their limited resources to prepare for sea level rise and increased flooding, or risk as much as \$1 trillion in global annual damages (Hallegatte, Green, Nicholls, & Corfee-Morlot, 2013).

Programs offered by the federal government to assist American coastal communities in planning and preparing for sea level rise are limited, with the National Flood Insurance Program taking a leading role yet setting minimum flood standards that do not account for anticipated SLR (Bubeck, Kreibich, Penning-Rowsell, Botzen, Moel, & Klijn, 2017). In addition, state activities range in their scope and level of assistance to local communities. This means that in many areas, local communities will be on their own to determine how to develop a local plan, what to include in it, and how to implement it. Local governments are one focal point for these community-based plans, but the public, to whom local officials are accountable to, are a critical part as well.

This study gathers a range of public opinions on the scope of a local plan to address sea level rise, including potential funding options and identifying methods to prevent and resolve conflict around planning. Survey responses were organized into common suggestions using open coding techniques and then categorized into broad categories using axial coding. Through this process, several key insights were obtained around the variability and range of public views of sea level rise policy, preparations, and response. This paper discusses these insights, describes the goals, process, results, and implications of this exercise, and lays out potential next steps for research.

LITERATURE REVIEW

Sea level rise creates the potential for great damage and disruption to many communities in the upcoming years and decades. Although the slow processes driving SLR could seem distant and abstract, the resulting flooding and damage, when combined with storms, is immediate and very tangible when it occurs. A large portion of the world's population lives in and around coastal areas, and much of the world's economic output relies on these communities.

Average global sea level has already risen about 0.2m since 1900 (United States Global Research Program [USGCRP], 2017). Global mean sea level rise of the next century cannot be precisely forecasted, but there are plausible projections from several sources, such as the U.S.

National Climate Assessment, which places the range at 0.30-2.5m by 2100 and the Intergovernmental Panel on Climate Change (IPCC) which places the range at 0.26m-0.98m for 2081-2100 (Intergovernmental Panel on Climate Change [IPCC] Working Group 1, 2013; USGCRP, 2017). There are several reasons for the large range of projections, including uncertainties around future human emissions (which are driven largely by economic and political factors that cannot be precisely predicted) and uncertainties regarding how sea level will respond to other changes in climate (Hunter, 2010). Emerging evidence suggests that some of these assessments could be too low. Recent findings on ice-sheet dynamics suggest that the models previously used were based on an overly simplified representation of Greenland and Antarctica's ice-sheet dynamics, missing potentially important contributions to sea level rise (Csatho, Schenk, Veen, Babonis, & Duncan 2014; Katz & Worster, 2010; Matsuoka, Hindarmsh, Moholdt, Bentley, & Pritchard, 2015). Millions of residents of U.S. coastal communities are expected to be impacted, especially considering that many of these communities have growing populations concurrent with this increased risk (Hauer, Evans, & Mishra, 2016).

Several methodologies for determining what future sea level to plan for have been proposed. For example, Hunter (2012) describes a methodology for picking a moderate and a high sea level rise projection and examining projected impacts under both, recognizing that the actual sea level rise in the future will likely be somewhere between the two. Another approach is to incorporate as wide of a range of future scenarios that is plausible given scientific knowledge and uncertainty, with an emphasis on those on the higher end of expected SLR, to allow for both sensitivity analysis and recognition of possible worst-case scenarios (Nicholls, Hanson, Lowe, Warrick, Lu, & Long, 2014).

Global sea level rise predictions do not, by themselves, inform a community on how to respond, because local sea level changes are influenced by additional factors such as changes in currents, erosion properties, and land subsidence or uplift (Melillo et al, 2014; Snow & Snow, 2009; Williams, 2013). Local changes in sea level are driven by at least five distinct processes. First, thermal expansion, where liquid-phase water expands as it heats up (Srifer, Urban, Olson, & Keller, 2012). Because of this process, the same number of water molecules take up more space when they are warmer, which is an imperceptible change for small volumes but substantial when aggregated across the world's interconnected oceans. Second, climate change will likely

lead to an increased volume of water in the oceans as land-based ice from ice caps and glaciers continues to melt and enters the oceans (Menon, Soberón, Li, & Peterson, 2010). Third, local sea level rise is influenced by land subsidence or uplift, which are geologic processes that are mostly independent of climate change but nevertheless can have a major influence on local impacts (Snow & Snow, 2009). Fourth, there is the possibility for changes to ocean circulation patterns to raise sea levels in some areas. Similar to what happens on a short-term basis in El Niño years, changing patterns could alter local sea levels in many communities (Melillo et al, 2014). Fifth, gravity from large masses (such as the Greenland ice-sheet) attracts the surrounding water inward, raising the local sea level near the mass and lowering the sea level far away from it (Katsman, Hazeleger, Drijfhout, van Oldenborgh, & Burgers, 2008). A substantial reduction in these ice masses would reduce this effect, causing sea level far away from them (in this example, the North American and European Coasts) to rise as local sea level falls near Greenland (Katsman et al., 2008). Given all these factors, communities could have a difficult time determining what to expect locally over the upcoming decades. This is especially true in smaller communities that do not have the resources to conduct detailed local sea level analyses.

Even if a robust profile of projected local sea level rise was known for an area, communities would still face a series of planning challenges, as limited resources will require examination of various tradeoffs. Each community would be faced with the difficult task of deciding what is most important to protect first, and which methodologies to use for protection. Therefore, a framework for developing a community-based sea level rise plan could be a useful tool for communities potentially impacted by sea level rise.

There are several state and local efforts to address sea level rise concerns, although many jurisdictions have no applicable policies (Griffin et al., 2008). Additionally, there have been some efforts to limit sea level rise action at the local level. In the former category, two leaders are the states of California and Maryland. California, on one hand, has taken an approach that involves providing planning resources with plausible ranges of SLR projections and suggestions for actions for local communities, with a strong difference in approaches for new development and existing development (California Coastal Commission, 2015). Maryland, on the other hand, has used the ‘power of the purse’ to limit the use of state administered funds and guarantees for projects that could be at high-risk from climate change unless they take actions to reduce their

vulnerability (Griffin et al., 2008). The legislature in North Carolina, taking an approach that could have made local planning much more difficult, considered draft legislation in 2011 that would have limited the local sea level rise projections used in planning only to models that assumed linear (and therefore, not exponential) sea level rise and that looked no further than 30 years in the future (North Carolina General Assembly, 2011). Although the intent of this policy is not fully documented, many believed it was to limit the impacts of sea level rise projects on real estate and future development in the short term (Montgomery, 2014). Although the final legislation did not contain many of these provisions, these actions show political controversy can be a significant barrier to developing SLR plans, increasing the importance of local buy-in.

There are documented examples of local sea level rise planning in the eastern United States. New York City has developed a comprehensive sea level rise study, showing that, among other findings, observed rise-to-date in New York City has been about double the worldwide average and that projections for the city are as high as 6ft by 2100 (New York Academy of Sciences, 2015). The City will consider several adaptations to address this looming threat. Miami has convened a *Sea Level Rise Task Force* that examined locally relevant resources and made a series of six high-level recommendations with supporting materials for the city to consider (Ruvlin, Murley, Enfield, Fain, Fair, Gonzalez, & Milian, 2014). The leadership of these and other cities is crucial in setting examples of how other communities can begin to address these issues. However, it is also important to recognize that many of the smaller communities across the coast will not have access to the level of resources available to large cities to implement detailed studies and will therefore face additional challenges in getting started and assuring that they are using reliable and useful information.

METHODS

This survey was designed to enhance understanding of public opinions on several major subjects surrounding sea level rise planning, to help expand known planning factors, funding mechanisms, and conflict resolution methods preferred by the public. The survey was approved by George Mason University Institutional Review Board and conducted by the author from November 14 to November 30, 2016. It focused on east coast residents of the United States to help identify factors for local sea level rise plans, which could be of value to coastal

communities across the eastern United States and potentially elsewhere. There were 22 to 24 respondents per question, with each respondent providing multiple suggestions on each question. This resulted in a range of 107-120 valid responses for each of the three questions. The modest sample size of this survey means it was not sufficiently large to be representative of the U.S. Eastern coastal population, but, rather, represents a stepping stone towards a generalized understanding of these questions.

