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Science, Policy, and Decision Making: A Case Study of Deliberative Rhetoric and Policymaking for Coastal Adaptation in Southeast Florida

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by

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DEDICATION

This dissertation is dedicated to my parents, who supported my decision to pursue this degree and were always confident that I would complete this project successfully. Without their confidence and support, my PhD experience would not have been nearly as positive, productive, and rewarding as it has been. This dissertation is also dedicated to the Dutch scholars, consultants, and engineers who have provided me with professional mentorship and the unique opportunity to learn about the Dutch approach to climate adaptation policy. Their insight, enthusiasm, friendship, and advice has motivated me to pursue this topic and has been strongly influential in the arguments made throughout this dissertation. I am particularly humbled and grateful to benefit from the advice of Arno Willems, Aline te Linde, and Warren Walker.

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ABSTRACT

The purpose of this study was to observe and analyze the process of regional climate adaptation planning and the role of stakeholder deliberation in decision making about adaptation actions. It employed a case study approach based on one of three total study sites of an international, multidisciplinary grant titled, "METROPOLE: An Integrated Framework to Analyze Local Decision Making and Adaptive Capacity to Large-Scale Environmental Change". The purpose of the case study of this project was to analyze stakeholder deliberation at two workshops at the grant's Broward County, Florida site regarding two adaptation options: elevation/floodproofing and voluntary buyouts. Analyzing stakeholder deliberation about these two options allowed for the identification of specific barriers to adaptation for stakeholders in this region. These barriers were then used to suggest values regarding adaptation priorities and planning. The primary idea driving this project was that deliberation provides a pragmatic approach to determining stakeholder values and preferences – which ought to be used to inform planning and decision making about climate policy. The ultimate goal of this project was to demonstrate how the rhetorical concepts of situated judgment, persuasion, and deliberation can be applied in adaptation planning processes and therefore, how applied rhetoric contributes to the production of "usable" science, or science that takes decision makers' preferences and needs into account when making policy decisions.

The problem that this project responds to involves three interrelated parts: framing, communication, and policymaking. Currently, climate change framing in the US is largely characterized by "debate" and emphasizes only one aspect of the climate change problem: cause. The second part of the problem pertains to communication and in particular, the way in which scientific and economic data about climate change/adaptation is typically delivered to non-scientific audiences. The third part of the

problem as it is addressed in this project pertains to policymaking, or what enables or prevents progress toward effective policymaking.

Data collected for this project include: surveys, 10 in-depth interviews, and field notes. The first layer of analysis was facilitated through Decision Explorer, a qualitative software commonly used in strategic management and decision sciences. For this project, Decision Explorer was used to cognitively map and analyze data from the 10 in-depth interviews. The second layer of analysis used NVivo, a qualitative coding software, to organize and code data collected from all sources. The findings of this project concluded that for stakeholders in this region, the four primary barriers to adaptation were: leadership, resources, invisibility/timing, and the limitations of modeling processes. Stakeholders' primary values about climate adaptation reflected their strong sense of place attachment. These values were expressed in terms of altruistic values, or concerns about how the local implications of climate may affect humans (e.g., how vulnerably located critical infrastructure and weakening transportation infrastructure will affect citizens' safety and community resilience) and "scientific" values, such as the inclusion of regional scientific factors in climate modeling and adaptation planning.

One of the most significant contributions of this project was the development of an approach that leverages the application of rhetorical concepts in science policy planning/decision making. This unique strategy embedded the rhetorical components of deliberation, situated judgment, *phronesis* and persuasion within the three framing tasks of collective action framing (i.e., diagnostic, prognostic and motivational framing) to illustrate a unique approach for engaging stakeholders in adaptation planning. More broadly, this project responded to calls for social science research to provide useful recommendations about how to facilitate more effective stakeholder engagement and communication about climate adaptation planning and policy.

CHAPTER ONE:

APPROACHING "DEEP UNCERTAINTY:" STAKEHOLDER ENGAGEMENT IN ADAPTATION PLANNING AND DECISION MAKING IN BROWARD COUNTY, FLORIDA

1.1 Climate Change Framing of the Problem and Communication Strategies

Climate change is one of the most widely contested "grand societal challenges" today (Lyall & Fletcher, 2013; Olson, 2013). This is largely because in many cases, policymaking has framed climate change as an *exclusively* scientific problem which can be solved by increasing the scientific literacy of the public/non-scientists (Nisbet & Scheufele 2009; Moser & Dilling, 2011; Ungar 2007). More research and data on climate science does not necessarily guarantee the success of policy or decision making about how to respond to the implications of climate change (e.g., adaptation) because prediction in science is different than prediction for policy (Pielke, 2001).[1] As a result of the failures to motivate coordinated action on climate change, it is now widely suggested that research in the social sciences can provide useful recommendations about how to facilitate more effective public engagement and communication (Beichler, Hasibovic, Jan Davidse & Deppisch, 2014; Cozzens & Gieryn, 1990; Fuller, 2006; Hadorn et al., 2008; Moser, 2010; Olsen et al., 2013; Pidgeon & Fischhoff, 2011; Weaver et al., 2014). One of the most valuable insights social sciences research offers the natural sciences is that "systematic empirical understanding of an intended audience's existing values, knowledge and attitudes, their interpersonal and social contexts and their preferred media sources and communication channels" is necessary for facilitating effective public engagement and support for climate science policy (Nisbet & Scheufele, 2009, p. 1767). The primary idea driving this project is that deliberation provides a pragmatic approach to

[1] This is the basis of the "deficit model" approach to science policy, which is explained below in the section titled "Climate Change Framing and Communication."

planning and decision making about climate policy (Danisch, 2010; Garsten, 2009; Grabill, 1998; Keranen, 2008; Scott, 2006; Simmons, 2007). Traditional approaches to climate policy planning and decision making typically presume that it is necessary to reduce uncertainty or "settle" the science before engaging decision makers (Pielke, Sarewitz & Dilling, 2010). Research in rhetoric and communication shows that because deliberative approaches are situated or tailored to the problem and context of a specific situation, they often yield trade-offs and constructive formulation of common interests that promote broadly supported decisions (Lindseth, 2003; Tompkins et al., 2002). However, these deliberative approaches also have limitations and challenges (for instance, selecting relevant stakeholders and facilitating a genuinely balanced exchange where experts and stakeholders construct, discuss and promote alternative options together (Brown et al., 2002; Few, Brown & Tompkins, 2011; Mikalsen & Jentoft, 2001).

This project used a case study approach to research stakeholder deliberation about coastal hazards in Broward County, Florida. This study[2] is part of a National Science Foundation/Belmont Forum grant titled, "An Integrated Framework to Analyze Local Decision Making and Adaptive Capacity to Large-Scale Environmental Change."[3] Data includes observations and qualitative surveys from two stakeholder participation workshops. In-depth interviews with 10 stakeholders who participated in both workshops further inform the results. The purpose of the grant is to examine local stakeholder values and beliefs about sea level rise and coastal hazards. To discover this information, the grant activity provided Geographic Information System (GIS) visualizations of potential inundation in their community and data estimating the subsequent cost-benefits of implementing adaptation actions to fortify, accommodate, or relocate critical assets in their communities. At the stakeholder participation workshops, regional decision makers, academics, representatives from nonprofit organizations (NPOs), urban planners, local elected officials and private citizens deliberated about these visualizations and the possibility of implementing

[2] The other two research sites are Selsey, the United Kingdom and Santos, Brazil.
[3] Referred to subsequently as "the grant" to distinguish the grant from the case study of this dissertation.

two adaptation options in their communities – elevation/floodproofing or voluntary buyouts. My research is focused on identifying the barriers to adaptation that stakeholders expressed during these workshops in the process of determining effective coastal adaptation policy. These barriers provide insight into participants' values, which can be used to frame more effective communication about adaptation planning.

1.1.1 Grant and Case Study Objectives

The purpose of the grant is to enable social and natural scientists to collaboratively develop alternative ways of responding to stakeholder preferences, values, and beliefs regarding their vulnerability to coastal hazards[4] (e.g., storm surge, sea level rise). Stakeholder selection consisted of identifying municipal staff, elected officials, agencies, utilities, water management boards, and business and citizen leaders in the region (METROPOLE Project Description, 2013). The objectives of the grant are to analyze:

- How attitudes and values of decision makers can influence receptivity to scientific/economic data and scenarios, and build flexible governance approaches
- How stakeholders perceive and respond to locally specific scientific knowledge and economic and adaption options presented in visualizations
- Decision making tradeoffs about costs, risk, and public good for defined adaptation options and stakeholders' and institutions' willingness to support actions
- Regional adaptive capacity – institutional factors that support citizens' ability to adapt and to mobilize toward change (METROPOLE Project Description, p. 1).

[4] Although "coastal hazards" is the term used in the grant proposal, I will use "coastal vulnerabilities" instead, because of the rhetorical distinctions between the two terms: whereas "hazard" implies an inevitable danger or risk, in which only a reaction is possible, "vulnerability" identifies a weakness; a susceptibility to danger/risk. Consequently, "vulnerability" *allows* for a response, whereas "hazard" does not. Since the ultimate focus of this project is to determine the factors influencing citizens' preferences for adaptation options, vulnerability is more accurate because it frames the problem as one that citizens can positively influence/change.

These objectives are possible through the COAST (Coastal Adaptation to Sea Level Rise Tool) process, which uses software designed to produce 3-D spatial data representing damage from sea level rise and storm surge by estimating the costs and benefits (based on exceedance curves of flood elevations) of various adaptation actions. In preparation for the two participatory planning meetings at each research site, the natural sciences team used the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) models to produce regional climate change scenarios using maps of landscapes and infrastructure that are familiar to participants in order to more effectively understand – and potentially revise – coastal planning practices within their respective communities. During the first meeting, participants were presented with visualizations (GIS maps) of the effects of sea level rise at low and high projections (per the U.S. Army Corps of Engineers' sea level change calculator, which projects the amount of predicted sea level change from 1992 forward) in 2030 and 2060[5] (Climate Change Adaptation, 2014). At the end of this meeting, they voted on whether the grant planning team should model the adaptation options discussed – elevation/floodproofing and voluntary buyouts. At the second meeting, the planning team presented the cost-benefits data associated with implementing each adaptation action at the two timeframes, 2030 and 2060.

The premise of the COAST process is that providing participants with a visual simulation of how flooding from storm surge and sea level rise will affect infrastructure that is familiar to them (e.g., their local airport, privately owned buildings) along with an estimate of the costs and benefits of implementing various levels of adaptation actions in their region (including inaction) will motivate them to consider, and perhaps reconsider or change, their existing responses to coastal risks (Cutter, Mitchell & Scott, 2000; National Academy of Sciences, 2009; Slovic, 1993).

The research questions of this dissertation focused on the *process* of regional policymaking within conditions of deep scientific uncertainty and the possibility of using rhetorical strategies to

[5] For 2030, the low projection was three inches and the high, seven inches. For 2060, the low projection was nine inches and the high, 24 inches.

approach regional policymaking for coastal adaptation. Traditionally, the goal of science-policy research has been to provide detailed, generalizable models; however, in contexts of deep scientific uncertainty, scholars have suggested that concrete explanations of *how* other institutions succeed – information about their processes, versus recommendations based on their results – may provide more useful insight to decision makers (Logar, 2011). Walker, Marchau, and Swanson assert that new approaches are needed to deal with conditions of deep uncertainty since traditional approaches for handling uncertainty are inadequate for policy making (2010). This project responds to the need for more research on the process of policymaking under conditions of deep scientific uncertainty, as opposed to the development of frameworks or directives that prescribe policy.

Recent publications in science policy literature suggest that science policy scholars who seek to improve decisions should:

> look [for] empirical examples that work in certain situations and provide them not as recommendations, but as options in a range of alternatives that institutions can utilize in developing their science policies, adapt as needed, or attempt and then disregard. (Logar, 2011)

As a result of this shift in science-policy research and in light of calls for increased scholarly attention to the process of *how* policy making ought to occur in contexts of deep scientific uncertainty, the first two research questions of this project focus on identifying what values drive regional stakeholder perceptions of coastal vulnerabilities; how those values are expressed in their deliberation about regional climate models and the COAST maps/visualizations; and to what degree their deliberation emphasizes the necessity for improving predictive modeling. The last two research questions take up the challenge of how to improve climate change communication by suggesting alternative frames for communicating about climate change as it affects this specific region and conclude with insight into alternative approaches to adaptation planning in coastal regions.

1.2 Risk, Rhetoric and Climate Adaptation Policy

The type and severity of uncertainty that society faces has changed the relationship between science and the public (Beck, 1999, 2009; Danisch, 2010). Ulrich Beck calls this type of uncertainty "contemporary risk" – a risk that exists on an unprecedented scale, is difficult to quantify and therefore less available to the science of statistics for purposes of quantification (Beck, 1999, 2009; Danisch, 2010). "Deep uncertainty," defined as a situation in which the multiple possibilities of a particular event cannot be completely enumerated or ranked in order of how likely or plausible they are judged to be (Kwakkel & Pruyt, 2012; Lempert et al., 2013; Walker, Lempert & Kwakkel, 2013), is the term used to characterize contemporary risks. Deep uncertainty occurs where myriad factors – both scientific and social – are uncertain, making it difficult to accurately define, quantify and agree on system models, prior probability distributions for inputs and interdependencies, and value systems to rank alternatives (Kandlikav, Risbey & Dessai, 2005; Kwakkel, Walker & Marchau, 2010; Lempert et al., 2003; Lempert, Nakicenovic, Sarewitz & Schlesinger, 2004; Thissen & Walker, 2013). Because of the deep uncertainty inherent in contemporary risks like climate change, complete reliance on predictive approaches is likely to lead to policies that perform poorly (Kwakkel, Walker & Marchau, 2010; Kwakkel & Pruyt, 2012), as we have witnessed with U.S. climate policy. As a result, new approaches are needed for responding to conditions of deep uncertainty and adapting to contemporary risks (Walker, Marchau, Swanson, 2010).

Rhetoricians argue that in an age of contemporary risk, it is necessary to develop a scientific "prudence"[6] capable of guiding deliberation in public culture – and that rhetoric is uniquely positioned for this challenge (Danisch, 2010; Grabill, 2007; Herndl 2013, 2015; Keranen, 2008; Sauer, 2003; Scott, 2006; Simmons, 2007). Rhetoric is an approach to reasoning and argumentation that hinges on situated judgment, persuasion and deliberation. Where traditional approaches to policy and decision making perceive a universal "Public," alternative, rhetorical approaches perceive of multiple, unique "publics,"

[6] Prudence is the ability to deliberate about particular, contingent matters while relying on practical experience and virtue (Aristotle, trans. 2006).

meaning that rhetoric is "situated," or focused on how to shape communication so that it reflects the unique characteristics, values, and attitudes of particular publics (audiences) and contexts (Aristotle, trans. 2006; Garsten, 2009; Gross, 1994).

For the purposes of this project, the rhetorical concept of persuasion consists of ethical, emotional and logical appeals, all of which depend on listening to and understanding a particular audience's concerns, values, knowledge, attitudes and social context *before* attempting to engage the audience in argument or, in this case, discussion about adaptation planning (Aristotle, trans. 2006; Booth, 1988; Weaver, 1985). In rhetoric this is called "rhetorical reasoning," which is an approach to reasoning through argumentation, as opposed to reasoning through demonstration of logical necessity based on certainty (Spranzi, 2011). Without this integral, ethical effort to listen to and understand an audience's concerns, the approach is not rhetorical because it is not situated in the audience's context or strategic in customizing communication for that particular audience. Situated rhetoric emphasizes timing – the "when" of a conversation – and analyzes the audience and the relevant situation surrounding the conversation *at that moment* in order to develop relevant, effective arguments (Zimmerman, 2009). The difference in a rhetorical approach, as opposed to a traditional approach to public engagement in policy and decision making, is that it starts the task of argumentation where a public "is," learns about their characteristics and preferences, and then shapes an argument within those preferences so that it can be more easily understood by that particular audience. The ends of an ethical, rhetorical persuasion are not conversion or the ability to successfully convince an audience. The motivation of an ethical, rhetorical persuasion is for the audience to judge *for themselves* whether an argument is appealing and convincing enough to be worth their consideration and support (Garsten, 2009; Meyer, 2015).

Deliberation is the process of dialogue and decision making about uncertain matters. It is concerned with the future and the present, as it involves choosing among competing courses of action now, in order to attain future advantage (Danisch, 2010; Hart & Dillard, 2006; Mouffe, 1999; Murphy, 2005). Deliberation is part of deliberative rhetoric – an approach to stakeholder engagement about the

courses of future action that may be considered for responding to an existing contingency. The goal of deliberative rhetoric is to come to a decision that will profit the audience in the future; however, oftentimes, the outcome of this process is not a decision, but further clarity and definition of the problem itself (Few, Brown & Tompkins, 2011; Lindseth 2003; Spash, 2001; Tompkins et al., 2002). As is explained in Chapter Two, the deliberative rhetoric that stakeholders engaged in during the two participatory planning workshops of this case study culminated in the identification of specific factors (values) that needed to be considered in order to strengthen the argument for adaptation action in their community.

The following sections of this chapter establish the boundaries of this project and highlight literature that supports the research questions, which are:

1. What opportunities/barriers do stakeholders deliberate about when responding to the modeling predictions generated by COAST? In relation to these barriers, how does stakeholder deliberation reinforce/delimit the significance of the prediction imperative for decision making processes in contexts of deep scientific uncertainty?
2. What are the implicit values embedded within stakeholder perceptions of coastal vulnerabilities?
3. What frames engage stakeholders in decision making about adaptation actions in this region?
4. What are the challenges and opportunities of stakeholder engagement in adaptation planning?

1.3 U.S. Science Policy

My project is situated in a science policy context and specifically focuses on how to facilitate alternative approaches to developing policy in contexts of "deep" scientific uncertainty – specifically, climate change. Science policy in the US has recently undergone (and is still undergoing) a significant shift. The seminal science policy report, *Science: The Endless Frontier* (Bush, 1945) is most well-known for its assertion that the US ought to prioritize funding for basic research – or research that is "performed without thought of practical ends" (p. 38). In applied scientific work, in contrast, a scientific problem was defined *for* a scientist, who was then responsible for discovering the best possible solution. In basic

research, these constraints didn't exist – the scientist was confined "only by his own imagination and creative ability" (p. 39). Unfortunately, one of the most pervasive implications of this report was the division of applied and basic research, with the leveraging of basic research focused on achieving objectivity and on the premise about quantitative measurement, that "when you cannot express [data] in numbers, your knowledge is of a meager and unsatisfactory kind" (Thomson, 1883).

In the 1970s, there was a resurgence of applied research as well as a pragmatic emphasis on the economic value derived from scientific research. Currently, the "applied versus basic" dichotomy is being challenged again, but with a completely new frame for articulating its purpose – the "discovery-invention" cycle (Vinsel, Odumosu & Narayanamurti, 2013). The discovery-invention cycle is an attempt to complicate the reductionist distinctions between basic and applied research (Vinsel, Odumosu & Narayanamurti, 2013) by suggesting that we look beyond just the motivations and results of basic or applied research. Doing so necessitates that we approach science policy more broadly, considering the ways in which discovery and invention reinforce one another and the ways in which new research and innovation is linked to individual projects' results – requiring a longer-term view of the research process as a network (Vinsel, Odumosu & Narayanamurti, 2013).

This project advocates an interdisciplinary approach, focused on both the creation of new knowledge ("discovery") and the creation of a new process ("invention"). Interdisciplinary research, which often produces advances in both applied and basic science, provides an example of how this new paradigm of science policy operates. It requires an approach to research that "integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines … to advance fundamental understandings or to solve problems whose solutions are beyond the scope of a single discipline …" ("What is interdisciplinary research?," 2015). It is dual-purposed and cyclical, creating new knowledge while producing new tools and processes in tandem, and often with unintentional or unexpected results.

An interdisciplinary research approach is increasingly being considered appropriate for practicing science in contemporary contexts, where pervasive and unpredictable change necessitates that decisions be made in spite of vast uncertainties – for instance, in the context of climate change communication and policy (Fischhoff, 2000; Hadorn et al., 2008; Hagemeier-Klose, Beichler, Hasibovic, Jan Davidse & Deppisch, 2014; Olsen, Borlaug, Klitkou, Lyall & Yearley, 2013; Pidgeon & Fischhoff, 2011; Roll-Hansen, 2009). It is widely acknowledged that climate change represents a contemporary risk, meaning that it is: invisible and hard to measure; involves social inequality; is not limited to national boundaries; and generates new social conflicts (Beck, 1999, 2009). Because of the nature of this scientific problem as a contemporary risk, a new approach for responding to it is necessary – an approach for making decisions within this context of pervasive and "deep" uncertainty.

1.4 Traditional Versus Alternative Approaches to Policymaking

Traditional approaches to policy analysis and decision making focus on modeling a system or choosing among policy alternatives (Dunn 1981; House 1982; Miser & Quade 1985, 1988, 1995; Patton & Sawicki 1993; Quade 1989; Stokey & Zeckhauser 1978; Thissen & Walker, 2013). Robert Lempert (2004) refers to this type of approach as the "predict-then-act" method, in which the ultimate goal of analysis is to characterize uncertainty for decision makers so that they can (presumably) make more informed choices. This method leverages the prediction imperative, or the idea that predictive data/models about climate science simplify the decision-making process by creating a clearer and more accurate picture of the future (Meyer, 2011; Sarewitz, Pielke & Byerly, 2000). The prediction imperative implies that reducing scientific uncertainty as much as possible is the best way to provide useful information to decision makers. However, with contemporary risks like climate change, because climate models are likely to project a *wider* range of uncertainty, non-scientific stakeholders may assume that scientific understanding about the climate system is becoming less clear (Maslin & Austin, 2012). Alternative approaches, on the other hand, focus on suggesting all possible vulnerabilities of the strategies being examined and then helping decision makers choose the strategy with the most acceptable

vulnerabilities (Lempert, Nakicenovic, Sarewitz & Schlesinger, 2004). The goal of this type of applied, problem-focused research is to develop a range of choices and policy alternatives that represent avenues or "pathways" that all lead toward the same, desirable future (Haasnoot, Kwakkel, Walker & ter Maat, 2013; Hojer & Mattson, 2000; Lovins, 1976; Quist & Vergragt, 2006) as opposed to investing in research that seeks to reduce or eradicate uncertainty. In this approach, characterizing uncertainty isn't a necessary requirement for exploring policy options because it is accepted that the nature of contemporary risks necessitates that decisions be made within deeply uncertain circumstances.

1.5 U.S. Climate Change Research and Policy

In the US, climate change research on a national level emphasizes improved understanding of the climate system – including the drivers (causes) of change and improved climate modeling projections. In the most recently published National Climate Assessment (NCA) (2014) the authors assert that "significant knowledge gaps remain for all of the research priorities identified in 2009".[7] The 2009 goals recommended research on:

- Climate change impacts on ecosystems, the economy, health, and the built environment
- Projections of climate change and extreme events at local scales
- Decision-relevant information on climate change and its impacts
- Thresholds that could lead to abrupt changes in climate or ecosystems
- Understanding the ways to reduce the rate and magnitude of climate change through mitigation
- Understanding how society can adapt to climate change (Karl, Melillo & Peterson, 2009)

In chapter 29 of the 2014 report, "Research Needs for Climate and Global Change Assessments," the updated research goals are to:

- Improve understanding of the climate system and its drivers
- Improve understanding of climate impacts and vulnerability
- Increase understanding of adaptation pathways

[7] Before the 2014 assessment, 2009 was the date in which the previous assessment was published.

- Identify the mitigation options that reduce the risk of longer-term climate change
- Improve decision support and integrated assessments (Corell, Liverman, Dow, Ebi, Kunkel, Mearns & Melillo, 2014)

The goals identified in the NCA reflect a traditional approach to policymaking because of the emphasis on establishing certainty: identifying the cause of the problem, a tested framework for adaptation "best practices" and using social sciences to obtain more data on climate science and human effects on the system (Corell, Liverman, Dow, Ebi, Kunkel, Mearns & Melillo, 2014, p. 713). It is possible that the NCA's goals for establishing further certainty about the causes and implications of climate science are a response to political pressure and the growing denial and skepticism about climate change (Dunlap, 2013). However, even if this is the case, the NCA's approach is *still* traditional because it operates under the assumption that more evidence will convince denialists/skeptics that climate change is real (Brin, 2010; Powell, 2011; Washington & Cook, 2011).

Despite its emphasis on reducing uncertainty, the 2014 NCA does cite "integrating disciplines and conducting research into the behavioral and other factors that influence individual decisions" as one of its goals. One of the most important deliverables of my research is to provide an empirical example of *how* this type of research occurs in practice and to argue that a rhetorical, deliberative approach may empower stakeholders and citizens to decide more effectively on the future development of their communities. The following analysis provides a brief explanation of each of the 2014 NCA goals listed above, linking them to the research questions of my project.

The first two goals of the 2014 report, to "improve understanding of the climate system and its drivers" and "improve understanding of climate impacts and vulnerability," focus on "improving understanding," and therefore reiterate the motivation to continue researching the *origin/cause* of the problem. These goals entail research on the drivers and causes of climate change, how to more accurately trace its patterns and predict its impacts over time; an emphasis on reducing uncertainties in our existing knowledge about the climate system and its drivers and impacts. Improving understanding is a necessary

component in scientific advancement, but it is important to ask how this research goal meets the needs of decision makers. More knowledge is not always useful – many times, we have adequate information to address a problem and additional research to "settle" the science may not be the best approach or investment (Pielke, Sarewitz & Dilling, 2010). My research takes up this argument in one of the research questions of this project, "How does stakeholder deliberation reinforce/delimit the significance of the prediction imperative for decision making processes in contexts of deep scientific uncertainty?"[8]

The third goal, increasing understanding of adaptation pathways, cites two specific tasks: to identify best practices for adaptation planning (which requires rigorous and comparative analyses of their effectiveness) and to understand institutional and behavioral barriers to adaptation and how to overcome them. The goal of determining "best practices" for adaptation planning may be likely to work if it accounts for the diversity of ways in which adaptation occurs in a variety of regions, under a multitude of risks and socio-economic uncertainties. Because adaptation efforts look very different within specific locations, regions and across states, what works in one region is not likely to work exactly the same way in another (Burton, Diringer & Smith, 2006). As a result, there will be a great many "adaptation pathways" or potential responses to the impacts of climate change because the effects of climate change are experienced locally – and *differently* – throughout regions and states. Adaptation goals are largely place-based; successful adaptation efforts are situated and context-specific (Funfgeld & McEvoy, 2011). Therefore, the goal of seeking "increased understanding of adaptation pathways" will ultimately break down into an understanding of individual case studies. Even if a categorization such as "adaptation to sea level rise" is used to consolidate actions in multiple regions, the practices within that category will inevitably be shaped by socio-economic factors and peoples' perceptions and motivations to act, and therefore, actions that are best for one region's adaptation are likely to be different from what is best for another region's response to the same issue.

[8] This question is the second of a two-part research question.

My project responds to the argument that empirical examples, and not frameworks, ought to be provided as options in a range of alternatives that can be utilized in developing science policy, adapted as needed or attempted and possibly disregarded (Logar, 2011). This perspective emphasizes the importance of providing decision makers with "usable" science, or science that takes into account decision makers' vastly different – and constantly changing – needs (Pielke, Sarewitz & Dilling, 2010). The case study design of this project, as well as research question four, which asks, "What are the challenges and opportunities of engaging local stakeholders in adaptation planning?" respond to this argument.[9]

The last goal, improving decision support and integrated assessments, prioritizes providing the "best available scientific information in support of decision making…" but also cites that decision support and integrated assessment "requires research into behavioral and other factors that influence individual decisions" (Corell, Liverman, Dow, Ebi, Kunkel, Mearns & Melillo, 2014, p. 712). Overall, although the Assessment reiterates the need to increase understanding and improve projections – to reduce uncertainties – it also asserts the need to integrate natural and social sciences with climate science research. However, it does so by suggesting that, "research investments across a broad range of disciplines are critically important to building understanding of and *reducing uncertainties* …" and that the "social sciences are essential to *improved understanding and modeling of the drivers* of climate change." Research question four, which asks "What are the challenges and opportunities of engaging local stakeholders in adaptation planning?" provides an analysis of how social sciences research was incorporated into the COAST workshops. It also suggests strategies for using philosophical and pragmatic rhetorical concepts in traditional approaches to stakeholder engagement and participation, especially when deliberating about issues of scientific uncertainty.

[9] The NCA's fourth research goal, identifying mitigation options, will require international collaboration – an issue that is distinct from adaptation and as a result, isn't taken up in this project.

1.5.1. State of Florida: Climate Change Research and Policy

Responses from state-level leadership in Florida to questions about climate change consistently link climate change with environmental issues and insist that scientific expertise is necessary for making decisions about improving the state's resilience to sea level rise, in particular. In 2011, when asked about whether he believed that humans have caused climate change, Florida Governor Rick Scott responded that he was not convinced of anthropogenic climate change. In 2014, when asked, "Do you believe man-made climate change is significantly affecting the weather, the climate?" he responded that he was not a scientist and shifted his response to a discussion of flood control funding and Everglades restoration and water flow – planning and environmental issues. Now, in 2015, he is facing criticism again because of reports that he banned the term "climate change" in certain state agencies. When asked about the accusation, his response deferred again to environmental issues (Korten, 2015). Scott's responses have been criticized by the media; however, the criticism has yet to examine the questions that have been posed to him by the media. In each instance, the media's questions have been framed around "man-made climate change" (i.e., cause) and "belief" in climate science. The media's rhetoric emphasizes the cause of the phenomenon and the uncertainty surrounding it. Framing questions with this rhetoric has consistently proven that anthropogenically driven climate change isn't an effective frame for communicating with Governor Scott about this issue. As is discussed in Chapter Four, the "climate change debate" frame, which is focused on whether the causes of climate change are anthropogenic/natural, is contentious and highly politicized and therefore unproductive for decision making about how to respond to climate impacts (Ford, Berrang-Ford & Paterson, 2011; Pielke, 2010). The media's demands that Governor Scott assert the cause of climate change or that he attest belief in science are unproductive tactics because they rely exclusively on science to motivate action. By framing questions with rhetoric that emphasizes "cause" and "belief," those asking the questions are ironically reinforcing the prediction imperative – the idea that predictive data/models about climate science are necessary for simplifying the decision-making process because they create a clearer and more accurate

picture of the future. Alternative ways of reframing communication about climate change and shifting the emphasis from cause to response are provided in Chapter Four of this project.

1.5.2 Regional Climate Change Research and Policy

As a result of inaction at the state level in Florida, efforts to respond to climate change (as of November 2015) are occurring on a regional level. The Southeast Florida Regional Climate Compact, established in 2010, was the first of its kind in terms of a collaborative effort toward planning for climate change adaptation (Lobo, n.d.; World Resources Institute, 2013). The Compact consists of bipartisan collaboration between Broward, Miami-Dade, Monroe, and Palm Beach counties in conjunction with federal, state, municipal, non-profit, academic and private sector partners. The purpose of the Compact is to influence climate/energy legislation at the state and (ultimately) federal levels. In 2011, after amendments to Florida's Community Planning Act (CPA) which allowed for the (optional) designation of "Adaptation Action Areas," (AAAs) the Compact has made significant progress in establishing an AAA in Broward County and in developing policy tools and resources that can be useful for advising future adaptation and resilience planning around the state. One of the Compact's first priorities was to establish a unified sea level rise projection *despite* existing uncertainties about differences in sea level projections (Regional Climate Action Plan, 2012). The Compact, and this decision, represent an alternative approach to policymaking – one that is regionally driven and one that accepts that decisions must be made despite the inevitable uncertainties of scientific data. Regional approaches to policymaking, like the Compact, can serve as empirical examples of stakeholder participation in adaptation planning; however, the adaptation strategies that work in Southeast Florida will not work for West Central Florida, as these two regions do not experience the same types of effects of climate change. For instance, Southeast Florida experiences "sunny-day" flooding when high tides push seawater through the storm drains and into the streets. West Central Florida doesn't experience this same phenomenon, so the adaptation actions taken within these two regions – within the same state – are very different. One of the goals of the NCA, discussed above, is to "increase understanding of adaptation pathways." While this goal does need to be

pursued, research question four of this project argues that regions and communities are affected very differently by climate change (as in the example with Southeast and West Central Florida) and furthermore, that their stakeholders and private citizens hold different values and perceptions as a result of their experiences. These specific values and perceptions – along with the unique impacts of climate change seen in different regions – ought to significantly influence the ways in which climate change and adaptation planning are communicated and enacted. Chapter Four cautions about implementing state-level adaptation action, given the perception that broad, generalized policies are unlikely to effectively address the vulnerabilities and impacts experienced in the state's unique regions and communities.

1.6 Climate Change Framing and Communication

Framing climate change as a scientific problem has proven ineffective in most policymaking contexts because the majority of public/non-scientist citizens don't connect the technical details of climate science with other salient issues and priorities within their lives (e.g., the economy, their children and families, health, safety). As a result, trying to persuade a non-scientist with purely scientific evidence doesn't usually result in the understanding and action that scientists hope to achieve (Moser & Dilling 2011; Nisbet 2009). Frames, or the connections that people intuitively make with certain words, images, tones of voice, and particular messengers, provides triggers that often lead to action – for instance, the correlation of the word "green" with the environmental movement and "going green" by recycling (Benford, 1993; Benford & Snow, 2000; Moser & Dilling, 2011; Snow et al., 1986). What is significant to note is that in this example, the "green" frame is only effective with those who *already* share some values with the larger environmental/sustainability movement and it is generally ignored or challenged by those who don't consider themselves to be environmentalists or who don't wish to be associated with the movement for various reasons. When frames aren't carefully constructed – when they're assumed to "fit" a universal audience – they aren't effective because they aren't situated. Framing climate change exclusively as a scientific problem only resonates with those who *already* value climate science and not with those who don't identify with those same priorities, backgrounds or experiences.

Similarly, increasing climate literacy has also proven ineffective as a solution for obtaining more widespread support for climate science and policy. This purported solution is based on the "deficit model," which follows that if citizens are educated about the technical details of climate science, then they will subsequently understand and therefore value climate science and support climate change policy. In a deficit model approach, communication is defined as transmission. Experts *tell* lay audiences about the technical aspects of climate change, which typically occurs in a one-way communication where there is little room for dialogue, building a shared understanding of the problem (and therefore trust-building) and consideration of the feasibility of potential solutions (Hulme, 2009; Moser & Dilling, 2011).

There are two major explanations for why the deficit model approach hasn't proven to be an effective solution (Layton et al., 1993; Wynne, 1991; Ziman, 1991). First, when experts teach audiences about the technical details of climate science, this almost always occurs without a thorough understanding of the characteristics, experiences, and existing knowledge of the audience – without first assessing the audience through observation, engagement, and most importantly, deliberation focused on how the audience perceives of climate change and its expected implications. When this "careful listening" (Smith et al., 2013) doesn't occur, the scientist's communication may either be too basic or too complicated for the scientific proficiency, awareness and experience of the audience. When this occurs, the scientist's message often fails to resonate with and persuade the audience because it isn't linked to a matter that individuals in the audience are already concerned about. Following Aristotelian rhetoric, citizens deliberating about matters relating to their own concerns are thought to judge better than those asked to judge about distant matters, or issues that don't invoke existing values (Aristotle, trans. 2006; Garsten 2006; Marcus 2002; Marcus, 2000).

Secondly, when scientists attempt to educate a non-scientific audience about climate science, they don't typically engage the audience in deliberation about the problem or solutions that have either been attempted or that are being discussed on a local scale. Consequently, the focus is on educating the audience about the specifics of the problem and not on determining the audience's ability, capacity or

preferences for responding to it. When climate change information is presented without any viable solutions – what Robert Brulle (2010) calls "challenge appraisals" – the result is often disengagement by the public because the implications of the problem seem unmanageable. In contrast, when scientific information about climate change is partnered with effective, specific actions for responding, it proves to be strongly motivating (Hassol, 2015; MIT, 2015; Moser & Dilling 2011; Moser & Ekstrom 2010). Given the failures of the educational project dictated by the deficit model, I argue that the only way to determine the actions that a particular audience will agree to is to deliberate, listen, and negotiate with that audience to collaboratively determine how to effectively implement desired actions.