I used purposeful and snowball sampling to contact people I knew who lived, worked in, or regularly visited coastal communities in the eastern United States by email and social media. I asked each of them to forward the study to others who may live, work in, or regularly visit coastal communities to consider participation. Targeting those known to be likely to live, work, or frequently visit an eastern coastal community was appropriate for this exercise, as only those meeting those criteria were qualified to answer the survey. The insights derived from their input are informative despite the small sample size. Specifically, individuals meeting these criteria in states bordering the Atlantic Ocean or water bodies influenced by it were targeted (this includes CT, DE, DC, FL, ME, MD, MA, NH, NJ, NY, NC, PA, RI, SC, VA). I gave no advice to potential respondents, beyond asking them to read the survey's consent form, instructions and questions, and to answer honestly. Because I knew initial participants, it is likely that some respondents are identifiable to me, personally. However, no personal identification was collected in the survey and the consent form made it clear that the survey was anonymous. Therefore, there was no way for me to connect data to specific, identified individuals.

I used open coding techniques to analyze results (Strauss, 1990). To allow for proper coding, I completed a series of preparatory checks and processing steps on the data prior to running the analysis. These steps included correcting obvious and unambiguous spelling errors, spelling out abbreviations that could be clearly identified in context, fixing punctuation issues that would prevent machine processing, and removing five responses that were clearly not attempts to address the question, as noted in the results section. There was also one instance within Question 1 where a respondent cross-referenced his or her responses, and in this case, I added the relevant cross-referenced information within brackets to allow for analysis.

Once I completed pre-coding procedures, I used open coding analysis techniques to allow for the emergence of usable categories that could inform the respective main survey questions

(Strauss, 1990). After labeling substantive codes, I tied codes together using axial coding techniques, taking care to minimize accidental forcing of the data as described in Kelle (2007). The process included: 1) reading each response carefully to gain a better understanding of the variety and diversity of responses; 2) labeling each response with a primary *category* after reading each response again; 3) labeling each response with a subcategory with a second pass as well as identifying responses that may have been mislabeled in the primary category on the first pass; 4) reviewing all the responses within each category and across each category's subcategory(s) to assure consistent application; 5) reviewing all the responses one last time for consistency. A list of the most frequently mentioned categories for each question was developed, with the results included below. A short summary of each major category is included in the results.

In addition to reviewing the data through the processes of coding described above, I analyzed the frequency of words in responses to each question. I analyzed the full text of the responses (after going through pre-coding preparation described above) with a word frequency utility to identify the most commonly seen words (Friedman, n.d.). Common words that would not contribute substantively to the analysis (such as 'the' and 'it') are automatically removed by the software. Words that appeared at least five times within the responses for a question are displayed in the results.

RESULTS

For each of the three questions, I asked respondents to provide at least five factors they believed were important, with the option of including up to eight. Although 24 respondents entered answers to at least one question, only the first question had entries from all respondents, with 22 respondents answering the second and third questions.

Summary of Responses

Question 1 (n=24) asked respondents to describe planning factors important to building a community-based sea level rise plan. Specifically, it stated:

Preparing for flooding, whether from sea level rise, significant storms, or other reasons is challenging. Please list any factors that you think are important for planning for sea level rise and future flooding in your community? As examples only, these could include the

community better understanding the causes of flooding, looking for places at high risk for flooding, and finding the least expensive ways to protect the community. Please list at least five important things to consider.

There was a total of 121 responses to this question (23 respondents included five responses and one respondent included six responses). One response was deemed invalid as not responding to the question (stating “I ran out of ideas”) leaving 120 valid responses to this question for analysis. This question is referred to as *Planning Factors* in this analysis.

Table 1 shows the observed planning factors from the responses in descending order of frequency. A description of each category is included below the table, with additional analysis on the most commonly observed factors.

Table 1
Planning Factors (Question 1) Table of Categories

Category	Responses	Description
Mitigation Measures	34	Specific mitigation measures that can be built into plans
Information Resources	25	Data and information to assist in planning
Public Engagement	19	Planning ways to actively engage the community
Policies	12	Setting regulations, codes, or other requirements or incentives
Research	12	Advancing methods to predict flooding, improve mitigation, or study other communities
Response Planning	11	Develop plans for post-incident response and recovery
External Factors	7	Understanding how factors outside the community can have an impact

Mitigation Measures were the most frequently suggested planning factor. These were specific improvements identified by respondents to mitigate the impacts of sea level rise and flooding, including building/construction standards, built/engineered systems, and the incorporation of natural systems. Several responses were generic, such as “taking remedial action to avoid flooding” and were placed into this factor but not into a subcategory. As the most

recommended planning factor, incorporation of specific mitigation measures will be a priority in community-based sea level rise plans.

Information Resources were the second-most suggested planning factor. These responses referred to various forms of information that could help the community in conducting planning for SLR. Over 70% (18 of 25) of responses in this category referred to risk mapping that would help to determine where impacts are more or less likely, which could help with identifying actions to move forward. Other responses in this category included developing cost projections, information about impacts (without mentioning specific locations), and improving risk disclosure.

Public Engagement was third on the list of frequently observed factors. Although public engagement could take several different forms, in this context most responses (16 of 19) mentioned some form of education or awareness-building. These responses are different from many of the public engagement activities that will be discussed in Question 3, discussed below, which focused on conflict resolution. Based on several responses, one possibility is that increasing awareness and understanding through education would help make any planning process more productive through greater participant knowledge and would allow for greater overall interest and engagement.

Policies was the fourth most recommended factor, including setting, revising, or removing policies focused on broader mitigation strategies (e.g., land use or municipal budgeting) or in influencing individual behavior through insurance incentives or similar requirements. Policies could be regulatory, codes, standards, or public and private incentives that encourage or require protective actions.

Although they do not appear in the summary of most common responses, there were two suggestions that advocated for taking no action, either by not spending any funds to address this issue or by not interfering in other's decisions, even if those decisions are ill advised. Question 2 (n=22) asked respondents to describe funding mechanisms that could be used to help develop and implement a community-based sea level rise plan. Specifically, it stated:

Preparing for flooding, especially related to future sea level rise, is likely to be expensive. Presuming that sources outside your community (such as federal and state funding) will not pay the entire cost, please list at least five other ways of paying for these activities.

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As examples, this could include a dedicated tax for upgrades, requiring property owners to install measures on their land, or cutting expenses in other programs.

There were 110 responses to this question (all 22 respondents included five responses). One response was deemed invalid as not responding to the question, stating “NA”, leaving 109 valid responses for analysis. This question is referred to as *Funding Mechanisms* in this analysis. Table 2 shows the observed funding mechanisms from the responses in descending order of frequency. A description of each category is included below the table, with additional analysis on the most commonly observed mechanisms. Responses to Question 2 were more concentrated in the top categories than Question 1.

Table 2

Funding Mechanisms (Question 2) Table of Categories

Category	Responses	Description
Taxes	46	Various forms of taxes (income, property, sales, etc.) to cover the costs
Regulatory Cost Shifting	30	Shifting the costs to homes and businesses through regulatory requirements
Loans	8	Obtaining loans (such as issuing bonds) to pay for protective activities now and repay over time
Self-Funding	7	Encouraging homes and businesses to pay for protective activities voluntarily
Allocation	5	Re-prioritizing existing public resources to dedicate more towards protective activities
Cost-Avoidance	5	Finding places to reduce costs and using those savings to pay for protective measures
Specific Measures	4	Specific measures to protect against flooding and SLR
Outside Assistance	4	Paying for protective activities through outside assistance (such as federal, state, and outside private grants)

Taxes was the most commonly recommended category. With 46 responses, this category

includes several types of taxes to fund these programs, such as property taxes, risk-based taxes (those at greater risk contribute more), user fees, and other dedicated taxes such as sales taxes, or construction taxes. Additionally, there were two responses that specifically stated that taxes should not be used for this purpose.

Regulatory Cost Shifting was the second most observed category with 30 responses. These responses focused on encouraging or requiring funding of implementation or mitigation measures through using various types of regulations rather than funding them directly. Responses in this category include spurring mitigation through insurance requirements, requiring owners to protect their own properties, changing land-use policies, implementing building standards, and using eminent domain to secure high-risk areas. One respondent also specifically stated that there should not be regulations in this field.

Question 3 asked respondents to describe conflict resolution methods that could be used to help overcome barriers to developing a community-based sea level rise plan. Specifically, Question 3 (n=22) read as follows:

Preparing for flooding, especially related to future sea level rise, has the potential for conflict. Please list at least five ways that could be used to address conflict in preparing for flooding and sea level rise. As examples, these could include holding public meetings or voting on protection strategies.

There were 110 responses to this question (all 22 respondents included 5 responses). Three responses could not be coded and two were invalid, answering “NA”. One response, “Pistols at 50 yards,” does not appear to be a serious attempt to answer the question, but it is unclear whether it was a protest response, an expression that there appear to be no reasonable methods of addressing this type of conflict, or an actual suggestion (however unlikely). For this reason, that response was also excluded from analysis, leaving 107 valid responses to this question.

Table 3 shows the observed conflict resolution options from the responses in descending order of frequency. A description of each category is included below the table, with additional analysis on the most commonly observed options.

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Table 3

Conflict Resolution Options (Question 3) Table of Categories

Category	Responses	Description
Public Engagement	67	Various forms of taxes (income, property, sales, etc.) to cover the costs
Regulatory Methods	12	Shifting the costs to homes and businesses through regulatory requirements
Specific Measures	12	Obtaining loans (such as issuing bonds) to pay for protective activities now and repay over time
Analytical Methods	7	Encouraging homes and businesses to pay for protective activities voluntarily
Incentive Methods	3	Re-prioritizing existing public resources to dedicate more towards protective activities
Business Engagement	2	Finding places to reduce costs and using those savings to pay for protective measures
Legal Avenues	2	Specific measures to protect against flooding and SLR
Political Engagement	2	Paying for protective activities through outside assistance (such as federal, state, and outside private grants)

Public Engagement was the most frequently observed category, constituting 67 of 107 (about 63%) of all responses to this question, and having eight distinct subcategories. Education (21 responses) focuses on various methods to better inform the community about the risks, the science, mitigation measures, and other aspects to help prevent and resolve conflict. Public meetings (18 responses) involves working through conflicts in an open and transparent manner in public meetings, workshops and similar activities. Collective action (eight responses) includes various forms of organizing the community to directly implement mitigation measures (for example, using volunteers to build barriers). Media outreach involves using the press (e.g., television, written news and opinion pieces, documentaries, social media, etc.) to involve the community and build buy-in. Voting (six responses) suggests resolving conflicts through a public vote. Three responses encouraged planning through public engagement (but were otherwise not specified), whereas two discussed transparency as vital to engagement and one

suggested mediation to resolve conflicts. Given that the substantial majority of responses revolved around public engagement, this demonstrates the need for one or more champions in the community (whether individuals, organizations, governments, or others) who can help to organize and facilitate engagement efforts.

Regulatory Methods include activities (zoning, disclosure rules, etc.) that either reduce risk by setting common rules or inform all parties to the risk to assist with making informed decisions. Three responses stated there should be specific new regulations and one specifically stated there should not be new regulations on existing uses. Although most of these responses did not directly state how they would be used for conflict resolution, regulatory processes can set a common baseline that reduces free-ridership (where some would benefit at the expense of others) and could help to prevent direct conflict in some instances.

In both Question 2 and Question 3 (funding and conflict resolution) several respondents suggested actions for risk reduction, coded as “specific measures” in both questions. Although these responses were valid, they were nevertheless of minimal usefulness for answering the questions at hand, because they did not address funding mechanisms or methods to prevent and resolve conflict. Therefore, for the purposes of identifying top categories these responses were excluded, although they are noted in the above tables. It may be that those individuals did not fully read or understand the questions or that they could only think of these adaptation measures and not responses to the questions.

Word Frequency Analysis

Additional insight on the survey responses was obtained through analyzing the full text of the responses for common words, as described in the methods section. Recognizing that the same data was used to generate the word frequencies as was analyzed to create above-described categories, similarities or differences in topics seen and help to either reinforce or reduce the validity of the categorizations. The summary of most frequently seen words for Question 1 (planning factors) is shown in Figure 1.

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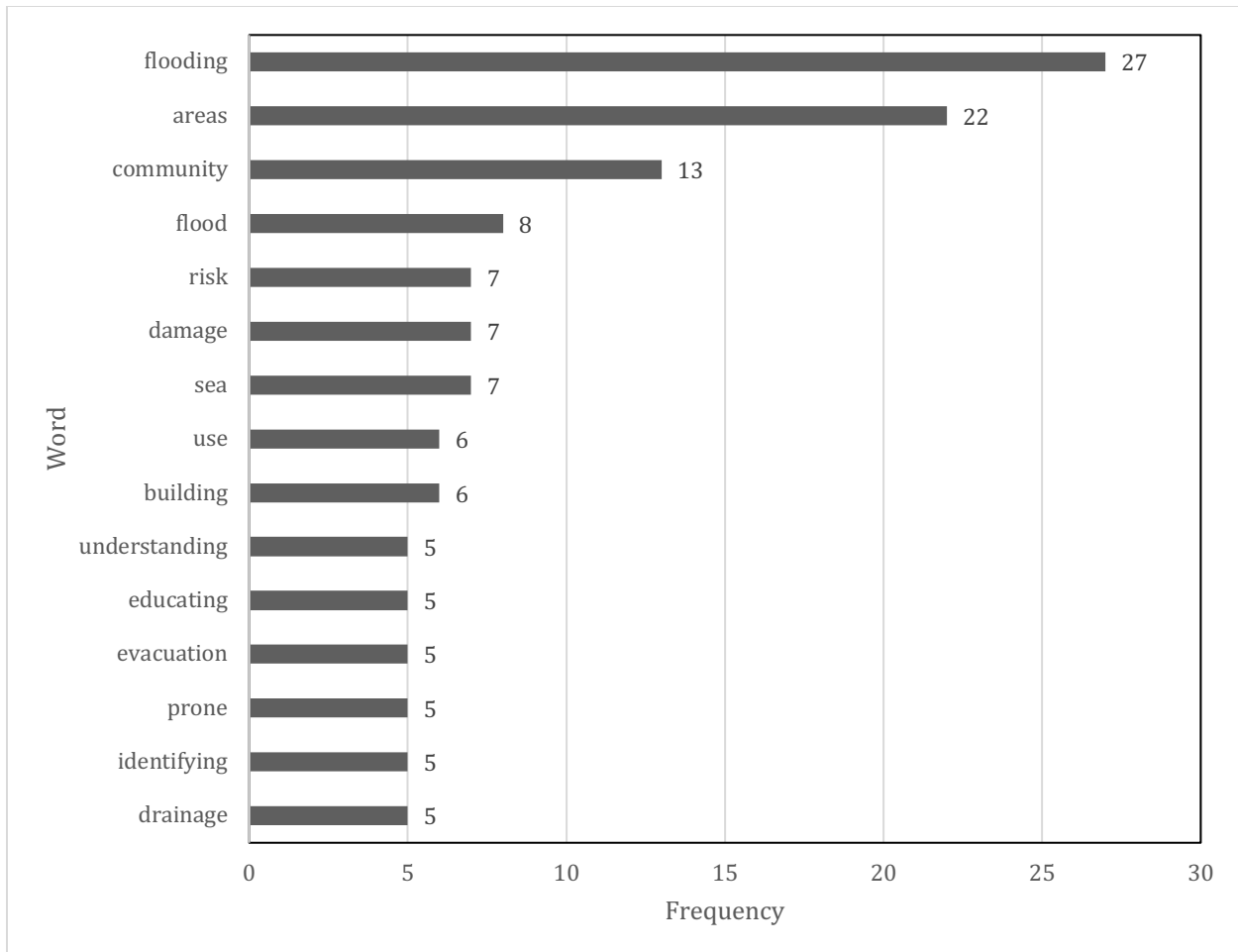


Figure 1. Frequency of common words in question 1 (planning factors)

The words “flooding,” “areas,” and “community” are the most commonly seen in the text, with 27, 22, and 13 instances respectively. “Flood,” “risk,” “damage,” and “sea” were also common with eight responses for flood and seven for the other three. Given the strong emphasis the coding found for risk mapping (areas), the cross-cutting nature of flooding across responses, and the goal of the project (focused on communities), this word count analysis reveals that the concepts that involve these words are important to participants, helping to reinforce the categorization analysis discussed above. The presence of “risk” as a fairly common word is significant and surprising, given that risk is a complex concept that is easily misunderstood.

The chart of frequently seen words for question 2 (funding mechanisms) is shown in Figure 2.