1.7 Research Questions

RQ 1: What opportunities/barriers do stakeholders deliberate about when responding to the modeling predictions generated by COAST? In relation to these barriers, how does stakeholder deliberation reinforce/delimit the significance of the prediction imperative for decision making processes in contexts of deep scientific uncertainty?

Research Question one is significant because it examined the extent to which stakeholder deliberation reflected problems within climate change communication. Whereas traditional policymaking approaches rely primarily on cost-benefits analyses to inform decisions, this type of approach is not fully appropriate for the "climate problem" because to a large degree, many affects cannot be expressed monetarily and because the uncertainties are so pervasive (Tol, 2003; Yohe, 2004, Yohe & Leichenko, 2010). Therefore, careful attention to the opportunities and barriers that stakeholders deliberate about provides critical insight into their values (Dietz, 2013). The values expressed by stakeholders during deliberative sessions in both COAST meetings are important to identify and understand because values and personal experiences have a significant influence over non-scientists' judgment about scientific uncertainties like climate change (Fischhoff, 2007; Patchen 2006; Slovic 2000). Although the purpose of the COAST process was to provide detailed technical and economic data (i.e., rational information) in order to position stakeholders to make "better," more informed judgments about the feasibility of

adaptation options, the deliberative aspects of the process provided useful insight into barriers to adaptation – and subsequently, insight into participants' values, emotions and perceived control/agency; factors that are argued to be extremely useful in motivating action and behavior change.

Research question one also provides useful insight into the degree to which the "prediction imperative" influenced stakeholder deliberations about COAST data and models. It is widely argued that predictive information *alone* does not lead to effective decision making (Lempert et al., 2013; Pielke, 2001; Sarewitz, Pielke & Byerly, 2000; Weber, 1999). As a result, it is suggested that prediction be considered as an element in a process in which a variety of participants, perspectives, institutions, values and resources are considered (with predictive information) in order to determine policy options. Data obtained from the in-depth interviews conducted for this project – in particular, answers to one of the questions to interviewees, "How does the uncertainty of the COAST models affect your confidence in their predictions?" – provides answers to this question. Additionally, this data is useful for developing suggestions about how to position prediction and modeling data to better serve effective decision making in regional policymaking processes.

RQ 2: What are the implicit values embedded within stakeholders' perceptions of coastal vulnerabilities?

Research question two was developed in light of the acknowledgement that traditional approaches to climate change communication are failing in part because of the assumption that scientific/technical information (alone) will motivate public support for climate science. Deficit model approaches which attempt to educate or persuade non-scientific audiences with purely scientific evidence aren't resulting in the understanding and support that scientists are seeking (Kahan et al., 2011; Moser & Dilling 2011; Nisbet 2010; Nisbet & Scheufele, 2009). As a result, the challenge is to determine *how* to incorporate stakeholder values into decision making about complex, deeply uncertain environmental problems such as long-term coastal planning (Davos 1998; Davos & Lajano, 2001; Tomkins, Few & Brown, 2008). In response to this challenge, social science research in psychology, political science and rhetoric suggests

that connecting climate science information with an audience's *existing* values is an effective means of achieving better, more informed judgments and decisions (Aristotle, trans. 2006; Garsten, 2006; Kahan et al., 2011). For this project, understanding stakeholder perspectives about the COAST process, including the usefulness of visualization tools and mapping; infrastructure vulnerability and the costs and benefits of resiliency planning; and leadership preferences for adaptation strategies, clarifies specific values about coastal vulnerability and planning for this region. Determining these values is necessary for developing the frames that engage stakeholders in decision making about adaptation actions in this region; research question three of this project.

RQ 3: What frames engage stakeholders in decision making about adaptation actions in this region?

Framing climate change as a scientific problem has proven ineffective because the majority of non-scientist citizens don't connect the technical details of climate science with other salient issues and priorities within their lives (e.g., the economy, their children and families, health, safety). It is generally agreed upon that existing approaches to communication about climate change aren't working (Moser & Dilling, 2011) and that a different approach is needed. This project takes up this challenge by exploring how rhetorical concepts may be used to guide the development and implementation of regionally led adaptation policymaking. To date, although rhetorical analysis has sometimes been incorporated into theoretical approaches in policy studies and political science (Gottweis, 2007), it has not explicitly been used as a tool informing an alternative approach to policy and decision making (Fischer & Gottweis, 2012). Chapter Four, which answers this research question, explains how an Aristotelian definition of rhetoric justifies its usefulness as a tool for regional policymaking especially in contexts of deep uncertainty, like climate change and adaptation. As a contemporary risk, the implications of climate change are largely invisible and hard to measure (e.g., sea level rise projections); involve social inequality; cannot be confined to national boundaries; and generate new social conflicts, such as the paralyzing debate over causation and uncertainty of scientific data. Chapter Four also suggests that there

are productive possibilities for reframing climate change (and especially adaptation) by distinguishing it from environmentalism and the environmental movement. Doing so may shift the emphasis of climate change conversations from an overreliance on establishing the accuracy of quantitative modeling data and beyond the highly politicized frame of determining the causes of climate change into more pragmatic and adaptive responses to coastal vulnerabilities (Marshall, 2014; Nisbet 2010).

RQ 4: What are the challenges and opportunities of engaging local stakeholders in adaptation planning?

Regionally led approaches to policymaking are proving to be effective means of determining how to respond to environmental change (Brysse, Oreskes, O'Reilly & Oppenheimer, 2013; Moser & Dilling, 2007; Osterblom et al., 2013; Schreurs, 2008; Shaw et al., 2009; Vasconcelos, Santos & Pacheco, 2013). These smaller-scale negotiations address the *specific* experiences and challenges that particular communities cope with on a regular basis. In doing so, these approaches show how framing climate change as a *global* problem; setting goals for enhancing "Public" understanding of climate science; or deferring exclusively to expert-led research and transmission of climate science data are largely ineffective for motivating action on regional and local scales. Local levels of governance are typically where policy ideas are first generated and where some of the most creative policy solutions are being tested (Haasnoot, Kwakkel & Walker, 2012; Schreurs, 2008). For instance, the South Florida Regional Climate Compact proposed an amendment to Florida's Community Planning Act (CPA), which allowed for the optional designation of "Adaptation Action Areas," (AAAs). The amendment passed in 2011 and since that time, the Compact has made significant progress in establishing an AAA and in developing policy tools and resources that should be useful toward future adaptation and resilience planning around the state. However, despite this progress, to date there is little systematic research into *how* to facilitate collaborative local policymaking processes to respond to environmental change. As a result, Chapter Four takes up this research question by focusing on the process of organizing and implementing regional adaptation planning workshops, as this insight is argued to provide more value than blueprint approaches

or frameworks (Few, Brown & Tomkins, 2007; Tomkins, Few & Brown, 2006; Vasconcelos, Santos & Pacheco, 2013).

Chapter Four answers research questions three and four above by suggesting that *situated* frames that define local problems versus global issues are more effective in motivating action in response to climate vulnerabilities. Situated frames are argued to enable deliberation about future responses to a phenomenon and are therefore explored within this chapter in an effort to provide usable science for decision making (de Boer & Wardekker, 2010; Dilling & Lemos, 2011; Nisbet 2009; Pielke, 1995; Robinson et al., 2006; Schlumpf et al., 2001). Chapter Four also provides a critical analysis of the process of stakeholder engagement in adaptation planning discussions, focusing on the challenges inherent in efforts to engage diverse stakeholders in these processes and on how to balance scientific expertise with deliberative, rhetorical approaches to problem definition and planning.

CHAPTER TWO:

METHODOLOGY: AN INTEGRATED METHODOLOGICAL APPROACH TO DECISION MAKING UNDER DEEP UNCERTAINTY

2.1 A Methodological Approach to Deep Scientific Uncertainty

Scholars across the natural and social sciences have asserted that a new approach is necessary for responding to deep scientific uncertainty (Crick, 2014; Fischhoff, 2000; Hadorn et al., 2008; Hagemeier-Klose, Beichler, Hasibovic, Jan Davidse & Deppisch, 2014; Keranen, 2013; Olsen, Borlaug, Klitkou, Lyall & Yearley, 2013; Pidgeon & Fischhoff, 2011; Prelli, 2013; Roll-Hansen, 2009; Scott, Segal & Keranen, 2013; Wynn & Walsh, 2013). A new approach is needed because deep scientific uncertainty has different characteristics from traditional uncertainty and risk; the assumptions we traditionally make about uncertainty and risk don't hold for deep scientific uncertainty. Ulrich Beck calls traditional uncertainties and risks "older dangers" to distinguish them from "contemporary risks," such as the deep scientific uncertainty inherent in climate science (Beck, 1992, 1999, 2009; Danisch, 2010). Contemporary risks cannot be contained, quantified, predicted or managed – as older dangers were understood to be (Kandlikav, Risbey & Dessai, 2005; Kwakkel, Walker & Marchau, 2010; Lempert et al., 2003; Lempert, Nakicenovic, Sarewitz & Schlesinger, 2004; Thissen & Walker, 2013). Traditional approaches to science policymaking, which presume that it is necessary to reduce uncertainty or "settle" science before engaging decision makers (Pielke, Sarewitz & Dilling, 2010), aren't appropriate for responding to contemporary risks and deep uncertainties, which are often invisible, hard to measure, involve social inequality and breach national boundaries (Beck, 1999, 2009). Contemporary science, and especially climate science, involves irreducible uncertainties which cannot be settled or contained before making decisions. Therefore, a new approach to making decisions about these types of uncertainties and risks is

necessary – an approach for making decisions *within* this context of inherent, pervasive and "deep" uncertainty. This new approach to science policymaking differs from a traditional approach because it accepts that decisions must be made within contexts of deep uncertainty – which means developing responses without waiting for the science to be "settled." As a result, these decisions often involve "solutions sets," which present a range of acceptable decisions, as opposed to one, optimal decision (Tompkins, Few & Brown, 2008). These types of decisions are flexible in order to allow for the inclusion of additional scientific information as it becomes available (Tompkins, Few & Brown, 2008).

This new approach is also distinct because it involves coordinated action with stakeholders and decision makers *throughout* the policymaking process. Stakeholder engagement is an effective approach in many complex cases, especially those that have longer-term, far-reaching implications (e.g., climate change) and is argued to be "crucial to the success of adaptation projects" (Conde, Lonsdale, Nyong & Aguilar, 2005). Engaging stakeholders and decision makers in policymaking processes is argued to have numerous advantages, some of which are:

- Greater community support, buy-in and responsibility for decisions and tradeoffs
- More creative ideas, opportunities and recommendations for action
- Increased understanding of community context; enabling decision makers insight into local knowledge and constituents' preferences
- Improved cost effectiveness of policy decisions (Adomakai & Sheate, 2004; Fischer, 2000; McNie, 2008; NOAA, 2007; Nyong & Aguilar, 2004; Twigg, 1999)

Like other scholars in sociology, economics and political science, I argue that an approach which emphasizes a systematic, empirical understanding of an audience's values, knowledge, attitudes and interpersonal/social contexts provides a more effective strategy for public engagement and building support for regional adaptation options (Nisbet & Scheufele, 2009).

This project uses an empirical example of stakeholder engagement in decision making about adaptation planning in order to examine the *process* of decision making under scientific uncertainty. In

order to answer the research questions of this project, I have used an integrated methodological approach, borrowing methods from public policy, qualitative decision sciences and sociology, in order to determine stakeholder perceptions about the opportunities/barriers of regional decision making about coastal vulnerabilities. This particular approach was chosen in order to provide "usable" scientific information to decision makers (Dilling & Lemos, 2011; Pielke, Sarewitz & Dilling, 2010). Usable science is science that meets the changing needs of stakeholders and decision makers, needs which are defined by their perception of scientific "usefulness" and their willingness or capacity to respond to it (Dilling & Lemos, 2011; Pielke, Sarewitz & Dilling, 2010). Usable science is rhetorical: it is context-driven, situated and necessitates deliberation – the process of meeting the needs of decision makers by involving them throughout the process of decision making for institutions, policies and processes (Pielke, Sarewitz & Dilling, 2010). Providing usable science involves engaging in science at the intersection of policy and decisionmaking. The argument of this project is that rhetoric offers the theoretical and pragmatic tools for approaching this challenge.

2.2 An Integrated Methodology for Applied Rhetoric of Science

By incorporating rhetorical theory into these methods, the findings of this dissertation contribute unique insight into the process of decision making under uncertainty – what is referred to as "contingency" in rhetoric. For Aristotle, rhetoric is explicitly bound to the contingency of a moment, the motivations of a particular audience (public) and imperatives of judgment (Crick, 2014). My decision to integrate other disciplines' methodologies was a response to recent scholarship in rhetoric (and in particular, in the rhetoric of science) encouraging researchers to engage in scholarship that addresses the interface between publics and science – an *Applied* Rhetoric of Science or "ARoS" (Ceccarelli, 2013; Druschke, 2014; Goodwin, 2014; Herndl & Cutlip, 2013; Walker, 2014). This type of research contributes to the discipline as well as to the stakeholders who can benefit from it (Ceccarelli, 2013). It contributes explicitly to the ARoS project by taking up the appeal to rhetoricians to think beyond the traditional "rhetoric toolbox" (e.g., rhetoricial criticism, discourse analysis and ethnography) toward how

to utilize methods of social science in ways that leverage our uniquely rhetorical contributions (Scott, Segal & Keranen, 2013). For this project, these rhetorical contributions are the situated practice of rhetoric (including deliberation, situated judgment and persuasion) and the Aristotelian concept of contingency as the realm of rhetoric.

Rhetorical concepts – in particular, situated judgment, persuasion and deliberation, provide insight into how perceptions and arguments are shaped, how and why they differ and what the implications of these perceptions/arguments are for different audiences (Prelli, 2013). All of these insights can inform the type of communication, framing and messaging that is most effective in *particular* circumstances and with *particular* audiences and publics. This is a productive "place" for rhetoric in science-based decision making: to provide insight into *how* and *why* arguments are deployed during the process of deliberation and decision making in situations where multiple, alternative possibilities exist (Crick, 2014). In contexts of uncertainty and contemporary risk, where certainty and prediction cannot be assured, a rhetorical perspective and practice and its concern for judgment and matters of action adds practical value to the interface between publics and science. In this dissertation, I have addressed this public/science interface using a case study method and applying two layers of interdisciplinary qualitative analysis.

My first layer of analysis was facilitated through Decision Explorer, a qualitative software which has been developed in strategic management and decision sciences, to cognitively map and analyze data from 10 in-depth interviews of participants who had attended both COAST (Florida) workshops. The second layer of analysis used NVivo, a qualitative coding software, to organize and code data from three sources: a set of surveys from attendees who had participated in the two COAST workshops, field notes from researcher observations of the two workshops and in-depth interviews of 10 participants who attended both COAST workshops.

Although the analytical tools used to examine this data are similar, the maps generated using Decision Explorer provided a visual representation (a "cognitive map;" explained below) that was useful

in two ways. First, the maps revealed participants' patterns of reasoning about coastal vulnerabilities in their community, the types of adaptation options that they believed may be feasible and their preferences for governance and policymaking about these issues. This insight into participants' judgment and decision making processes allowed for deeper analysis of their values and importantly, the ways in which those values were prioritized and interrelated (in terms of responding to coastal vulnerabilities in their community), contributing to the answer to research question two of this project, "What are the implicit values embedded within stakeholder perceptions of coastal vulnerabilities?". Decision Explorer also provided a visual, logical tracing of information regarding the specific opportunities and barriers that influenced those values – contributing to the answer to research question one of this project, "What opportunities/barriers do stakeholders deliberate about when responding to the modeling predictions generated by COAST?" and "In relation to these barriers, how does stakeholders' deliberation reinforce/delimit the significance of the prediction imperative for decision making processes in contexts of deep scientific uncertainty?".

NVivo provided similar benefits. Most importantly, it provided a portal for organizing and analyzing my large data set: approximately 110 single-spaced, typed pages of data (field notes, in-depth interviews and surveys). The ability to code each of these three data sets on-screen, separately, and then to organize and synthesize them by code provided a much easier and more efficient approach to the coding process, which is traditionally extremely time consuming. Additionally, using NVivo's "merging" tool allowed me to revise and refine codes quickly and easily, therefore eliminating any redundancy among my code themes and further narrowing my analysis.

2.3 Sources of the Data Set

This project is a single-case study of two COAST workshops in Broward County, Florida. This particular case was selected because it provided an opportunity for me to observe how to facilitate a new approach to the process of policymaking – identifying and engaging local stakeholders in deliberation about regional planning for climate change adaptation. Additionally, the larger context of this case

(scientific uncertainty) has provided data and useful insight into how non-scientists and decision makers perceive of and respond to risk and uncertainty.

The first COAST workshop was held on January 29, 2015 from 9:00am – 4:00pm at the Garfield Community Center in Hollywood, Florida (approximately 11 miles south of Ft. Lauderdale). The second workshop was held on March 26, 2015 from 9:00am – 1:30pm at the I.T. Parker Community Center in Dania Beach, Florida (approximately five miles south of Ft. Lauderdale). Participants included local stakeholders and private citizens, with the majority of participants consisting of county commissioners, urban planning and design professionals, transportation engineers, water advisory board members, and local business owners.[1] The majority of participants for the in-depth interviews conducted for this dissertation were identified during the second COAST meeting, as described below. A total of 50 participants attended workshop one and 45 participants (consisting of 27 who had attended workshop one and 18 new participants) attended workshop two.

2.3.1 Field Notes

I attended both workshops as a grant team member and as an observer taking field notes. In the field notes for workshop one, I focused on transcribing as much communication as possible – everything from the grant team's presentations to participants' questions and conversations during the deliberative sessions of these workshops. Field notes for workshop one consist of 13 single-spaced pages of notes taken during this seven-hour meeting and workshop two field notes consist of seven single-spaced pages of notes taken during the three-hour meeting. Workshop two field notes focus primarily on the deliberative sessions of the workshop, in which a grant team member facilitated participants' discussion about the feasibility of the adaptation options that had been modeled based upon participants' votes in workshop one (elevation/floodproofing and voluntary relocation).

[1] See Appendix D for a list of workshop attendees.

2.3.2 Surveys

The second source of data used in this project was collected from two surveys, which were developed by the grant team and administered to participants at both workshops. The first survey (referred to throughout as "survey one") collected participants' demographic information (e.g., age range, gender, ethnicity, political affiliation, level of education) as well as information about their experiences with coastal hazards, their level of concern about the short- and long-term implications of coastal hazards, preferences for adaptation actions and a preferred timeframe within which to take action, as well as preferences for funding sources (e.g., a county-wide resiliency fund, an increase in sales tax, a low-interest loan program, etc.).[2] Although the grant team developed this survey prior to my involvement with the grant, I participated in the review and revision of the survey questions and asked that the following question be added to the survey (survey one, question eight): "Some people in your community may NOT want to support local government adaptation plans. What do you think are some of the most common reasons for not supporting plans?" This question was developed to provide this project and the grant team with data on the specific, local barriers to adaptation in this community. The information provided in this question contributed significantly to the process of reframing climate change adaptation in this region – the purpose of Chapter Four of this project. This question was also a response to calls for researchers to analyze the *specific* barriers of a community (e.g., attitudes, values) and to define very clearly what may prevent individuals in this region from supporting adaptation and other climate-related initiatives (Eisenack et al., 2014; Gifford, 2011; Moser & Eckstrom, 2010). Understanding these specific barriers to action informed my approach to developing alternative terms for communication and framing about coastal adaptation in this region – terms that are hopefully more situated, democratic and rhetorical.

The second survey (referred to throughout as "survey two") was administered to participants at the end of workshop two, after they had been presented with the cost-benefits analysis of the two adaptation actions and participated in deliberative sessions to discuss the feasibility and likelihood of

[2] See Appendix E for Survey One.

implementing those adaptation actions in their communities. This survey asked most of the same questions as survey one, in order to allow for analysis that could assess changes in participants' choices about adaptation over time. However, it also asked three new questions. The first new question asked about participants' preferences for action (i.e., now, in the next 10 years, in the next 25 years, in the next 100 years, never or "unsure") regarding the two adaptation actions discussed during workshop two.[3] The second question asked about participants' opinions about the clarity and trustworthiness of the technical information presented (i.e., the GIS maps showing levels of inundation in the study area), whether they felt more knowledgeable about adaptation and coastal hazards as a result of attending the workshops, and whether they agreed with the judgments expressed by other participants during the deliberative sessions. The third question asked participants to identify their intentions for acting on what they had learned during the workshops. This multiple-choice question included options such as, "contact my local elected official …" and "conduct an internal review of plans and budgets."[4]

2.3.3 In-Depth Interviews

In addition to the two sources identified above – field notes and surveys one and two – data was also obtained through in-depth interviews which were held during the week of May 4-8, 2015 at neutral locations throughout south Florida that were convenient to the respondents.[5] The sample size consisted of 10 respondents (n=10) and the study population was defined as stakeholders and private citizens who had attended both COAST workshops. Out of a total of 50 participants at workshop one and a total of 45 participants at workshop two, 10 agreed to in-depth interviews. The interviews were conducted face to face and each interview lasted from between 60 to 90 minutes. Interview scheduling was coordinated by email and per IRB protocol for human subjects considerations, participants' verbal informed consent was obtained prior to interviewing and at this same time, participants were provided with a brief synopsis of

[3] See "Q" and "R" of question five on Survey Two; Appendix F.
[4] See Appendix F for the complete list of options for question 12 on survey two.
[5] See Appendix G for the interviewing instrument.

the research purpose and goals after obtaining consent.[6] All interviews were transcribed and together, the 10 interviews consist of approximately 50 pages of documentation.

2.4 Data Analysis Strategy One: Decision Explorer

The first analytical layer of this research methodology uses software called "Decision Explorer," which is a qualitative, visual thinking tool. The "classic" use of Decision Explorer is for interview structuring and data analysis (Eden, Ackermann & Cropper, 1992). For this project, I used this software to analyze data obtained through in-depth interviews of 10 participants. In order to structure and analyze data, Decision Explorer uses a cognitive mapping technique that has been specifically designed for issue/problem structuring in the context of action-oriented strategic management (Brightman, 2014). Figure One below provides an example of a cognitive map generated in Decision Explorer.

A cognitive mapping approach provides a visualization or "map" of how an individual makes sense of a particular issue. It is argued to be an effective strategy for structuring complex problems and informing decision making (Eden, Ackermann & Cropper, 1992; Kelly, 1955; Martin & Hanington, 2012). Within a map, many of the concepts have incoming or outgoing links, which represent the implications or cause-and-effect relationships between concepts – the insight into *how* individuals make sense of particular issues. The analytical functions provided within Decision Explorer use these links to analyze the concepts on the map and subsequently, to highlight the salience of particular concepts.

In this project, this tool was used to create a cognitive map of each respondent's in-depth interview answers and then to analyze and compare the aggregated mapping data of all interviews (n=10) in order to determine key concepts and issues that participants prioritize in terms of planning for coastal adaptation in their community. Although I created the concepts and decided on linkages between these concepts on each of the maps, the analytical functions I used were run by Decision Explorer; I simply selected which functions I wanted to apply to the map and Decision Explorer facilitated the analysis.

[6] See Appendix H for IRB documents.

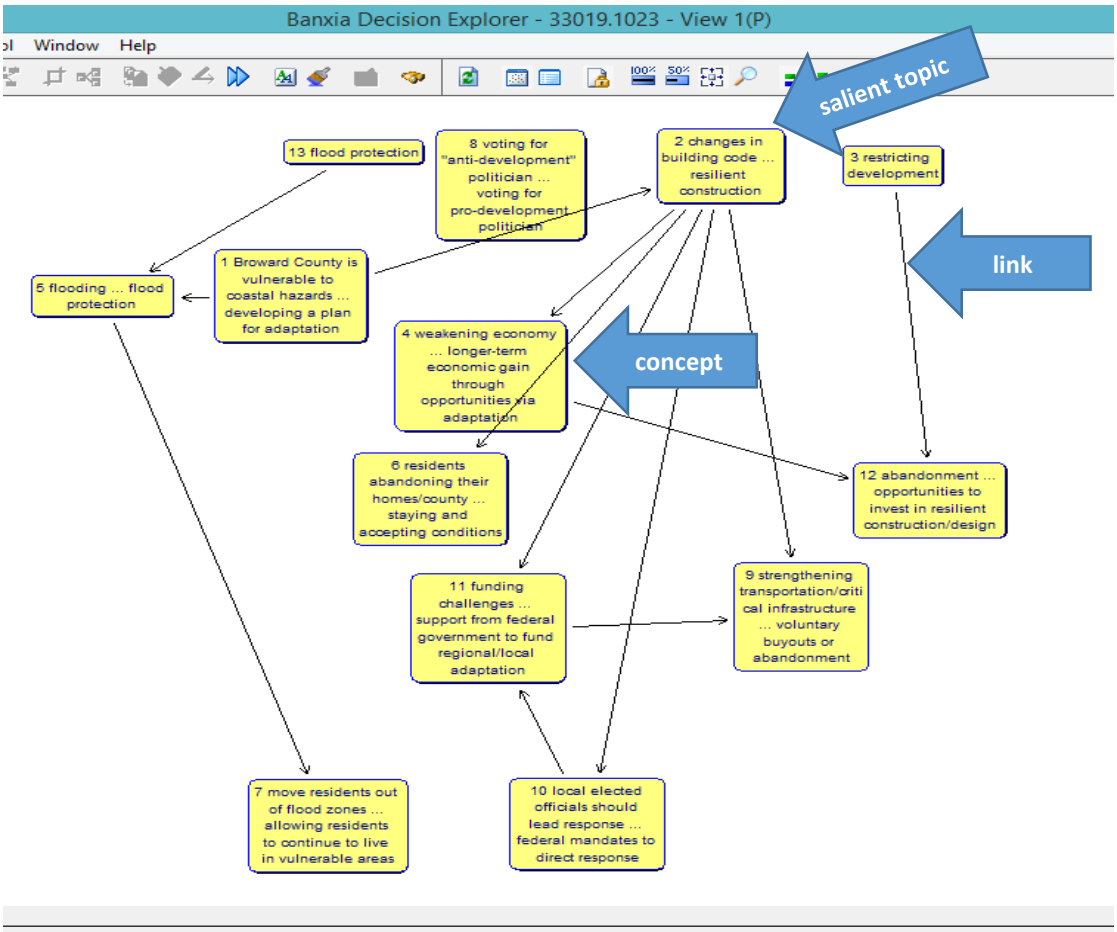

Figure 1. Example of participant 33019-1023's in-depth interview answers. The most salient topic on this map is this participant's preference for "changes to the building code" as opposed to "resilient construction." (As explained below, the ellipsis in each concept on the map translates to "as opposed to.")

Although this tool has been used for a variety of purposes (e.g., strategy development, interview analysis, risk identity, structured brainstorming and scenario building) for this project, it was used only for comparison and analysis of participants' in-depth interview responses, including their perspectives about the usefulness of COAST data, opinions about the feasibility of the adaptation options modeled in Workshop Two and their understanding of the relationship between uncertainty and modeling and preferences for leadership in adaptation planning. This tool was an appropriate choice for this project because it has been designed specifically for organizing, streamlining, and analyzing decision-making processes under deeply complex/uncertain situations; situations in which participants do not know or cannot agree upon appropriate models to describe interactions among a system's variables, the probability

distributions to represent uncertainty about key parameters, or about how to value the desirability of alternative outcomes (Walker, Lempert & Kwakkel, 2012).

The process of using this tool involved three stages: first, I analyzed my interview transcripts and converted each meaningful response into a "concept," which is the term that Decision Explorer uses for condensed ideas (phrases) or paired alternatives of data (e.g., "sea wall or dune"). For instance, for my in-depth interview question five, "Did the visualizations affect your level of concern about how sea level rise may affect your community? Did they affect your level of concern about your home/property?" respondent 33139-0615 answered:

> *With the visualizations – for me, money is not primarily the issue … seeing that an extremely luxurious building would be affected … that is not relevant … residents of both buildings would be affected – I am more interested in the human aspect than the wealth aspect.*

One of the concepts I developed for this response was, "purely financial analysis is limiting … holistic analysis with human aspect." Figure Two below shows the concepts on this participant's map.

Identifying concepts that are mapped by Decision Explorer is the same process of coding qualitative data in more traditional analytic methods using software such as NVivo or other qualitative analysis packages. Like themes or codes in traditional analysis, "concepts" name ideas, themes or patterns that emerge from a researcher's reading of transcripts. These concepts emerge as significant within the context of the COAST research project and within this dissertation's interest in decision making and deliberation. Once concepts were established, if paired alternatives were present, I input them using an ellipsis (…) which is the command Decision Explorer uses to represent the oppositional relationship "as opposed to," (e.g., prioritizing human lives … [as opposed to] buildings). For example, considering the excerpt of respondent 33139-0615's answer above, the paired alternatives were, "purely financial analysis is limiting … holistic analysis of human aspect."

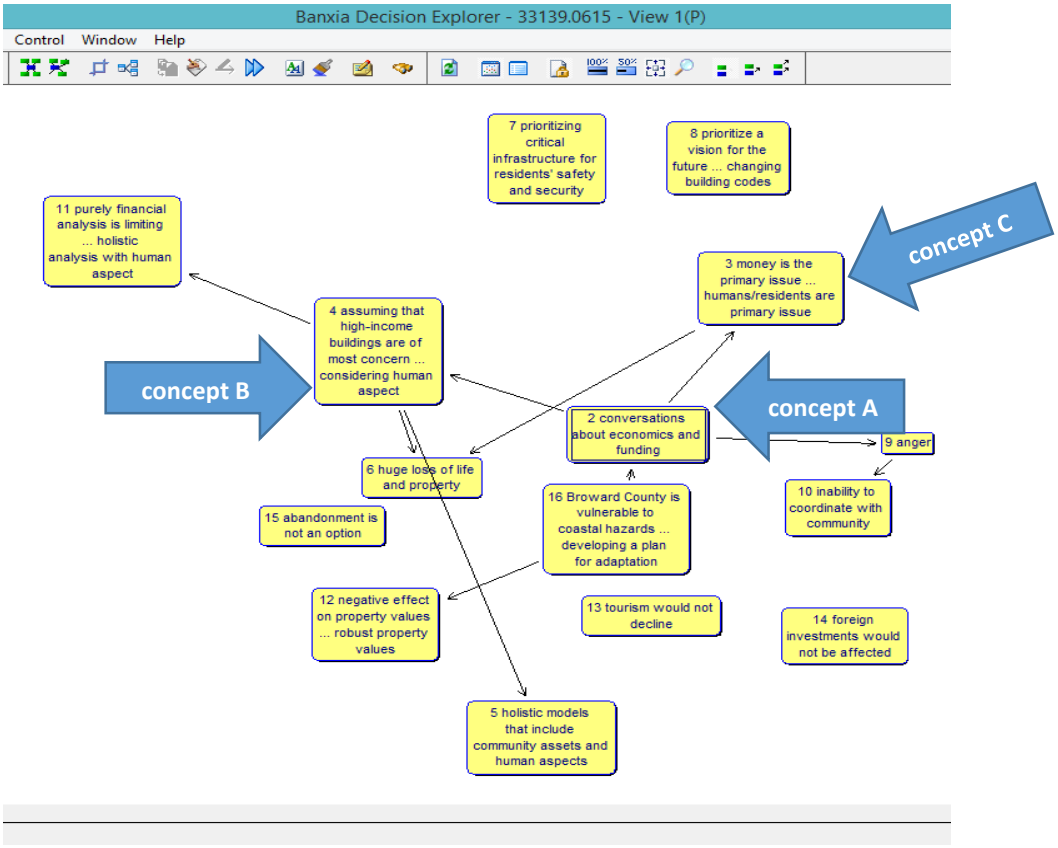

Figure 2: Participant 33139-0615's responses to the in-depth interview questions. The concepts with the most links are concept A, "conversations about economics and funding" and concept B, "assuming that high-income buildings are of most concern" as opposed to "considering human aspect."

After this phase was complete, I drew links between the concepts on the map using the software's arrow tool, which designates the cause-and-effect relationship, "may lead to" (e.g., sea wall → [may lead to] localized protection during storm event). The links are extremely important in that they illustrate the interrelatedness and interdependencies between concepts, which helped to clarify and define, both visually and logically, the specific problem of the situation (i.e., how to respond to coastal risks given local stakeholders' various perceptions of socio-economic vulnerability).

2.4.1 Methods of Analysis

Most of the analytical functions in Decision Explorer are designed for very large amounts of data (maps that contain 150 concepts or more) as well as for determining the *means* (i.e., solutions) by which a concept or goal can be achieved. The maps created for this project consist of an average of five concepts; therefore, many of analytical functions available weren't necessary or appropriate for analyzing this data

set. Additionally, the purpose of this dissertation was to provide an empirical example (and not a framework) as insight into options in a range of alternatives that can be utilized in developing usable science policy for regional adaptation. This project's purpose was not to recommend *solutions* for coastal adaptation in this region because doing so would not respond to the need for attention to the *process* of how policy making occurs in contexts of deep scientific uncertainty. The value of this project is its insight into a regional policymaking *approach* (Tompkins, Few & Brown, 2008). Furthermore, recommending solutions would suggest that there are universal barriers to adaptation and "best practices" for how to overcome them. Rather, the purpose of this project is to offer insight into the process of deliberation as a part of informing "usable" science. Therefore, of the 16 analytical functions available in Decision Explorer, the only functions used in this project were those that matched this purpose and these objectives.

After exploring the available functions, I identified four of the 16 that provided a more explicit picture of stakeholders' deliberation about their preferences regarding adaptation options for their region, insight about barriers to adaptation, opportunities and ideas for innovative solutions to coastal vulnerability and values about their local economy (in particular, development/real estate market). These four functions were:

- Heads
- Cluster
- Domain
- Centrality

One of the most basic analytical methods functions in Decision Explorer is the "heads" function, which I used to identify concepts on the map that did not have any links either coming into or going out of them. These concepts were the outcomes, goals, or targets of decision making. Another analytical function, called "cluster analysis," was used to identify groups of related ideas by highlighting relatively isolated "islands" of concepts where there were a minimum of connections between the islands; resulting

in clusters that were mutually exclusive. This mode of analysis was based upon the structure – and not the content – of the map, showing the intensity of linkages between concepts.

Using domain analysis, another analytical function, I considered the link structure immediately surrounding a particular concept and identified highly linked concepts, focusing on the connectivity between those concepts. This analytic function was important because it allowed me to see the "busiest" concepts on the map; the concepts that were key issues.

The centrality analysis function considered the structure of the map by analyzing the whole map and designating a score for each concept. Concepts that were very influential (concepts that had the most links coming into and going out of them) were scored highly, revealing the most significant concepts within the map. Scores were calculated according to the number of concepts within a particular concept's "band," which is the term Decision Explorer uses to refer to the concepts deviating from the central concept. See Figure Three below.

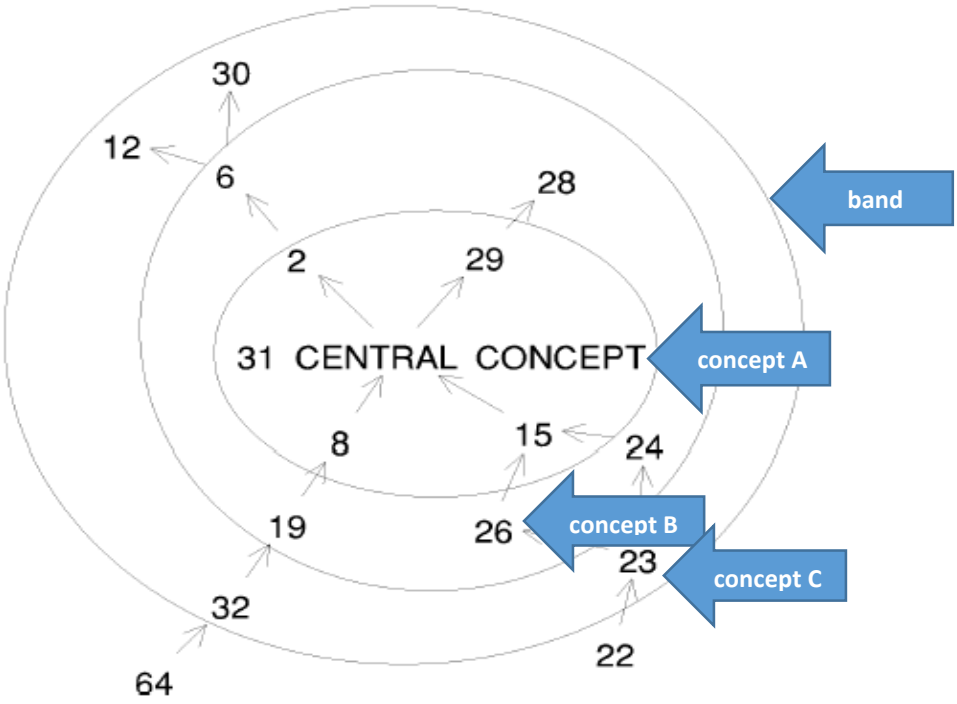

Figure 3: Diagram of a Decision Explorer central analysis function showing three bands around a central concept.

Each concept was weighted according to how many subsequent concepts were traversed in its band levels. All concepts at level one were divided by one, all concepts in level two were divided by two, etc. Each band score was then added together to give a total overall score for the concept. This mode of analysis allowed for insight into the significance of the various layers of meaning within a concept on the map; therefore providing further understanding of the reasoning motivating the concept (Decision Explorer Online Reference, 2014). For example, one of the concepts on participant's 33139-0615's map is: "conversations about economics and funding." (For this example, I call this "concept A".) One of the concepts related to concept A, "assuming high-income buildings are of most concern … considering human aspect" (concept B) had the most links coming into and going out of it; it had numerous concepts in its band. Another concept, "money is the primary issue … humans/residents are the primary issue" (concept C) is related to concept A, but doesn't have as many links coming into and going out of it as concept B; its band wasn't as "heavy" as the band in Concept B. As a result, concept B, "assuming high-income buildings are of most concern … considering human aspect," is weighted more heavily than concept C and therefore represents the priority for a majority of stakeholders.

These heavily weighted, priority concepts represented participants' values and beliefs, which informed the development of frames that were suggested to have strong resonance with local stakeholders (the purpose of research question three, "What frames for environmental change engage stakeholders in decision making about adaptation actions in this region?").

Lastly, the "printing lists" function of Decision Explorer produced a list of concepts/map contents in a text view, which I then scanned again for relevant codes to inform the coding terminology and definitions I then created in NVivo, the second layer of qualitative analysis used to analyze my data.

2.5 Data Analysis Strategy Two: NVivo

In the second analytical layer of this project, all of the data sources – field notes, surveys one and two and the 10 in-depth interview transcripts – were coded using NVivo. The first step was to identify each document with the "zip code (dash) month and day of birth" format in order to ensure that data

would be correctly and consistently (but anonymously) attributed when coding and analyzing data across the three sources. In the field notes, whenever possible, participants were identified using this code (zip code – month and day of birth); however, when participants' identity was unknown, they were identified as "participant one [two, three]" … etc.

Of the 10 participants represented in the surveys, many participants did not complete *both* survey one and survey two; however, I personally interacted with each of these participants at both meetings and was therefore able to verify their attendance (and that they met the requirements I had established for the study population).

After formatting the field notes and in-depth interviews consistently, I conducted initial coding in Microsoft Word, in which I assigned "first impression" phrases to attach descriptive and *in vivo* codes to nearly every line of text within the notes and interviews. I used a grounded theory design and constant comparative method to code the field notes and in-depth interviews[7] because this theory provides tools specifically for learning about individuals' perceptions and feelings regarding a particular subject area. Grounded theory offered me a powerful methodological framework because the aim of this study was to learn about individuals' perceptions and feelings about a particular subject (Gorra, 2007). The objectives of grounded theory involve:

- Focusing on everyday life experiences
- Valuing participants' perspectives
- Approaching inquiry as an interactive process between researcher and respondents
- Preserving respondents' language (Marshall & Rossman, 1999)

In grounded theory, the researcher goes through multiple stages of collecting, refining, organizing and categorizing the data (Strauss & Corbin, 1990). The "constant comparative method" used in this approach consists of developing concepts from data by coding and analyzing the data at the same time

[7] Surveys were coded using NVivo's "auto-code" tool because these sources were structured consistently; they asked the same set of questions, the majority of which were multiple choice.

(Taylor & Bogdan, 1998). To begin this process, first I conducted initial or "open" coding in order to understand the context of the data I was working with; during this phase, I did not search for patterns, or further manage, filter or focus the data. After completing this initial phase, I saved two versions of the field notes and in-depth interviews – an original version and a coded version.[8]

After this first cycle of "broad-brush" initial coding in Microsoft Word, I imported all original (un-coded) versions of the field notes (two documents), COAST surveys (nine documents) and interviews (10 documents) into NVivo and began the second cycle: focused or "selective" coding. In this phase, I manually coded the data using the "drag and drop" function in NVivo to match data sets with their appropriate "nodes."[9] In order to focus this process, I created a memo identifying my research questions and the most frequent terms/phrases I had identified during the initial coding phase. As I coded the interviews and field notes in NVivo, I used this memo as a guide to ensure that I was primarily coding data that would enable me to answer the specific research questions of this project. See Appendix C for a list of the 28 codes developed during this phase.

I began the next level of analysis, called "axial coding," by using NVivo's word frequency query tool to obtain a list of the top 50 most frequently used words within all of the data sources.[10] In grounded theory, axial coding is "the act of relating categories to subcategories along the lines of their properties and dimensions" (Strauss & Corbin, 1998, p. 123). The purpose of this phase of coding was to add depth and structure to my existing nodes/categories (Gorra, 2007). The 10 most frequently used words, in order from most used to least used, were: floods; level; adaptation; concerned; people; buildings; property; models; regional; and elevation.[11] Although this information wasn't directly applied in further analyses of

[8] See Appendix A for original in-depth interview documents and Appendix B for coded in-depth interviews.
[9] A "node" is the term NVivo uses to refer to a collection of references about a specific theme, place, person, etc. which allowed me to view all participants' references to a particular theme (e.g., all references to "visualization tools") in one place. Once refined by various phases of analysis, my nodes became my codes.
[10] Grounded theory methodology typically does not use quantifying data to obtain meaning; however, counting the frequency was useful for showing me these terms' importance for interviewees (Gorra, 2007).
[11] See Appendix I for the complete list of most frequently used words in the data.

this data, it provided a useful initial "snapshot" of the most significant themes within the synthesized nodes.

Next, in order to eliminate redundancies and to determine the most appropriate nodes for answering the research questions of this project, I used NVivo's "merge" tool to merge content from one or more nodes into an existing node – which eliminated a significant number of nodes. For example, I merged the original node "visualization" into the node, "COAST approach," and the nodes "development" and "resiliency" into the node, "development/the real estate market." Grouping several nodes/codes into categories through the merging process was the first step of theory-building, which is addressed fully in Chapters Three and Four.

As a result of this process, I reduced the number of nodes and identified five nodes/codes to use in my analysis of the in-depth interview and field notes data:

- COAST approach
- governance
- barriers to adaptation
- innovation
- development/the real estate market[12]

Analysis of the survey data provided trending information about the 10 participants' demographics, level of concern and experience with coastal hazards, preferences for funding of adaptation strategies, governance of adaptation policy and their perceived local barriers to adaptation. For example, for the Workshop One survey question, "Do you agree or disagree with the following statement: Implementing projects to reduce potential impacts of climate-related hazards in our community should be a local or regional government priority, even if it will require a slight increase in taxes or new fees?" out of the participants who attended both workshops, five selected "agree strongly"; however, on Survey

[12] See Appendix C for a complete codebook, including definitions and examples of the codes used in this project.

Two, within this same population, two selected "agree strongly" and two selected "agree somewhat." The reasons for this discrepancy are explored in Chapter Three.

The survey data was used to provide demographic information about participants' professions (their role in the community), gender, educational background and political affiliation, as well as their individual experiences with coastal hazards (e.g., storm surge, sea level rise), an assessment of their level of concern about short- and long-term hazards, preferences for and barriers to adaptation and support for adaptation funding options. Four of the nine surveys represent matches; participants who completed both Survey One and Survey Two. These matches allowed me to assess any changes in participants' preferences for adaptation action, funding, barriers to adaptation, level of concern about short- and longer-term hazards and support for their preferred timeframe for action (e.g., now, in the next 10 years, in the next 100 years, or never). This data was primarily useful for answering research question four in this project, "What are the challenges and opportunities of engaging local stakeholders in adaptation planning?" which is taken up in Chapter Four of this project.

The next chapter of this project presents the findings of the data sources described within this chapter, providing answers to research questions one and two:

- What opportunities/barriers do stakeholders deliberate about when responding to the modeling predictions generated by COAST? In relation to these barriers, how does stakeholders' deliberation reinforce/delimit the significance of the prediction imperative for decision making processes in contexts of deep scientific uncertainty?
- What are the implicit values embedded within stakeholders' perceptions of coastal vulnerabilities?

Part One of Chapter Three focuses on data collected in the five codes listed above: COAST approach; governance; barriers to adaptation; innovation; and development/the real estate market. It also identifies the specific barriers that stakeholders expressed, as well as their insights into and optimism about potential adaptation opportunities, focusing on the influence of the prediction imperative on their

values and preferences about modeling data for adaptation planning and decision making. Part Two of Chapter Three provides a comparison of participants' values with traditional assumptions about climate change communication (e.g., framing climate change as a scientific problem; increasing scientific literacy with the assumption of increasing support for climate change policies; top-down education of non-scientific publics; and providing information about climate science without providing viable solutions.[13] Identifying these values provided insight into the specific, situated experiences and preferences of stakeholders in this region, which subsequently informed how to shape communication, messaging and framing about climate change and feasible adaptation options for this region (the purpose of Chapter Four of this project).

[13] See Chapter One, "Climate Change Framing and Communication."

CHAPTER THREE

FINDINGS: BARRIERS TO ADAPTATION AND THE ROLE OF THE PREDICTION IMPERATIVE IN CLIMATE MODELING AND ADAPTATION PLANNING

3.1 Part One

Part One of Chapter Three presents the findings that were generated using Decision Explorer and NVivo. These findings are organized around stakeholder barriers to adaptation as a means of answering one of the research questions of this chapter:

- What opportunities/barriers do stakeholders deliberate about when responding to the modeling predictions generated by COAST? In relation to these barriers, how does stakeholder deliberation reinforce/delimit the significance of the prediction imperative for decision making processes in contexts of deep scientific uncertainty?

Part One describes the COAST tool and approach by contextualizing it within consolidative and exploratory techniques, which are two distinct approaches to modeling. This section focuses specifically on the challenge of providing predictive data to policy and decision makers, highlighting the difficulty of incorporating uncertainties like sea level rise projections and human factors into models of climate impacts. The focus of Part One is to define and provide supportive data for the most significant barriers to adaptation cited by stakeholders in the study population of this project. These barriers were:

- Leadership
- Resources (funding)
- Invisibility and timing of coastal vulnerabilities
- Expectations of modeling

Part Two of Chapter Three provides discussion and analysis of the findings provided in Part One, identifying the values that are elicited from the barriers to adaptation listed above. It answers the research question, "What are the implicit values embedded within stakeholder perceptions of coastal vulnerabilities?" Most importantly, it uses the rhetorical concepts of situated judgment, *phronesis*, persuasion and deliberation to explain the reasons motivating participants' values and preferences for adaptation actions.

3.1.1 Coastal Adaptation to Sea Level Rise Tool (COAST) Overview

The Coastal Adaptation to Sea Level Rise Tool (COAST) is proprietary software designed by GEI Consultants, Inc. that uses a GIS application to produce 3-D spatial images of how buildings within a designated area would potentially be impacted by flooding, storm surge and sea level rise (Blue Marble, 2015). This tool calculates cost-benefits analyses that illustrate the tradeoffs of implementing various adaptation actions at two points in time (between now and 2030 and between 2030 and 2060) that could reduce the risk of flood damage to publicly and privately owned buildings. For the Broward County study area, the team chose to model two adaptation options: elevation/floodproofing and voluntary buyouts.

Floodproofing consists of modifications that either reduce or eliminate flood damage to a structure. "Wet" floodproofing is intended to reduce flood damage and can be accomplished by installing impermeable walls or vents that allow *some* flood waters to enter enclosed, uninhabited areas of a house/building. "Dry" floodproofing consists of modifying a structure so that it is watertight, for instance by sealing the walls with a waterproof coating (FEMA.gov). Elevation involves raising a vulnerable structure to a height based on its existing freeboard[1] requirements plus sea level rise estimates (FEMA.gov).

The second adaptation option modeled for the COAST workshops was a voluntary buyout, which is a government-led program in which public funds are used to purchase vulnerable, privately held land

[1] Freeboard is "a factor of safety usually expressed in feet above a flood level for purposes of floodplain management. It is intended to compensate for unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood, such as wave action, bridge openings, and the hydrological effect of urbanization of the watershed" (fema.gov/freeboard).

from willing sellers. Once the land is purchased, existing structures are demolished and no further development is permitted on the land.

COAST is a different type of tool than existing sea level rise maps and tools, such as NOAA's "Sea Level Rise Viewer" or The Nature Conservancy's (TNC) "Coastal Resilience Tool." The purpose of the NOAA and TNC tools is to simulate how sea level rise scenarios would inundate different geographic locations; COAST is different because it calculates the impact of flood and storm surge damage (with sea level rise projections) specifically to buildings within a particular region. At the beginning of workshop one, the COAST team member facilitating the presentation explained to participants how COAST generated its data:

> *COAST virtually flooded the land, measuring the depth of flooding at the center of each [land] parcel. Property appraiser records were used to classify buildings as elevated or not, according to the year the building was built. COAST uses LiDAR– Light Detection and Ranging … a remote sensing method used to examine the Earth's surface … but it can't assess peat or limestone in the ground. We used the Corps' [United States Army Corps of Engineers] tables for predicted percentage damage to a building based upon how deep the floodwaters get at its base.*

For the COAST workshops in Broward County, the COAST team selected a study area within the county that included 10,000 land parcels (See Figure One below). Within this area, vulnerable buildings were identified in blue, where the various heights of the blue bars designated the extent of damage; high blue bars represented more costly damage whereas lower bars represented less costly damage (see Figure Two below).

3.1.1.1 The COAST approach. The purpose of using COAST maps (referred to by the COAST team as "visualizations') of the study area was to provide a "way to engage communities in proactive planning in protecting vulnerable economic assets" (Merrill, Yakovleff, Holman, Cooper & Kirshen, 2010) by showing them how specific assets may be affected by different degrees of flooding. Visual

communication (e.g., the COAST visualizations) has been suggested to, "increase engagement, enhance learning and strengthen conceptualization of even complex environmental issues" (Salter, 2005; Sheppard & Meitner, 2005; Winn, 1997). Visualization tools are argued to provide more effective and explicit evidence of climate change to stakeholders, as this kind of communication provides glimpses into possible future scenarios – making them seem more realistic and therefore more important in the short term (Sheppard et al., 2011). By simulating the potential future effects of flooding, storm surge and sea level rise to buildings within the study area (where stakeholders were presumably invested or at least familiar) the COAST approach attempted to incentivize long-term action through deliberation about the cost-benefits tradeoffs of two adaptation options. The COAST visualizations invoked stakeholders' own "backyards" in order to suggest that coastal vulnerabilities would significantly impact the regional economy where they live and work. This approach is suggested to be effective in motivating action because it represents an invisible, slow-moving threat like sea level rise as a personal issue where we can "see" the effects of now.

3.1.1.2 Futuristic visioning and engagement. Throughout the two workshops, the COAST team repeatedly used phrases like, "thought experiment," "let's pretend that …" and "make an assumption" to encourage participants to engage in futuristic visioning and to think about the incentives of making decisions *now* in order to assure future economic benefits (i.e., avoided damage costs). For example, during the deliberation session in Workshop One, participants had been split into two groups to discuss the elevation/floodproofing option. While leading their deliberation, the COAST facilitator reiterated:

> *… this is a thought experiment. Let's pretend that 100% of all eligible buildings were protected … subject to your input. We're going to ask you folks about making a judgment … if there was a grant program or subsidized program where people in your community could "get elevated," what would the participation rates be?*

In another instance during that same deliberative session, the facilitator emphasized that, "COAST operates on the assumption that if the adaptation action were to occur, funding would be

possible for it." Concern about funding sources was a significant and recurring theme expressed by a number of participants, primarily when they were deliberating about the floodproofing/elevation adaptation option. The COAST team's attempts to encourage stakeholders to think *beyond* the immediate barriers to adaptation (e.g., funding) and toward making judgments about larger-scale options were met with some resistance. This situation is explained in more detail below, in the "Modeling" section of "Barriers to Adaptation."

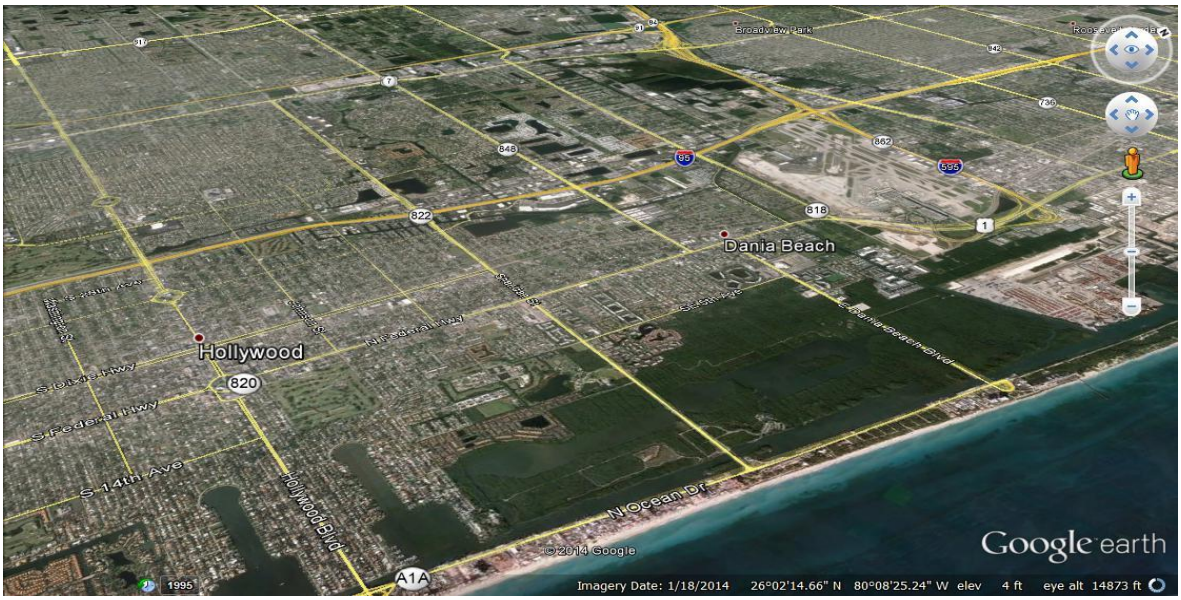

Figure 4: COAST visualization of the Broward County, Florida study area.

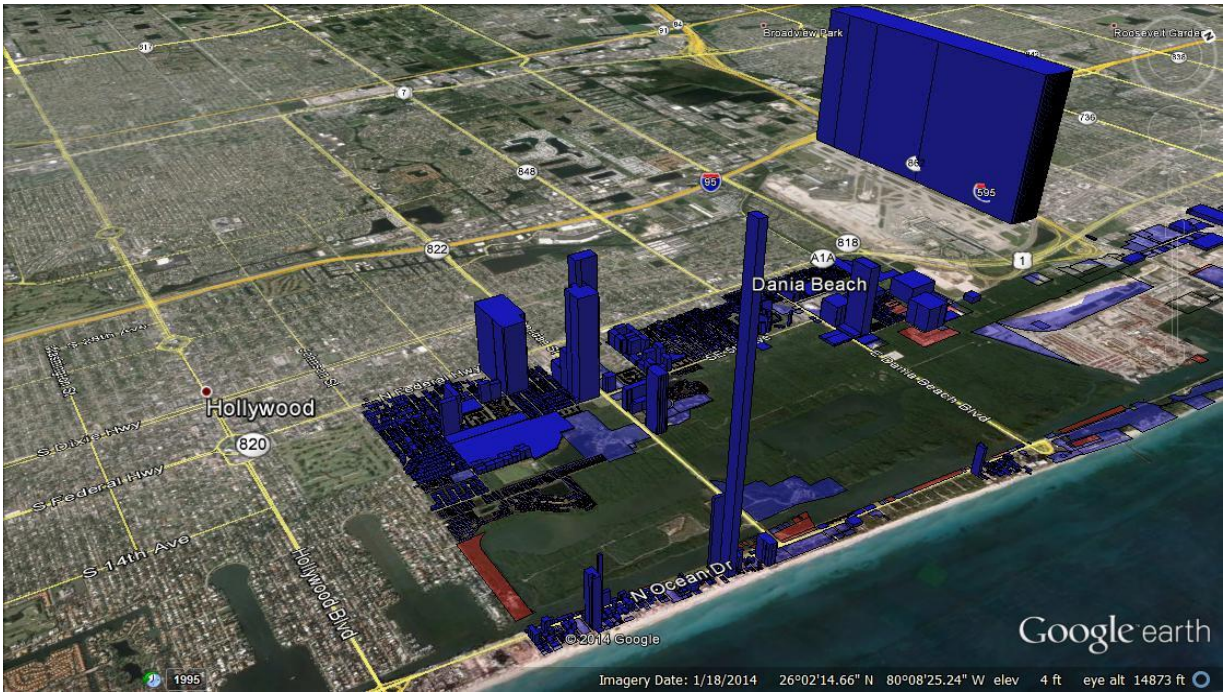

Figure 5: COAST visualization of a Hurricane Wilma-sized flood in 2030 with a high sea level rise projection (24 inches). Total Storm Damage from this event was estimated at $518.4 million for the entire study area, not just for the extent pictured here. Red areas represent areas that were removed from asset inventory due to permanent inundation from sea level rise (if no action taken); blue areas represent the extent of damage to buildings as a result of storm surge.

In addition to these visualizations, participants were also provided with an economic vulnerability assessment that illustrated cumulative damage resulting from four projections of sea level rise, plus flood and storm surge damages (see Table One below).

Table 1: COAST vulnerability assessment of cumulative damage in Broward County study area.

Cumulative Damage to Buildings Over Time		
Timescale	**SLR Scenario**	**Cumulative Damage to Buildings by Scenario Date**
2014-2030	Low – 3”	$1.009 billion
2014-2030	High – 7”	$1.132 billion
2031-2060	Low – 9”	$2.339 billion
2031-2060	High – 24”	$4.125 billion

3.1.2 Deliberation about Adaptation Options

Once the visualizations and economic vulnerability assessments had been provided, participants were divided into two groups. Each group was given a poster-sized version of the visualization of the study area (see Figure Two above) and asked to deliberate about the two adaptation options that had been modeled. For the first option, elevation and floodproofing, the group was asked to deliberate about the following two questions:

- If floodplain property owners were offered grants or subsidized loans to elevate their V-zone properties or floodproof their A-zone properties, what percent of these eligible owners do you think would participate?
- How high should the COAST model assume buildings currently at grade level would be elevated, should such a program be instituted?

A COAST facilitator led each group's discussion. In the group I observed, the facilitator emphasized that the purpose of these questions was for participants to collaboratively negotiate a judgment about the percentage of residents that would willingly participate in this adaptation option.

For the second adaptation scenario, relocation over time through voluntary buyouts, participants were asked to deliberate about the likelihood that residents whose property was predicted to be overcome by sea level rise between now and 2030 would accept voluntary buyouts of their property. In a voluntary buyout scenario, the property owner would be given a cash payment (based upon the current assessed value of the parcel) in exchange for transferring the title of their property in five years (2020). During the discussion of this option (as in their deliberation about the first option) participants were encouraged to focus on deliberating about the *willingness* of residents in the study area to accept a financial incentive to sell their property.

At the end of Workshop One, participants were asked to vote on whether the COAST team should model these two adaptation options for Workshop Two; the majority of participants (25/32) voted

"yes" in favor of modeling the elevation/floodproofing option. Participants also voted "yes" in favor of modeling the voluntary buyouts option (25/31).[2]

During Workshop Two, participants were presented with the COAST visualizations and cost-benefits analyses showing how each adaptation option affected the amount of damage (between now and 2030 and 2030 to 2060) to buildings within the study site.[3] In the second half of this workshop, participants were again divided into two groups and asked to deliberate about the feasibility of each of these adaptation options in order to "determine whether it was necessary to tie together a plan," as one COAST facilitator explained.[4] Their deliberation was captured in the Workshop Two field notes and their preferences were identified in Survey Two.[5]

The next section of this chapter explains two approaches to modeling, consolidative and exploratory, in order to position the motivations of the COAST tool and approach within more general modeling paradigms.

3.1.3 Modeling

Judgments about the usefulness of a model are traditionally based on its completeness; operating under the assumption that the inclusion of more details leads to greater accuracy of modeling predictions. Oftentimes when this approach is used, the opposite outcome occurs: either the results produced are too numerous to be analyzed in a reasonable timeframe or circumstances affecting the factors being modeled change these factors after the outcome has been generated; therefore affecting the model's validity and necessitating additional modeling. This type of modeling is called "consolidative" modeling (Dessai, Lu & Risbey, 2005; Functowitz & Ravetz, 1993; Lempert, Groves, Popper & Bankes, 2006; Oreskes, Shrader-Frechette & Belitz, 1994; Pielke, 2003; Stainforth, Allen, Tredger & Smith, 2007). A consolidative modeling approach works well in a closed system or when facts are known to be correct.

[2] Participants used polling keypads to cast their votes, which were digitally recorded and displayed in real time. In the first vote, a total of 32 votes were recorded; however, in the second vote, only 31 votes were recorded.
[3] See Appendix I for the final comparison of costs/benefits of the adaptation actions.
[4] See Appendix K for workshop two Field Notes.
[5] See Appendices J and K for field notes and Appendix F for survey two.

However, in contexts where there are uncertain components or other barriers to validation (e.g., the unpredictable nature of socio-economic systems) the outcomes of consolidative strategies do not help to reduce uncertainty among alternatives or make decision-making choices clearer or easier. Today, most decision making about risks like flooding, storm surge and sea level rise cannot be managed or controlled in the sense that they are networked, largely invisible and often irreversible. These types of risks, which Beck (1992, 1999) refers to as "contemporary" risks,[6] are deeply uncertain and therefore cannot be quantified (Lempert et al., 2013; Walker, Lempert & Kwakkel, 2012). In situations where decisions need to be made despite significant uncertainties about these types of risks, consolidative modeling isn't usually the most productive approach for providing useful information in *policy* contexts (Bankes, 1993, 2005; Beck, 1992, 1999; Pielke, 2003).

In contrast to consolidative modeling, exploratory modeling is an approach that analyzes the types of possible interactions between variables of complex and *uncertain* systems (Bankes, 1993; Pielke, 2003). The COAST modeling approach has some exploratory components – for instance, it focused on modeling *scenarios* of how different adaptation options affected cost-benefits tradeoffs at future points in time. However, it seems to be generally consolidative in that its primary object was to provide accurate cost-benefits estimates of an isolated factor (i.e., damage/avoided damage to buildings within the study area). Additionally, there are two specific components of the COAST process that reflect consolidative approaches to modeling and analysis. First, economic aspects (i.e., damage from flooding, storm surge and sea level rise to buildings) were modeled *independently* of other factors that had the potential to affect modeling outcomes. During Workshop One, participants recognized this aspect and expressed their concerns about isolating the modeling inputs to expected flood risk, storm surge and sea level rise projections *only*. For example, one participant explained his concern that porous limestone had not been factored into the COAST modeling formula. His response suggested that the cost-benefits estimates

[6] See the section titled "Risk, Rhetoric and Climate Adaptation Policy" in Chapter One for further discussion on contemporary risks.

would have been significantly affected by this factor; implying that isolating the projected economic impacts of flood, surge and sea level rise *alone* didn't provide an accurate or useful estimate of damage:

> Participant 33022-0125: *This model does not take into account our porous limestone … damage to buildings with certain amount of surge and sea level rise and depth of water seeping in … and how much damage … there is more than one thing operating here and you're only showing us one thing – it almost seems like it isn't valid*.

For this participant, generating estimates of damage to the buildings in the study area needed to take this scientific factor into account in order to provide a more contextualized, useful outcome for adaptation decision making in this region.

The second aspect of the COAST modeling process that reflects a consolidative approach pertains to the perceived need for accuracy as the motivating factor for decision making. As explained above, at the end of Workshop One, participants were asked to make a judgment about the percentage of citizens who would be likely to support each of the adaptation options. The percentage of citizen support was then factored in to the initial cost-benefits analysis in order to reduce the estimate and therefore, *improve the accuracy* of the cost-benefits assessments that had been presented during Workshop One. For example, for the elevation/floodproofing option, participants estimated that 75% of citizens would be likely to support this option.[7] This percentage was used to reduce the estimate from 100% to 75% in order to calculate a cost-benefits ratio showing that elevation/floodproofing was the best adaptation option for this region.[8]

Many participants were hesitant about making a judgment about the percentage of citizens that would be likely to support the adaptation options presented during the workshop. Some cited concerns about funding sources and others suggested that they needed more context in order to make a good

[7] Fourteen out of 32 participants submitted votes for this question.
[8] See Appendix I for the costs/benefits analysis of the two options.

judgment. The excerpt below provides an example of the exchange between a facilitator and two participants regarding the necessity of making a judgment:

> Participant Six:[9] *When we're voting on what percentage of people would go for a buyout, is there any assumption that we support it? We should also guess a percentage of people who would support such a program … that's a big deal for where the money is coming from, isn't it?*
>
> Participant 33020-0625: *Right - are we assuming that there is a big pile of money somewhere for doing this?*
>
> Facilitator: *The reason is to model choices. We don't know yet. We want to look at avoided damage costs versus having to fund the level of mitigation and hazard that is chosen. You have to take it on faith that this is a step to explore what might happen if we made this decision … Very rarely does this action take place without higher levels of funding … but there is owner money being put into these things but you just have to make your own judgment about what percentage of these properties might choose to elevate … you're just being asked to make a judgment.*

The COAST team's perceived need to increase the accuracy of the cost-benefits assessments between Workshops One and Two reflects the perspective that more precise quantitative/predictive data directly correlates with decisive (desired) action on climate adaptations. In a climate science policy context, this perspective is called "the prediction imperative," (Meyer, 2010) a term used to refer to the notion that predictive data from climate science models can *simplify* the decision-making process by creating a clearer and more accurate picture of the future (Meyer, 2010, 2011; Sarewitz, Pielke & Byerly, 2000).[10] However, participants' concerns throughout the workshops reinforced the fact that they were not

[9] This participant's zip code is unknown because he/she did not attend both COAST workshops, therefore excluding him/her from the study population of this project. Within the field notes, participants who attended both workshops are identified by their zip code and month and day of birth. Participants who didn't attend both workshops but who are included in the data cited here are identified as "participant one," etc.

[10] See the section titled "Traditional versus Alternative Approaches to Policymaking" in Chapter One.

primarily concerned with the *accuracy* of the cost-benefits estimates, but rather with the *other* factors (e.g., regional scientific factors, human safety, access to homes and communities) that had not been incorporated into the models.

Understanding the modeling approach of the COAST process is important because it helps to explain why the outcomes (i.e., cost-benefits analyses of the two adaptation options modeled for the workshops) did not reflect stakeholder values and therefore, did not motivate their decisions about adaptation actions. In this case, given a consolidative modeling approach, the outcomes were *economics-based* predictions.[11] However, the nature of participants' concerns alluded to *other,* non-economics based priorities and preferences for making decisions about adaptation. Therefore, although accurate, the outcomes (predictions of the cost-benefits of each action) did not appear to be influential factors for *policy* decisions for stakeholders in this case. The distinction between *prediction for science* and *prediction for policy* provides some insight into why the accuracy of the economic data was not the most convincing factor for stakeholders' preferences for adaptation priorities.

3.1.3.1 Prediction for science and prediction for policy. Predictive data that validates the success of scientific research is different from predictions that are useful in policy and decision making. However, this distinction has not been thoroughly articulated, primarily because of evidence from the long history of success in traditional predictive science (i.e., the testing and confirming of hypotheses in order to deduce fundamental laws of nature). (Hempel, 1966; Popper, 1959; Sarewitz & Pielke, 1999). As a result of the success of the traditional approach to scientific prediction, *modern* approaches to generating predictive data are assumed to operate the same way: to contribute directly to effective decision making because of the presumed ability to inform policy choices and therefore "reduce the need for divisive debate and contentious decision making based on subjective values and interests" (Sarewitz & Pielke, 1999, p. 129). However, in complex and uncertain systems (e.g., the climate system) predictive

[11] For example, the outcome of the COAST modeling process proved, through a cost/benefits analysis, that elevation and floodproofing was the best choice for adaptation in this region.

data alone is not sufficient for guiding policy that fulfills desirable societal goals. The modern approach to generating predictive data, as distinguished from a traditional approach to scientific prediction, uses "suites of observational data and sophisticated numerical models in an effort to foretell the behavior or evolution of complex phenomena" (Sarewitz & Pielke, 1999, p. 123). This approach to prediction operates differently than the traditional approach because instead of testing the predictive principles of *nature*, it seeks to contribute directly to societal goals by foretelling the behavior of complex – and *open* – systems (Oreskes, Shrader-Frechette & Belitz, 1994; Sarewitz & Pielke, 1999). As a result, the outcomes of prediction that are useful for validating science are different than the outcomes of prediction that are useful for guiding policy decisions: the former emphasizes the certainty of an isolated factor while the latter emphasizes the use of prediction for the resolution of societal problems *within an inherently uncertain context*.

The next section identifies the factors that COAST workshop participants emphasized during deliberation about the predictive data on adaptation options. Three data sources were used to elicit these findings.[12] Identifying these factors is important because it provides useful insight into how to provide stakeholders with the information that they need for making policy decisions about adaptation (the topic of Chapter Four of this project).

3.1.4 Coding

Using a qualitative coding approach, I organized and consolidated stakeholder concerns into specific codes. Once I established these codes, I further narrowed them by focusing *only* on the codes that would be likely to provide me with evidence for answering the research question of this part of Chapter Three. Once I eliminated the codes that did not pertain the research question of this chapter, I was left with five codes. Table Two provides a general definition of each of the five codes used to organize my data, as well as examples of prevalent sub-themes within these codes. For example, within the code

[12] See Chapter Two for a full explanation of data sources.

"COAST Approach," various sub-themes such as "judgment" and "place" emerged and were coded accordingly in order to allow for more detailed and rigorous analysis.[13]

Table 2: Five codes used to analyze the data sources in this project

Parent Code	Definition
COAST Approach	This code indicates stakeholder references to the COAST models/maps and facilitators' explanations of COAST software (the process of generating cost/benefits analyses of adaptation options). It includes facilitators' responses to stakeholder questions about the COAST process as well as references to the COAST models in relation to the prediction imperative. Seven sub-themes emerged from the "COAST Approach" code: Value (V); Prediction Imperative/Modeling (PI/M); Elevation/Floodproofing (EF); Judgment (J); Voluntary Buyout (VB); Place Attachment (PA); and Visualization (Viz).
Barriers to Adaptation	Obstacles that temporarily delay/impede the process of adaptation, but which can be overcome with cooperation, alternative approaches to policymaking, etc. Five sub-themes emerged from the "Barriers to Adaptation" code: Anger, alarmism, and linking adaptation with "environmental problems" (A/EP); Context (C); Invisibility/timing (I/T); Funding (F); and Leadership (L).
Governance	Stakeholders' preferences for leadership and management of adaptation strategies. Four subthemes emerged from the "Governance" code: Autonomy (Au); Responsibility (R); Action (A); and Development/construction/building code (D/C).

[13] See Appendix C for a complete codebook.

Table 2 Continued

Parent Code	Definition
Development/Real Estate Market	Stakeholders' references to real estate, development/developers, Florida Building Code, flooding/flood prevention, place attachment, and cooperation. Three subthemes emerged from the "Development/Real Estate Market" code: Flooding/flood insurance (Fl); Building in flood zones/building code (BC); and Revenue/economic value of land (R).
Innovation	Stakeholders' ideas about how to creatively approach coastal vulnerabilities through incremental adaptive action, promoting/supporting resilient design projects, and developing holistic models that integrate community residents and local geologic challenges (e.g., porous limestone, saltwater intrusion). Four subthemes emerged from the "Innovation" code: Coordination/leadership (C/L); Models (M); Applied/innovative research (R/V); and design/resilient design (D).