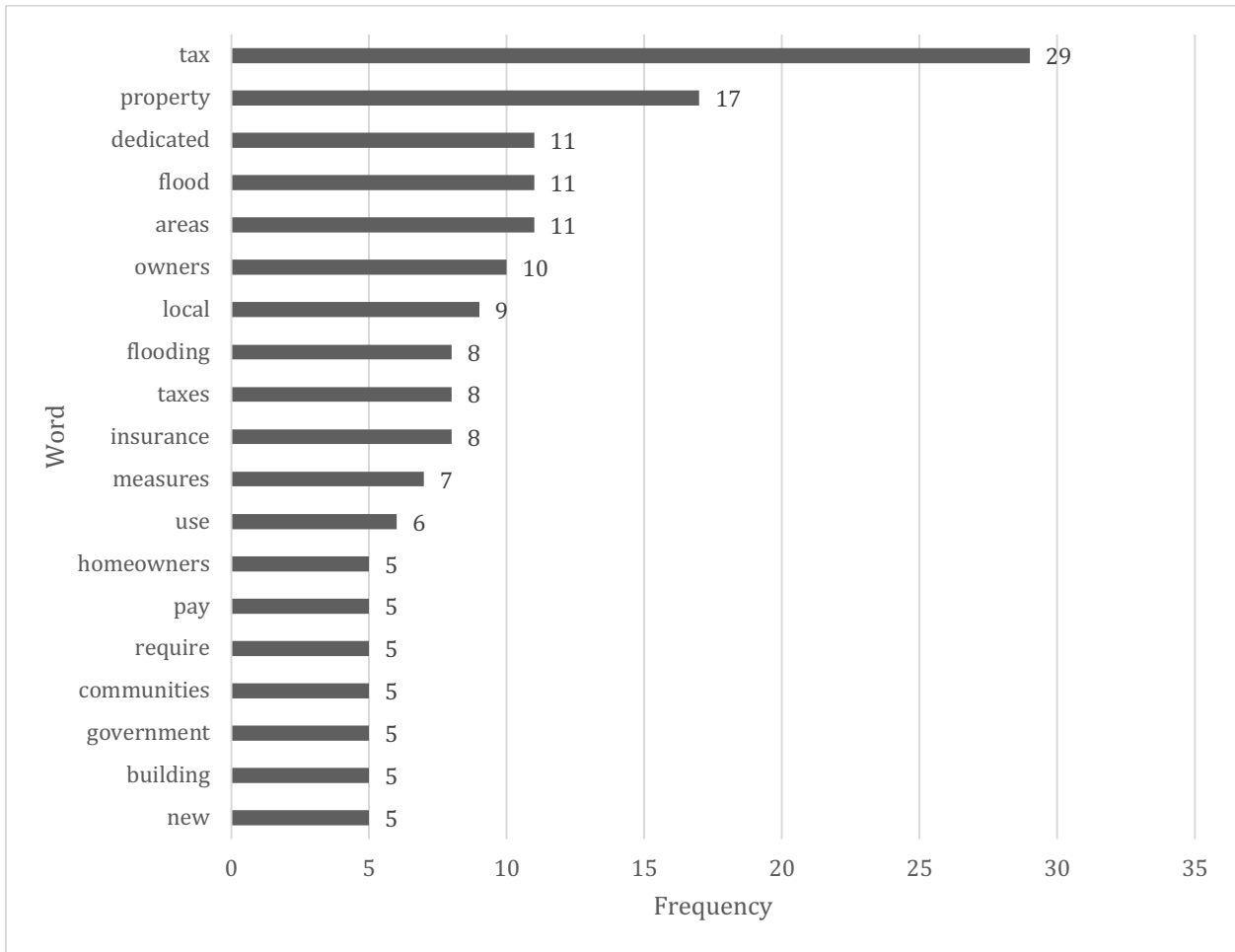


Figure 2. Frequency of common words in question 2 (funding mechanisms)

“Tax” and the related word “Taxes” are commonly seen, with 29 and eight responses, respectively, or 37 combined. “Property” is both a common sub-response (e.g., property tax) and a cross-cutting topic that applies to many types of funding mechanisms and is seen 17 times. 17 other words appear at least five times as shown above. The frequency of words like “tax,” “property,” and “dedicated” show that these issues are of importance to the respondents, helping to reinforce the analysis by categorization described above.

The responses to question three (conflict resolution methods) had a higher concentration of the most commonly seen words. The frequency of these words is shown in Figure 3.

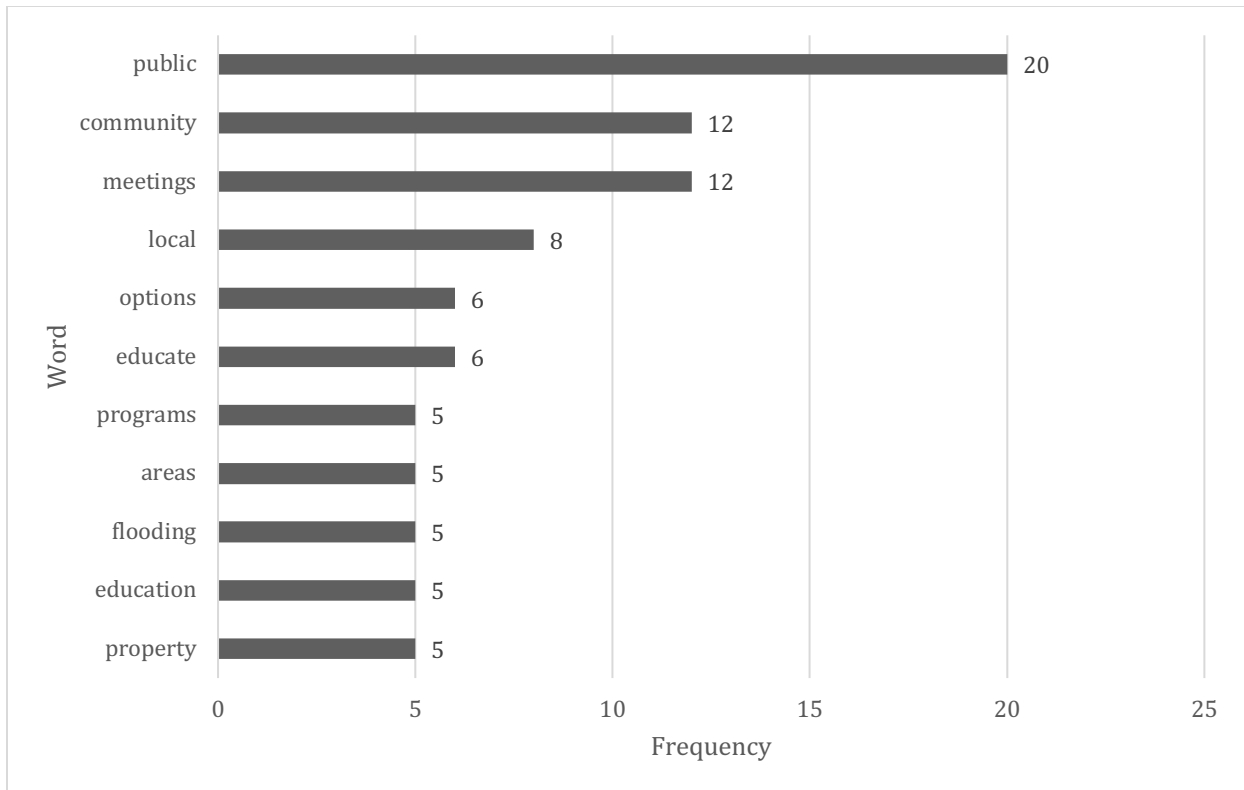


Figure 3. Frequency of common words in question 3 (conflict resolution methods)

The words “public,” “community,” “meetings,” and “local” dominate this analysis at 20, 12, 12, and eight entries, respectively. “Educate,” “education,” are also common, with six and five each, or 11 combined. Such a large concentration in the top few words reinforces the importance of including these concepts in conflict prevention and resolution methods, similar to what was seen in the categories and subcategories above.

Relation Between Examples and Responses

Each of the three questions had several example responses embedded within as described with the text of each question. I deemed this necessary to provide sufficient clarity in the question itself and to spur additional ideas. One foreseeable outcome of a free-form question without providing any examples would be that a significant number of potential respondents would not have completed the survey because they did not understand what type of information was being sought or they would have provided responses to perceived questions other than those that were asked. Therefore, including sample responses was necessary, and I drew the samples

from what I believed were the most obvious responses for each category. For example, one respondent provided all three example responses from Question 1 word-for-word, along with two unrelated suggestions. In Question 2, five responses used the phrase “dedicated tax.” Finally, in Question 3 three responses included voting and six mentioned public meetings. A total of 19 responses mentioned one of the examples, including five responses that were more specific than the example. Four to six percent of the responses derived from offered examples, demonstrating that the examples were a minority of the overall responses.

DISCUSSION AND NEXT STEPS

Overall, this study engaged 24 respondents, involving 336 valid responses across the three questions on the topics of planning factors, funding, and conflict resolution. The question on planning factors had seven major categories, ranging from seven to 34 responses and a total of 28 subcategories. This is a broad diversity of responses that may have been greater with a larger sample size. The question on funding had eight major categories of funding mechanisms, but the distribution was more heavily weighted towards the two most popular ones, meaning that the diversity of responses may or may not have been broader with a larger sample size. Taxes had 46 responses and regulatory cost shifting had 30 responses. Question 3 on conflict resolution had the least variety of the three questions, with 67 responses falling under the “public engagement” category, and of the three is the least likely to have a greater diversity of responses with a larger sample size.