3.1.5 Findings

It is important to identify *specific* barriers to adaptation for a particular group/region because these challenges can provide useful information about how to shape more effective communication about adaptation. A better understanding of specific barriers can inform creative approaches for overcoming them (Moser & Ekstrom, 2010); the barriers point to opportunities for connecting with stakeholder values about coastal vulnerabilities and preferences for long-term coastal management (Dietz, 2013).

3.1.5.1 Barriers to adaptation. The definition of barriers to adaptation that is used in this project was adapted from Klaus Eisenack et al. (2014) because this particular definition accurately fits this

project's emphasis on the importance of *situatedness* for communication within contexts of deep scientific uncertainty. According to Eisenack et al., barriers to adaptation are impediments to adaptation actions for *specified actors in their given context* that arise from a condition or set of conditions. Identifying the specific barriers of a particular public or stakeholder group is important because barriers are transmutable and can possibly be overcome by tailoring communication about the problem and potential solutions to an audience's preferences and values (Bridle, Gavaz & Kennington, 2009; Eisenack et al., 2014; Sherwood & Huber, 2010). Knowledge of barriers lends helpful insight into opportunities for leveraging communication that can motivate action; identifying barriers is the first step in understanding participants' values.

The most common barriers that stakeholders expressed were:

- lack of leadership
- invisibility of the problem
- consistent funding
- modeling factors

3.1.5.1.1 Leadership. During the in-depth interviews, at least four of 10 total participants expressed concerns about a lack of leadership in adaptation efforts, citing the need for a "good local partner" and coordinated regional efforts. They also cited concern about how anger and alarmism often jeopardize efforts at coordination and in some cases, impede action. On Survey One, for the question, "Some people in your community might not want to support local government adaptation plans. What do you think are some of the most common reasons for not supporting plans?" the majority of participants selected the option, "local government doesn't have technical expertise to solve the problems." For this same question, on survey two the majority responded that opposition to locally driven adaptation planning may be due to local government's "lack of knowledge/understanding of future hazards and local consequences." Answers from both surveys indicate participants' concern about local governments' resources – whether a lack of knowledge in terms of technical proficiency for addressing adaptation

effectively or scientific knowledge about how climate may affect the region's vulnerability in the future. Despite this concern, all participants in the study population who completed survey two *(n*= 4*)* "strongly agreed" with the statement, "I think it is likely that my local governments need to implement some of the adaptation options discussed." Therefore, even though they were concerned about their local government's resources and capabilities, participants acknowledged that local-level government would most likely be responsible for adaptation planning.

3.1.5.1.1.1 Need for a local partner. One of the most articulate responses about leadership alluded to the need for a "good local partner" and acknowledged that even though the South Florida Regional Climate Compact ("The Compact") has made great progress and has successfully affected some change, this type of entity doesn't hold enough "real" power. In response to the in-depth interview question, "Who do you think should take the lead in responding to this region's coastal hazards?" participant 33022-0125 explained that:

> *… the problem is that there are too many entities and not enough coordination. The problem is that there is not really a good local partner to deal with this. The Compact is doing a lot to promote change at the state level, but that will continue to be a challenge if things keep going as they are. I think they've made some steps but they don't have a lot of power really, and no funding except for grants. If they want to do anything, they can't really. It's like Regional Planning, they can advise – which is good because they've got some great people there who are doing a good job …*

3.1.5.1.1.2 need for coordination of efforts. Coordination, in terms of regional and community-level cooperation, was also frequently cited as a necessity for leadership of adaptation planning and implementation. During an in-depth interview, one key stakeholder asserted that: "We [Broward County] would not be able to move on our own … we all have to be on the same page before anyone moves forward …".[14] Community-level coordination was also cited as a concern about leadership and the

[14] See Appendix A, interview "33020."

importance of coordinated action toward the same goals. During the deliberative session about the elevation/floodproofing option in Workshop One, two participants discussed what they had experienced in their communities when adaptation efforts weren't coordinated:

> Participant 33020-0625: *I just want to make a point of how high … these are older homes or properties that were built a long time ago all of my neighbors tell me that their properties never flooded until they were elevated … and it's like a dam now, so when we think about how high, the water has got to go somewhere so that will affect the properties located near them … they're going to be the ones that flood as a result of elevation in another area … am I negatively impacting my neighbor?*
>
> Participant Five: *Yes, if you're doing fill, you're just offsetting that water to someone else …*

Interestingly, one participant provided an explanation about why she felt that community- and regional-level coordination was not occurring. During an in-depth interview, participant 33319-1615 explained:

> *The communities aren't getting together – there are lot of very strong opinioned people who are trying to ring the alarm bell but they aren't trying to collaborate with one another … a few very strong characters [are the loudest voices] … but they are more the aggressive type … angry people but not the kind of people that could really touch a community … lots of confusion about what to do …*

Examples of this type of angry, strongly opinionated communication occurred at times throughout the workshops and occasionally during the in-depth interviews. For example, during the deliberative session about the elevation/floodproofing adaptation option in Workshop Two, one participant responded brashly to a participant who had made a negative comment about the length of time it would take for elevation/floodproofing adaptation option to be useful:

> Participant Two: *The insanity you've got – this is what's destroying us… when you have this kind of environment to deal with this is what makes it so difficult to educate the public … now you guys are educated, and now it's frightening you … you realized that you should have been doing this [adapting to coastal hazards] 25 years ago, but you didn't. When you start to realize that guys like this [the COAST facilitators] tell you … you can't raise houses high enough … this gentlemen talked about increments … the increment is … by 2100 they're predicting to a four meter rise in the ocean … this is what it's going to look like down here [holding his hand parallel above his head and ducking his head]*.

The effect of angry or fear-inducing messages on efforts to coordinate action toward adaptation is taken up in Chapter Four, which suggests ways of reframing adaptation so that it motivates engagement and action.[15]

3.1.5.1.2 Invisibility. Another pervasive barrier to adaptation was the invisibility of the longer-term problem and the slow, imperceptible rate at which it occurs (i.e., sea level rise). Contemporary risks like climate change are historically unprecedented in their spatial/temporal reach, making them especially challenging to address (Beck, 1992, 1999; Cottle, 1998). As a result, we often have difficulty determining effective ways of responding to them because we have no means of perceiving how they affect us on an individual level (Roewe, 2015; van der Linden, Maibach & Leiserowitz, 2015).[16] The tendency to realize the effects of visible risks over longer-term, invisible risks (e.g., coastal/beach erosion, high winds and flooding versus sea level rise) was evident in many instances throughout the surveys and in-depth interviews. In response to the Survey One question, "Which of the following natural hazards that seriously and negatively affected your household or town in the past ten years have you experienced?" the

[15] Angry, alarmist and fearful messages such as the comment above are argued to be ineffective for motivating genuine stakeholder engagement (Bain, 2015; O'Neill & Nicholson-Cole, 2009); therefore strengthening the argument for reframing adaptation (taken up in Chapter Four).

[16] The significance of personal experience in motivating decision making (i.e., situated judgment and *phronesis*) is taken up in the second part of this chapter.

majority of participants (four out of five) cited that coastal/beach erosion – *visible* risks – had impacted their town. Three out of five respondents answered that storm surge and extended flooding had also impacted their town. Interestingly, three out of five participants answered that rising sea levels had impacted their town.[17]

Participants' responses to questions about their past experience with coastal hazards and their concern about future impacts revealed that they were most concerned about what they could see: coastal/beach erosion and high winds in storms (i.e., hurricanes).

3.1.5.1.2.1 Experience with coastal hazards. Question one on Survey One asked participants, "Which of the following natural hazards that seriously and negatively affected your household or town in the past 10 years have you experienced?" Four out of five participants answered that "coastal or beach erosion" had impacted their town but not their household, followed by three participants who answered that storm surge, rising sea levels[18] and extended flooding had impacted their towns but not their households.[19] One participant answered that rising sea levels had affected his/her town *and* household.

3.1.5.1.2.2 Concern about impacts to primary residences. Question three on Survey One[20] inquired about participants' level of concern about the effect of natural hazards *on their primary residences* in the next 10 years. Question three asked: "Thinking about the next 10 years, how concerned

[17] If sea level is rising at a rate of approximately .12 inches per year since 1992 (oceanservice.NOAA.gov) then it would be likely to have risen approximately 1.2 inches by 2015. It is highly unlikely that a 1.2-inch rise in Atlantic Ocean sea levels would be perceptible to the human eye. It *is* likely, however, that participants may have experienced the *implications* of rising sea levels (such as increased intensity and/or frequency of flooding, storm surge) and attributed these experiences to sea level rise. It is also possible that extensive and ongoing media attention to sea level rise (Miami Herald, 2015; CBS Miami, 2014; Sun Sentinel, 2011; WLRN, 2014) has resonated with stakeholders/citizens in this region to such an extent that it has shaped their perception of reality so that they "see" sea level rise even where it can't be perceived (Berger & Luckmann, 1966, p. 66). The discrepancy between "experiencing rising sea levels" versus "experiencing the implications of rising sea levels" is semantic; therefore it is not taken up further in this project. However, it is addressed here because it was part of the data set used to support this topic.

[18] See footnote 18 above regarding perception of rising sea levels versus perception of the implications of rising sea levels.

[19] This question was not asked on Survey Two so it is not possible to compare participants' responses between the two surveys.

[20] See question four on Survey Two for matching question.

are you that these natural hazards may seriously and negatively affect your primary household in terms of physical and economic damage?"

The scale for this question ranged from one to five, nine and zero:

1 = not concerned

2 = somewhat concerned

3 = concerned

4 = moderately concerned

5 = highly concerned

9 = don't know

0 = not applicable[21]

Of the study population for this project *(n*= 10), there were five responses to this question on survey one and four responses on survey two. On survey one, most participants *(n*=3) indicated that they were "highly concerned" about high winds in storms and moderately concerned about coastal beach erosion. Answers about their level of concern about rising sea levels varied: one participant answered that he/she was "not concerned" about rising sea levels, two participants selected that they were "concerned" about rising sea levels and two selected that they were "highly concerned." On Survey Two, most participants *(n*= 3) indicated that they were "highly concerned" about high winds in storms, followed by two participants who answered that they were "highly concerned" about rising sea levels and two who answered that they were "somewhat concerned."

Comparing participants' answers to this question showed that the majority of participants were concerned with high winds in storms. In terms of their concern about rising sea levels, on Survey One, less than half of participants (two out of five) answered that they were "highly concerned" about sea level rise, whereas on Survey Two, half of participants (two out of four) answered that they were highly

[21] The surveys provided the following scale: 1 = not concerned to 5 = highly concerned, 9 = don't know, 0 = not applicable. For this project, in order to analyze the specific degree of participants' level of concern, I needed to create a scale that provided an answer to all of the options (1-5; 9 and 0) and not just the poles of "not concerned" and "highly concerned."

concerned. Additionally, on Survey One, one participant answered that he/she was not concerned about rising sea levels, whereas *all* participants on Survey Two indicated *some* level of concern about sea level rise (i.e., two participants answered that they were "somewhat" concerned).

3.1.5.1.2.3 Concern about impacts to town. Question two on Survey One[22] asked: "How concerned are you that the following natural hazards might seriously and negatively affect your town in the next 10 years in terms of physical and economic damage?"[23] The majority of Survey One participants (four out of five) answered that they were highly concerned about storm surge and extended flooding. Three participants answered that they were highly concerned about sea level rise. On Survey Two, the majority was the same as in Survey One: out of a total of four answers, all indicated that they were highly concerned about storm surge and extended flooding. All four participants for Survey Two also indicated that they were highly concerned about sea level rise – in comparison, on Survey One only three out of five participants answered that they were highly concerned. Therefore, between Workshops One and Two, stakeholders in this study population expressed increased concern about sea level rise.

3.1.5.1.2.4 Need for evidence. The "need" for a big storm or a natural disaster to bring visible destruction to this region was cited by some participants as necessary for compelling adaptation action. In an in-depth interview, a key stakeholder shared his perspective about what he thought would motivate people to support adaptive action:

> *It [sea level rise] doesn't happen tonight – it starts with flooding … water doesn't go back in [the] drain … street is part of the tertiary drainage system … that is when those things start to kick in … what are impacts to property values … incremental changes add up over time and the issue becomes less debatable … it is really a timing issue … people*

[22] See question three on Survey Two (Appendix F) for matching question.
[23] Question three on Survey Two was written slightly differently than it had been written in Survey One. On Survey Two, the question was written: "Thinking about the next 10 years, how concerned are you that these natural hazards may seriously and negatively affect your town in terms of physical and economic damage?" Despite this minor difference, the core meaning of the question was the same in both cases, allowing for comparison between survey responses to this question.

don't do things unless they see evidence … if it's [flooding] in your backyard, now you will skip and jump …

Another key stakeholder explained how the region responded when it had been affected by a major storm – and visible destruction – in 2012:

What happened a few years ago with A1A is a good example [of responding to coastal vulnerability]. It had been flooding consistently for years and finally we just experienced an insurmountable amount of flooding … it was so problematic that the whole road crumbled and buckled and then we really had to do something about it. They built it higher and I think that was necessary and a good thing … they really needed to … so for this situation … climate change wasn't the reason it was built that way, the storm was the reason … and the continuous flooding. They built the road a bit higher to account for those factors, but they weren't necessarily using climate models to figure out how to do it, just to account for the flooding it was experiencing at the time.

3.1.5.1.3 Consistent funding. As explained above, an important aspect of the COAST approach was engaging participants in futuristic visioning. "Pretending" and making assumptions (in particular, about funding) was difficult for many of the participants. During the deliberative session about the elevation/floodproofing option in workshop one, the facilitator and a participant conversed about the difficulty of making a judgment in absence of information about funding sources:

Facilitator: *In some cases with this approach, an option may be well thought out and judgments may be made about vulnerable properties … but the cost benefits ratio … turns out that might not be the best payout. Other factors are avoided costs … so the right question is, who would be willing to do this and who wouldn't …? The primary question here is, what percentage of eligible property owners who aren't elevated yet in areas noted on the map do you think would voluntarily participate in elevating – the question at*

this time is not about funding sources, it's about what percentage would agree to participate.

Participant Six: *We need more parameters to make those decisions [making a judgment about the percentage of people who would support the elevation/floodproofing option]. What is the context … this question is hard to answer if we're talking about hotels and other properties, which would be very open to participating dependent on who is paying, versus homes, where the homeowner may be financially responsible. We just don't know that. We can help you figure out the factors that would affect people choosing to or not to participate but we can't tell you if they will or won't. It's not just funding – it's other things … given my house and the way it's constructed, it might be … my decision will change depending on the funding structure … so we have to know that.*

3.1.5.1.3.1 Sources of funding. Although concerns over the source of adaptation funding were commonly expressed throughout the workshops, surveys and interviews, they were especially prevalent during Workshop One. During this workshop, the COAST facilitator had to repeatedly explain that the COAST approach operated under the assumption that funding for adaptation would be available for whichever adaptation options the participants supported. For instance, in one of the deliberative sessions about the voluntary buyout adaptation option, a COAST facilitator explained:

It [voluntary buyouts] would not be offered on undeveloped land and there isn't money out there for this now, but we want you to assume that if this were to occur, they [the home owners] would get money somehow. Imagine that we're not going to worry about where the money will come from but … we're just exploring here, this is a thought experiment, so I don't want you to feel like you're endorsing this idea, we're just doing a 'what if' idea …

The primary issues about funding pertained to concern over existing municipal debt, as well as internal competition for limited financial resources among local government agencies. During Workshop

Two, one key stakeholder explained the infeasibility of allocating municipal funding for the adaptation options discussed during the COAST workshops:

> Participant Six: *I was at a Hollywood Beach Civic Association meeting – I was told that this city is a billion dollars in debt and this is because of contracts that were signed with the fire and police department – we're in a nearly bankrupt situation to begin with – the City of Hollywood!*

Similarly, another key stakeholder explained the tradeoffs that would be necessary in order for the county to be fully responsible for funding adaptation options:

> Participant 33020: *There are limited financial resources [in local governments] and our agencies compete for that … Water Management Districts don't necessarily have the same interest in sea level rise as coastal communities have … so where does government put its resources … the funding … when they have to sacrifice some other services for adaptation planning … your voters will not like that… it is all about priorities*.

3.1.5.1.4 Modeling and the prediction imperative. The fourth barrier to adaptation was the call for regional factors to be included in projections of climate impacts. During the first COAST workshop, many of the stakeholders questioned the COAST model's credibility and usefulness because it assessed building damage *in isolation* of other factors that would have affected modeling outcomes. They were primarily concerned that the COAST model did not consider regional scientific factors that they believed were important to include in a model that would be useful for adaptation policymaking. The COAST team explained that these other factors were not included in the COAST model because doing so would not help them to generate accurate estimates of damage – and because the purpose of the tool was not scientific, but based on spatial factors. As a COAST facilitator explained:

> *We can't cover [regional scientific factors] because the COAST approach really deals with the impacts of sea level rise and storm surge on property and on the economic*

resiliency and sustainability of an area as affected by those impacts – it is more spatial and doesn't deal with intrusion …[24]

The preference for increasing the accuracy of the model in order to assure the credibility of its outcomes for policymaking reflects a tendency toward the "prediction imperative," or the idea that predictive data simplifies the decision-making process by creating a clearer and more accurate picture of the future (Meyer, 2011; Sarewitz, Pielke & Byerly, 2000). The following section focuses on findings that inform answers to the second part of research question one, regarding how stakeholders' deliberation reinforces or delimits the significance of the prediction imperative for decision-making processes in contexts of deep scientific uncertainty. It provides evidence of some of participants' most assertive and articulate comments about modeling factors and predictive capability, which were captured within the field notes and in-depth interviews.[25] It is organized according to the key themes that resonated with the majority of stakeholders, which were:

- regional science in modeling (e.g., saltwater intrusion, groundwater, porous limestone)
- critical and transportation infrastructure
- human safety and security

3.1.5.1.4.1 Regional science in modeling. Regional scientific factors such as groundwater, saltwater intrusion and porous limestone are particularly challenging issues for water management in Southeast Florida. These factors were not included in the COAST model because, as explained in the "COAST Approach" section above, the purpose of this model was to calculate cost-benefits estimates of flood damage from storm surge and sea level rise to buildings within the study area. COAST provided stakeholders with an economic model with the intent of engaging them in futuristic visioning and decision making about economically feasible adaptation options for their region. However, many participants argued that regional scientific factors should have been included in the model because they

[24] See Appendix J, Workshop One Field Notes
[25] Questions on the two surveys didn't explicitly address stakeholders' expectations about the role of prediction in modeling; therefore, data from this source is not available for answering the research question of this section.

would have had a significant effect on the outcomes generated by COAST. As a result, some participants expressed skepticism of the model's validity. For example, one participant explained his concern that porous limestone had not been factored into the modeling formula:

> Participant 33022-0125:[26] *This model does not take into account porous limestone … damage to buildings with certain amount of surge and sea level rise and depth of water seeping in … and how much damage … there is more than one thing operating here and you're only showing us one thing – it almost seems like it isn't valid*.

Another participant explained that factoring groundwater conditions into the model would have strengthened its credibility by modeling the relationship between groundwater and flooding, and therefore affecting the degree of impact. He suggested that:

> Participant One: *The biggest problem is groundwater. The model doesn't take into account groundwater … and we've modeled this and you'll find in Southeast Florida that groundwater is a bigger driver and you see far more flooding inland than you see on the coast … if you don't include that [groundwater] that is a bit of a problem … so you're really just looking at surges …*

In response to these comments, the COAST facilitator validated the importance of these concerns but reiterated the purpose of the model, explaining that:

> *The COAST approach really deals with the impacts of sea level rise and storm surge on property and on the economic resiliency and sustainability of an area as affected by those impacts – it is more spatial …*

Throughout the in-depth interviews, participants continued to express similar concerns in response to the question, "How does the uncertainty of the COAST models affect your confidence in their predictions?". However, key stakeholders held a different position about modeling than stakeholder-participants. This finding is surprising because it challenges the prediction imperative, or the notion that

[26] This excerpt was also used above in the section titled "Modeling."

policy makers value predictive data because of the assumption that predictions can help them to make more effective decisions.

Four key stakeholders expressed that uncertainty was an inherent characteristic of modeling and that is was constantly necessary for them to make decisions despite uncertain predictions from models. In one instance, an interviewee was more concerned about the repercussions of *not* acting despite uncertainties:

> Participant 33021-0509: *We never talk about the consequences [of waiting for more accurate predictions] – but to me, the level of service doesn't suffice … planning utilities … have to try to be predictive … imperfect as they may be … and move forward with actions that must have a sense of potential risk. There are a set of assumptions that you have to put into a model that may not be certain … are we willing to take that chance [of expecting/waiting for certainty from a model] – because if we do, and we wait, people are going to say, "Why weren't you prepared? Why didn't you do anything?*"

These stakeholders explained that if they chose not to make decisions because of uncertainties, they wouldn't be fulfilling their professional responsibilities and as a result, their constituents would potentially be vulnerable or unsafe. From their perspective, models were productive tools but were not expected to provide solutions, only useful scenarios of what *may* happen in the future. Despite the uncertainties in modeling outcomes, they saw their responsibility as the obligation to act. Therefore, in terms of coastal vulnerabilities, the primary barrier for them was not prediction, but their access to sufficient funding either from the state or federal government or by making tradeoffs to reallocate funding from existing policies to adaptation planning.

Another one of the key stakeholders interviewed for this project explained that models aren't intended to provide "silver bullet" answers for policymaking, but that it was important to generate models that reflected situated, regionally specific factors in order for them to provide useful outcomes. He emphasized the importance of including regional factors such as groundwater and porous limestone in

models of climate impacts to this region. In his opinion, the only way that this region could effectively respond to its vulnerabilities was to model the interaction of regional processes:

> Participant 33020-1013: *… many people now don't understand how modeling works and they want this easy clear fix to problems … models can't do that, and they haven't and never will. They won't provide this silver bullet to the issue. I don't think I'm bothered by it but I know that a number of people are. I do think that models need to be situated and specific and tied to … what's actually happening. For those models [the COAST models] not to take into consideration something like groundwater or limestone is an oversight because that is our situation – that's our context and if you want to get us to talk about solutions, then we need to be having a real conversation*.

Stakeholders' concerns about the exclusion of regional scientific factors from the COAST model can be interpreted in two different ways. On one hand, their concern about a more holistic model could be interpreted as their preference for an exploratory approach to modeling. An exploratory approach focuses on experimenting with the possible interactions between uncertain components within a system in order to generate insight into the variety of possible scenarios that may exist (Pielke, 2003).[27] In this sense, stakeholders' concerns would not reflect the prediction imperative because their preference would be seen as the need for more comprehensive data about *interactions* within a system, as opposed to more *accurate* outcomes. On the other hand, if their concern was interpreted as a belief that the model was invalid because it didn't incorporate all relevant factors, then this preference would be more indicative of the prediction imperative. These conflicting interpretations of stakeholders' expectations of modeling point to a significant problem in science, policy and decision making: the difference between the use of predictions for *science* and the use of predictions for *policymaking*. This issue is taken up further in Part Two of this chapter.

[27] Exploratory modeling is explained in more detail above, in the section titled "Modeling."

3.1.5.1.4.2 Critical and transportation infrastructure. In at least seven instances, participants argued that the model needed to consider the effects of flooding, surge and sea level rise on critical and transportation infrastructure in order for the outcomes to be useful. One participant summarized her concerns about the need for a vulnerability assessment of critical and transportation infrastructure:

> Participant Two:[28] *My concern has to do with infrastructure which your model doesn't include … but let's say that water is rising and sewer and water systems aren't functioning properly … the fact that we're occasionally going to have damage to buildings isn't as important as the fact that if we don't have support systems that we take for granted …*

Similarly, during an in-depth interview, one key stakeholder asserted that moving critical infrastructure out of vulnerable areas ought to be the priority for adaptation planning. In response to the in-depth interview question, "What regional assets do you think should be prioritized in adaptation planning?" he explained:

> Participant 33020: *[The priority should be] the location of critical utilities … they are located in places where they may be wiped out … and if that happens … it won't matter if peoples' homes are protected, there won't be any services for them. It's a security issue … and a safety issue*.

Other participants recognized that the cost-benefits estimates generated by the COAST models were much lower than if the models had factored in how transportation infrastructure was likely to be affected:

> Participant Two:[29] *The problem I have is with the infrastructure – how will people get to their homes? You haven't put this into your scenarios yet … even if we waterproof and*

[28] See Appendix J for Workshop One Field Notes.
[29] See Appendix K for Workshop Two Field Notes.

raise the homes, the roads are still vulnerable – the cost you're coming up with is just a fraction of what it really is. I don't see it being cost effective if you can't get there …

These arguments highlight the discrepancy between participants' priorities for adaptation planning and the priorities of the COAST approach. Although the COAST modeling process involved a rigorous cost-benefits analysis (which participants "strongly agreed" was credible) this information didn't reflect stakeholders' perceptions of the policy problem: the need to relocate vulnerable critical infrastructure and strengthen or replace vulnerable transportation infrastructure.

When the COAST team was confronted with participants' arguments about critical and transportation infrastructure during the workshops, they encouraged participants to think *beyond* this existing barrier and to engage in futuristic visioning – to think longer term. As explained above in the "COAST Approach" section, the facilitators used terms like, "thought experiment" and "make an assumption that …" in order to encourage participants to think about the cost-benefits of the larger-scale, longer-term adaptation options that had been modeled. They explained that even though the COAST model didn't include critical and transportation infrastructure in its formula, the outcome was still useful for providing "a conservative estimate" and "a good first step" in the process of adaptation planning. Despite this encouragement, it appeared difficult for many of the participants to recognize cost-benefits analyses of damage to buildings as a starting point for adaptation planning discussions.

By emphasizing futuristic visions and long-term economic benefits, the COAST approach appeared to be operating under rationalist assumptions. In a rationalist paradigm, people are thought to make prudent and logical decisions based on straightforward cost-benefits analyses (Akers, 2000). By providing participants with accurate cost-benefits data on adaptation options, it was presumed that participants would choose the option that delivered the highest expected total value (e.g., elevation and floodproofing). In climate science, rationalist theory manifests as the prediction imperative – the idea that accurate scientific predictions lead to easier decision making. This idea is taken up further in Part Two of

this chapter, using theory from rhetoric, psychology, decision sciences and political science to provide insight into motivations for decision making within uncertain contexts.

3.1.5.1.4.3 Human safety and security. Another major theme among participants' responses to the COAST models was human safety and security. As one key stakeholder explained, when visualizing the future, there are many significant factors to consider. One of the primary factors participants were concerned about was the safety and security of their neighbors and other members of their communities – the cultural aspects that defined their communities' uniqueness and value. One participant captured the essence of these concerns by emphasizing the limitations of a "purely financial analysis" and stressing that adaptive options should aim to maintain the components of a functioning, thriving community:

> Participant 33139-0615: *When you make that investment [in an adaptation option] you need to know … community is not only made of buildings – the services, the neighbors … if you lose one part of that community it disintegrates that community … if you see abandoned homes on each side of your dwelling or you see that people move out … it just isn't the same so the shops that you used to shop in … they have to go … do you stay … the purely financial analysis is very limiting*.

The barrier, in this case, was the exclusion of the human factor from models of climate impacts and adaptation options. For this participant, human contributions to a community's resilience must be taken into consideration in decision making about adaptation options. Emphasizing the usefulness of accurate cost-benefits tradeoffs over human factors reflects prediction imperative-thinking about decision making. The value of "human safety and security" is further analyzed in Part Two of this chapter and the cultural dimensions of adaptation planning[30] are addressed in Chapter Four.

In another in-depth interview, in response to the question, "Did the visualizations affect your level of concern about how sea level rise may affect your community? Did they affect your level of

[30] Cultural dimensions are argued to be as important to scientific and technical information for decision making about adaptation (Adger, Barnett, Brown, Marshall & O'Brien, 2013; Barnett & Adger, 2003; Fresque-Baxter & Armitage, 2012; Wolf, Allice & Bell, 2012).

concern about your home or property?" another participant explained her preference for modeling that incorporated human safety and security over buildings' vulnerability:

> Participant 33020-1013: *In the workshops, they took high-income buildings to show value … to me that is not relevant. It would have been more relevant to see how many people lived there than one building of lower value than another. What about people whose primary home is threatened – without anywhere else to go? That is the thing of more value than the buildings. The human aspect was absent … it [the COAST model] gives you the extent of flooding … red patches [on the visualizations] showed how far the water could come inland … but not who was there. We were only looking at water from above – if you mapped water seeping in and put them together, showing the impact to the human aspect too, a fuller picture of the impact … that probably would show more destruction.*

Humans are critical factors in nearly every issue of environmental policy (Pielke, 2010). This participant's response calls for the inclusion of human aspects in models of climate impacts – which is extremely difficult to accomplish (if not impossible) in *predictive,* outcomes-based models. Because the human aspect of climate adaptation makes for inherently unpredictable outcomes, *scenarios* are suggested to be the only way to generate useful scientific modeling data for policy. Exploratory approaches to modeling generate these types of scenarios using computations to analyze the interactions between complex and/or uncertain systems (Bankes, 1993; Bankes, Walker & Kwakkel, 2013). Exploratory models provide computational decision support for decision making under deep uncertainties, like human responses to climate change. However, human responses to climate change are motivated by values. Therefore, qualitative research that unearths these values can provide useful information about the type and extent of adaptation action people are likely to support (Adger, Barnett, Brown, Marshall & O'Brien, 2013; Fresque-Baxter & Armitage, 2012; O'Brien & Wolf, 2010; Stern, 1992; Weber, 2006). Therefore, in addition to quantitative decision support provided by consolidative models, it is necessary to engage in

qualitative research that provides insight into human values as they pertain to the adaptation planning process. Part Two of this chapter provides discussion and analysis of the findings above and identifies the specific values that are embedded in stakeholder perceptions of coastal vulnerability and the opportunities for adaptation planning in this region.

3.2 Part Two

3.2.1 Stakeholder Values and the Role of Rhetoric in Generating Usable Information for Adaptation Policy

Part One of this chapter described the COAST modeling approach and identified the barriers to adaptation that emerged from the data. Knowing those specific barriers is crucial for identifying what stakeholders value. A growing body of research in communications, sociology, and political science suggests that identifying individuals' social values can provide useful information about the types of adaptation actions they perceive as effective and legitimate (Amundsen, 2015; Camfield & McGregor, 2005; Corner, Markowitz & Pigeon, 2014; Dobson, 2010; Evans, Maio, Corner, Hodgetts, 2013; Fresque-Baxter & Armitage, 2012; Howell, 2013; O'Brien, 2009; O'Brien & Wolf, 2010; Stern, 1992; Turner et al., 2008; Weber, 2006; World Wide Fund, 2009, 2010). In an attempt to understand the values behind these barriers, Part Two of Chapter Three answers the research question, "What are the implicit values embedded in stakeholders' perceptions of coastal vulnerabilities?" In this case study, stakeholders' primary values about climate adaptation reflected their strong sense of place attachment. These values were expressed in terms of altruistic values, or concerns about how climate change may affect humans (e.g., citizens' safety and community resilience) and "scientific" values, such as the inclusion of regional scientific factors in climate modeling and adaptation planning. Beyond identifying stakeholder values, this section also explains *why* stakeholders may have held these particular values; highlighting how rhetorical theory strengthens the perceived link between human values and adaptation preferences.

3.2.2 Values and Climate Impacts

In this case study, "value" was used in three contexts simultaneously: economic, social and environmental. The COAST model emphasized an *economic* valuation of climate impacts through cost-benefits analyses; however, throughout the workshops, many participants suggested that altruistic values were important to consider in addition to economic values, such as real estate market and property values. The COAST survey from Workshop One added yet another interpretation of value – biospheric value, or concerns about the welfare of the environment (de Groot & Steg, 2010).

3.2.2.1 Economic valuation. As explained in Part One of this chapter, COAST facilitators provided stakeholders with visualizations of potential damage to buildings and a vulnerability assessment showing an estimate of the cumulative cost of damage that could potentially result from flooding and storm surge. Stakeholders were provided with this economic information and asked to deliberate about the percentage of public support that each option was likely to receive, given the estimates of potential damage "avoided" (i.e., the costs that could be avoided as a result of implementing an adaptation). At Workshop Two, they were provided with a cost-benefits analysis of the two adaptation options which showed that elevation/floodproofing was the best choice for their region based on the positive cost-benefits ratio.[31] This cost-benefit analysis illustrates an economic interpretation of value; climate impacts were assessed in purely monetary terms and participants were asked to make judgments about investments in the economic resilience of their region. This approach is indicative of most existing adaptation planning and decision-making contexts, which focus discussions about climate impacts exclusively on technical solutions or economic tradeoffs (Agyeman et al., 2009). However, recent scholarship on adaptation planning and stakeholder engagement suggests that peoples' emotional attachments to "place" play a powerful role in motivating climate adaptation actions (Amundsen, 2015).

[31] See Appendix I for the final comparison of cost-benefits of the adaptation actions provided during Workshop Two.

3.2.2.2 Altruistic values. Despite the economic framing of "value" throughout the COAST workshops, stakeholders expressed numerous *altruistic* values and priorities for adaptation planning. In contrast with an economic interpretation of value, altruistic values are ethical assumptions about what is right or important in particular situations; human values. Human values are guides and norms that help individuals determine desirable goals and objectives and to judge appropriate courses of action for achieving those goals (Rokeach, 1973). Throughout the COAST workshops and the in-depth interviews, stakeholders emphasized the importance of including human values with economic valuation in decision-making conversations. These values ranged from concerns about being a good citizen and neighbor to issues of innovation and human intelligence, community resilience and social justice. For example, one participant explained her concern about the lives of *residents*/tenants in the buildings that had been included in the COAST models, as opposed to emphasizing the monetary value of impact and/or cost of protection of these structures themselves:

> Participant 33139-0615: *For me, money is not primarily the issue … seeing that an extremely luxurious building would be affected … that is not relevant … residents of both buildings would be affected – I am more interested in the human aspect than the wealth aspect.*

3.2.2.3 Biospheric values. Survey One shifted the focus from economic valuation to yet another emphasis on values: participants' biospheric values. Question five on survey one assessed participants' environmental values using the New Ecological Paradigm (NEP), a series of 15 questions intended to measure human-environment values or the degree to which people view humans as part of nature rather than separate from it (Dunlap, Van Liere, Mertig & Jones, 2000). The NEP scale asked participants to rank claims like, "Humans are severely abusing the environment" and "Despite our special abilities, humans are still subject to the laws of nature" using a five-point Likert scale, where "1" represented "strongly disagree" and "5" represented "strongly agree."

All of these interpretations are valid ways of addressing "value" in contexts of climate implications. However, in this case study, all three interpretations—economic, altruistic and biospheric –

were used by different groups, simultaneously, and their differences in meaning were not explicitly distinguished. As a result, there was a significant disconnect between what participants innately valued, the values that were being assessed (i.e., human-environmental) and what participants were being asked to value (i.e., economic valuation). The importance of defining a consistent frame for "value" is taken up in Chapter Four.

While economic valuation and human-environmental values are integral components of the adaptation planning and policymaking process, altruistic values are also critical for determining how to make effective policy (Adger, Barnett, Chapin & Ellemor, 2011; Corner, Markowitz & Pidgeon, 2014; Graham, Barnett, Fincher, Hurlimann, Mortreux & Waters, 2013; McCright & Dunlap, 2011; O'Brien & Wolf, 2010; Stern, 2000; Whitmarsh, 2011; Wolf, Allice & Bell, 2013). For the stakeholders in my case study, making good investments in their region went beyond economic valuation and cost-benefits tradeoffs. Good investments were primarily defined in terms of *place* and the types of adaptations that would enable them to continue living in the place that they valued, even though that meant responding to its existing and future vulnerabilities.