Determining planning factors is one of the vital components of developing a community-based sea level rise plan. Recognizing this diversity of opinion and that other opinions are possible will allow for a more thoughtful discussion of planning factors amongst stakeholders. The goal of this exploratory survey study was to understand what members of coastal communities believe are important factors in planning for sea level rise, how activities related to mitigating flooding and risks from sea level rise should be paid for, and how conflicts related to planning and mitigating risks should be avoided and resolved. Overall, respondents to the survey had a broad diversity of responses to questions about the factors involved in planning for sea level rise, resulting in seven broad categories such as specific mitigation measures and policy changes. In addition, responses to the survey emphasized the role of community engagement and

informational resources in planning for sea level rise across all survey questions.

These findings point several specific areas that individuals responsible for creating sea level rise plans should consider when working with local communities. First, there were several responses that explicitly indicated that government should not be involved in planning, that coastal residents live there at their own risk, that taxpayer funds should not be used, and similar types of responses. Although it is not possible to follow-up with these respondents to gather more details on their responses, the presence of this type of response provides important insight for future research. It may be that distrust or lack of engagement on this issue may vary depending on what level of government could potentially be involved (federal, state, local, and/or quasi-governmental organizations like public utilities), or it may be that no form of government involvement is desired from these individuals. The concept of ‘community-based’ sea level rise planning is not intended to exclusively mean administered by governmental entities. Although communities can use government entities to coordinate local sea level rise planning, other entities could do the same for at least portions of planning given appropriate resources. Additional understanding of this phenomenon might be developed through education about post-disaster requirements (generally when structures are rebuilt there are some requirements to mitigate similar damage in the future) to see if that changes the concerns. This could help identify how effective education might be in advancing local SLR planning.

This exploratory study points to several avenues of promising future research. First, given the diversity of responses from this survey, future research can further examine the relative importance of factors related to priorities, funding methods, and conflict resolution methods to each other and better understand variability in these priorities across respondents. Second, because two funding mechanisms dominated the survey responses (taxes and cost shifting), it makes sense for future research to examine public opinions on these concepts in greater detail, including gathering more detail on some common subcategories, such as property taxes and risk-based taxes. Third, to gain a more thorough understanding of how the public would prefer to address conflict prevention and resolution on sea level rise planning, there is a need for future research that could examine methods of public engagement in more detail. Finally, future research could clarify that planning does not always mean governmental entities, only, and could explore public perceptions of the role of government in planning (which is the focus of this

research) and response (such as the role of the Federal Emergency Management Agency in responding post-disaster). Recognizing and integrating community members' preferences on sea level rise planning are far from the only component necessary to successfully develop and implement a sea level rise plan. Local communities will need to develop a technical understanding of potential changes and ways to adapt and protect the community in light of them. They will need to overcome funding challenges and navigate complex tradeoffs across competing priorities. It is precisely because of this wide array of challenges that understanding and integrating public preferences is so important. It will allow communities to start with a mutual understanding of how to determine what they should include in a plan, how to fund it, and what to do to address conflict. Recognizing the data collected here is far from the final word on the subject, the insights from this study could help communities start down this path.

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SUPPLEMENTAL MATERIALS

Part 1: Coding Summary by Question

Table 4

Planning Factors (Question 1) Coding Summary Table of Categories

# Responses	Primary Category	# Responses	Subcategory
34	Mitigation Measures	12	Built Systems
		8	Not Specified
		6	Natural Barriers
		5	Building Standards
		2	Natural Systems
		1	Permanent Relocation
25	Information Resources	18	Risk Mapping
		4	Cost Projections
		2	Impact Information
		1	Risk Disclosure
19	Public Engagement	16	Education
		2	Decision-making

(Continued)

Table 4 (Continued)

# Responses	Primary Category	Advocacy	
		# Responses	Subcategory
12	Policies	1	Land Use
		3	Insurance
		2	Budgeting
		1	Not Specified
		1	
12	Research	4	Flooding Prediction
		3	Long-term Impacts
		2	New Building Standards
		1	Comparative Study
		1	Natural Systems
		1	New Response Measures
		1	
11	Response Planning	7	Temporary Relocation
		4	Warning Systems
7	External Factors	3	Climate Change
		3	Climate Mitigation
		1	Extreme Events

Table 5

Funding Mechanisms (Question 2) Coding Summary Table of Categories

# Responses	Primary Category	# Responses	Subcategory		
46	Taxes	9	Property Tax		
		9	Risk-based Tax		
		7	User Fees / Taxes		
		6	Tax Incentives		
		5	Dedicated (Not Specified)		
		5	Sales Tax		
		2	Construction Tax		
		2	No Taxes		
		1	Not Specified		
		30	Regulatory Cost Shifting	10	Insurance Requirements
				7	Owner Mitigation
6	Land Use				
4	Building Standards				
2	Eminent Domain				
1	No Regulations				
1					
8	Loans	5	Bond issuance		
		3	Loans to individuals/businesses		
7	Self-Funding	5	Owner Responsibility		
		2	Local Cost Sharing		
5	Allocation	4	Modify Existing Budget		
		1	Reserve Funds		
5	Cost-Avoidance	3	Reduce Other Expenses		
		1	No Funding		

(Continued)

EXPLORATION OF LOCAL SEA LEVEL RISE PLANNING PUBLIC PERCEPTIONS

Table 5 (Continued)

# Responses	Primary Category	# Responses	Subcategory
		1	Reduce Labor Costs
4	Specific Measures	3	Mitigation
		1	Recycling
4	Outside Assistance	2	State / Federal Funds
		2	Non-profit Funds

Table 6

Conflict Resolution Options (Question 3) Coding Summary Table of Categories

# Responses	Primary Category	# Responses	Subcategory		
67	Public Engagement	21	Education		
		18	Public Meetings		
		8	Collective Action		
		8	Media Outreach		
		6	Voting		
		3	Planning (Not Specified)		
		2	Disclosure / Transparency		
		1	Mediation		
		12	Regulatory Methods	4	Disclosure / Transparency
				4	Zoning
3	Additional Regulation				
1	Exempt Existing				
12	Specific Measures			3	Emergency Response
		2	Taxes		
		2	Zoning		
		1	Building Standards		
		1	Insurance		
		1	No Action		
		1	Not Specified		
		1	Recovery Funds		
		7	Analytical Methods	5	Cost Benefit Analysis
				2	Scientific Basis
3	Incentive Methods	2	Public Recognition		
		1	Funding		
2	Business Engagement	2	Real Estate Community		
2	Legal Avenues	2	Legal Actions		
2	Political Engagement	1	Campaign Issues		
		1	Collective Action		

Part 2: Coding Results by Question with Full Responses

Table 7

Planning Factors (Question 1) Coding Results with Full Responses

Category	Subcategory	Full response with coding preparation applied
External Factors	Climate Change	Global warming
External Factors	Climate Change	Weather pattern changing sea currents
External Factors	Climate Change	When will the next ice age start.... If ever
External Factors	Climate Mitigation	Develop incentives to minimize auto use and other activities to reduce carbon emissions that contribute to sea ice melt
External Factors	Climate Mitigation	Steps to contain global warming
External Factors	Climate Mitigation	Incentivize overall sustainability initiatives - solar, wind power
External Factors	Extreme Events	Increased hurricane frequency / severity
Information Resources	Cost Projections	Future cost of water containment adjacent to flood prone areas
Information Resources	Cost Projections	Identifying cost-effective solutions
Information Resources	Cost Projections	Finding the least expensive ways to prevent flooding
Information Resources	Cost Projections	Finding cost effective solutions
Information Resources	Impact Information	Clear data outlining potential impacts
Information Resources	Impact Information	Use [Understand the Location impact of flooding] to project where damage will be the heaviest
Information Resources	Risk Disclosure	Requiring sellers of flood-prone property to make full disclosure before transfer
Information Resources	Risk Mapping	Locations of houses / buildings
Information Resources	Risk Mapping	Designation of areas likely to be impacted
Information Resources	Risk Mapping	Predicting areas most likely prone to flooding
Information Resources	Risk Mapping	Accurate mapping of neighborhood terrain above or below current sea level
Information Resources	Risk Mapping	Understand the Location impact of flooding...where it will take place first
Information Resources	Risk Mapping	Conducting a risk assessment, including identification of at-risk areas, at-risk populations, and critical infrastructure vulnerable to flooding
Information Resources	Risk Mapping	Accurate prediction of at-risk areas
Information Resources	Risk Mapping	Tides, in particular king tides and how they affect coastal areas
Information Resources	Risk Mapping	Seeking out locations where flooding may arise
Information Resources	Risk Mapping	Identifying particularly flood-prone areas
Information Resources	Risk Mapping	Identifying areas at greatest risk
Information Resources	Risk Mapping	Focus on most at risk population / locations to establish priorities for action
Information Resources	Risk Mapping	Looking for places at risk of flooding
Information Resources	Risk Mapping	Identification of existing land uses in areas in danger