3.2.3 Place Attachment and Climate Adaptation

"Place" emerged as the strongest value for stakeholders in this study population. This value represents their emotional and cognitive connections with the subjective and physical aspects of their communities – their sense of "place attachment" (Adger et al., 2013; Amundsen, 2012, 2015; Hess et al., 2008; Ross et al., 2010; Scannell & Gifford, 2013). The following excerpt provides an example of a key stakeholder's assessment of the degree to which residents and stakeholders valued Southeast Florida:

> *You have the most valuable land right there in Florida [pointing to the COAST study area] – and the same is true for Dania Beach … if I have to swim to it, I'll swim to it …we have people that are ready to invest $50 million in those spots [areas of inundation within the COAST study area] right now.*

The significance of place attachment as a motivating factor in decision making about climate adaptation has not yet been thoroughly researched (Scannell & Gifford, 2013). However, existing case studies on this emerging topic suggest that an individual's connectedness to place motivates place-protective and pro-environmental behavior (Clayton, 2003; Nordenstam, 1994; Scannell & Gifford, 2010; Stedman, 2002; Vaske & Kobrin, 2001). Leila Scannell and Robert Gifford's 2013 study on place attachment as a predictor of climate change engagement[32] was one of the first to suggest that residents who possessed a stronger sense of place attachment were more engaged with climate change issues.

Recent research in neuroscience, psychology and political science also supports the significance of emotional factors in decision making and judgment, explaining *why* the "place" value may have emerged in this case. This research has shown that humans do not make judgments – especially in contexts of risk and uncertainty[33] – based on reason or logic, such as cost-benefits analyses (Bandes & Salerno, 2014; Damasio, 2005; Ekman, 2007; Frijda, 1988; Garsten, 2003; Gilbert, 2006; Hughes, 2014; Keltner & Lerner, 2010; Keltner et al., 2014; Lazarus, 1991; Lerner, Li, Valdesolo & Kassam, 2014; Lowenstein, Weber, Hsee & Welch, 2001; Rustichini, 2005; Scherer & Ekman, 1984; Simon, 1983; Solomon, 1993; van der Linden, Maibach & Leiserowitz, 2015). Rather, people are motivated to act primarily because of their emotional connections with a place (Amundsen, 2015) and as a result, it is suggested that affect and emotions play an important role in decision-making processes (Kunreuther, 2002; Loewenstein, Weber, Hsee & Welch, 2001; Slovic, Finucane, Peters & MacGregor, 2002; Slovic, Lichtenstein & Fischhoff, 1988; van der Linden, Maibach & Leiserowitz, 2015). Theory in rhetoric and political science supports this argument, suggesting that although there are many different reasons that motivate decision making (e.g., political, religious, economic), humans most often make judgments about

[32] Scannell & Gifford's study randomly selected 327 adults in three regions of British Columbia: West Kootenays, Okanagan Valley and Vancouver Island.

[33] In neurobiology, this is called the "somatic-marker hypothesis," which is a theory of how decisions are made in the context of uncertainty. It suggests that decisions are aided by emotions which are elicited during deliberation about future consequences (Damasio, 2005; Naqvi, Shiv & Bechara, 2006).

uncertainties based upon the "attachments, concerns and goals that define who they are as individuals and as a society" (Garsten, 2003, p. 9).

In rhetoric, the personal, emotional motivation involved in decision making is called "*phronesis*." For Aristotle, *phronesis* was, "an intellectual virtue [which was] reasoned and capable of action based on what is judged to be good or bad for man" (Aristotle, trans. 2006; Kennedy, 2006; Flyvberg, 2004). In contemporary times, *phronesis* can be equated with prudence or even "common sense" (Garsten, 2003). For participants in this case study, *phronetic* motivations were more influential than logical motivations given that their values emerged from their commitment to making the place in which they lived and worked safer and more resilient.

The utility of the rhetorical concept of *phronesis* is already being demonstrated in planning theory and practice as a new area of study called "phronetic planning research." Phronetic planning research is a situated, contextualized approach to planning that emphasizes altruistic values, evaluative judgments and the power relations that define them, over a rationalist, economics-based approach to planning (Banfield, 1959; Crush, 1994; Dalton, 1986; Fischler, 1998, 2000; Flyvberg, 2004; Hillier, 2002; Huxley, 1994, 2002; Jensen & Richardson, 2004; Watson, 2003; Yiftachel, Little, Hedgecock & Alexander, 2002). Within uncertain contexts like coastal planning and resiliency, *phronetic* planning may prove to be a valuable, rhetorical tool for planning and decision making about land use.[34]

3.2.3.1 Community-level adaptation and stakeholder values. Research in psychology suggests that locally relevant information is influential in motivating engagement with climate change (Amundsen, 2015; Gardner, Dowd, Mason & Ashworth, 2009; Marshall, 2010; Scannell and Gifford 2013). Adaptation at a "community level" means being able to maintain – and improve – existing living standards in the face of anticipated climate impacts (van Aalst, Cannon & Burton, 2008). This approach to adaptation planning suggests that because adaptation operates at a local scale, it should reflect human

[34] Phronetic planning research is not the focus of this project; however, it provides a useful example of how to apply rhetorical concepts in adaptation planning.

and natural situations on a *local* level (Ayers & Forsyth, 2009; van Aalst, Cannon & Burton, 2008). The human and natural situations of a community can be assessed through engaging stakeholders in deliberation about the feasibility of adaptation options and, as a result of this engagement, the identification of specific, place-based barriers to adaptation. As explained in Part One of this chapter, understanding the barriers to adaptation for a particular group provides insight into potential opportunities for overcoming them. Barriers to adaptation provide invaluable knowledge about the factors that may more effectively motivate action within a particular group. As explained above, values motivate judgment and action; therefore, by identifying barriers, it is possible to gain a better understanding of human values.

The most frequent barriers expressed by stakeholders in this study pertained to the "modeling factors" identified in Part One of this chapter. These barriers all point to the significance of the *altruistic* and *scientific* priorities for adaptation planning in stakeholders' communities, namely:

- safety and security of residents
- location of critical infrastructure and the condition of transportation infrastructure
- inclusion of regional scientific factors in modeling

3.2.3.1.1 Altruistic values. As one COAST participant explained to me during an in-depth interview, "*a community is not only made of buildings – [it consists of] the services, the neighbors … if you lose one part of that community it disintegrates that community".*[35] The altruistic aspects of stakeholders' adaptation goals pertained to their concerns about the safety of their neighbors and residents of their local communities and their need for critical services (e.g., potable water, wastewater treatment) and reliable transportation into their communities (and access out of them in emergency situations).

3.2.3.1.1.1 safety. Participants' concerns about the welfare of their neighbors and community members was particularly revealing of the role of *phronesis* and the influence of emotions on decision making. In contexts of risk and uncertainty, people do not usually make judgments based solely on reason and logic (O'Brien & Wolf, 2010). One participant acknowledged this inclination, explaining that "…*a*

[35] See Appendix A for In-Depth Interviews; participant 33139-0615.

purely financial analysis is very limiting …" and that human safety and welfare was more valuable than an economic assessment of structural damage: "*What about people whose primary home is threatened – without anywhere else to go? That is the thing of more value than the buildings. The human aspect was absent …"*[36]

Under uncertain, contingent conditions, people typically make decisions based upon their experiences, attachments and emotions; illustrating the *phronesis* that Aristotle believed was critical in making decisions under uncertainty. In this case study, participants' preferences for adaptation action suggested that the safety of their neighbors and residents of their communities was a strongly motivating value influencing their deliberation and judgment about feasible adaptation options.

3.2.3.1.1.2 access. Participants' "motivation to seek, stay in, protect and improve places that are meaningful to them" (Manzo & Perkins, 2006, p. 347) meant that they would need safe and reliable access to and from their homes and workplaces. "Access," in terms of reliable transportation arteries and utility infrastructure, was the most prominent value that emerged from stakeholders' barriers to adaptation. As one participant explained during the deliberative session in Workshop One, *"… the fact that we're occasionally going to have damage to buildings isn't as important as the fact that if we don't have support systems that we take for granted* …" implying that without critical and transportation infrastructure, residents would not be unable to stay in their homes or communities given a major storm or extensive flooding, etc. Similarly, in their responses to the in-depth interview question, "What regional assets should be prioritized in adaptation planning discussions?" the majority of participants identified critical and transportation infrastructure. Many of these responses were similar to this participant's perspective on the urgency of relocating vulnerable critical utilities:

> Participant 33020: *The location of critical utilities … in places where they may be wiped out … it won't matter if peoples' homes are protected, there won't be any services for them. It's a security issue … and a safety issue.*

[36] See the section titled "human safety and security" in Part One for this participant's complete response.

Although the objective of the COAST process was to provide stakeholders with useful information about the economic tradeoffs of two specific adaptation options, the majority of participants focused on:

- the effects of flooding and storm surge on their communities' aging infrastructure
- the location of critical infrastructure
- the vulnerability of their personal property

Transportation infrastructure was also cited as a priority for adaptation planning in this region. As one participant remarked, even if a larger-scale adaptation option like elevation/floodproofing was adopted in this region, a significant vulnerability would still remain – access:

> Participant Two:[37] *The problem I have is with the infrastructure – how will people get to their homes? Even if we waterproof and raise the homes, the roads are still vulnerable … I don't see it [elevation and floodproofing] being cost effective if you can't get there …*

As explained in Part One, the majority of stakeholders were concerned with the physical and/or economic damage to their communities/personal property because of high winds in storms and flooding. Flooding is a pervasive and ongoing problem in Southeast Florida – even in sunny weather (Davenport, 2014; Parker, 2015; Valentine, 2014). Additionally, high winds and flooding are *visible* risks and represent the immediate events that are already affecting their communities. Participants' adaptation priorities emphasized these existing and familiar vulnerabilities, which were largely influenced by their *situation* – what was occurring now that required their attention and support. As a result, during the COAST workshops, participants struggled to make judgments about the feasibility of the longer-term, larger-scale adaptation options that were presented because these options did not address their existing climate vulnerabilities.

3.2.3.1.2 Scientific values. Concerns about water quality and supply are everyday realities for residents of Southeast Florida. Currently, the region is facing significant water management problems,

[37] See Appendix K for Workshop Two Field Notes.

which include: reduced groundwater flow, increasing saltwater intrusion, higher volumes of stormwater and reduced capacity of flood control structures (FAU, 2011).

As explained in Part One, these "regional scientific factors" were not included in the COAST models. Based on the qualitative data obtained and analyzed for this project, stakeholders considered regional scientific factors to be an integral part of exploring projections of climate impacts to this region, and therefore a necessary factor in generating useful or "usable" information for adaptation policy.

3.2.3.1.2.1 usable climate science for decision making. "Usable" climate science for decision making is defined as information that satisfies the value demands of decision makers (Clark, 2002; Dilling & Lemos, 2011; Lasswell, 1971; Lemos & Morehouse, 2005; McNie, 2008; Weiss, 1978). It is science that is "produced to contribute directly to the design of policy or the solution of a problem" (Dilling & Lemos, 2011). In this case study, the COAST model generated *economic* scenarios of climate impacts to public and privately owned buildings within the study area. However, this information did not match stakeholders' perception about the context of the problem. For instance, throughout the workshops and interviews, they expressed the need for place-based, integrated models of the region's known risks (i.e., reduced groundwater flow and increased saltwater intrusion due to the region's porous limestone foundation). In order for climate information to be considered "useful" for policymaking, it must be perceived by decision makers to be accurate and valid (Cash & Buzier, 2005; Jacobs, 2002; Lasswell & McDougal, 1992; McNie, 2008; Miller, 2007). As explained in Part One of this chapter, during Workshop One a number of participants questioned the validity of the COAST model because of the scientific factors that had not been included in the modeling mix. As one participant explained:

> Participant 33022-0125: *This model does not take into account porous limestone … damage to buildings with certain amount of surge and sea level rise and depth of water seeping in … there is more than one thing operating here and you're only showing us one thing – it almost seems like it isn't valid*.

It is likely that participants' proximity to regional water management challenges, as well as the extensive and ongoing media coverage of these problems, provides an explanation for why so many participants were concerned about generating exploratory, place-based models of sea level rise impact (Goodell, 2013; Hudson, 2014; Michot, 2015; Reid, 2011). For example, in the Hallandale Beach community (See Figure Six below), six out of eight total wells in the area have been closed because water pumped from them was brackish and therefore contaminated (McNoldy, 2014). Hallandale Beach happened to be the "backyard" of many of the workshop participants, as it is located approximately two miles from the city of Hollywood (the site of Workshop One) and approximately seven miles from Dania Beach (the site of Workshop Two).

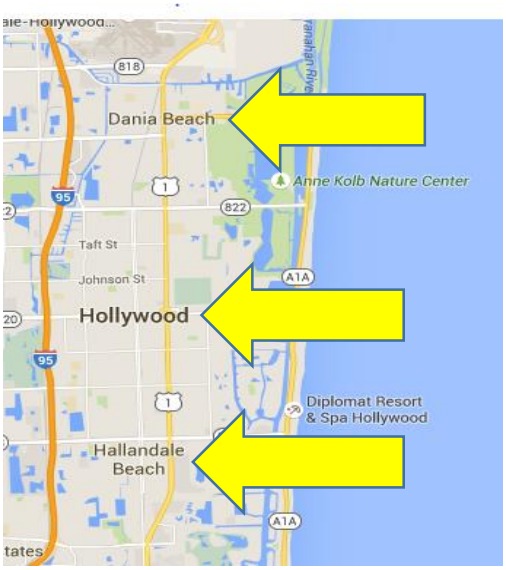

Figure 6: The proximity between Hallandale Beach (furthest south), Hollywood and Dania Beach (furthest north).

3.2.3.1.2.1.1 situated judgment. In rhetoric, the effect of proximity and familiarity on decision making is referred to as "situated judgment." This concept provides useful insight into why participants were concerned about the inclusion of regional scientific factors in climate impact models. Situated judgment is an Aristotelian concept suggesting that citizens make better (or at least more critical) decisions about issues that relate directly to their *personal situation and context* based on their knowledge and experience (Campbell, 2006; Garsten, 2003; Glasby, 2011; Miller, 1999; O'Neill et al., 2013). Situated judgment supports the necessity of understanding *who* evidence/data is being constructed for and

the *meaning* that the evidence/data will hold for that particular audience *before* engaging in negotiation (Glasby, 2011; Miller 1990).[38] In order to understand a particular audience's situation, it is necessary to listen to the audience's interests, experiences, opinions and feelings about the issue *before* engaging in further deliberation and planning. Otherwise, it is not possible to know what information an audience needs: "there is no way to know what information people need without doing research that begins by listening to them" (Pidgeon & Fischhoff, 2011). Baruch Fischhoff and Nick Pidgeon refer to this process as "strategic listening." The first step in the process of strategic listening, they argue, is to "let people talk about the decisions that they face until scientists can paraphrase what people say well enough to be told, 'Yes, you understand us.'" (SciDev, 2015). The purpose of this step is to clarify an audience's perception of the problem, their preferred outcomes, the options that may be possible for attaining these outcomes and the additional information that they may need in order to support planning and decision making (Gregory, Arvai & McDaniels, 2001; Clemen, 1996; Pidgeon & Fischhoff, 2011). As a result of strategic listening, the scientist/facilitator can then develop communication tools that address what an audience *needs* to know in order to address the problem as the audience sees it.

This does *not* imply that more general scientific or economic data about climate or climate impacts is not important. Scientific and economic models have an extremely prominent role in science and decision contexts; the argument of this dissertation is not to dispute the significance of quantitative data for decision making. However, models built prior to identifying the values and priorities of interest to a particular group of stakeholders will seldom be ideal or adequate for addressing stakeholders' needs effectively (Bankes, 1993). When scientific/economic data is privileged over other factors, it can distance rather than engage stakeholders from the issue under discussion (Tsoukas, 1997). Therefore, it is important for the purpose and application of modeling data to be clearly established before providing modeling outcomes to an audience.

[38] This argument is taken up further in Chapter Four.

3.2.3.1.2.1.2 persuasion. As opposed to colloquial interpretations of "persuasion" as manipulation, pandering and coercion (where a listener is convinced or worse, "brainwashed" to adopt a position) a rhetorical persuasion is ethical. It requires that the speaker/facilitator pay attention to their audience and respect their points of view and judgments (Garsten, 2003). Persuasion is inextricable from judgment, as it is the process that occurs when an individual considers an argument in order to make a decision (Aune, 2008; Deneen, 2007; Garsten, 2003; Koehler & Harvey, 2007). Persuasion occurs when an individual decides that an argument is compelling enough to adjust or change their own beliefs in light of what has been argued (Garsten, 2003). The process of strategic listening leverages an ethical – rhetorical – persuasion. Strategic listening provides the speaker with valuable insight into an audience's interests, experiences, opinions and feelings before engaging that audience in deliberation/negotiation about an issue. To be persuasive, an argument must connect with an audience's interests, experiences, opinions and existing knowledge about an issue.

In the next chapter, the values identified above are used to inform ways of reframing climate adaptation for stakeholders in this region. Frames are persuasive strategies for communication that connect an argument or idea with certain aspects of an audience's existing interests, experiences, opinions and knowledge – their values (Benford & Snow, 2000; Garsten, 2003; McAdam, McCarthy & Zald, 1996; Polletta & Ho; Tarrow, 1998). The process of framing begins with a rhetorical approach: determining the "available means of persuasion," or the values and priorities held by a particular audience. These values "*must* be taken into account if adaptation is to be effective, efficient, legitimate and equitable" (Adger & Barnett, 2009; Barnett & Campbell, 2010). Chapter Four also uses framing to inform an alternative way of engaging stakeholders in genuine deliberation and decision making about adaptation planning. It concludes by acknowledging the significant challenges of stakeholder engagement, such as stakeholder identification and eliciting stakeholder participation in the knowledge-generation process and the creation of adaptation plans and policies.

CHAPTER FOUR

FRAMING ADAPTATION: ENGAGING STAKEHOLDERS IN DELIBERATION AND DECISION MAKING ABOUT ADAPTATION PLANNING

4.1 The Significance of Framing in the Adaptation Planning Process

This chapter answers the research questions, "What frames engage stakeholders in Broward County in decision making about adaptation?" and "What are the challenges and opportunities of stakeholder engagement in adaptation planning?" It addresses the first research question above using findings from the data sources analyzed in Part One of Chapter Three to support the argument that the COAST workshops were a useful and necessary starting point for clarifying specific barriers to adaptation and establishing priorities and preferred options for adaptation. The unique stakeholder values that were elicited from these barriers are used in this chapter to suggest ways of reframing adaptation policy development and practice in this region. As explained in Part Two of Chapter Three, stakeholders' primary values were "safety and access" concerning individual properties and the larger community in which they live, with specific preferences for:

- Relocation of vulnerable critical infrastructure/strengthening of transportation infrastructure (e.g., roads, bridges)
- Prioritization of human welfare/quality of life and community resilience

These values provide useful insight about alternative ways of framing climate adaptation so that it is salient to stakeholders in this region. Framing is an integral part of eliciting stakeholder engagement in adaptation planning and policymaking – but in order to determine how to frame information appropriately for a particular audience, it is necessary to allow for deliberation about stakeholders' experiences and

preferences for action. Hartmut Fuenfgeld and Darryn McEvoy, researchers with the Victorian Centre for Climate Change Adaptation Research (VCCCAR),[1] argue that although deliberation about how to frame adaptation goals, outcomes and processes is time-consuming, it should "be regarded as a way of defining adaptation planning processes" and that it is "likely to significantly influence the type of adaptation measures that will emerge as a result of the process" (2011, p. 58).

Although there are many ways to frame climate change,[2] this chapter focuses exclusively on how to frame climate *adaptation* in Southeast Florida. Focusing on adaptation frames, as opposed to climate change frames more generally, is an important step toward identifying the scientific research that is needed to address stakeholder values and priorities for adaptation planning *in this region* (Scannell & Gifford, 2013). Adaptation framing contributes to the production of usable science – science that is produced to contribute directly to the design of policy or the solution to a problem (Dilling & Lemos, 2011)[3] because it clarifies priorities for action. Once these priorities are established, it is then possible to set a scientific agenda to determine ways of achieving them. Individual communities have distinct values and priorities which *must* be taken into account if adaptation strategies are to be effective, efficient, legitimate and equitable (Adger & Barnett, 2009; Barnett & Campbell, 2010).

The first part of this chapter provides a brief definition of "frames" and the framing process and then distinguishes between "outcomes-based" and "process-based" approaches to adaptation. A process-based approach elicits and then incorporates local values into deliberation about adaptation options. This chapter suggests that this type of approach may provide a more flexible way of facilitating adaptation planning that is more likely to encourage bi-partisan support and result in effective negotiation and decision making about what adaptation means for particular regions (Nisbet, 2011; Scheufele &

[1] The VCCCAR Framing Adaptation project was an 18-month research project that focused on how to achieve effective adaptation to climate change through various approaches and framings. Its goals were to facilitate research on climate change adaptation that was immediately relevant to adaptation policy development and practical applications at the state/local level. It was funded by the State Government of Victoria (Australia; Funfgeld & McEvoy, 2011, 2014).

[2] For example: scientific uncertainty; economic consequences; conflict and strategy; Pandora's Box; public accountability; public health

[3] See Chapter Three, Part Two for full explanation of "usable" science.

Tewksbury, 2007). The next part of this section uses the values identified in Part Two of Chapter Three to suggest two specific frames for adaptation planning in this region. It also explains how these frames may be used to further explore and identify feasible adaptation options in this region. It accomplishes this by illustrating how rhetorical concepts fit into a "collective action framing" process and suggests that this process is a useful approach for engaging stakeholders in deliberation and decision making about adaptation. Lastly, it acknowledges some of the significant challenges of stakeholder engagement in adaptation planning, such as stakeholder identification, selection, and the challenge of eliciting genuine participation in the knowledge-generation process and the creation of effective adaptation options (Few, Brown & Tompkins, 2011).

4.2 Frames

Frames are "schemata [construction/organization] of interpretation that enable individuals to locate, perceive, identify and label occurrences within their life and space and the world at large" (Goffman, 1974, p. 21). They are principles of selection, emphasis and presentation that derive from experiences, beliefs and practices and culminate in theories about what exists, what happens and what matters (de Boer, Wardekker & van der Sluijs, 2010; VCCCAR, 2011; Gitlin, 1980; Rein & Schon, 1991; Weick, 1995).

Rhetoric and the strategic process of framing are linked: both are persuasive and situated in particular places, audiences and times. Frames are interpretive and persuasive *devices* because they reflect and emphasize certain aspects of an audience's existing interests, experiences, opinions and knowledge (Benford & Snow, 2000; Garsten, 2003; McAdam, McCarthy & Zald, 1996; McGuire, 1985; Polletta & Ho, 2006; Tarrow, 1998). In order to determine what an audience's existing interests and experiences are, it is necessary to engage in strategic listening – the ethical, rhetorical act of paying attention to an audience and respecting/responding to the audience's perspective and judgments (Pidgeon & Fischhoff, 2011; Garsten, 2003). For Aristotle, a rhetorician was someone who was able to see what was persuasive in a given situation – someone who engaged with an audience in order to determine what interested them,

what experiences were salient to them and how they perceived the significance of a particular issue. Rhetoric, in seeking available means of persuasion, is a process for determining how to frame a particular issue for a *given audience* at a *given point in time*. Timing is a crucial factor in determining how to effectively frame an issue because frames are constantly evolving and changing. For instance, if an audience becomes more educated about a particular issue, they may shift their perspective; adopting a new frame about the issue. Therefore, although frames are useful for demarcating and punctuating particular aspects of reality at a specific point in time, it is important to realize that they are *dynamic*, evolving and, at any point in time, limiting (Benford & Snow, 2000; Goffman, 1974). For this reason, rhetoric – and in particular, deliberation, is a necessary component of frame-building and frame alignment for adaptation planning and policy making. Deliberation exposes whether existing frames are effective ways of communicating about an issue or whether new frames are needed. If frames are not elicited and discussed through deliberation, they can potentially act as limits to adaptation (Adger, Barnett, Brown, Marshall & O'Brien, 2012).

Frames are particularly useful for defining/redefining complex policy problems and are critical to the direction of public policy conversations (VCCCAR, 2011; Nisbet, 2009; Nisbet & Mooney, 2007). As a broad public policy issue, climate adaptation planning can benefit from the organization and specificity that framing provides. In particular, strategies for scenario planning and stakeholder engagement in adaptation planning can benefit from the concept of "frame alignment" (Benford & Snow, 2000; Snow et al., 1986) and the subsequent alignment processes of frame "amplification," "extension" and "bridging" (Benford & Snow, 2000) – all of which are informed by the rhetorical process of deliberation.

Frame alignment is a strategic effort to link the interests and interpretive frames of an issue with those of existing or prospective stakeholders (Benford & Snow, 2000; Snow et al., 1986). There are four basic approaches to frame alignment: amplification, bridging, extension and transformation.[4]

[4] Transformation isn't discussed here because it pertains to changing old understandings and meanings and generating distinct, new frames. The purpose of this chapter is not to generate *new* frames for climate adaptation, but to argue that *shifting* the existing frame through the other alignment processes (bridging, amplification and

One of the approaches to frame alignment, frame amplification, is the process of determining, clarifying and invigorating an audience's existing values and beliefs through the process of deliberation or negotiation about a particular issue (Benford & Snow, 2000). The second approach, extension, involves building upon an issue's existing frame to incorporate issues and concerns that are significant to potential adherents (Benford & Snow, 2000). In this case, extension can be useful for engaging decision makers who may be neutral, reluctant or non-receptive to climate-related issues. The third approach, bridging, is the process of "linking two or more ideologically congruent but structurally unconnected frames" about an issue (Benford & Snow, 2000, p. 624). Bridging can motivate policymakers by showing how an existing issue, for instance, adaptation, isn't *exclusively* about costly, large-scale, long-term actions, but that it is also about shorter-term, existing priorities like emergency management and infrastructure resilience. Issues like emergency management and infrastructure resilience aren't *typically* used to frame climate adaptation; however, they may be effective means of engaging particular individuals and organizations in negotiation and planning for adaptation. These three approaches are taken up in more detail in the section below titled "Collective Action Framing for Adaptation Planning."

4.2.1 Adaptation Framing

Adaptation framing is a pragmatic planning approach for responding to the regional impacts of climate change. It deemphasizes the barriers inherent in climate change framing (e.g., causation, uncertainty, greenhouse gas emissions) and refocuses communication on smaller-scale opportunities and actions to reduce vulnerability to more local, immediately felt pressures (Moser et al., 2008; Moser & Dilling, 2011; Moser & Ekstrom, 2010). Because adaptation is local, reframing the global issue of climate change so that it links with a specific context and audience may trigger productive new ways of thinking about climate change as a *local* issue with *local* solutions. Within the literature on climate change framing, this approach is referred to as taking a "proximal" view on adaptation. A proximal view is an

extension) and rhetorical strategies may be effective for making more effective progress toward decision making about adaptive actions.

implementation-oriented approach to adaptation planning that focuses on shorter-term actions as *entryways* for initiating adaptation action. It is suggested that taking a proximal view on adaptation may motivate action within traditionally reluctant or resistant individuals or groups because emphasizing what is already familiar to an audience (e.g., stormwater management) is more likely to be accepted over making arguments about responding to an unfamiliar or invisible event (e.g., sea level rise) (de Boer, Wardekker & van der Sluijs, 2010; Higgins, 1997, 2000; Nisbet, 2009).

Within the proximal point of view, there are two distinct ways of decision making about adaptation options: outcomes-based adaptation framing and process-based adaptation framing. It is important to understand the implications of each of these approaches prior to inviting stakeholders to participate in adaptation planning because the way in which adaptation is framed will substantially affect adaptation goals and outcomes (de Boer, Wardekker & van der Sluijs, 2010; VCCCAR, 2011; Smit, Burton, Klein & Street, 1999).

4.2.1.1 Outcomes-based framing. Outcomes-based adaptation is a "framing by numbers" approach which is "strongly influenced by the need for evidence-based decision making [and therefore reliant] on hard data generated by modeling climate change impacts, vulnerabilities and adaptive capacities" (VCCCAR, 2011, p. 31). This type of framing reflects a traditional, consolidative approach to policymaking in which a system is modeled to provide predictive (quantitative) data, which is then expected to provide a more accurate picture of the future; therefore streamlining the decision-making process by identifying a clear policy alternative[5] (Lempert et al., 2004; Meyer, 2011; Sarewitz, Pielke & Byerly, 2000). This approach (also described as an "impact modeling and decision-analytical" frame) has tended to dominate communication about climate science to decision makers, who have subsequently come to understand – and expect – adaptation outcomes exclusively in terms of engineering/technological solutions (Collins & Ison, 2009; VCCCAR, 2011; Hinkel et al., 2010; McEvoy, Matczak, Banaszak &

[5] See the section titled "Traditional versus Alternative Approaches to Policymaking" in Chapter One for more details on traditional approaches and the "Modeling" section of Chapter Three, Part One for further information on consolidative modeling.

Chorynski, 2010). Quantitative, predictive data is a critical component of determining feasible and desirable adaptation decisions; decision making necessitates making predictions about the expected outcome of a particular action on society. However, in an outcomes-based approach to adaptation, predictive data is often *translated* into policy without reflecting on the factors that can influence and change the predictions (VCCCAR, 2011). As a result, outcomes-based adaptation framing often leads to decisions that are based on *existing* situations without taking into consideration the ways in which natural, social, economic and environmental factors can significantly affect the robustness of predictions and therefore lead to ineffective policies (Collins & Ison, 2009; NRC, 2002). The economic analyses provided by the COAST process largely reflects an outcomes-based framing of adaptation, in which a consolidative approach was used to determine an accurate cost-benefits comparison of the two adaptation options. This economic data satisfies *part* of the requirement for providing decision makers with information that is useful for policy making. The other part of usable scientific information for policy making considers the interrelationships between factors within a system throughout time; a process-based, exploratory approach to framing adaptation.

4.2.1.2 Process-based framing. A process-based framing of adaptation considers the role of people and institutions, their evolving capacity for effectively dealing with climate impacts (i.e., adaptive capacity) and the role of non-technological or "soft" adaptation considerations in adaptation planning (VCCCAR, 2011). Process-based framing recognizes that effective adaptation planning involves an awareness of the ongoing, changing interactions between human social systems and their environment (Collins & Ison, 2009). This approach suggests that these interactions significantly affect the ways in which individuals understand the climate implications they experience and therefore, the types of actions they support. A process-based framing approach to adaptation involves an exploratory process of negotiation, deliberation and modeling which generates numerous possible scenarios for how to respond to vulnerabilities within places that people value (Hinkel et al., 2010).

Framing adaptation as either outcomes-based or process-based has a significant effect on the types of outcomes that result from the planning process. As discussed below in the section titled "Strategic Framing for Adaptation Planning," it is recommended that adaptation framing be made explicit at the outset of the planning process. Funfgeld and McEvoy (VCCCAR, 2011) argue that when this first step is overlooked, the process may be less constructive in identifying a range of creative, effective opportunities for adaptation:

> If groups of adaptation actors persistently lack a shared understanding [framing] of what constitutes climate change adaptation, this can lead to inefficiencies in adaptation planning processes, as people talk unknowingly at cross-purposes, in discussions that evolve along existing value dispositions, where biases based on personal beliefs, fiercely held assumptions, political affiliations or professional interests can remain unchallenged. (p. 21)

An outcomes-based framing, which relies on consolidative modeling, generates accurate results *if* the factors within the system being modeled are certain. However, when factors are uncertain (as in *projections* about sea level rise and human behavior) a process-based framing approach, which uses exploratory models to generate possible scenarios of future conditions, provides more contextualized and useful information for *policymaking.*

Despite the outcomes-based framing of adaptation and the consolidative modeling approach to generating cost-benefits analyses of adaptation options, the dominant frames for adaptation that emerged from the COAST process were based on stakeholders' emotional attachment to place; their home. This finding indicates that future efforts toward adaptation planning may want to consider a process-based, exploratory modeling approach in order to account for stakeholders' values. One such approach is suggested below, in the section titled "Collective Action Framing for Adaptation Planning."

The next section suggests two frames for climate adaptation, based on the most pervasive values expressed by stakeholders in the case study of this dissertation. It also provides context and insight into

why these particular frames may have emerged from the COAST process despite COAST's emphasis on economic valuation.

4.3 Frame One: Human Welfare and Community Resilience

The viability of adaptation strategies largely depends on cultural values and objectives because "values give meaning to action" (Rokeach, 1973, p. 5). When cultural factors are overlooked in adaptation planning, the strategies chosen may not be perceived by the community as necessary, feasible, legitimate or effective; potentially resulting in maladaptive outcomes (Adger & Barnett, 2009; O'Brien & Wolf, 2010; Wolf, Allice & Bell, 2012; Snow et al., 1986; Zuo & Benford, 1995). The "human factor" is relevant to the success of adaptation planning and decision making because the natural (climate) system is integrated with and affected by the human system, and vice versa (Eakin & Patt, 2011; Pielke, 2007; Sarewitz, Pielke & Keykhah, 2003). Human agency to positively or negatively respond to the natural system must therefore be taken into account with equal emphasis in adaptation planning and decision making: successful and legitimate adaptation is determined by what people perceive to be worth preserving, and this hinges on peoples' underlying values and motivations (Adger et al., 2009; Benford & Snow, 2000; O'Brien & Wolf, 2010; Wolf, Allice & Bell, 2012). Many of the existing frames of adaptation address the "human factor" only in terms of *causation* – therefore activating the "anthropogenic versus natural" frame and focusing debate largely on arguments about environmentalism and/or the origin of the problem, either justifying the problem as "natural" or laying blame on developed countries, capitalism, major carbon producers, etc.; essentially, pitting humans against nature (Fischer, 2009). This framing of the human factor has widened the political divide over climate change. More importantly, as a result, it has not proven to be productive in motivating the development of innovative strategies for meeting the challenge of changing conditions or fulfilling stakeholder and citizen values (Cramer & Karabell, 2010; Revkin, 2011). An example of this type of divisive framing about climate change occurs in Part One of Chapter Three, when a participant at COAST Workshop Two responds to

another participant's comment about the length of time it would take for elevation/floodproofing adaptation option to prove useful:

> Participant Two: *The insanity you've got – this is what's destroying us… when you have this kind of environment to deal with this is what makes it so difficult to educate the public … now you guys are educated, and now it's frightening you … you realized that you should have been doing this [adapting to coastal hazards] 25 years ago, but you didn't. When you start to realize that guys like this [the COAST facilitators] tell you … you can't raise houses high enough … this gentlemen talked about increments … the increment is … by 2100 they're predicting to a four meter rise in the ocean … this is what it's going to look like down here [holding his hand parallel above his head and ducking his head]*.

These types of frames, which use anger, criticism and fear to make arguments about responding to climate change, are not productive for *solutions-oriented* conversations about how to adapt (Downing, 2012; Fazey et al., 2010, 2011; Gorddard et al., 2012; O'Brien, 2012; Pelling, 2011; Swim, Clayton, Doherty, Gifford, Howard, Stern, Reser & Weber, 2009; Wise et al., 2014). As a result, this chapter argues that refocusing adaptation frames on stakeholder values (versus global climate change or environmentalist rhetoric) may be a more positive and productive way of engaging more stakeholders in productive conversations about investing in the future of their communities.

One example of an alternative frame for adaptation can be derived from the data analyzed within this project: the "human welfare and community resilience" frame. Throughout the COAST workshops and in-depth interviews, participants expressed concerns about the safety of their neighbors and other residents of their communities and the protection and resilience of community assets. The preference for human welfare and safety was communicated in a variety of ways. For example, during an in-depth

interview, a participant explained her perspective about how/whether the COAST visualizations influenced her level of concern about her community and/or the vulnerability of her property:[6]

> *For me, money is not primarily the issue … seeing extremely luxurious building – would be affected … more value … that is not relevant … residents of both buildings would be affected – more interested in the human aspect than the wealth aspect…*

This participant's response reflects the significance of altruistic values in decision making about adaptation planning and policy. Her emphasis on the consideration of the human elements of adaptation (as opposed to the economic tradeoffs of different adaptation actions) suggests that reframing adaptation as a social issue may be a salient way of engaging stakeholders in conversations about adaptation options (Carter et al., 2007).

Similarly, during the deliberative session in the first workshop, another participant expressed concern about the negative implications of uncoordinated residential adaptation:

> *My neighbors tell me that their properties never flooded until they were elevated … and it's like a dam [now] so when we think about how high, the water has got to go somewhere, so that will affect the properties located near them … they're going to be the ones that flood as a result of elevation in another area … am I negatively impacting my neighbor?*[7]

Stakeholders' altruistic values ranged from concerns about the safety of residents and their neighbors, as in the two comments above, to other considerations such as:

- Maintenance of robust community resources and amenities
- Calls for attention to vulnerable populations and social justice

[6] The in-depth interview question was, "Did the visualizations affect your level of concern about how sea level rise may affect your community? Did they affect your level of concern about your home/property?"
[7] See Appendix J for complete Workshop One field notes.

- Belief in the ingenuity and motivation of humans to respond to existing challenges and to protect their property at all costs

Participants' strong commitment to "place" and their emphasis on altruistic values suggests that reframing adaptation in terms of human welfare and community resilience may be a productive way of engaging more stakeholders' support of adaptive action. Reframing the issue of adaptation around human/community welfare and quality of life can be useful for determining "how to enable people to *lead the kinds of lives they value* in the *places where they belong*" (Barnett & Adger, 2003, p. 328). As discussed in Part One of Chapter Three, COAST workshop participants were primarily concerned with adaptation strategies that would enable them to enjoy their communities and stay in their homes. This strong valuation of "place," therefore, should influence the types of adaptation that are proposed as feasible and appropriate options for stakeholders in this region.

4.4 Frame Two: Vulnerable Critical Infrastructure and Strengthening of Transportation Infrastructure

The most dominant adaptation frame for stakeholders in this region is based on their strong preferences for place and especially for safely accessing and continuing to live in their homes and communities. During Workshop Two and throughout many of the in-depth interviews, "critical and transportation infrastructure" was cited as the most important factor to consider in adaptation planning.

A "critical" asset, in terms of infrastructure, is defined as a feature that is "so important to an area that its removal would result in significant losses" (DHS, 2015). Some examples of critical infrastructure include:

- facilities used for public safety (civil-defense facilities, fire stations, national-security facilities, police stations, and radio and television stations)
- medical services (ambulances, hospitals, outpatient-care centers, and physician offices)
- basic necessities (banks and credit unions, gas stations, and grocery stores)

- government functions (courts and legal offices, government offices, international-affairs offices, and U.S. Post Offices)

Transportation infrastructure is also considered to be "critical," but refers specifically to the underlying structures that support the delivery of inputs to places of production, goods and services to customers and customers to places, such as transit, highways, airports, railways, waterways/ports (U.S. Chamber, 2010). Through their deliberation about the two adaptation options modeled by COAST, it became clear that stakeholders were primarily concerned with critical infrastructure (which they defined as access to power/electricity and the functioning of water/wastewater treatment) and transportation infrastructure (defined as the roads, highways and bridges that they rely on for access to and from their homes and workplaces). As discussed below, further stakeholder deliberation about this specific value will be necessary in order to determine which critical infrastructure is most vulnerably located and which vulnerable roads, highways and bridges ought to be the focus of adaptation and resiliency building.

On a national level, U.S. transportation infrastructure is largely considered to be outdated and in need of major repair and replacement. For example, in 2014 nearly 70,000 bridges – one out of every nine – were considered to be structurally deficient (Senate Budget Committee). In 2013, the American Society of Civil Engineers' study on the status of U.S. infrastructure, "Report Card for America's Infrastructure," assigned a "D+" for the performance of overall infrastructure, with roads receiving a "D" and bridges, a "C+."

In Southeast Florida, infrastructure that is already considered outdated or in need of repair is being impacted by storms and higher tides, further compromising its resilience over time. These existing stressors and the projected impacts of sea level rise to the region have caused many local government officials to argue that retrofitting existing transportation infrastructure/new construction projects must take into account a structure's anticipated lifespan *plus* rising sea levels (Streeter, 2013). During an in-depth interview for this project, one participant reflected this same concern – that the region will soon be faced with making decisions about infrastructure that will be expected to have a lifespan well into the

future. In response to the interview question, "What concerns you most regarding the potential effects of storm surge and sea level rise?" one of my respondents explained that:

> *Sea level rise is a slow steady creep so dealing with that for me is all about trying to put in controls today that are going to be realized 50 years from now. So what will happen is if I install a pipeline or building … I'm probably figuring its life is at least 50 years … so what you have to avoid doing is installing critical infrastructure and finding that that isn't going to deal with 50-year condition …*

Regional decision makers in Southeast Florida are not only concerned with the safety risks of vulnerable transportation infrastructure, but also with the substantial taxpayer investments that are required for retrofitting or rebuilding (Streeter, 2013). Rachel Cleetus, lead climate economist at the Union for Concerned Scientists, captured these concerns in her response to an executive order to strengthen the Federal Flood Risk Management Standard.[8] She asked, rhetorically, "Why would the federal government build or repair buildings in ways that continue to put communities at risk? And why would we waste taxpayer dollars rebuilding in ways that are likely to result in repeated future flood damages?" Regional decision makers in Southeast Florida are currently deliberating over how to address these very priorities given their concern with the safety and resilience of the region's critical and transportation infrastructure throughout the infrastructures' expected lifespan (Berry & Koch, 2010; Bloetscher, 2009; Heimlich, Bloetscher, Meeroof & Murley, 2009).

If people are to continue to live in this region, they will need safe and reliable transportation infrastructure and access to critical services. Stakeholders' strong attachment to and willingness to invest in the place in which they live means that safe and reliable transportation infrastructure and access to critical services are extremely relevant priorities for adaptation planning. In the in-depth interviews, many participants explained their concerns with transportation and critical infrastructure as these factors were likely to be affected by *existing* vulnerabilities: flooding and storm surge. One participant emphasized the

[8] Executive Order 11988/13690

necessity of prioritizing the vulnerability of critical utilities because of the need to continue providing services for residents of vulnerable/affected areas during a storm/event. In response to the interview question, "What regional infrastructure do you think should be prioritized in adaptation planning discussions?" he answered:

> *The location of critical utilities … they are located in places where they may be wiped out … and if that happens … it won't matter if peoples' homes are protected [elevated/floodproofed], there won't be any services for them. It's a security issue … and a safety issue.*

Another participant emphasized the necessity of considering transportation infrastructure *before* deliberating about larger-scale adaptation options, such as elevation and floodproofing. In response to the interview question, "How does the uncertainty of the COAST models affect your confidence in their predictions?" he explained:

> *The problem with these models is that roadway infrastructure isn't taken into account. [The COAST facilitator] said on several occasions that they didn't factor in infrastructure … the problem is the model fails because most of the time when you get to those pieces of property you can't access them. What good is that? What we have to look at is the infrastructure system has failed to a point that we can't make it accessible …*

In the survey results, there was an increase in participants' perception of the need to respond "now" to vulnerable public facilities between Workshop One and Workshop Two. For the question, "There are a variety of programs and actions a city or county could implement to reduce the potential for physical and economic damage caused by climate-related hazards. Which planning activities or programs do you think your local government should implement?" only one participant from Workshop One selected "now" as the preferred timeframe for action to address vulnerable public facilities (with the remaining four selecting "in the next 10 years."). However, on Survey Two, half of participants selected

"now" as their preferred timeframe for action; the remainder of participants selected "in the next 10 years."

4.5 Reframing Adaptation as Continuous Transformation

The two frames above represent the most valuable outcomes of the COAST process. Without the COAST workshops, it would not have been possible to identify regional barriers to adaptation or to subsequently understand the values that motivate adaptive behavior in this region. Given this knowledge, the next steps for adaptation planning in this region may want to consider how to reframe conversations about adaptation around stakeholders' preferences for human welfare and quality of life *in a place they value* despite its vulnerabilities (e.g., critical and transportation infrastructure). A major part of operationalizing these values is determining how to fulfill stakeholder preferences for addressing existing vulnerabilities while planning for future resilience. The balance between these goals may be achieved through what is called "continuous transformation," an approach to adaptation planning that incorporates shorter-term, incremental adaptive actions within more substantial, robust adaptation goals.

Participants' emphasis on the importance of starting with their existing vulnerabilities (i.e., the location of critical infrastructure and the condition of transportation infrastructure) reflects their preference for an "incremental" approach to adaptation. Incremental adaptation consists of adjustments that are intended to enable decision makers to continue meeting existing objectives under changed conditions (Craig, 2010; Kates, Travis & Wilbanks, 2012; NCA 2014; Park et al., 2012). In this case, participants preferred adaptive actions that could ensure that their neighbors and other citizens of their communities could safely access and inhabit their communities despite anticipated changes in flooding frequency or storm surge intensity.

4.5.1 Incremental Adaptation

In terms of the barriers and values identified in Chapter Three, the majority of participants in the study population expressed preferences for approaching adaptation through incremental steps as opposed

to larger-scale, transformational shifts. For example, as one participant[9] explained during an in-depth interview, when Hurricane Sandy (2012) washed out portions of State Road AIA in Fort Lauderdale and flooded numerous Miami Beach and inland Fort Lauderdale roadways, engineers decided to rebuild the affected section of A1A higher than its initial elevation. However, as this participant explained, it was not rebuilt this way *explicitly* because of "climate change" or with a longer-term goal toward adaptation in mind, but because of the storm:

> *It took a natural disaster to create the opportunity to actually move … to make decisions … we had an opportunity to put it [A1A] back together the same way … or to do it better. It [A1A] had been flooding consistently for years and finally just experienced an insurmountable amount of flooding … it was so problematic that the whole road crumbled and buckled and then we really had to do something about it. They built it higher and I think that was necessary and a good thing … they really needed to ….*

In an emergent, follow-up question, I asked this same participant, "In these conversations about rebuilding A1A, was climate change part of the conversation?" The respondent answered:

> *… for this situation … climate change wasn't the reason it [A1A] was [re]built that way, the storm was the reason - and the continuous flooding. They built the road a bit higher to account for those factors, but they weren't necessarily using climate models to figure out how to do it, just to account for the flooding it was experiencing at the time.*

In this situation, the storm (a one-time event) was used as justification for increasing the resilience of this roadway. This respondent's explanation about how the road was built "a bit higher" and that the decision made was "not necessarily because of data from climate models" illustrates the primary challenge of incremental actions: ensuring that they address existing challenges but *also* contribute to capacity-building over time. The tendency to focus on proximate causes is one of the most significant drawbacks of incremental adaptation. When incremental steps are taken only to address proximate causes,

[9] This interviewee was a key stakeholder for the City of Hollywood, Florida.

a system often functions normally – *temporarily* – but later experiences greater, sometimes irreversible and catastrophic loss in the long term (Carpenter & Brock, 2008; Kates, Travis & Wilbanks, 2012; White, Kates & Burton, 2001). This occurrence is sometimes referred to as the "risk spiral" process or the "catastrophic" effect – a situation in which a short-term, one-time effort to address an issue is understood to have "solved" the problem and therefore, the initial problem is assumed to necessitate no further attention.

In the example above, the impacted area of A1A was rebuilt to be more resilient than it had been before, but *not* as a capacity-building effort. Therefore, it accomplishes an incremental adaptive action but not in the sense that it intentionally contributes to the longer-term adaptive capacity of the region. Much of the criticism of an incremental adaptive approach points to these types of situations, where action is taken to address a proximate cause, but not designed to increase adaptive capacity overall (Barnett & O'Neill, 2010; Fazey, Pettorelli, Kenter, Wagatora & Schuett, 2011; Herriman et al., 2012; Park et al., 2012). If the decision to rebuild the impacted section of A1A had been intended as one *step* contributing to a *continuous* process of capacity building, where a series of other similar incremental adaptations could accumulate in more substantial adaptive capacity, then it would be considered to be "continuously transformative" and not simply incremental. Focusing on incremental adaptation to existing coastal impacts that are intended to build adaptive capacity over time could provide a useful way of framing the conversation about how to accomplish effective adaptation policy (Palutikof et al., 2013).

4.5.2 Continuous Transformation

Continuous transformation positions incremental adaptation as part of a *process* in which adaptation decision making is disaggregated into actionable (incremental) steps that, over time, coalesce into more substantial adaptation strategies (Pelling, 2011; Smith, Horrocks, Harvey & Hamilton, 2010). This approach incorporates incremental actions within longer-term transformational strategies by "nesting" incremental actions within long-term adaptation goals (Horrocks & Harvey, 2009; Smith, Horrocks, Harvey & Hamilton, 2010). From this perspective, climate change doesn't need to be an

explicit component of shorter-term decision making (Gardner, Dowd, Mason & Ashworth, 2009); however, shorter-term, incremental actions *do* need to be perceived as ways of experimenting with and learning about which options are successful for a particular region in order to decide how to build resiliency and adaptive capacity. This may mean making decisions now that can be reversed, modified or built upon in the next 10-20 years, as opposed to committing to transformational actions that require significant shifts to economic, social and political systems (Tompkins, Few & Brown, 2008).

4.5.3 Transformational Adaptation

Transformational adaptation is defined as action that is adopted at a much larger scale, involving ideas or actions that are truly new to a particular region or resource system. Transformational adaptation substantially changes a place and even shifts locations (Agard & Schipper, 2013; Kates, Travis & Wilbanks, 2012; Titus et al., 2009). This type of adaptation focuses on the causes of climate impacts and vulnerability and suggests ways of changing existing economic, political or behavioral structures (Rickards & Howden, 2012). Most importantly, transformational adaptive responses are necessary primarily in cases where there is large vulnerability in populations or resource systems and/or severe climate impacts that *overwhelm* robust human systems *despite incremental adaptive efforts* (Kates, Travis & Wilbanks, 2012). Transformational adaptation often comes with significant, daunting costs for benefits that are not realized until well into the future; thus making this approach to adaptation a hard policy "sell" (de Sherbinin et al., 2011; Kates, Travis & Wilbanks, 2012).

This type of approach would not be appropriate for Southeast Florida because this region is not in a situation where its social/economic systems are untenable or undesirable, or in which incremental adaptive efforts have proven ineffective (Dinshaw & McGray, 2014; Nelson, Adger & Brown, 2007). Additionally, in this region, stakeholder values reflect a preference for incremental adaptations that address existing vulnerabilities. If stakeholder values are to be included in adaptation planning, transformational adaptation may be a longer-term goal, but should *not* be the shorter-term priority for adaptive action.

4.6 Deliberative, Participatory Planning for Adaptation

Moving forward, decision making about the next steps of adaptation planning for this region may want to consider a continuous transformative approach beginning with incremental adaptive steps. As discussed below, this will involve deliberative, participatory scenario-planning for exploring and sequencing sets of possible adaptive actions to respond to the short- and long-term viability of this region and its inhabitants (Butler et al., 2014; Leach et al., 2010; Park et al., 2012). One of the primary benefits of engaging stakeholders in deliberative, participatory planning is that it provides an opportunity for insight into stakeholders' preconceived knowledge and value-based priorities; the factors that constitute the ways in which they frame adaptation. Scenario planning for adaptation allows for "unearthing" existing frames, discussing them and working toward agreement about the definition and purpose of adaptation (Funfgeld & McEvoy, 2011; Rein & Schon, 1991). Making frames explicit during the planning process is extremely important for establishing genuinely collaborative processes for adaptation planning: "a lack of attention to the frames that underpin adaptation can lead to inefficient and/or ineffective use of scenario planning processes and result in poor adaptation outcomes" (Adger, Barnett, Marshall & O'Brien, 2012; VCCCAR, 2011).

4.6.1 Framing and Rhetorical Concepts

Framing is embedded in social and political planning and policymaking processes; therefore, it is a significant factor in influencing the adaptation pathways or directions for a particular group (Barnett & O'Neill, 2010; VCCCAR, 2011). The framing approach described below is unique in that it incorporates the rhetorical concepts of deliberation, situated judgment, *phronesis* and persuasion within the three core tasks of collective action framing: diagnostic framing, prognostic framing and motivational framing (Benford & Snow, 2000; Hunt, Benford & Snow, 1994; Snow & Benford, 1988; Wilson, 1973). Although existing literature on rhetorical strategies and framing has explored rhetorical concepts, styles, strategies and criticism as *components* of framing analyses (an *ex post*[10] examination of communication) current

[10] "after-the-fact"

scholarly research has not addressed the potential for applying rhetorical concepts within the core framing tasks of collective action framing as part of a scenario-planning *process* (Conger, 1991; Hallahan, 1999; Jerit, 2007; Kaplan, 2013; Kuypers, 2014; Kuypers, Cooper & Althouse, 2012; Kuypers & D'Angelo, 2010; Lowry, Xie & Witte, 2008). This project suggests that incorporating rhetorical concepts into a framing strategy can elicit useful information about human values, experiences and preferences for action regarding visible climate impacts in this region (e.g., flooding, coastal/beach erosion and high winds because of increased/intensified storms). The intention of this process is to model an adaptation planning strategy that more genuinely incorporates stakeholder knowledge and preferences into adaptation planning and decision-making agendas. In contrast with existing scholarship incorporating rhetoric and framing, this approach argues that a framing strategy embedded with rhetorical concepts to inform and direct the processes involved in planning and facilitation is an "*ex ante*[11] part of the political process that produces decisions" (Kaplan, 2013).

As with any framing strategy, making decisions about what information is emphasized and what information is deemphasized often means making tradeoffs (VCCCAR, 2011). In this case, as discussed above, a potential tradeoff means emphasizing shorter-term, incremental adaptation strategies with the confidence that these smaller actions will serve as a means of building toward the more robust strategies that are necessary for substantial change. The potential danger here is that if incremental adaptation strategies are not critically approached as part of a capacity-building process, these actions may not have positive impacts on the underlying problem because they only address the immediate, proximal problems (Funfgeld & McEvoy, 2014). In light of this challenge, the adaptation planning approach described below emphasizes incremental adaptation strategies as part of a flexible process of continuous transformation in which these smaller actions accumulatively affect more substantial change and capacity-building over time.

[11] "before-the-fact"

The framing approach described below suggests beginning with incremental adaptation strategies that address the familiar, visible implications of coastal vulnerability (i.e., flooding, coastal/beach erosion and increased/intensified storms and high winds) because these factors were of most concern to the majority of stakeholders in this study.[12] This kind of "particular" framing may "elicit knowledge on some climate change impacts and adaptation options while concealing/suppressing others" (VCCCAR, 2011); however, particular framing provides more usable scientific information than the existing framing of adaptation. Existing adaptation framing is broad and not "usable" in the sense of providing scientific information to address policy problems; therefore, this framing is "unlikely to provide the guidance needed to devise an effective planning and decision-making process" (VCCCAR, 2011). For instance, the IPCC defines adaptation as, "an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects" (McCarthy et al., 2001). Similarly, the NCA defines adaptation as "action to prepare for and adjust to new conditions, thereby reducing harm or taking advantage of new opportunities" (2014). In light of these widely used but broad definitions, careful, critical engagement with regional stakeholders should define what *specifically* climate adaptation means to them and what adequate policy responses for their communities might look like. These kinds of conversations may lead to action that responds to *existing* pressures while allowing for the time that is necessary for adaptation frames to resonate with and influence communities to take more action toward continuous transformative adaptation and increased adaptive capacity (Collins & Ison, 2009; Funfgeld & McEvoy, 2014; Lakoff 2004).

Despite these efforts, in certain instances it still may not possible to come to a truly shared framing of adaptation at first; however, the process of deliberation may enable continued, focused negotiation about the specific goals of adaptation and the identification of processes and resources that are necessary for achieving these goals (de Boer, Wardekker & Sluijs, 2010; VCCCAR, 2011). If the only outcome of the first attempt at a deliberative process of stakeholder engagement in adaptation planning is

[12] See Chapter Three, "Invisibility."

a more specific definition of the problem or the elimination of infeasible adaptation options, then progress has been made toward the larger goal of determining what successful adaptation means for a given context (VCCCAR, 2011; Funfgeld & McEvoy, 2014; Gardner, Dowd, Mason & Ashworth, 2009).

4.7 Collective Action Framing for Adaptation Planning

Collective Action frames are "action-oriented sets of beliefs and meanings that inspire and legitimate the activities and campaigns of social movement organization" (Benford & Snow, 2000); the outcome of negotiating shared meaning (Gamson, 1992). The process of creating these types of frames involves generating interpretive frames that differ from and/or challenge existing frames (Benford & Snow, 2000; Gamson et al., 1982; Snow et al., 1986; Snow & Benford, 2000). Collective action frames are primarily used for social movement organization activities because their intent is to "mobilize potential adherents and constituents, garner bystander support and to demobilize antagonists" (Snow & Benford, 1988, p. 198). However, for the purpose of this project, the intent is not to mobilize adherents or garner support, but to provide a useful tool for science, policy and decision making about effective adaptation planning processes. Therefore, I have embedded the rhetorical components of deliberation, situated judgment, *phronesis* and persuasion within the three framing tasks of collective action framing (i.e., diagnostic, prognostic and motivational framing) to illustrate a unique approach to engaging stakeholders in adaptation planning (Benford & Snow, 2000; Snow & Benford, 1988; Wilson, 1973).

As explained above, while rhetorical concepts, styles, strategies and criticism have been identified as components of framing analyses, they have not yet been positioned as *ex ante* tools for science policy. The purpose of illustrating a new approach here is to suggest a methodology, based on the empirical research and analysis of the case study in this project, for how planners/facilitators of adaptation planning processes may consider leveraging the usefulness of deliberation in stakeholder engagement for adaptation planning.

4.7.1 Task One: Diagnostic Framing

The first component of collective action framing is diagnostic framing. The task of diagnostic framing traditionally involves two priorities: identifying the problem and clarifying the sources of causality, blame and/or culpable agents (Benford & Snow, 2000). However, in the adapted version of diagnostic framing proposed here, the second priority of this task (identifying who/what to blame) is not taken up because of concerns about activating the contentious and highly politicized frame of the climate change debate (i.e., activating environmentalist rhetoric and/or determining whether the causes of climate change are anthropogenic/natural) (Ford, Berrang-Ford & Paterson, 2011; Pielke, 2010). Because of the association of adaptation within the larger context of climate change and the salience (and polarization) of the existing "climate change debate" frame, making attributions about who or what to blame would likely serve as a *barrier* to deliberation as it would be counterproductive in narrowing the focus of adaptation for the purpose of planning and decision making. For these reasons, the diagnostic task of collective action framing for adaptation planning that is proposed here does not include an attributional component. Instead, it focuses attention on the process of engaging in extensive deliberation with stakeholders in order to elicit existing frames about adaptation and to more specifically define locally experienced climate problems.

Although the concept of diagnostic framing is well understood and clearly defined, there is less insight into the *process* of diagnostic framing. Rhetoric's traditional concern for questions of *how* a problem is defined and what "problem definition" looks like in practice are useful starting points for informing how to approach the challenging process of achieving a genuinely inclusive planning process with deliberative, strategic facilitation. This project approaches diagnostic framing by focusing on how to inform the process of defining the problem by asking the question: "How can we determine the specific ways that stakeholders define adaptation?" This question is explored through the concept of deliberation, arguing that deliberation provides a means of facilitating diagnostic framing about adaptation – the first step in the adaptation planning approach illustrated below.

In most adaptation planning discussions, it is assumed that the purpose and goals of adaptation are shared among stakeholders (VCCCAR, 2011); however, most of the time stakeholders involved in local adaptation policy formulation do *not* have a shared view about the meaning or purposes of adaptation (Dovers, 2009; Funfgeld & McEvoy, 2014). For example, during the first COAST workshop, within the first 30 minutes of the facilitator's presentation, participants interrupted him multiple times to express concerns about the impact of climate on ocean acidification and mercury levels, saltwater intrusion, groundwater, porous limestone and other regional scientific factors of concern.[13] These comments represent the diversity of ways in which stakeholders defined the problem, illustrating the challenge of this first task in the planning process.

As another example, during this same point in the meeting it became clear that the term "value" was being used in a variety of ways – economic, social and environmental. As explained in Part Two of Chapter Three, the role of "value," as it was being used by facilitators of the workshop, was never explicitly distinguished. As a result, communication between participants and facilitators often became disconnected and unfocused – especially when participants were asked to make judgments about supporting adaptation options.

For these reasons, eliciting stakeholders' existing frames about the problem is "the *first* step toward improving the efficacy of local adaptation planning policy" (Funfgeld, Wallis, Rance & Millin, 2012). Doing so clarifies the specific goals of engagement and can ultimately lead to increased ownership of the problem and willingness to support processes for responding to it (Funfgeld & McEvoy, 2014). One of the roles of deliberation in adaptation planning is to make existing frames explicit and to provide an opportunity for negotiating a shared definition of the problem (Funfgeld & McEvoy, 2014).

Deliberation also facilitates frame amplification, or the clarification and invigoration of existing values and beliefs (Benford & Snow, 2000). Through deliberation with one another about their adaptation experiences, beliefs, values and preferences, certain frames resonate more strongly than others, prompting

[13] See Appendix J for Workshop One Field Notes.

participants to become more inquisitive and creative in their problem-solving efforts and in some cases, more likely to develop greater empathy and understanding of others' situations (Adger, Barnett, Marshall & O'Brien, 2012; Bravo, 2009). All of these implications are useful in drawing boundaries around policy topics and establishing direction for policy goals; leading to more productive planning conversations.

In practice, diagnostic framing through deliberation is the first step of the approach to the adaptation planning process described here. It is important for deliberation to occur *before* any adaptation options are introduced to the group because the outcomes of deliberation will provide significant insight into the types of adaptation options and strategies that stakeholders prefer and consider feasible. If adaptation options aren't informed by the priorities that are expressed during stakeholder deliberation, it is unlikely that they will resonate with stakeholders. The National Oceanic and Atmospheric Administration's (NOAA) "Introduction to Stakeholder Participation," a publication designed to provide coastal management professionals with insight into how to incorporate social science tools into their work, suggests that:

> Stakeholders should be actively and meaningfully involved in a deliberation; their input should inform final decisions, and in some cases they can help design and guide the decision-making process itself and can help to implement final decisions. (2007)

Approaching the diagnostic framing task through deliberation will require the planner/facilitator to take on a different and more challenging role. Instead of defining the meeting agenda and directing the flow of conversation (e.g., deciding who speaks and when, who listens and for how long) the facilitator should serve as more of a "convening host" who shares control of the meeting with participants and strategically co-participates in deliberation throughout the meeting process (Quick & Sandfort, 2014; Wheatley and Frieze, 2011). Enacting this new role may include some of the following:

- providing stakeholders with the opportunity to express their views about adaptation
- using small groups to facilitate stakeholder-led deliberation
- organizing space that is conducive to small discussion groups

- allowing conversations to be stakeholder-led (i.e., minimal intervention by project facilitators) (Tompkins, Few & Brown, 2008)

As a result of this approach, by strategically listening to stakeholder communication, the facilitator can gain valuable insight into stakeholders' specific conceptions of the problem and potentially, valuable insight into their preferences for who should be responsible for decision making, when decisions should be made and what risks and costs they consider to be appropriate (Gardner, Dowd, Mason & Ashworth, 2009; Tompkins, Few & Brown, 2008).

These insights represent how deliberation can elicit the available means of persuasion – the specific ways in which stakeholders perceive the problem; influential terms for communicating about solutions. The next step in this process is to use the insights obtained from the diagnostic phase to prepare for the next phase of the framing process in which solutions are developed: prognostic framing.

4.7.2 Task Two: Prognostic Framing

The prognostic framing task involves articulating potential solutions to the problems that were identified during the diagnostic phase. Prognostic framing answers questions about what should be done (in response to the problems identified in the diagnostic phase) and identifies potential problems regarding consensus that may arise from the suggested responses. The diagnostic and prognostic framing tasks are related in that the identification of problems during the diagnostic phase *informs* the types of strategies and solutions that will be suggested for responding to these problems in the prognostic phase.

The rhetorical concepts of deliberation, situated judgment and *phronesis* inform *how* prognostic framing may occur within an adaptation planning context. In this phase, the facilitator should still defer the majority of the speaking and deliberating to participants; however, it is important that the facilitator strategically organize participants' deliberation around the specific problem/problems that were identified during the diagnostic phase. Focusing their deliberation will increase the likelihood that participants' decisions about potential solutions are critical and informed, given that citizens often judge best when asked to make decisions based upon the "attachments, concerns and goals that define who they are as

individuals" (Garsten, 2003, p. 9). A persuasive approach to the prognostic phase would involve framing decision making around the experiences, expertise and values that were amplified by the group during the diagnostic phase. Framing the prognostic phase in this way would be likely to increase the cultural resonance of the frame, or the degree to which it reflects the group's existing values (Benford & Snow, 2000; Snow & Benford, 1988; Swart, 1995).[14] Reflecting stakeholders' concerns back to them, *in their language*, further amplifies the frames that are most salient and therefore increases frame resonance. It also establishes "empirical credibility" by aligning the "real" world, as it is perceived by the group, with the framing of the problem. In framing theory, empirical credibility is a critical component of establishing a resonant, and therefore successful, frame (Benford & Snow, 2000).

One of the likely challenges of this phase is the time that would be required of the planner/facilitator in researching the problems and determining how to provide useful information about the specifics of these problems to participants. In this case study, for example, this may have involved research to determine which regional critical infrastructure was most vulnerably located and which transportation structures were suggested to be least resilient. It may also have involved providing participants with information about the various potential tradeoffs that may be involved in cost structuring, decision making about responsibility and timeframes for action. This data would then be used to structure participants' deliberation and decision making about how they want to respond to this problem during the prognostic phase of planning.

A dialogic method called the "World Café" technique provides a good example of what this type of deliberative, situated decision making might look like in practice (Brown & Bennett, 2005; Brown & Isaacs, 2005). This technique is an alternative to the traditional, deficit model method of "listening sessions" which rely on a facilitator who mediates a single, large-group dialogue. In the World Café

[14] The concept of resonance explains why some frames are effective while others are not (Snow & Benford, 1988).

technique, participants are pre-assigned to sit in small groups and then asked to refer to a set of carefully crafted questions pertaining to the policy problem.[15]

After receiving a brief explanation of the purpose and parameters of the Café, the facilitator may consider providing a demonstration modeling what participants' deliberation should look like. For example, in one World Café planning session on how to expand the growth of a financial planning association, the facilitator began the session with a panel discussion featuring three community leaders in the field (e.g., an academic, a local politician and a private practitioner). She asked the leaders to sit comfortably at the front of the room and to engage with one another in civil conversation about their various perspectives about the purpose of the workshop (i.e., growing the association).

After observing the panelists model deliberative conversation, the participants are then asked to designate a "host" for their small groups. The host is responsible for encouraging the group to take up the designated questions and for keeping notes of the group's discussion. At certain times throughout the session, the facilitator will ask the individuals in the groups (except for the host) to disperse from their groups and join new groups, where they take up the same questions with new participants and new hosts. While a World Café technique is not the only way of generating productive, deliberative conversation, it provides an example of how this step of the adaptation planning process might take place in practice.

4.7.2.1 Stakeholder identification and selection. Another challenge involved in the prognostic phase is ensuring that the "right" stakeholders are included in planning discussions. In preparation for engaging in the prognostic framing phase, it is extremely important for the planner/facilitator to consider the types of stakeholders who should be involved in this phase of the planning process *based on the nature – and framing – of the specific problem.* It is important to identify and engage stakeholders who are affected by the problem, are willing to engage in communication about solutions and who can be influential (i.e., have decision-making power) in taking action on the particular issue. In the context of

[15] For example, if this technique were to be used with the stakeholders of this case study, small groups of participants may have been asked to deliberate about questions pertaining to vulnerable critical and transportation infrastructure; priorities for community resilience.

coastal adaptation in particular, it is "particularly formidable" to identify appropriate stakeholders because of "the seemingly endless list of people who use coastal resources, either directly or indirectly" (NOAA, 2007).

In their case study of stakeholder engagement in coastal planning for climate change in the UK, Emma Tomkins, Roger Few and Katrina Brown emphasize that "for many coastal management approaches, understanding and eliciting stakeholder preferences is critical" (2008, p. 1582). In their study, stakeholder identification involved research on who would be directly affected by and/or could influence long-term coastal management, with consideration of these stakeholders' expressed level of interest in the coast and coastal planning. Their selection criteria required them to reach out to citizens who had "a direct personal 'stake' in coastal impacts (residents, businesses, users of coastal resources) or a role in governance of coastal resources/the coastal zone" (p. 1582).

Stakeholders in the COAST workshops represented a variety of citizens who were extremely knowledgeable about and engaged in various aspects of adaptation planning and environmental/sustainability efforts in their region; however, the information they were provided with during the workshops did not fit well with their existing situations, experiences or level of knowledge about the problem. The problem, defined by COAST facilitators as the economic vulnerability of private- and publicly owned buildings to future flooding and inundation, was not addressed to the stakeholders who were affected by it, who could meaningfully engage in communications and solutions about it, or who could be influential in decision making about investing in the resilience of this infrastructure.

The rhetorical concepts of situated judgment and *phronesis* support the argument that critical attention to *who* modeling data is intended for is crucial for the success of stakeholder engagement efforts. Determining how to match modeling data with appropriate stakeholders is challenging, but can largely be accomplished through careful, critical stakeholder identification and selection processes before engaging in the prognostic phase of adaptation planning.

4.7.3 Task Three: Motivational Framing

The motivational task of collective action framing traditionally involves a "call to arms" or "rationale for engaging in ameliorative collective action" (Benford & Snow, 2000; p. 617). In the adapted version of collective action framing for adaptation planning that is proposed here, instead of a "call to arms," the motivational phase requires that the facilitator first engage in critical reflection about the nature of stakeholder interaction and deliberation (from the diagnostic and prognostic phases) and adjust or revise the framing of the problem to reflect stakeholders' definition of the problem and preferences for action. Adjustment is necessary because frames are not static, but flexible and subject to change (Coburn, 2006; Entman, 2004; Miller, 2000). It is likely that the initial framing used to guide the prognostic phase may have shifted throughout deliberation during that phase. For example, if the "vulnerable critical/transportation infrastructure" frame had emerged from the diagnostic framing phase and was deliberated about further during the prognostic phase, it is possible that stakeholders may have identified barriers to addressing this problem (e.g., determining that it would be too expensive or that it would take too long to accomplish, etc.). As a result of this deliberation, they may have emerged from this phase with *different* conclusions about how to frame/define the problem or how they preferred to respond to it. For this reason, it is important to approach the stakeholder engagement process with the willingness to be flexible and open to unexpected changes in direction that are likely to result from stakeholder-led planning (Reed, Fraser & Dougill, 2006).

The motivational framing phase focuses more narrowly on the potential barriers to different ways of responding to the problem and on identifying the specific values that motivate behavior in support of the proposed solution/solutions. In this phase, the facilitator provides more guidance and structure through stakeholder participation methods (e.g., breakout sessions, structured focus groups) in order to focus deliberation on barriers and values regarding action toward implementing adaptation solutions. As explained in Part Two of Chapter Three, values have been shown to motivate behavior (Bandes & Salerno, 2014; Damasio, 2005; Ekman, 2007; Frijda, 1988; Garsten, 2003; Gilbert, 2006; Hughes, 2014;

Keltner & Lerner, 2010; Keltner et al., 2014; Lazarus, 1991; Lerner, Li, Valdesolo & Kassam, 2014; Lowenstein et al., 2001; Rustichini, 2005; Scherer & Ekman, 1984; Simon, 1983; Solomon, 1993). Therefore, because values derive from the beliefs, attachments, concerns and goals that define individuals' self-perception and sense of agency, determining stakeholders' specific values will be useful toward developing motivational language that incites support for and action toward the desired outcomes. In this way, the motivational phase of the collective action framing approach described here points to *phronesis* and the importance of eliciting and leveraging personal, emotional aspects in decision-making processes.