(Continued)

EXPLORATION OF LOCAL SEA LEVEL RISE PLANNING PUBLIC PERCEPTIONS

Table 7 (Continued)

Category	Subcategory	Full response with coding preparation applied
Information Resources	Risk Mapping	Pay particular attention to roads when identifying areas prone to flooding
Information Resources	Risk Mapping	Identify areas that will inevitably be hard hit
Information Resources	Risk Mapping	Density of people at or near beach increasing
Information Resources	Risk Mapping	Environmental impacts of flooding
Mitigation Measures	Building Standards	Freeboard under building first floor in flood prone areas
Mitigation Measures	Building Standards	Ensure that houses and / or buildings are built on stilts
Mitigation Measures	Building Standards	Improve and modify building codes to allow for more resistant structures e.g. Elevations, height restrictions, under house parking etc.
Mitigation Measures	Building Standards	Construction on stilts in coastal areas
Mitigation Measures	Building Standards	Enforce building codes and zoning codes that disallow construction in floodable areas
Mitigation Measures	Built Systems	Ensure that existing drainage is working & well maintained
Mitigation Measures	Built Systems	Drainage development
Mitigation Measures	Built Systems	Maintaining / creating drainage ditches
Mitigation Measures	Built Systems	Sea walls (although prohibited in most areas)
Mitigation Measures	Built Systems	Install flap gates on drain outfalls to prevent back flow at high tides
Mitigation Measures	Built Systems	Mitigation (rerouting, dams, hurricane wall -New Bedford, MA)
Mitigation Measures	Built Systems	Maintaining / creating storm drains
Mitigation Measures	Built Systems	Identify areas prone to flooding and add additional drainage
Mitigation Measures	Built Systems	Undertaking structural improvements to prevent or lessen damage caused by flooding
Mitigation Measures	Built Systems	Boats legally should be secured.
Mitigation Measures	Built Systems	Determining levels of seas walls needed
Mitigation Measures	Built Systems	Installing underground holding areas where run-off can be held and slowly reabsorbed
Mitigation Measures	Natural Barriers	Maintaining / creating dunes
Mitigation Measures	Natural Barriers	Beach refurbishing
Mitigation Measures	Natural Barriers	Artificial modification of natural barriers
Mitigation Measures	Natural Barriers	Reinforcing foundations and buffering for new dunes
Mitigation Measures	Natural Barriers	Planting to protecting erosion (sea grapes- sea oats-etc.
Mitigation Measures	Natural Barriers	Artificial reefs
Mitigation Measures	Natural Systems	Creation of "green" areas where the water can be absorbed
Mitigation Measures	Natural Systems	Use of materials that promote surface drainage
Mitigation Measures	Not Specified	Taking remedial action to avoid flooding

(Continued)

Table 7 (Continued)

Category	Subcategory	Full response with coding preparation applied
Mitigation Measures	Not Specified	Plan for protecting communities from impacts
Mitigation Measures	Not Specified	Permanence of any solution
Mitigation Measures	Not Specified	Use [project where damage will be the heaviest] to mitigate the damage
Mitigation Measures	Not Specified	Take appropriate action regardless of cost
Mitigation Measures	Not Specified	Use [understanding locations] and [areas of greatest impacts] to try to put in preventative measures.
Mitigation Measures	Not Specified	Limiting activities known to increase flooding risks
Mitigation Measures	Not Specified	Publish - distribute Government available funding, grants, support for implementing mitigation approaches
Mitigation Measures	Permanent Relocation	Re-location of facilities
Policies	Budgeting	Budgeting for prevention and mitigation, when possible/applicable
Policies	Budgeting	Do not invest tax dollars in efforts to prevent flooding that will benefit few people
Policies	Insurance	Establishing policy for home insurance
Policies	Insurance	Flood insurance that is attainable and reasonable
Policies	Insurance	Allowing adults to make ill-advised decisions to build in flood-prone areas but not provide insurance
Policies	Land Use	Zoning for housing taking into account risks of flooding
Policies	Land Use	Future building too close to flood line
Policies	Land Use	Setting economic incentives to avoid building in danger areas
Policies	Land Use	Push for laws restricting building close to coasts, riverways that are affected
Policies	Land Use	Restrict the use of impervious surfaces (driveways, patios, sidewalks, etc.
Policies	Land Use	Preventing development in areas at risk for flooding
Policies	Not Specified	Consider ways to enforce policies aimed at countering flooding
Public Engagement	Advocacy	Identifying individuals in the community who will advocate for the solutions
Public Engagement	Decision-making	Developing consensus in the community about best methods to avoid damage
Public Engagement	Decision-making	Triage decisions as to what should and should not be done
Public Engagement	Education	Educating the public regarding causes of flooding
Public Engagement	Education	Community education
Public Engagement	Education	Community better understanding causes of flooding

(Continued)

EXPLORATION OF LOCAL SEA LEVEL RISE PLANNING PUBLIC PERCEPTIONS

Table 7 (Continued)

Category	Subcategory	Full response with coding preparation applied
Public Engagement	Education	Educating the community
Public Engagement	Education	Community education to on risk to build knowledge and support for change needed
Public Engagement	Education	Educating community about this
Public Engagement	Education	Educating the public on the causes of climate change
Public Engagement	Education	Community outreach to spread the message
Public Engagement	Education	Ensuring the community is aware of the risks of flooding
Public Engagement	Education	Publish -distribute proven cost-beneficial mitigation approaches
Public Engagement	Education	How to address the naysayers who oppose climate change projections
Public Engagement	Education	Educating the public regarding the hazards of flooding
Public Engagement	Education	Communication and education for community
Public Engagement	Education	Engaging entire community in educational programs re flooding
Public Engagement	Education	Those living on the water should attend discussions about what supplies to keep and preventative measures
Public Engagement	Education	How to educate the community on the interconnectivity of [location, severity, and mitigation]
Research	Comparative Study	Reviewing actions of other similar communities
Research	Flooding Prediction	Better understanding the causes of flooding
Research	Flooding Prediction	Improving the prediction of flooding events
Research	Flooding Prediction	Effect of reductions of permeable land
Research	Flooding Prediction	Run off from flooding in areas that normally don't flood
Research	Long-term Impacts	Erosion, whether it be beaches or marshes
Research	Long-term Impacts	Better understanding of the effects of subsidence on existing coastal terrain
Research	Long-term Impacts	Understanding the risk of sea level rise vs temporary flooding
Research	Natural Systems	Beach erosion increasing. Loss of beach
Research	New Building Standards	Government sponsored research and marketing of construction-property fortification techniques that minimize future flood damage
Research	New Building Standards	Developmental standards that would lessen damage caused by flooding
Research	New Response Measures	Understanding ways to counteract flooding
Response Planning	Temporary Relocation	Evacuation plans
Response Planning	Temporary Relocation	People must be aware that they must evacuate during significant storms

(Continued)

Table 7 (Continued)

Category	Subcategory	Full response with coding preparation applied
Response Planning	Temporary Relocation	Clearly marking evacuation routes
Response Planning	Temporary Relocation	Development of effective evacuation routes and plans
Response Planning	Temporary Relocation	Designated shelters
Response Planning	Temporary Relocation	Preparing a response plan to flooding, including (but not limited to) evacuation route, shelters, etc.
Response Planning	Temporary Relocation	Establish evacuation plans
Response Planning	Warning Systems	Implement better flood warning systems and communicate potential impact to community stakeholders early.
Response Planning	Warning Systems	Emergency notification like a amber alert if water rising
Response Planning	Warning Systems	Monitoring of actual tide and flood levels under varying conditions
Response Planning	Warning Systems	Advanced warning