4.8 Applied Rhetoric of Science Research

The approach outlined above shows how science policy is a rhetorical issue, reflecting one example of a project in the Applied Rhetoric of Science (ARoS) (Cox, 2010; Foust & Murphy, 2009; Herndl & Cutlip, 2013; Lakoff, 2010; Nisbet, 2009; Zittoun, 2011). The responsibility of ARoS is to take up the question of how we can act, given what we know about science and its possible implications (Herndl & Cutlip, 2013). Within contemporary rhetorical studies, an "applied" rhetoric of science means turning rhetorical theory and concepts into practical strategies and tools to be used for facilitating effective decision making about scientific uncertainty (Herndl & Cutlip, 2013). In terms of the case study of this dissertation, one example of how to enact ARoS would be to use deliberation as a strategy for eliciting stakeholders' barriers to adaptation, as explained above in the diagnostic framing task above. I would define ARoS as the act of *showing* how rhetorical theory and concepts inform pragmatic and useful ways of planning and policymaking – essentially, showing how rhetoric facilitates democracy (Danisch, 2007). From this perspective it is not important for scientists to be *educated* about rhetorical concepts or theories; ARoS is not concerned with instructing, educating or advocating rhetorical theory in itself. Rather, *applied* rhetoric in science is contextual, meaning that it is focused on questions of engagement and deliberation rather than on questions of content delivery (Druschke, 2014). An Applied Rhetoric of Science is a mission-oriented practice (Herndl & Cutlip, 2013); the rhetorician's role in this practice is to

inhabit the gap between science and policy by negotiating the activities of multiple researchers and practitioners into useful language for decision making and policy (Ceccarelli, 2014; Druschke, 2014; Walker, 2013). This role requires a deep understanding of how to analyze situations and audiences, as these factors will change with each science policy problem; there is no "one-size-fits-all" method for carrying out ARoS research.

4.8.1 Applied Rhetoric of Science and Climate Adaptation Planning

Adaptation planning literature provides numerous, useful resources on the principles of stakeholder engagement, guidelines for best practices and recommendations for engagement processes in adaptation planning (Gardnes, Mason, Dowd & Ashworth, 2009; Hanson & Hoffman, 2011; Moser & Boykoff, 2013; NOAA, 2007). However, most of these resources do not provide pragmatic examples of *how* these goals can be materialized. For example, the NOAA Coastal Services Center's "Introduction to Stakeholder Participation" (2007) explicitly cites the benefits of stakeholder engagement as: producing better outcomes/decisions; garnering public support for agencies and their decisions; bringing to light important local knowledge about natural resources; increasing public understanding of natural resource issues and management decisions; reducing/resolving conflicts between stakeholders; ensuring implementation of new policies/programs; increasing compliance with natural resources laws and regulations; helping agencies understand flaws in existing management strategies; and creating new relationships among stakeholders (p. 1). These insights are extremely useful for asserting *what* we know about the need for stakeholder engagement in decision making, but they do not answer the question of *how* we can act on these imperatives.

It is important to reiterate that the approach to stakeholder engagement in adaptation planning that is outlined in this chapter is not a universally effective approach. However, this approach may be a useful starting point for determining how to begin the challenging process of achieving genuinely inclusive stakeholder participation through deliberative, strategic facilitation. As explained in Chapter One, one of the primary deliverables of this project was to provide an empirical example of *how* a rhetorical,

deliberative approach may help to facilitate stakeholders' decision making about incorporating questions of how to respond to longer-term coastal vulnerabilities into development and planning decisions in their communities. The example of ARoS scholarship that is provided in this chapter is not intended to be used as a framework: this proposed process could be adapted as needed, attempted as is, or disregarded altogether (Logar, 2011). It is representative of only *one* in a range of approaches that could be utilized to develop science policy that genuinely reflects the context of a situation and the preferences of the stakeholders within it. The type and extent of regional vulnerability, as well as citizens' and stakeholders' risk tolerance and preferences for adaptive action should be the primary factors informing planners' and facilitators' approaches to adaptation planning. Without a deliberative process that elicits barriers and exposes the various ways that stakeholders frame policy problems, there is no way of knowing how to propose adaptation solutions that reflect their values. When adaptation solutions don't reflect stakeholder values, they are unlikely to be perceived as effective and legitimate; therefore threatening their viability and impact. Policies that do not genuinely represent stakeholder values are not democratic; a major responsibility of scholars and practitioners of the rhetoric of science is to *engage* in modern democracy and to *influence* the revitalization of political culture (Carcasson, Black & Sink, 2010).

The following chapter explores the opportunities and challenges of obtaining federal funding for research in ARoS. It also suggests directions for future research in applied rhetoric and climate adaptation planning and policy.

CHAPTER FIVE

APPLIED RHETORIC OF SCIENCE AND INTERDISCIPLINARY SCIENTIFIC RESEARCH: CHALLENGES AND OPPORTUNITIES

The previous chapter identified and explained two of the dominant frames that emerged from the data analyzed for this project: "human welfare and community resilience" and "vulnerable critical infrastructure and strengthening of transportation infrastructure." Both of these frames derive from stakeholders' emotional attachments to place; reflecting their preference for prioritizing altruistic values (ensuring that their families and neighbors are protected against coastal vulnerabilities and that their communities remain resilient and accessible) over economic valuation (cost-benefits analyses) in adaptation planning and decision making. These findings contribute to a growing body of evidence supporting the significant role of emotions and altruistic/human values in decision-making processes – especially when decision making occurs within contexts of risk and uncertainty. As explained in Part Two of Chapter Three, human values *must* be taken into account in shaping adaptation options – otherwise, stakeholders may not consider adaptation options that are chosen to be effective, efficient, legitimate and equitable (Adger & Barnett, 2009; Barnett & Campbell, 2009). Theory in rhetoric and political science supports this argument, suggesting that although there are many different reasons that motivate decision making, humans most often make judgments about uncertainties based upon the "attachments, concerns and goals that define who they are as individuals and as a society" (Garsten, 2003, p. 9).

Chapter Four also illustrated the usefulness of rhetoric and deliberation in the process of frame identification, frame building and frame alignment and argued that framing is an integral part of a participatory, scenario-planning process for adaptation. It suggested that deliberation provides an opportunity for insight into the ways that stakeholders frame adaptation (which are often initially

divergent) and subsequently, that such insight can help to open space for negotiation about planning priorities and goals. This unique approach connects rhetorical concepts with the act of deliberation and the process of framing and subsequently shows the value of an Applied Rhetoric of Science (ARoS) project in helping decision makers to determine *how* to act democratically *given what is known* about an inherently uncertain scientific issue (Herndl & Cutlip, 2013).

In light of recent calls within the field of Rhetoric for increased attention to the growing sub-field of ARoS (Ceccarelli, 2014; Druschke, 2014; Goodwin, 2014; Parks, 2014; Vernon, 2014; Walker, 2014) this dissertation concludes here, with Chapter Five. This chapter highlights the need for ARoS to organize and define itself so that it is more strategically and persuasively positioned as a valuable tool/approach in interdisciplinary scientific research. It also articulates some of the challenges and opportunities in ARoS research as this emerging sub-field becomes further engaged in interdisciplinary work in science, policy and decision making.

5.1 Challenges of Funding ARoS Research

One of the primary challenges to obtaining funding for ARoS research is that its approach to research is *emergent*; it derives a research agenda from collaboration and partnerships with scholars across scientific disciplines *and* with the public (citizens/stakeholders). In most cases, ARoS research requires public engagement in order to *determine* its research agenda; outcomes cannot be specified prior to engaging in collaboration with citizens/stakeholders. In ARoS research, such as the case study of this dissertation, it was not possible for me to articulate policy problems, objectives or policy options prior to genuinely engaging with stakeholders and learning from the context in which these priorities were discussed.

Secondly, and relatedly, ARoS research is process based and recursive, as opposed to outcomes based. This means that instead of thinking of rhetorical techniques as "quick fixes" that can be applied to scientific data in order to make it more palatable to the public (what Goodwin (2014) calls the "conduit model") AroS scholars are critical practitioners who provide expertise in the *processes* of deliberation and decision making under scientific uncertainty by *practicing* rhetorical strategies with audiences and

providing insight into strategic communication and democratic social action (Walker, 2014). Applied Rhetoric of Science scholarship is process based because it is founded on this type of extended action and engagement in order to provide usable science – science that is produced to contribute directly to the design of policy or the solution to a problem (Dilling & Lemos, 2011).

The emergent, practical and process-based nature of ARoS research makes it challenging to meet many of the guidelines of most large-scale research grants. Many large-scale grant applications require specific explanations of parameters such as: defining the scientific/policy problem; identifying the significance/effects of the research activity on science, education, etc.; and articulating policy options *before* funding is awarded. Research in ARoS can't make many of these promises definitively because of its process-based, recursive approach and its reliance on an *emergent* research agenda. For instance, some grant proposal applications require that the significance of the proposed work and/or that the extent of the effects of the research activity on science, technology, education, etc. be explicitly defined within the *proposal*. However, the nature of ARoS research is emergent and requires a large amount of flexibility in these areas – and although *existing* research can be used to *contextualize* the policy problem, research objectives and expected outcomes of a particular project, its significance and/or effects cannot be explicitly defined.

For instance, in the METROPOLE project, one of the anticipated impacts (at the proposal stage) pertained to the significance of cost-benefits analyses in providing useful information for addressing stakeholders' needs and therefore simplifying the decision-making process. However, once stakeholders were engaged in conversation about the COAST models, the majority of them suggested different priorities for adaptation planning, such as the need to focus on the vulnerability of existing critical and transportation infrastructure (as opposed to the cost of damage or benefits of avoided damage from flooding to privately owned buildings and the local airport) and the "human factor," or the vulnerability of residents and community assets to coastal hazards. This unanticipated impact – stakeholders' priorities – provides information that could be very useful to adaptation planning and decision making efforts;

however, it could not have been articulated within the grant proposal because it *emerged from* strategic listening to and engaging with participants.

5.2 Challenges of Establishing ARoS as an Alternative to the Prediction Imperative

To add to the complication of an emergent approach to the research process, much of the context of ARoS research focuses on scientific uncertainties (e.g., climate change). This poses additional barriers pertaining to long-held perspectives about the necessity of accuracy and scientific certainty for policy making – namely, the prediction imperative. As explained in Chapter One, U.S. climate adaptation policy, as directed by the National Climate Assessment (NCA), is largely concerned with *improving understanding of the drivers and causes* of climatic change and with *improving the accuracy* of modeling projections (NCA, 2014). And although the NCA has asserted that one of its goals is "integrating natural and social sciences in climate science research," it justifies this goal by suggesting that research in social sciences is "essential to *improved understanding and modeling of drivers* of climate change" (National Research Council, 2014). As a result of this perspective, climate change communication – including adaptation – is still being framed largely in terms of causation and blame. As explained in Chapter Four, this framing further politicizes this issue, making it an unproductive frame for negotiating politics, planning, and policy (Cramer & Karabell, 2010; Revkin, 2011).

Because of the pervasiveness of traditional approaches to science policy and risk management, most (but not all) of the NCA's goals represent a prediction-imperative approach in which more and/or better information is believed to result in improved decision making. This approach subsequently affects climate adaptation research and planning goals, which are often largely based on technical solutions or economic tradeoffs as opposed to identification of stakeholder values and preferences for action (Agyeman et al., 2009; Marx et al., 2007). One of the biggest challenges for ARoS research is to determine how to *show* that although modeling and predictive data are incredibly important for climate science research and adaptation planning, this information *alone* does not seamlessly translate into productive or lasting action.

5.2.1 An Alternative Approach to Climate Change Communication

One way for ARoS scholars to address this challenge is to take up one of the NCA's broader goals of "integrating disciplines and conducting research into behavioral and *other factors that influence individual decisions*" (2014) by focusing on further establishing the link between these "other factors" (e.g., altruistic values, such as safety) and decision making as related to climate vulnerabilities and adaptation actions. Further evidence of such links (e.g., case studies) is needed to provide insight into new, more rhetorically persuasive and effective ways of communicating how citizens, stakeholders, and policy makers may choose to respond to the short- and longer-term implications of climate change.

Literature in climate change communication research suggests that there are better, more effective ways of motivating action toward climate adaptation than framing it as an environmental problem (i.e., by using images of polar bears clamoring for disappearing ice sheets) (Geiling, 2014; Maibach, Nisbet, Baldwin, Akerlof & Diao, 2010; Nordhaus & Shellenbergerm 2014). Although the "dominant frame used by most members of the public to organize their conceptions about climate change is 'climate change as environmental problem'" (Maibach, Nisbet, Baldwin, Akerlof & Diao, 2010, p. 2) this frame "likely *distances* many people from the issue and contributes to a lack of serious and sustained public engagement necessary to develop solutions" (p. 2). When communication about climate change is framed around environmental and/or scientific issues instead of human values and priorities, those who do not already privilege environmental values aren't likely to be compelled to respond positively because they do not *personally experience* the implications of the issue. As explained in Part Two of Chapter Three, emotions and values are significant factors in motivating human judgments especially in contexts of risk and uncertainty (Bandes & Salerno, 2014; Damasio, 2005; Ekman, 2007; Frijda, 1988; Garsten, 2003; Gilbert, 2006; Hughes, 2014; Keltner & Lerner, 2010; Keltner et al., 2014; Lazarus, 1991; Lerner, Li, Valdesolo & Kassam, 2014; Lowenstein et al., 2001; Rustichini, 2005; Scherer & Ekman, 1984; Simon, 1983; Solomon, 1993;). Therefore, whereas environmental framing often distances people from engaging in communication about climate adaptation, situated, contextual and values-based frames (e.g.,

residents'/neighbors' safety and access to homes and community resources) may hold more promise for eliciting interest in and action toward adaptation planning.

Social scientists – especially ARoS scholars – have much to contribute to the development of an alternative approach to climate change communication (Goodwin, 2014; Walker, 2014). Shifting the focus of climate change communication away from environmentalism and/or anthropogenic *cause* toward a focus on local *response*, however, requires engaging stakeholders in conversations about their values and preferences for action in order to determine how *they* prefer to respond to their *particular* circumstances. This is the only genuine and democratic way to engage stakeholders in science policy. As explained in Chapter Four, it is important for stakeholders to genuinely engage in adaptation planning because their values and priorities *must* be taken into account if adaptation strategies are to be effective, efficient, legitimate and equitable (Adger & Barnett, 2009; Barnett & Campbell, 2009; Few, Brown & Tompkins, 2011). However, there are numerous challenges to accomplishing effective stakeholder engagement. It is not only time consuming, costly, labor intensive, and often confrontational and complex, but requires skillful, balanced facilitation and strategic listening. Most notably, stakeholder engagement is less predictable – and therefore riskier – because the outcomes of engagement cannot be guaranteed: researchers engaging in these types of projects have limited control over what type of data emerges because genuine stakeholder engagement processes *elicit* the outcomes that then determine the research agenda. Therefore, as explained above, funding this type of research will require more flexibility than is traditionally given in grant proposal requirements – especially for large-scale, long-term projects such as the case study of this dissertation.

5.3 Opportunities for ARoS Research

Despite this challenge, a number of universities,[1] institutions[2] and publications[3] already provide interesting potential for ARoS researchers; however, although most of these opportunities strongly encourage interdisciplinary cooperation and alternative research methods, most of them do not explicitly call for qualitative, action-oriented research (such as research in ARoS). This is understandable primarily because ARoS is still an emerging sub-field in the process of defining: the scope of its research and practice areas; establishing sound research methods; and most importantly, proving its value through case studies and collaborative work. There *are* opportunities for ARoS work – but it is the responsibility of ARoS researchers to clearly articulate the specific, practical contributions of this research to scientific audiences and granting agencies (Walker, 2014). This requires taking the initiative to seek out creative sites for conducting research and most importantly, developing accessible language that clearly explains how this work adds value to science-based projects.

5.3.1 Imperatives for ARoS Research and Practice

While the task of organizing and building a coherent research agenda and identity for ARoS is pressing, existing efforts have begun this work. One important resource for this project comes from research published in the *Project of Rhetoric of Inquiry* (*POROI*) journal and from the outcomes of collaborative discussion about future directions for the field which were generated during the 2012 Association for the Rhetoric of Science and Technology (ARST) pre-conference at the 2012 annual

[1] A few examples of university programs are: The University of Arizona's Carson Scholars program, which awards scholarships to students engaged in interdisciplinary environmental research and emphasizes problem-solving and strategies for communicating science to diverse audiences; Georgia Institute of Technology's Public Policy doctoral program, which features a concentration in science and technology policy; and the University of California-San Diego's Master of Advanced Studies in Climate Science and Policy program.

[2] The National Science Foundation's Integrative Graduate Education and Research Traineeships (NSF-IGERT) is an example of this type of institution. NSF-IGERTs emphasize collaboration, problem-based learning, teamwork and practical applications of scholarship. As a second example, NOAA's Risk Communication project (2009) represents an institutional opportunity where ARoS research may be likely to receive support.

[3] Academic journals such as *Palgrave Communications*, the *Journal of Science Policy and Governance*, the *Journal of Responsible Innovation* and the *Journal of Policy Analysis and Management* represent a few examples of publications that feature scholarship that is similar to ARoS research.

meeting of the National Communication Association conference. The three imperatives for ARoS research and practice that emerged from these sources are:

- defining the Applied Rhetoric of Science in practical, understandable terms
- articulating sound research methods
- showing the value of ARoS through case studies and collaborative work with scientists and researchers across the disciplines

One of the goals that emerged from the ARST pre-conference was the need to establish a definition of the field that explicitly articulates the value and usefulness of rhetorical approaches in larger academic/scientific discourses and sites (Fahnestock, 2013; Herndl & Cutlip, 2013; Keranen, 2013; Prelli, 2013; Walker, 2014;). Because of the situated, case-based nature of ARoS work within the larger sub-field of ARST, I suggest that ARoS definitions must emerge from the context in which rhetoric is being applied; there will not likely be a *useful* way of generalizing the purpose of work in ARoS prior to engaging in more ARoS case studies. However, as more ARoS scholars engage in case studies and publish their findings, over time, their contributions will help to shape a common theme and purpose for ARoS research and practice.

5.3.1.1 Defining ARoS research. In Chapter Four, I suggested that ARoS can be defined as the act of *showing* how rhetorical theory and concepts inform pragmatic and useful ways of planning and policymaking – essentially, showing how rhetoric facilitates democracy through deliberation. However, this definition is specific to the context of my project and should not be applied to the field in general. Not all manifestations of ARoS research and practice focus (or *should* focus) on deliberative democracy; there are a variety of ways to approach ARoS projects and therefore a variety of ways of defining the value of this type of research. For example, an ARoS project could be useful for planning and policymaking processes (e.g., deliberation, facilitation) or for developing professional and technical writing resources in Science, Technology, Engineering and Math (STEM) disciplines (e.g., digital communication, web content/design) or for enhancing the public understanding of science (e.g., Gross' rhetoric of

reconstruction).[4] In this dissertation, the value of scholarship and practice in ARoS is in the insight into how to approach deliberative processes – involving stakeholder identification, engagement, and facilitation – and negotiating conflicting perspectives during processes of decision-making under scientific uncertainty through strategic/rhetorical listening and mediation. This work provides insight for scientists, policymakers, and planners about effective ways for responding to scientific uncertainties *within this particular situation* in a way that represents stakeholder values and priorities about coastal vulnerabilities and adaptation actions. Not all ARoS projects will occur in this context; therefore, definitions of the usefulness and value of ARoS work are situation dependent. Nonetheless, it is extremely important to be able to clearly articulate the purpose of ARoS research because doing so is critical for securing access to scientific research sites.

5.3.1.2 Identifying ARoS research methods. Articulating and justifying the use of sound research methods is also an important priority for further legitimizing the value of ARoS research and practice – but ARoS research methods do not necessarily have to "belong" uniquely to ARoS. As explained in Chapter Two, this dissertation borrowed methods from public policy, qualitative decision sciences, and sociology but strengthened them with rhetorical concepts and strategies (Ceccarelli, 2014; Druschke, 2014). The methods used were not uniquely rhetorical; however, the results of this pluralistic approach to methods *did* contribute unique insight into how rhetoric can be applied to produce usable science without having to invent "new" methods, as opposed to using methods that have already proven successful (Walker, 2014). Embedding rhetoric within social science methods is illustrative of an ARoS approach – one that is contextual, deliberative, and "encourages multiple kinds of actors with multiple kinds of expertise to engage with one another and determine a course of action" (Druschke, 2014; Gross, 1994). A genuinely participatory collaborative effort among rhetoricians, scientists, stakeholders, and policymakers that uses the "available means" of established methodologies can still produce work that is

[4] In "The roles of rhetoric in the public understanding of science," Alan Gross (1994) outlines a case for rhetoric as action primarily through a contextual model in which rhetoric reconstitutes "fact" and scientific facts in terms of public interest.

unique and usable for science *and* contribute evidence of how rhetoricians of science creatively synthesize existing methods with rhetorical approaches.

5.3.1.3 Showing the value of ARoS research. Lastly, it is imperative that researchers in the rhetoric of science pursue collaborative work with scientists and researchers across scientific disciplines in order to provide examples of the value of ARoS projects. This takes initiative, patience, and creativity – primarily because of the time involved in identifying productive sites for collaborative work and the networking that is required with researchers and practitioners who are outside of the "comfort zone" of English and Communications departments and located in the labs of universities and research institutions. Determining how to explain what rhetoric "is" and "does" and how it is valuable to scientific research is challenging – but necessary – in order to secure a meaningful role for an ARoS scholar in a science policy project. When ARoS scholars are genuinely engaged in collaborative scientific research, they can then provide examples of the value of their work; therefore contributing knowledge that is both useful to the science policy project itself *and* to the development and expansion of ARoS research.

The aspiration of this dissertation was to take up these challenges: to engage in research that responded to the need for social scientists to provide useful recommendations about how to facilitate effective engagement in science policy and, at the same time, to contribute to ARoS scholarship, showing how this interdisciplinary approach can contribute to the production of usable science.

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APPENDICES

Appendix A: Original In-Depth Interviews

33019-1023

1. [Obtain verbal consent] Do I have your permission to interview you today?

   Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze in my dissertation.

   Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

   330

   10/23

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations? I'm referring to the maps that were shown to you during the first workshop and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts from the second workshop.

   I belong to the Technical Advisory Board of the Water Management District … and flooding is a major concern …It [my perspective] did not change – I am still very much concerned about sea level rise. The maps reinforce what I've been hearing – I'm on a committee that goes through this thing on a regular monthly basis. I finally said someone has to know about this – so I called my insurance company and they didn't have a clue – they went over it with me, which reinforced what I had known … don't do a "v" or "z" [zone] but "b" "c" and "d" [zones] are fine, no "AE"s from the FEMA maps.

5. Did the visualizations affect your level of concern about how sea level rise may affect your community? Did they affect your level of concern about your home/property?

   My property is south of the region that was shown on the map.

6. What concerns you most regarding the potential effects of storm surge and sea level rise?

   I think we're doing too much building in flood zones – unwise building. They are talking about raising buildings and then they're building new ones the same way [as the old ones; without stricter building codes for construction in flood zones]. They're talking about infrastructure but keeping the same building codes. I think they're going to have to restrict development and do more about the barriers – they were talking about sand dunes, mangrove, out there that way [motions toward the bridge] they removed a lot of mangroves …. So I hope I can go somewhere smarter than that.

7. What regional assets (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

Well they have talked – of raising where they have the building – the floor – and I know when I lived in the Keys the first level was on stilts. But you can't do that on a condominium. To see those illustrations was fine … that's something they will have to address but on the other hand, what about the road – where is it going to go? A couple years ago they were out there in front of my building taking pictures because A1A was flooded … that floods too … I had missed a couple of concerts because of that flooding … so I want to be in an area where I can go to concerts and not worry about getting home.

8. Now I want to ask you about the adaptation actions that were modeled and discussed during the second meeting. Would you support the voluntary buyout adaptation option if a regional asset (office building, church, school, etc.) was identified as a flood-prone property? Why or why not? Do you see advantages to this option? Do you see disadvantages?

I think you're going to have to – move people out of the flood zones because the water has to go someplace and the more you move out the better off you are in terms of ecological and … property values. Like I say, Sheridan – there is a lot of wetlands there but further on it is a flood zone there. And I'm thinking in terms of the Mississippi river floods …well after having to drive through the water I might be willing to go. But some people just won't move. I haven't spoken to people in this building …

9. Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not?

We have to do that – we have to do something now. Some of that is … I have a picture of a house and floodproofing … I don't know how much that will work because depending on how high these sea levels will rise … two foot level, that's going to flood the airport and a few other places too. The new runway and once you get down … it all depends on who you listen to though. Chicago had raised their buildings – well, I'm not sure I have it accurate … but if you can raise a building on a cement slab, but you can't raise a condo building … and they have moved houses around … and they have built new ones.

Now when I get a chance to, we need to leave these fossil fuels in the ground.
In some ways, there isn't a way to vote for someone who is not pro-development but that is a foolish way to think. They are thinking in terms that it won't happen until 2100. I'm sorry, but it is happening now. I was kicked out of a green team here… there was a terrific presentation and there was a climate denier there – so even if you have 97 people who say this is going to adversely affect you – at that point, I left … why do people deny reality? They don't want to accept the responsibility … where we absolutely deny what's happening. As Groucho Marx once said … believe me or believe your lying eyes.

They're being told that this isn't happening and they believe it. Even if they're standing in water up to their knees they still don't affect it because of climate change and global warming and I have been a member of different environmental organizations since the 1960s and they said that and it's true. And it is. This is a symptom of that … now we're seeing in the arctic it is melting, the permafrost is releasing more methane gas, and I'm really concerned about the gulf stream – if that happens we'll be in serious trouble. The Gulf Stream is an engine that drives our climate

and it veers to the east, then drops down and comes back as another current. As you get more fresh water in the arctic, it will affect its flow.

10. Other than voluntary buyouts or elevating/floodproofing, were there other adaptation strategies that you would have liked to discuss? Are you familiar with what other regions/cities may be doing? For instance, beach re-nourishment for better retention of shoreline and property, revising building codes, sea walls, elevating or hardening transportation infrastructure, etc.

For us to do here – say that we don't want any more drilling, fracking, we have to wean ourselves off of fossil fuels … but the electric vehicle is a great idea but you're tied to however your electricity is being generated and Elon Musk has come out with the batteries and I'm also in favor of solar energy … every flat roof should have solar panels on it. There are other alternatives that we really need to pursue. I went to a meeting where they talked about wanting to harness the Gulf Stream… for energy. And of course the tides are sufficient so we [could] have energy from that. On the other hand, tar sands in Canada … we have to weigh it – this is where adaptation actions should be inspired as much as we can and have to think out of the grid because if everyone is their own energy generator … I mean there's geothermal energy … so we aren't taking this seriously enough.

11. How does the uncertainty of the COAST models affect your confidence in their predictions? For instance, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors …

I've gone to a number of meetings and I'm not sure … they're having experts over here from Holland and one of the things they've come up with – artificial dunes, parking in the dunes, and water spreading out … because it has to have some place to spread, which is why the buyout programs have to be used. Water has to go someplace. And as far as sea level rise is concerned, it's going to go up … the porous limestone, saltwater comes in under fresh water, and we are having a problem with saltwater intrusion. As we move further west, there is a flooding problem off the Everglades … so we are in a problem area, we are going to have to move the water around but gravity isn't going … pumping out isn't going to work if the water is higher up there. That has to be included in this model – we'll figure this out without gravity … it adds up after a while.

12. Are there other factors that you would have liked to seen accounted for in the COAST models?

Yes.

13. What is at stake in decision making about adaptation planning in this region?
What seems to be the most contentious or argued about factor among decision makers or politicians? What do you think may be "holding up" adaptation planning?

Mostly infrastructure … buildings, roads, what are we doing about – I haven't heard what we're doing about it. That's another reason for moving to an area where I don't have to wade through the water. What is important to me is the science stuff and I try to religiously go to the museum of science and discovery … I want to be part of that and that's why I think that area where you are [St. Petersburg] is good …

14. Who do you think should take the lead in responding to this region's coastal hazards? Meaning on a regional level, municipal or state-led …

Elected officials – primarily the mayor, commissioners, and legislators … state and federal … that Compact is really good for sure it's Miami Dade, Broward, Palm Beach… I think they have to continue with that the sea levels aren't just rising in Broward. North Broward is better off than south Broward.

15. What is your level of confidence about a regional approach to adaptation planning? Do you think that regional approaches – similar to the COAST process – are effective ways to approach the adaptation planning process?

I am fairly confident in it … I go to these different meetings … are they going to actually follow through … it sounds like they know what they're talking about and now we have to come up with some actions.

16. How would you describe a bottom-up approach to adaptation planning? Bottom up: regionally led initiatives (versus national guidelines or mandates) for policy making that asks citizens and stakeholders to engage with regional leaders in making decisions about policy.

Just talking about the Everglades itself, the Federal government didn't kick in [funding]… it shows the flow of water down into the Everglades down into Okeechobee and if nothing is done … wasting gallons of water that's going to be flooding in that way too so we have to restore the flow of the Everglades and remove the dike and come up with a way of storing water. They're dumping millions of gallons of water and polluting the Kissimmiee and the Peace Rivers … destroying peoples' livelihoods if they have to do with seafood … and I approved of Crist's plan, not the whole thing but the ones that were south of the lake. You have to store and purify that and it has to be fairly shallow because the original Everglades were shallow … we need as much as we are able to restore that – we can't do it entirely … because things have gone way too far and there are certain areas … that will need to be bought out because ….
That's [regional planning] the only way we can do it because no one county can do it … because of funding and because we need help from the state and federal levels so if you have climate deniers in office … not much at all regarding the current state level leadership. They took their ball and went home. That's not how you solve problems. Denying it won't make it go away. Now that we have climate deniers in charge in the US Congress and Senate, it won't work there either. We will have to get the climate deniers out of office, so it has to be political. We have to put people in office who don't deny the science.

33020-0625

1. [Obtain verbal consent] Do I have your permission to interview you today?

Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze …

Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

   330

   06/25

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

   It didn't change but put into visual perspective the economic impact. We need to convince our decision makers to make plans either moving people off that land or trying some of the water proofing …

5. Did the visualizations affect your level of concern about how sea level rise may affect your community?

   Having a small area to focus on was good – and it was in the … I was outside of the area of the study region …

6. Did they affect your level of concern about your home/property?

   I suppose it helps, long term. I go back and forth … part of me feels like I should sell [my house] in the next five years – if not sooner. At the same time, I attended the University of Miami global warming class for two semesters …. I think it could tip and [sea level rise] will come faster … not as much my house … I have things in my house that I want to keep … you know, things like antiques and things of personal value that I just care a lot about.

7. What concerns you most regarding the potential effects of storm surge and sea level rise?

8. What regional assets (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

   Peoples' safety … you may like historical [assets] but sometimes that isn't possible …

9. Now I want to ask you about the adaptation actions that were modeled and discussed during the second meeting. Would you support the voluntary buyout adaptation option if a regional asset (office building, church, school, etc.) was identified as a flood-prone property? Why or why not? Do you see advantages to this adaptation option? Do you see disadvantages?

   Assuming that the money would be there, I think it would be feasible and it could be put into place … and quickly … and I would be one of the few to support it … I'm especially concerned about people that are struggling financially… they could be underwater … there is not a lot of talk about that … and there should be.

10. Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not? Do you see advantages to this adaptation option? Do you see disadvantages?

For new construction, elevation – certainly. I think Hollywood has that … breakaway walls and residential space starting on the third floor … This is feasible, certainly, to get rid of housing on the first and second flood … They've had a green building ordinance there … but once it passed it was watered down … The Miami Beach chamber is on board … but Hollywood …You should really look into what Scott Robbins is doing … He is a developer in Miami Beach and … also look into the Climate Change task force …

11. Other than voluntary buyouts or elevating/floodproofing, were there other adaptation strategies that you would have liked to discuss? Are you familiar with what other regions/cities may be doing? For instance, beach renourishment for better retention of shoreline and property, revising building codes, sea walls, elevating or hardening transportation infrastructure, etc.

Seawalls … and we have limestone here … there's also beach re-nourishment going on ... and dunes and mangroves help in a smaller way … In Hollywood, they are still attracting developers … and concerning FEMA's support, and the fact that there is no encouragement to build something more resilient because FEMA will rebuild and it will cost the developer more … There is a lot of concern about revenue. The building codes have changed a little – in Hollywood, but in general, they are just putting up the new buildings in the same old code …

12. How does the uncertainty of the COAST models affect your confidence in their predictions? For instance, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone …

I do because the points were well taken … this is just bare bones baseline … there were two variables … and in the end it will be much worse, that is the take-home message as far as economic impact.

13. Given some of those comments as examples of how the COAST model works, are there other factors that you would have liked to seen accounted for in the COAST models?

Probably groundwater and saltwater intrusion … those things would affect building foundation … that's a huge emphasis of the Citizens' Climate lobby …

14. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among decision makers or politicians? What do you think may be "holding up" adaptation planning?

Life and property …

15. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

Has to be local government … the counties themselves and the compacts because different areas have different risks. It would be great to have federal and state support but the management of it has to be local … so federal money and state money helping, but local decision makers … making the actual choices.

16. What is your level of confidence about a regional approach to adaptation planning? Do you think that regional approaches – similar to the COAST process – are effective ways to approach the adaptation planning process?

I think we need some people some other commissioners to be on board … I think some commissioners get it … but they may be being held back by belief, belief in climate science, and in Hollywood, the commissioner on the beach is very pro-business … some of the other districts don't feel like they're vulnerable … they're more inland so they feel like they aren't vulnerable … may need the storm for people to see something and do something about it … during the king tide here you see the water squirting up through the middle of the road …
This is an issue of long term planning … unfortunately we may need a big storm to come … when Sandy hit New York it made the city more resilient to another storm … our community has agreed to put in dunes … because of protection.

17. How would you describe a bottom-up approach to adaptation planning?

Bottom up: regionally led initiatives (versus national guidelines or mandates) for policy making that asks citizens and stakeholders to engage with regional leaders in making decisions about policy.

33020-1009

1. [Obtain verbal consent] Do I have your permission to interview you today?

Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze in my dissertation.

Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

330

10-09

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

I've been to a lot of seminars like this and I was thinking that there isn't much of a huge … there isn't much of a huge difference between something with such a high threshold. Like a building – that isn't something that is going to be near and dear to my heart, although I know it's important and it needs attention and needs to be resilient and such. I just don't think that is going to sway my opinion really because there's already someone taking care of that. There's already someone

on that who is supposed to do what they can to make sure it's safe. Our group did talk about other things that were important like what other cities were doing – but those are cities or countries that aren't like us, they have different funding structures … won't work here …

5. What concerns you most regarding the potential effects of storm surge and sea level rise?

   People getting so used to flooding that they won't think twice about whether it is a long-term issue or not. I think people just work around it but this is probably something that we can't work around, it just isn't going to happen for a long time so I just can't see it being prioritized now. It would be strange to respond to something that wasn't there because we're so used to being reactive. Rebuilding, after the storm, instead of making something better stand against the storm …

6. What regional infrastructure (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

   We need to really look at peoples' communities and see what is happening there – we know that there are flooding issues in a lot of places and I think that has just become a way of life unfortunately. What if that flooding becomes worse – that isn't going to work for us. The priorities should be roadways and ways out of this region (highways, bridges) instead of trying to fortress it off because with a hurricane, that wouldn't stand.

7. What specific adaptation actions are being discussed in this region?

   The Compact is doing a lot to promote change at the state level but that will be a challenge. I think they've made some steps but they don't have a lot of power really, and no funding except for grants. If they want to do anything they can't really. It's like Regional Planning, they can advise. Which is good because they've got some great people there who are doing a good job, I just think that we need conversation about how to protect infrastructure – roads, highways, bridges – so that they're strong enough for us to depend on when we need to evacuate. Then we can start talking about individual properties – and not everyone is going to be happy about that, but I think it's necessary.

8. You all are familiar with the concept of voluntary buyouts as an adaptation option …. Would you support the voluntary buyout adaptation option? Why or why not?

   I just don't think that anyone who lives in this area would go for that … I mean maybe some people, who aren't from here or don't have ties here, but that isn't really the majority. I wonder how that would work too – the federal government buys properties? I don't see that money so it … where does it come from? Who else is doing that? What about Virginia? They're having a huge problem so they'd probably be first pick if the federal government said they would do that. And then what, what happens to that land then? What about the market?

9. You're familiar with elevation and floodproofing as adaptation options … Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not?

   Again, this isn't something that this area would go for.

10. How does the uncertainty of climate models affect your confidence in their predictions? For instance, in the models we considered at the COAST meetings, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone … - that weren't included in the models.

That isn't a big thing for me, but I don't need models to tell me that it's flooding or that there are sunny days where water is shooting up out of the sewers. I think to a lot of people it's interesting – and maybe even something to really talk about – but I don't think they're running around looking for proof that that's happening. Whether it's climate change or not, it isn't the point. The point is that there are things that are happening and whether we can measure them for sure or not isn't going to be what the test is. The test will be what … how we can be creative and come up with some sort of money to use to make things better, even if it is just a little at a time to do that …

11. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among regional decision makers? What do you think may be "holding up" adaptation planning?