Table 8

Funding Mechanisms (Question 2) Coding Results with Full Responses

Category	Subcategory	Full response with coding preparation applied
Allocation	Modify Existing Budget	Make flood prevention a major priority within existing budget levels
Allocation	Modify Existing Budget	Set asides of funds from other areas (e.g., entertainment taxes)
Allocation	Modify Existing Budget	Redirect money going to less vital causes
Allocation	Modify Existing Budget	Rearranging of budgetary priorities
Allocation	Reserve Funds	Dedicated "emergency" funds
Cost-Avoidance	No Funding	No funding is an option
Cost-Avoidance	Reduce Labor Costs	Subsidize labor costs with volunteer efforts or with prison / community service teams
Cost-Avoidance	Reduce Other Expenses	Cutting expenses
Cost-Avoidance	Reduce Other Expenses	Balance the budget; cut other expenses
Cost-Avoidance	Reduce Other Expenses	Reducing expenses in other areas, for example our area spends as much on administration in the school district as teachers
Loans	Bond issuance	Local communities selling bonds like they might to build a school
Loans	Bond issuance	Raise funds via bond issue or bank debt
Loans	Bond issuance	Bonds
Loans	Bond issuance	Bonds
Loans	Bond issuance	Bond initiative

(Continued)

EXPLORATION OF LOCAL SEA LEVEL RISE PLANNING PUBLIC PERCEPTIONS

Table 8 (Continued)

Category	Subcategory	Full response with coding preparation applied
Loans	Loans to individuals/businesses	Low or no interest local, state or federal loans
Loans	Loans to individuals/businesses	Local government financing with owners repaying over 10 years (amortized payment)
Loans	Loans to individuals/businesses	Personal loan at financial institution
Outside Assistance	Non-profit Funds	Funding by non-profit environmental groups
Outside Assistance	Non-profit Funds	Donations from charities such as the American Red Cross
Outside Assistance	State / Federal Funds	Lobbying legislatures and government agencies for financial assistance
Outside Assistance	State / Federal Funds	Use federal and state funding to the maximum extent
Regulatory Cost Shifting	Building Standards	Incorporating relevant measures into new construction requirements
Regulatory Cost Shifting	Building Standards	Require improvements to be paid for by residential owners who insist on building close to shore
Regulatory Cost Shifting	Building Standards	Building requirements that would minimize flooding damage
Regulatory Cost Shifting	Building Standards	Local ordinances to force sound construction
Regulatory Cost Shifting	Eminent Domain	Eminent Domain takings of properties in danger
Regulatory Cost Shifting	Eminent Domain	Use dollars to buy out owners where it makes no sense to rebuild
Regulatory Cost Shifting	Insurance Requirements	Flood insurance is mandatory
Regulatory Cost Shifting	Insurance Requirements	Docks currently can't be insured in Florida, this should be changed
Regulatory Cost Shifting	Insurance Requirements	Mandatory federal insurance programs to pay for losses
Regulatory Cost Shifting	Insurance Requirements	Reducing government contribution to flood insurance
Regulatory Cost Shifting	Insurance Requirements	Money should be kept in escrow for flooding for those homes and buildings likely to be affected
Regulatory Cost Shifting	Insurance Requirements	Require all property owners in flood zone to purchase private flood insurance
Regulatory Cost Shifting	Insurance Requirements	The government should not act an insurer.
Regulatory Cost Shifting	Insurance Requirements	Require flood insurance
Regulatory Cost Shifting	Insurance Requirements	Require a level of insurance that will pay the entire cost
Regulatory Cost Shifting	Insurance Requirements	Insurance premium reduction incentives

(Continued)

Table 8 (Continued)

Category	Subcategory	Full response with coding preparation applied
Regulatory Cost Shifting	Land Use	Zoning laws that prohibit building in flood zones
Regulatory Cost Shifting	Land Use	Reestablish new flood zones based on expected flooding levels
Regulatory Cost Shifting	Land Use	Zoning / building restrictions
Regulatory Cost Shifting	Land Use	Consider whether rebuilding makes sense in certain areas
Regulatory Cost Shifting	Land Use	Local zoning ordinances
Regulatory Cost Shifting	Land Use	Don't expect to build a dike to hold back the seas, like in Holland. Prepare for a new coastline. Prohibit building where it makes no sense.
Regulatory Cost Shifting	No Regulations	It is not the government's job to maintain a coastline.
Regulatory Cost Shifting	Owner Mitigation	Property specific mitigation requirements
Regulatory Cost Shifting	Owner Mitigation	Fine property owners who fail to install reasonable countermeasures
Regulatory Cost Shifting	Owner Mitigation	Require home owners to act to remediate potential flooding
Regulatory Cost Shifting	Owner Mitigation	Requiring drainage improvements
Regulatory Cost Shifting	Owner Mitigation	Requiring property owners to install measures
Regulatory Cost Shifting	Owner Mitigation	Requiring owner mitigation improvements
Regulatory Cost Shifting	Owner Mitigation	Landowner mandates
Self-Funding	Local Cost Sharing	Home owners association (sharing costs)
Self-Funding	Local Cost Sharing	Fundraise
Self-Funding	Owner Responsibility	This is a property owner responsibility
Self-Funding	Owner Responsibility	Self-funding
Self-Funding	Owner Responsibility	Homeowners may end up paying some amount for flooding on their own property
Self-Funding	Owner Responsibility	Property owners should bear all the risk of sea rise
Self-Funding	Owner Responsibility	Mandatory requirement that home owner pay if they want to build or rebuild
Specific Measures	Mitigation	Planting sea oats on dunes
Specific Measures	Mitigation	Sand fences to slow wind and cause sand to drop
Specific Measures	Mitigation	Underground utilities
Specific Measures	Recycling	Creating ways to store / utilize flood waters for irrigation and other needs
Taxes	Construction Tax	Tax on new construction
Taxes	Construction Tax	Assessments on new development in the area

(Continued)

EXPLORATION OF LOCAL SEA LEVEL RISE PLANNING PUBLIC PERCEPTIONS

Table 8 (Continued)

Category	Subcategory	Full response with coding preparation applied
Taxes	Dedicated (Not Specified)	Dedicated tax
Taxes	Dedicated (Not Specified)	Dedicated tax for upgrades
Taxes	Dedicated (Not Specified)	Dedicated tax
Taxes	Dedicated (Not Specified)	Dedicated tax
Taxes	Dedicated (Not Specified)	Use specific, project related taxes as last resort. Such funds should not be for general budget use.
Taxes	No Taxes	This is not a taxpayer responsibility
Taxes	No Taxes	Tax money should not be used to protect people's shore houses
Taxes	Not Specified	People on the water are already heavily taxed so this might be decreased if measures are taken
Taxes	Property Tax	Assessments for those living in gated communities
Taxes	Property Tax	Dedicated tax on homeowners
Taxes	Property Tax	Dedicated tax on ocean front property
Taxes	Property Tax	Requiring property owners to pay tax
Taxes	Property Tax	Tax on insurance for these properties
Taxes	Property Tax	Surcharges on sale of property to fund community initiatives
Taxes	Property Tax	Dedicated local property tax assessment
Taxes	Property Tax	Increase overall property taxes
Taxes	Property Tax	Tax based on property value for those in coastal areas, floodplains, or areas prone to flooding
Taxes	Risk-based Tax	Assessment of taxes on properties most likely to need protection from flooding
Taxes	Risk-based Tax	Tax for facilities in a flood zone
Taxes	Risk-based Tax	Variable local tax for living in a 100 or 25- year floodplain, etc.
Taxes	Risk-based Tax	Increase property taxes for property in at-risk areas
Taxes	Risk-based Tax	A small property tax for those in affected areas
Taxes	Risk-based Tax	Tax on those homeowners' who do not install anti-flooding measures
Taxes	Risk-based Tax	Property assessment on communities where there be increased flooding risks
Taxes	Risk-based Tax	Tax on towns and communities in flood-prone areas
Taxes	Risk-based Tax	Tax any projects that build on threatened areas
Taxes	Sales Tax	Currently 1 cent sales tax for beach re-nourishment

(Continued)

Table 8 (Continued)

Category	Subcategory	Full response with coding preparation applied
Taxes	Sales Tax	Dedicated local, hotel, motel and home rental taxes
Taxes	Sales Tax	Dedicated Local business sales taxes
Taxes	Sales Tax	Meal tax in coastal areas
Taxes	Sales Tax	Impose higher taxes on cigarettes, gas, alcohol
Taxes	Tax Incentives	Providing tax incentives to private businesses / homeowners for implementing relevant measures
Taxes	Tax Incentives	Tax credit for homeowners' who install anti-flooding measures
Taxes	Tax Incentives	Incentives to encourage sustainability measure that cut carbon dioxide
Taxes	Tax Incentives	Providing tax incentives for "Leed" construction
Taxes	Tax Incentives	Tax credits for individuals that pay for upgrades
Taxes	Tax Incentives	Smaller tax for facilities adjacent to a flood zone
Taxes	User Fees / Taxes	Road use tax in coastal areas
Taxes	User Fees / Taxes	Fee, like the bag fee
Taxes	User Fees / Taxes	Emissions tax
Taxes	User Fees / Taxes	Increased charge to use the beach or for beach parking
Taxes	User Fees / Taxes	Tax on tourists
Taxes	User Fees / Taxes	Communities could out on functions and charge a fee which could be put into an account
Taxes	User Fees / Taxes	Higher bag tax, with proceeds dedicated to environmental protection measures

Table 9

Conflict Resolution Options (Question 3) Coding Results with Full Responses

Category	Subcategory	Full response with coding preparation applied
Analytical Methods	Cost Benefit Analysis	Cost - benefit analysis
Analytical Methods	Cost Benefit Analysis	Ranking options by cost
Analytical Methods	Cost Benefit Analysis	Position that has the least negative impact on local residents and property owners
Analytical Methods	Cost Benefit Analysis	Ranking options by permanence of fix
Analytical Methods	Cost Benefit Analysis	Identifying prohibitive (costly) options
Analytical Methods	Scientific Basis	Use good, peer reviewed science as basis for decisions

(Continued)

EXPLORATION OF LOCAL SEA LEVEL RISE PLANNING PUBLIC PERCEPTIONS

Table 9 (Continued)

Category	Subcategory	Full response with coding preparation applied
Analytical Methods	Scientific Basis	Ensure all communications are data-driven and unbiased
Business Engagement	Real Estate Community	Working with realtors and developers
Business Engagement	Real Estate Community	Working with local development communities
Incentive Methods	Funding	Position that has the most funding support
Incentive Methods	Public Recognition	Rewarding those companies in the private sector for environmental initiatives
Incentive Methods	Public Recognition	Recognize the efforts of communities that create programs to address these issues
Legal Avenues	Legal Actions	Municipalities prepare to defend homeowner and business lawsuits
Legal Avenues	Legal Actions	Lawyers or other representation
Political Engagement	Campaign Issues	Have local candidates develop focused plans in connection with their candidacies
Political Engagement	Collective Action	Work sessions with members of local governing body
Public Engagement	Collective Action	Establish a local committee with very broad property owner representation
Public Engagement	Collective Action	Volunteer organizations like the MRC or CERT where community members learn both about emergency response and about the cultural diversity of neighbors
Public Engagement	Collective Action	Canvassing door to door
Public Engagement	Collective Action	Tours / visits to imperiled areas
Public Engagement	Collective Action	Working with community organizations
Public Engagement	Collective Action	Making known how their neighbors are doing and how they could be disagreeing
Public Engagement	Collective Action	Involve equal parts political, academic, and corporate entities coalesced around a single message
Public Engagement	Collective Action	Organize volunteer days to plant sea grass, etc.
Public Engagement	Disclosure / Transparency	Listing alternatives (results of not responding)
Public Engagement	Disclosure / Transparency	Making public consultant reports on options
Public Engagement	Education	Community outreach education programs
Public Engagement	Education	Educate the public on ways these efforts will benefit the individual and the community
Public Engagement	Education	Education in schools
Public Engagement	Education	Community education
Public Engagement	Education	Educational efforts by local and state governments
Public Engagement	Education	Educate the public on the risks to them, individually of not taking these measures
Public Engagement	Education	Educating about consequences
Public Engagement	Education	Post internet information
Public Engagement	Education	Local educational programs

(Continued)

Table 9 (Continued)

Category	Subcategory	Full response with coding preparation applied
Public Engagement	Education	Teach mitigation methods, not just doom and gloom
Public Engagement	Education	Educational efforts by non-profit environmental groups
Public Engagement	Education	Community oriented written communications
Public Engagement	Education	Prior outline of what will happen after flooding
Public Engagement	Education	Those that have been impacted by flooding should give lectures and educate
Public Engagement	Education	Include information with property tax mailings
Public Engagement	Education	Creating program for students which teach them how to contribute to the resolution of this problem and the benefits of doing so
Public Engagement	Education	Curriculum in public schools
Public Engagement	Education	Better educate school children to need to plan for eventual flooding
Public Engagement	Education	Examples of how past situations have been responded to and results
Public Engagement	Education	State-sponsored educational programs
Public Engagement	Education	Educate community on protection strategies that have worked elsewhere, even though controversial at the time
Public Engagement	Media Outreach	Dedicated social media sites
Public Engagement	Media Outreach	Communicate frequently to all property owners (mailings, emails, etc.)
Public Engagement	Media Outreach	Radio advertising
Public Engagement	Media Outreach	TV advertising / programs
Public Engagement	Media Outreach	Public service announcements
Public Engagement	Media Outreach	Sending mailings to residents
Public Engagement	Media Outreach	TV ads
Public Engagement	Media Outreach	Documentary films
Public Engagement	Mediation	3rd party, independent mediators
Public Engagement	Planning (not specified)	Pre-planning and advanced agreement
Public Engagement	Planning (not specified)	Public prioritizing of options
Public Engagement	Planning (not specified)	Develop plans well in advance
Public Engagement	Public Meetings	Hold meetings
Public Engagement	Public Meetings	Public meetings are critical
Public Engagement	Public Meetings	Public meetings to educate public
Public Engagement	Public Meetings	Public meetings
Public Engagement	Public Meetings	Public education meetings
Public Engagement	Public Meetings	Public meetings
Public Engagement	Public Meetings	Holding public meetings
Public Engagement	Public Meetings	Public meetings
Public Engagement	Public Meetings	Public education through meetings
Public Engagement	Public Meetings	Public listing of options
Public Engagement	Public Meetings	Public planning meetings
Public Engagement	Public Meetings	Local community discussion and vote

(Continued)

EXPLORATION OF LOCAL SEA LEVEL RISE PLANNING PUBLIC PERCEPTIONS

Table 9

Category	Subcategory	Full response with coding preparation applied
Public Engagement	Public Meetings	Hold community outreach events in public places to ease discourse
Public Engagement	Public Meetings	Hold community meetings with concentration on areas where flooding likely to occur
Public Engagement	Public Meetings	Participatory, public forums to discuss issues
Public Engagement	Public Meetings	Public hearings on consultant reports
Public Engagement	Public Meetings	Each community should select an officer and a yearly convention
Public Engagement	Public Meetings	Hold town hall meetings for folks to congregate, ask questions, and propose new ideas
Public Engagement	Voting	Voting on protection strategies
Public Engagement	Voting	Voting
Public Engagement	Voting	Voting
Public Engagement	Voting	Ballot initiatives
Public Engagement	Voting	Vote on dedicated taxes up or down
Public Engagement	Voting	Vote on dedicated taxes - give 3 or 4 choices
Regulatory Methods	Additional Regulation	Enact federal legislation
Regulatory Methods	Additional Regulation	There should be direct consequences for those who do not vacate, etc.
Regulatory Methods	Additional Regulation	Change laws to better protect environment/people
Regulatory Methods	Disclosure / Transparency	Rules should not leave any room for interpretation
Regulatory Methods	Disclosure / Transparency	Require full disclosure
Regulatory Methods	Disclosure / Transparency	Include info with annual insurance policies
Regulatory Methods	Disclosure / Transparency	Government transparency when changing policy, voting, etc. On items like changes in taxes, response plans, etc.
Regulatory Methods	Exempt Existing	Grandfather existing uses
Regulatory Methods	Zoning	Clear regulations and zoning
Regulatory Methods	Zoning	Make coastal planning mandatory for all looking to build within flood zone
Regulatory Methods	Zoning	Don't encourage people to buy property in flood-prone areas
Regulatory Methods	Zoning	Building should not be allowed to close to water's edge and landfill should not be permitted
Specific Measures	Building Standards	Require all structures to have habitual area above flood prone areas
Specific Measures	Emergency Response	Clear evacuation plans
Specific Measures	Emergency Response	Backup communication systems
Specific Measures	Emergency Response	Use a triage model set up prior to flooding
Specific Measures	Insurance	Mandate insurance or a new form of insurance
Specific Measures	No Action	Let adults be adults
Specific Measures	Not Specified	Executive initiatives

(Continued)

Table 9 (Continued)

Category	Subcategory	Full response with coding preparation applied
Specific Measures	Recovery Funds	Designated disaster fund
Specific Measures	Taxes	Don't spend tax money for the benefit of a few
Specific Measures	Taxes	Let communities set tax rate to fund measures to be taken in advance, with an expectation that that is what will be done and that is the extent that the community is willing to protect itself
Specific Measures	Zoning	Change zoning laws to not allow building / rebuilding structures in flood predicted areas
Specific Measures	Zoning	Prohibit new uses