Funding , and a lot of times, it's the fact that there are these lies being spread about the facts. What does it matter – cause etc. It is going to have to be fixed somehow or else there are other tradeoffs which people may not like as much. No one wants to change and no one wants to feel like they don't understand the problem. I can't totally understand it but it doesn't mean that I have to disprove it somehow. I just need to figure out what I should do to be responsible. And to participate.

12. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

The state level isn't going to work right now, and do they have enough funding to really help? I wonder how that will start to play out. I think that the regional councils need to get together and try to influence the state level, maybe. Or that they need to be firm about how to involve developers and construction because they're constructing stuff here now that is … at the same code … it's the same as whatever building came before it and that makes all of this null. If there isn't any action … supporting the fact that we feel like we need to make wise adjustments … how are we supposed to convince citizens when the people who are running the city are letting construction go on without changing?

13. What is the most important consideration of facilitating bottom-up approaches to adaptation planning?

Figuring out how to make people interesting in what is going on. Well … you can't make them, but you can try to inform as best as you can and then start just making decisions. We can't just wait for whoever to get involved. It has to be making decisions now and even … what if the right decision isn't made? That could be costly and we just don't know. There are more conservative things that we can do before bringing out the big decisions and the big money when we just aren't sure just yet. Let's at least get good at doing some things right and stop arguing about whether – well the weather. Stop arguing about degrees and start figuring out how to really do a service to our citizens.

33020-1013

1. [Obtain verbal consent] Do I have your permission to interview you today?

   Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze …

   Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

   330

   10/13

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

   Planning in Broward is different – strict – stricter than in Hillsborough County – city has to be more stringent than the county's. The city is reliant on county for guidance. That is how the scheme works … county is in midst of rewriting comprehensive plan. County will have a --- sea level rise element … something that will be addressing … key issue. County that has to make the first move in Broward because of governmental structure. Functions that cities can't afford … Broward looks to county for environmental stuff … county can go into tell mode … can coordinate … Less storage in ground – and if ocean is rising, water has to get out … Confusion would be – what sea level rise impacts we would have -

5. What concerns you most regarding the potential effects of storm surge and sea level rise?

   The long-term socio-economic viability of this area – this area's economy is so important to the … state and the international economy. People want to live here – that won't stop – and I'm thinking that we'll be alright for the short term, but in the long term there will be some serious changes that are going to make some people mad. It isn't about trying to appease everyone though, and that isn't what the public wants us to do – they want us to make good decisions about what we think we need to do to keep them safe, functioning, etc. I'm concerned about people not being able to enjoy this special place and not having the experiences that we're having now which are generally good.

6. What regional infrastructure (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

   Roadways

7. What specific adaptation actions are being discussed in this region?

There isn't explicit talk … we are close to Miami Beach so we know a lot about the conversations there and they're spending a lot of money to remedy those issues now … storm water management … pumping … and these are short-term fixes. So they still aren't really addressing the problem. We need to start talking about safety and emergency management – like evacuation and bridges and other infrastructure that we absolutely need in order to assure our safety if there was an event.

8. You all are familiar with the concept of voluntary buyouts as an adaptation option …. Would you support the voluntary buyout adaptation option? Why or why not?

   I don't think that will work here because people are constantly moving to South Florida because of its reputation. South Florida is a great place to be and I genuinely don't think that …. Unless something is really terrible and it just isn't affordable, which means it was constructed badly … irresponsible … but thinking down the line, I don't think that will happen necessarily.

9. You're familiar with elevation and floodproofing as adaptation options … Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not?

   Definitely not I just genuinely don't … that isn't feasible and it just doesn't fit with what we think is reasonable down here. Think about the cost of doing that … where has it been done? And what about the roads once you've raised a home … if the road is washed out, which is likely, what good is it to have a home that is habitable?

10. How does the uncertainty of climate models affect your confidence in their predictions? For instance, in the models we considered at the COAST meetings, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone … - that weren't included in the models.

    We use models all of the time and I just don't know why the politicians and the public are so obsessed with talk of models and modeling. Maybe it was … was it bad to start publicizing this scientific issue? So many people now don't understand how modeling works and they want this easy clear fixes to problems … models can't do that, and they haven't and never will. They won't provide this silver bullet to the issue. I don't think I'm bothered by it but I know that a number of people are. I do think that models need to be situated and specific and tied to … what's actually happening. For those models not to take into consideration something like groundwater or limestone is an oversight because that is our situation – that's our context and if you want to get us to talk about solutions, then we need to be having a real conversation.

11. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among regional decision makers? What do you think may be "holding up" adaptation planning?

    The problem is that we're spending billions in another country … and not investing in own country … we have infrastructure that is rated so poorly and we are studying it … we aren't doing anything to genuinely … to make it better.

12. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

Local governance is best because they are the guys that know what is really going on. They know what has been tried and failed and what is not going to go over with residents and can make decisions that way … you can have good tools but if those tools don't address what needs to be fixed, they are just accessories, they aren't useful.

13. What is the most important consideration of facilitating bottom-up approaches to adaptation planning?

33020-1212

1. Obtain verbal consent: Do I have your permission to interview you today?

   Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze in my dissertation.

   Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

   330

   12/12

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

   Any map that puts my house underwater … [shaking head]
   What metrics would influence some of the decisions we would be making … From a utility perspective – already trying to do what we feel is critical – try to prevent stormwater infrastructure – prevent water from coming back in … flood gates … to insure that through those pipes we don't have increasing high tides … the most we can do right now … a lot of people ask about raising infrastructure – because the roadways are still on the same level … the question is about planning and what regulations/codes to put in place so that future development is more resilient.

5. What concerns you most regarding the potential effects of storm surge and sea level rise?

   Reduction in tax base … most valuable properties – most valuable properties will be affected most …

6. What regional infrastructure (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

   Transportation – major bridges, major roadways for evacuation

7. What specific adaptation actions are being discussed in this region?

   A lot of discussion, especially about infrastructure and development, but from a planning perspective, we're just now starting to develop long-term plans for resiliency. A major problem is flooding, which is tied to this issue as a whole …

8. You all are familiar with the concept of voluntary buyouts as an adaptation option …. Would you support the voluntary buyout adaptation option? Why or why not?

   It doesn't happen tonight – starts with flooding … water doesn't go back in drain … street is part of tertiary drainage system … that is when those things start to kick in … what are impacts to property values … incremental changes … becomes less debatable … timing issue … people don't do things unless they see evidence … if in your backyard, now you will skip and jump … I don't think you can count on the fed to do the buyout … Mississippi river … government reinsures them through FEMA, etc. … if I stay long enough the government will rebuild my house … they haven't demonstrated that they won't do that anymore … a number of people buying … ocean front property increasing in value … hasn't even stabilized … water issue …

9. You're familiar with elevation and floodproofing as adaptation options … Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not?

   I can't see that working here because it isn't … part of the way that people expect coastal homes to look … would be tremendously expensive and hard to do … would it work? Where is that working? I think it's more of an issue of insurance and if insurance costs are higher … maybe that would do some of the eliminating of people … along the vulnerable areas of the coastline … but then there's also inland flooding and saltwater intrusion …

10. How does the uncertainty of climate models affect your confidence in their predictions? For instance, in the models we considered at the COAST meetings, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone … - that weren't included in the models.

    Groundwater modeling – USGS to determine how drinking water is affected by SLR … surface water models too … that determine who will be impacted and who should evacuate … recently Broward County changed evacuation zones … those models play useful function …
    Models are good to a point – transportation models – models say everything will be fine … but not reality …

11. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among regional decision makers? What do you think may be "holding up" adaptation planning?

    Politics – in-fighting over human or natural causes … distracting … isn't a solution-oriented conversation, it's a conversation about who gets blamed and who has to pay …

12. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

13. What is the most important consideration of facilitating bottom-up approaches to adaptation planning?

    Took a natural disaster to create the opportunity to actually move … to make decisions … opportunity to put it back together the same way … OR do it better. What happened a few years ago with A1A is a good example. It had been flooding consistently for years and finally just experienced an insurmountable amount of flooding … was so problematic that the whole road crumbled and buckled and then we really had to do something about it. They built it higher and I think that was necessary and a good thing … they really needed to …

14. In conversations about A1A, was climate change part of the conversation?

    What will really have an impact is a major storm … then you begin to change your thinking … so for this situation … climate change wasn't the reason it was built that way, the storm was the reason. And the continuous flooding. They built the road a bit higher to account for those factors, but they weren't necessarily using climate models to figure out how to do it, just to account for the flooding it was experiencing at the time.

33023-no DOB

1. Obtain verbal consent: Do I have your permission to interview you today?

   Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze in my dissertation.

   Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

   330

4. Thinking about your perspective on coastal hazards and sea level rise, How – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

OK – so what is my change after exposure – my perception is that it is something real, something that if we do not do something about it, it could be there could be potential disaster in near future, if we do not put the mechanism in place to prevent and mitigate that (natural disaster, which is eminent, 5 10 or 15 years from now) if the local government or the state or fed or agencies responsible for property and investment – if all of these groups don't do something about it, it could be very catastrophic. My perception is also that we may not be doing enough as far as getting the word out to the public and the media – it should be a subject of conversation on a day to day basis, on the news more often so that people can become more cognizant about it, amd should also be included in the curriculum so that we can be teaching kids at the undergraduate level so that by the time you graduate you know the aspects of sea level rise and the concern that it presents and how to mitigate the impact and how to … I was less concerned because I didn't know much after the sessions so I became more concerned about it … it becomes a subject of problems and solutions and potential solutions … I believe in science and ….

5. Did the visualizations affect your level of concern about how sea level rise may affect your community?

   Yes – because the level when I looked at the 2010 … by 2030, we may have a SLR between 3 -8, 2060, I believe 9-24 inches … so when I saw that chart one thing that came to mind is that it is based on a model – note it is also an approximate. With that sort of visualization, I do not think that those numbers are 100% but it could be within the range. My concern is the method they used to come up with the numbers – has this method been proven before? I believed in it, could be reason …. Concern is that model that they used … has it been used before and do we have the evidence that it works …

6. What concerns you most regarding the potential effects of storm surge and sea level rise?

   I see here … they have to reinstate the growth management principle so certain areas by the coastline should be very susceptible to growth management … limit the infrastructure … but it generates revenue, it is political … two reasons – to just go ahead and … demand, pleasure, money … because of this concern we need to find ways to limit this kind of investment in the coastline. Whatever is there is already there … there should be a mechanism to encourage people to invest in … flood plain … versus high rise buildings … retract from the coastline … whatever exists now, incentive to be relocated … having high rise – still something there but in order to reduce potential life and property, should not be.

7. What regional assets (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

   Peoples' safety …

8. Now I want to ask you about the adaptation actions that were modeled and discussed during the second meeting. Would you support the voluntary buyout adaptation option if a regional asset (office building, church, school, etc.) was identified as a flood-prone property? Why or why not?

   So should we spend resources – in my area, voluntary buyout … whether it would be ok to sell if you explain … price … I think it would work … everything is about the market and the market value … if you offer them something marketable, except that trying to get people to volunteer, then you don't have to … insure or insure for flood …

9. Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not?

   Limit growth … kind of like rezoning. By 2020, no one is allowed to develop this close to the coastline … except of a certain style … that … could work.
   In my opinion, the flood proofing … don't think it will work – very costly, when you are talking about sea level rise, this is a different change in the atmospheric conditions – may also come with stronger winds … right now, 150 MPH … even if you elevate, you get a bit of floodproof, you could be facing windstorm … very costly, very uncertain … pile is good but remember that this is a coast … eroding the shore, those parts could be ruined as well. Because of that uncertainty, I don't think it's worth to even try to elevate – when the sea level is risen it may come with stronger winds as well.

10. Other than voluntary buyouts or elevating/floodproofing, were there other adaptation strategies that you would have liked to discuss? Are you familiar with what other regions/cities may be doing? For instance, beach renourishment for better retention of shoreline and property, revising building codes, sea walls, elevating or hardening transportation infrastructure, etc.

11. How does the uncertainty of the COAST models affect your confidence in their predictions? For instance, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone …

    My level of confidence is there, not 100% but maybe 80, 85% which is still good … the fact that there were a lot of factors that weren't included … roadway, structure, drainage … it was more like what will happen to vertical structure … model is not all inclusive … but you don't put for everything you develop software that works and then every year you enhance it … this is the same. The next year, there will be ways to improve that data as well … but for a start, it is …when you use a model, you use factors that works …

12. Given some of those comments as examples of how the COAST model works, Are there other factors that you would have liked to seen accounted for in the COAST models?

    No, because there is an opportunity to improve this data. Later on, you can include more data and see the impact better … for instance, roadways … you will definitely need to take this into account as well … not 100% sure but with data, 70-80% is fairly reasonable … Key West is an example, I see that you can get out of your car and put your foot in the ocean … here we have some areas that are so flat and you can feel the water is taking over …

13. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among decision makers or politicians? What do you think may be "holding up" adaptation planning?

Well, the most contentious here is … for politicians as far as employment – politicians can get elected when their agenda has development … everyone is at work … contentious to do something that they were elected for … cut employment in this area …. People don't think this way, they see I have a good paying job and now I am no longer in this hotel management … not an easy position to be in as a politician … what mechanism can be put in place to show opportunities … also the change, people are really reluctant to change by nature so if they have doubts, they will not change. They have to see the danger for them to accept the change … power of prediction and dealing with the politicians … growth management … contentious to see how they will present this to voters… big huge impact to life and lifestyle … to industry … the coastline brings a lot of tourism and tourism is a big money maker … industry … contentious as far as what areas can you have as touristic places … so you're looking at losing employment, very big impact to peoples' lifestyles … people invest millions in condos by the ocean … for a politician to convince the great majority otherwise … pretty difficult but doable. What happened in Japan with the tsunami … how many it killed, so and so … good examples to use to convince people to do something not wait.

14. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

Here, it should be what we call a multi-agency coordination – you have local involved with the state and fed as well … I think it would work if we have the local jurisdiction and state and fed working together … If you leave it to local it won't be successful because of limited power and resources. You have people all over the US coming to South Florida for tourism so it isn't a local impact … it is a national impact … it is not something that can be done at a local level only … it will work if you have the state and then the fed to back it up …. Only if you have multi-agency coordination. For instance, we have the American Association of Highway Officials. We use it to design highways even though highways are managed at a local level … we adhere to a manual … used nationally ... we use at local level. So that everyone can use the model … if we do any work on Interstate 95, we have federal aid to do that … federal money can be used for … we get local input … but we do not have the final say … federal government is there as big umbrella to look at best of nation … to figure it out, it has to be the state writing grants, etc. the state can write proposals … 95% of the time they will get the money … as long as we could prove that the money could be used well …

15. What is your level of confidence about a regional approach to adaptation planning? Do you think that regional approaches – similar to the COAST process – are effective ways to approach the adaptation planning process?

On a state level, the Governor should understand talking about loss of life and property … to put politics aside ... one of the ways it will work is to constantly have presentations to the commissioners … the commissioners meet regularly and there is room for private citizens to tell them their concerns … making sure to keep the commissioners informed, big investors, we don't want to lose those investments … in 10 years if you have an adverse impact, you don't want to lose. I employed ____ … but now my investment is at risk … commissioners are there to listen to the people and are all elected and have straight contact with the governor … Look at biggest

county and have a task team for them to address this issue … understanding means…. Action and you get citizens involved … all of the media etc … once the commissioner sees …commissioners are in touch with the reality of the region those are the ones we need to be speaking with and updating because they are going to react to that … once they are convinced, then they can reach the ears of the governor … and do something.

16. How would you describe a bottom-up approach to adaptation planning?

    Bottom up: regionally led initiatives (versus national guidelines or mandates) for policy making that asks citizens and stakeholders to engage with regional leaders in making decisions about policy.

33139-0615

1. [Obtain verbal consent] Do I have your permission to interview you today?

   Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze in my dissertation.

   Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

   331

   06/15

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

   No – perspective didn't change – there wasn't anything new in the second meeting … I would say that perspective changed by attending the meetings – I didn't have a clear idea of how close we are to potentially dramatic sea level rises … between the two meetings, no.

5. Did the visualizations affect your level of concern about how sea level rise may affect your community? Did they affect your level of concern about your home/property?

   Visualizations – for me, money is not primarily the issue … seeing extremely luxurious building – would be affected … more value … that is not relevant … residents of both buildings would be affected – more interested in the human aspect than the wealth aspect.
   In the workshops, they took high-income buildings … to show value … to me that is not relevant. Would be more relevant to see how many people lived there … than … one building of lower

value than another. You lose your second home … that is a small loss for them … but what about people whose primary home is threatened – without anywhere else to go … they lose everything … because of no social net to buy something else … that is the thing of more value than the buildings. The human aspect was absent … gives you the extent of flooding … red patches showed how far the water could come inland … but not who was there. We were only looking at water from above – presumably these maps … if you mapped water seeping in … and put them together, showing the impact to the human aspect too, a fuller picture of the impact … probably would show more destruction (shows hand motion layering maps on top of one another).

6. What concerns you most regarding the potential effects of storm surge and sea level rise?

   The loss of habitat for people who have nowhere else to go. Or people whose life investment goes into a house ….would be a huge loss …

7. What regional assets (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

   Vital interest – infrastructure – road, electrical … main services are still available for those who can stay … on the one hand some will lose their homes … that would be my priority … Samantha said… at the first meeting, she talked about futuristic visions … that is very interesting – the work that they do on elevating, parking, I think the city should prioritize the vision of how buildings should be built from now onwards – more than building code … vision for future … how do we envision our cities to become and how do we want others to see it too?
   Cities and counties should be starting campaign with presenting that vision so that they aren't just trying to enforce a stricter code on few members of society … people don't understand …no idea … probably not. Feeling from the meetings is that the communities aren't getting together – lot of very strong opinioned people who are trying to ring the alarm bell but they aren't trying to collaborate with one another … a few very strong characters [are the loudest voices] … but they are more the aggressive type … angry people but not the kind of people that could really touch a community … lots of confusion about what to do …. Or they keep silent …others are just unaware … younger people need to be involved … "youth" … I guess 30-40 is youth … but schools should be involved – high schools … opportunities to participate, to create a vision … get them involved in what it is going to look like. A lot of people who were in the room were way over 60 so even if sea level rises in their lifetime, it may not affect them really … so it is a generational thing where those who participate today … high school, design schools, colleges with architecture should be at forefront of creating this vision and working with the students. The county and the city should allow for this – space, funds … make it a research project … you have this idea … and you need someone who takes these ideas forward and makes them into reality … you have to have a few different levels of participation and a few different age groups – even you still get a lot of awareness and interest. Some of these ideas build into something that actually works … you have a base that five years later will be the architects of the future … investments based on what they know …

8. Now I want to ask you about the adaptation actions that were modeled and discussed during the second meeting. Would you support the voluntary buyout adaptation option if a regional asset (office building, church, school, etc.) was identified as a flood-prone property? Why or why not? Do you see advantages to this adaptation option? Do you see disadvantages?

9. Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not?

We live in a culture of discard rather than use and reuse … not sure if people would floodproof … let me buy something that is already floodproofed … I haven't seen a lot of floodproofed buildings being built. But I haven't seen that – it depends on the investment that is required – and it also depends on whether the floodproofed house would be useable if there is a flood. If you elevate and … then you expect to be able to be able to inhabit it. Of course you would have less damage to your home … but then the other issue is the water seeping in from below. Does floodproofing also help with that … I think people don't know enough. When you make that investment, you need to know … community is not only made of buildings – the services, the neighbors … if you lose one part of that community it disintegrates that community … if you see abandoned homes on each side of your dwelling or you see that people move out … it just isn't the same so the shops that you used to shop in … they have to go … do you stay … the fabric the financial purely financial analysis is very limiting. I live here on the beach and am thinking about this all of the time … we need a bigger space for our family and we are waiting just a little more for the prices but it breaks our heart because we love our neighbors, proximity … a lot of flooding … even when there is no storm surge … market has gone up now … but even if we make a low investment we should … insurance has gone up. We received a (March) letter saying they have to purchase flood insurance it is more expensive but you take a package. Insurance, taxes, everything is more expensive because that is what you accept. My husband and his friends don't take me seriously because there is no information about flooding … it is progressive flooding … the maps don't show you the progression … red spots are completely inundated …. The maps aren't really realistic … human nature – will we invent something? Combination of all of those things – media, denial, human nature – articles about how bad it is … sporadic news coverage … when there is nothing dramatic happening, no it doesn't take something drastic for things to change in Miami Beach – spoke to real estate agent… we live in Miami, that is part of what it life here … people deal with things and then they move on … lots of good sides to living here … if people were fully informed about the threat, it would drive the prices of property down … if you are well aware, you won't be willing to invest as much … it may not drive people away but it would affect the market … OK for those who bought at low prices … tourism will not be affected as much, might just be aware of when to come … if you look at weather forecast for Miami Beach, you need to have more accurate weather warnings … you think it is always stormy, always alerts of storms etc … need a more accurate picture day by day … tourism wouldn't be affected. That will not change – foreign investments …

10. Other than voluntary buyouts or elevating/floodproofing, were there other adaptation strategies that you would have liked to discuss? As examples, are you familiar with what other regions/cities may be doing? For instance, beach re-nourishment for better retention of shoreline and property, revising building codes, sea walls, elevating or hardening transportation infrastructure, etc.

Abandonment would not be an option … if you lower the cost of the building you can then … keeping prices down … the cities or the counties wouldn't lose anything because their base their taxes on appraised property value not market value …

11. How does the uncertainty of the COAST models affect your confidence in their predictions? For instance, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone …

    Starting point – that is what it stays – but if you don't include the other elements, the erosion from water seeping in etc., then it just doesn't … people can't do anything with it because it isn't so much about the money but if this building is going to be flooded … you have to calculate both … it is misleading a bit.

12. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among decision makers or politicians? What do you think may be "holding up" adaptation planning?

    I don't see any … but may … they have the money, and something is about having the funds. They have funds … it may be that if they do too much people might start being aware and would maybe affect investments … you would have to listen in to the meeting and figure out … could be anything.

13. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

    Municipal – they are very active and the Mayor's office … it is a highly efficient city in the way that they manage everything … they are independent financially … so they have their bits and pieces of money from the residents and they can actually plan for what they can afford as opposed to someone coming from outside and telling them what to do – they are creative and practical ….

14. What is your level of confidence about a regional approach to adaptation planning? Do you think that regional approaches – similar to the COAST process – are effective ways to approach the adaptation planning process?

    Full confidence in bottom up planning … I'm a communication specialist but I spend my career working with non-government human agencies … the last employer I worked for funds grassroots organizations … for planning and actually doing the work- I know it works. I don't see why it wouldn't work here .they work with people who earn less than $1 a day and even the World Bank doesn't want to fund … the results are … giving people the opportunity to voice their concerns and ideas and giving them the means to improve them … they are finally being heard – giving them a voice – and the poorest don't have anything to work with … if you give them the tools – education, training, creating an organization within the community with a leadership that can actually talk to the authorities … I've seen changes … the way in and the means to implement their ideas.

15. How would you describe a bottom-up approach to adaptation planning? Bottom up: regionally led initiatives (versus national guidelines or mandates) for policy making that asks citizens and stakeholders to engage with regional leaders in making decisions about policy.

The other question I have is how do they get the participants – I got an email from a university … for the next one … how would I know about it … how did they select? The public in general … they need to find a way to find those who … creative minds who haven't been exposed to that yet – another way to create the network … if you always reach the same people … it will stay that small.

33021-0509

1. [Obtain verbal consent] Do I have your permission to interview you today?

   Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze in my dissertation.

   Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

   330

   05/09

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

   The suggestions that Miami raise everyone's property … when and over what period of time? Having a serious discussion about that for the county – over 50 years, as redevelopment takes place we need to be committed to deciding on what elevation to go with … whether it is 20 … They've just built Margaritaville [Hollywood Beach] … with the existing code. Those at the forefront of looking at policy changes … trying to put in place some level of regulation – from The Compact, Broward taking a first stab at that … regional planning council … really policy wise … umbrella groups have to be on the same page … not an easy question … engineering standpoint – can a building be raised, lot of money and technical proficiency… or are we willing to sacrifice certain things … remediation or moving forward … lot of discussions of putting electrical equipment above whatever flood line is decided on … make sure electrical equip is above certain level … and just cars or parking on the floor level. FEMA requirements … any time new construction goes in … will flood neighboring property … Florida building code – moving so quickly that people are trying to wrap their heads around it now … certain parts of FL where there is still denial. Governor has put … no "sea level." There has to be some kind of consensus that there is an issue … in Broward County, it has been in the forefront … we know we're going to have a problem but the planning is still discussion … what do we DO about it.

5. What concerns you most regarding the potential effects of storm surge and sea level rise?

   Biggest concern – flooding issue … inundation, tides … peoples' properties … big concern … practical effects on people … all going to be local until it is in your backyard …

6. What regional infrastructure (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

   We need to really look at peoples' communities and see what is happening there – we know that there are flooding issues in a lot of places and I think that has just become a way of life unfortunately. What if that flooding becomes worse – that isn't going to work for us. The priorities should be roadways and ways out of this region (highways, bridges) instead of trying to fortress it off because with a hurricane, that wouldn't stand.

7. What specific adaptation actions are being discussed in this region?

   Stormwater management (to respond to king tides)
   Adaptation action areas

8. You all are familiar with the concept of voluntary buyouts as an adaptation option …. Would you support the voluntary buyout adaptation option? Why or why not?

   It is too early for that … by 2060 … nobody knows for sure – what we do know is that there is some level … they are not certain as to what that rise is going to be. There is not real evidence … maybe if there is more significant impact or if you have a storm … that really wreaks havoc … at this point in time I don't see it or for the next 10-20 years

9. Do you think they're stronger together or separately?

   The way people try to do this is … greenhouse gasses that are triggering … lot of strategizing to reduce greenhouse gasses … idea is … tackling root cause and effects … tackle all of them simultaneously as much … internationally … coordination … people are realizing that we have to rethink the way we do things … and then flooding, higher sea level, deliver it simultaneously …

10. You're familiar with elevation and floodproofing as adaptation options … Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not?

    I just don't think that's feasible. It isn't something that people are … willing … there isn't a willingness there because what are they floodproofing at that extreme? If you can't really see the problem it appears silly to make all of these expensive adjustments to your home, and really that type of change just seems like it is so extreme.

11. How does the uncertainty of climate models affect your confidence in their predictions? For instance, in the models we considered at the COAST meetings, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone … - that weren't included in the models.

    We never talk about the consequences – but to ME, level of service doesn't suffice … Planning utilities … have to try to be predictive … imperfect as they may be … sense of potential risk. Set of assumptions that you have to put into a model that may not be certain … are we willing to take that chance – people are going to say why weren't you prepared? Why didn't you do anything? Starting – first steps – green building … putting in green building requirements … consuming less energy … push back on 10 things to do … first baby steps are getting push back … always have to look for best tools to understand the risk … at least mitigate some of them … flood gates …

12. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among regional decision makers? What do you think may be "holding up" adaptation planning?

    Funding

13. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

14. What is the most important consideration of facilitating bottom-up approaches to adaptation planning?

Took a natural disaster to create the opportunity to actually move … to make decisions … opportunity to put it back together the same way … OR do it better.

33022-0125

1. Obtain verbal consent: Do I have your permission to interview you today?

   Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze in my dissertation.

   Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

   330

   01/25

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

   It didn't really … I've done a lot of that work before so I'm familiar with those, I knew what to expect … thinking about stuff in Ft. Lauderdale … nothing hugely unexpected. Good data … but nothing new.

5. What concerns you most regarding the potential effects of storm surge and sea level rise?

   Sea Level Rise is a slow steady creep so dealing with that for me is all about trying to put in controls today that are going to be realized 50 years from now. So what will happen is if I install a pipeline or building … I'm probably figuring its life is at least 50 years … so what you have to avoid doing is installing critical infrastructure and finding that that isn't going to deal with 50 year condition … most water, sewer, stormwater … probably works on 100 year time scale … water mains …
   What I'd told Miami Beach [officials], as you plan infrastructure you want to step into the problem … Miami Beach spent 40 million to put in pump … problem with the road is it is two feet above sea level. What about a foot … the only asphalt is good for is protecting base of road… whole idea of drainage systems is keep the base dry … roadways …
   Better alternative with $40 million … they can't continue to refuse to acknowledge that there are certain areas that just aren't salvageable … but many that are completely salvageable … want to use US 1 Dixie Highway as a corridor … all structures should be on that corridor … use natural lay of land … when we spend the 100 million dollars, they need to be at exactly the right point ….

6. Now I want to ask you about the adaptation actions that were modeled and discussed during the second meeting. Would you support the voluntary buyout adaptation option if a regional asset (office building, church, school, etc.) was identified as a flood-prone property? Why or why not?

Talking to Republicans – little project … broke Florida into 11 regions … the question was – what is political outlook … all boundaries line up with perceived risk – high risk, active. Middle part of state, risk issue with rain, heat … farmers, panhandle, Tallahassee doesn't see it … most Republicans done see climate change issue because they aren't in the purview of it … Naples/Ft Myers is as vulnerable … viable option – implementation strategy is a problem … here's what you should do – two ways – 1. Offer people money for an option to buy their property you can pay them and give them 30 years lease to stay in property, and pay taxes on it as though they own it, or when they sell back to government. In this scenario, the city says, live in the house … at some point, you will want to move, etc. – I give you $10,000 to have option to buy property at market value. I give you market value today with deed and property comes to me at the time that you wish to dispose of house/die. Those two would work. Trying to go in and sell the property and move in short time frame.

What happens to property … too vulnerable to protect … rent property, section 8 housing, etc. … no tax money comes off of it. There is 4 trillion worth of property in this region … in Southeast Florida … there is way too much value to give away … there is no limit to what we will do to protect South Florida,

The Kresge project shows how socially vulnerable people are vulnerable to SLR … they aren't because until the 30s, people started developing coast, Miami Beach is a manmade project … Reasons so much flooding clay … doesn't drain … sand ridge is porous … Topography – limestone underneath everything … definitely not as favorable as in Tampa … formation collapses …. Competent limestone transmits water easily … Saltwater intrusion is red herring … dropped water levels 4-6 feet so that we could develop … we have no idea how long it has to take to stabilize saltwater intrusion … people try to use those projections … SLR plus groundwater …

7. Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not? … Do you see advantages to this adaptation option? Do you see disadvantages?

   Cities have become entrepreneurial … I don't think a lot of those buildings are accessible if they were floodproofed even …so I'm unsure of the reasoning in floodproofing them.

8. Other than voluntary buyouts or elevating/floodproofing, were there other adaptation strategies that you would have liked to discuss? Are you familiar with what other regions/cities may be doing? For instance, beach renourishment for better retention of shoreline and property, revising building codes, sea walls, elevating or hardening transportation infrastructure, etc.

9. How does the uncertainty of the COAST models affect your confidence in their predictions? For instance, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone …

   In the second meeting, I made the comment (as I was sitting next to XX) that the problem with these models is that roadway infrastructure isn't taken into account. JT said on several occasions that they didn't factor in infrastructure … the problem is the model fails because most of the time when you get to those pieces of property you can't access them. What good is that? What we have to look at is the infrastructure system has failed to a point that we can't make it accessible … if three feet of sea level rise, the houses are above but three feet of water on the streets … your model doesn't show damage but the house has no value. You can't show – well, there isn't a good way to show how the value will decrease as sea level rise increases … there will be a point that I suspect will occur before models kick in where you will have value of property is zero because the cost of the improvements will exceed the value of the property. 4 million dollars a lane mile to make the kinds of modifications to roadway infrastructure that I'm talking about – this needs federal support. What I think will happen – will be in future – if it was today congress would be opposed to it … no more bailouts. No more debt. All of the arguments … 2009 get people back to work … if you look historically, we only have two examples … we didn't borrow enough money.

10. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among decision makers or politicians? What do you think may be "holding up" adaptation planning?

    The priority should be roadways because they are symptomatic of all other infrastructure … Florida Power and Light [electric companies] can't get to it [properties that are inundated/affected by extreme flooding or storm damage] …

11. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

    If you want something to happen, local. The compact is a great start … the South Florida Regional Planning Council probably is a created regional entity – but here's the problem: the Compact is great, the South Florida Regional Planning Council is great, the Water Management District (WMD), drainage districts … definitely not great … the problem is that too many entities and not enough coordination. Some people might argue that the WMD might be the right one to take control … appointed by governor, controlled by agriculture and interest on state government level, funding was cut for those activities and employees dismissed … the WMD is not the right

answer. The Compact has no authority to do anything … so they talk – the Planning Council doesn't have authority either but they are the entity that communicates as liaison … but they can't work with metropolitan planning orgs – the transportation guys – but their scope is too narrow. The problem is that there is not really a good local partner to deal with this. What may need to occur is we may need to create the South Florida Regional Service … South Florida Resiliency Service … district … then the Compact could merge into that … create as multiagency GUA, so there is authority to create … I have been involved in creating more than one of those … that would be the way to do it and you define it as the tri-county or quad-county area and you give it authority to issue bonds, create agreement with drainage districts, make agreement with Army Corps of Engineers and the WMD to allow to control stormwater issues, then try to roll up individual community plans … not a bad idea to take FAI and FIU or something similar … people who are embedded in situation and ask them to vet the long-term solution. You don't want a consultant to do it because they have looked for politically acceptable answers or expedient answers. You don't care whether it makes Hollywood and Dania Beach unhappy … you want someone to look at the global issues … maybe it is the climate institute for state … a regional entity – but keep legislature out of it. Some examples of governance for that … have the Regional Planning Council help with how it gets done, etc. – climate Compact – talk to each other and too many policy … they need leverage to get things done. Land use planners, developers, public works and engineering people … and financial entities. Planning council does some … universities give authority to assess taxes … sell bonds … apply rates … purely organized and controlled locally … appoint people and designate what they need to know to serve on the board … completely independent organization … once you have blueprint of this, then you have a potentially viable partner to coordinate this effort.

12. How would you describe a bottom-up approach to adaptation planning?

    Bottom up: regionally led initiatives (versus national guidelines or mandates) for policy making that asks citizens and stakeholders to engage with regional leaders in making decisions about policy.

33023-no DOB

1. Obtain verbal consent: Do I have your permission to interview you today?

   Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze in my dissertation.

   Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

   330

4. Thinking about your perspective on coastal hazards and sea level rise, How – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

OK – so what is my change after exposure – my perception is that it is something real, something that if we do not do something about it, it could be there could be potential disaster in near future, if we do not put the mechanism in place to prevent and mitigate that (natural disaster, which is eminent, 5 10 or 15 years from now) if the local government or the state or fed or agencies responsible for property and investment – if all of these groups don't do something about it, it could be very catastrophic. My perception is also that we may not be doing enough as far as getting the word out to the public and the media – it should be a subject of conversation on a day to day basis, on the news more often so that people can become more cognizant about it, amd should also be included in the curriculum so that we can be teaching kids at the undergraduate level so that by the time you graduate you know the aspects of sea level rise and the concern that it presents and how to mitigate the impact and how to … I was less concerned because I didn't know much after the sessions so I became more concerned about it … it becomes a subject of problems and solutions and potential solutions … I believe in science and ….

5. Did the visualizations affect your level of concern about how sea level rise may affect your community?

   Yes – because the level when I looked at the 2010 … by 2030, we may have a SLR between 3 -8, 2060, I believe 9-24 inches … so when I saw that chart one thing that came to mind is that it is based on a model – note it is also an approximate. With that sort of visualization, I do not think that those numbers are 100% but it could be within the range. My concern is the method they used to come up with the numbers – has this method been proven before? I believed in it, could be reason …. Concern is that model that they used … has it been used before and do we have the evidence that it works …

6. What concerns you most regarding the potential effects of storm surge and sea level rise?

   I see here … they have to reinstate the growth management principle so certain areas by the coastline should be very susceptible to growth management … limit the infrastructure … but it generates revenue, it is political … two reasons – to just go ahead and … demand, pleasure, money … because of this concern we need to find ways to limit this kind of investment in the coastline. Whatever is there is already there … there should be a mechanism to encourage people to invest in … flood plain … versus high rise buildings … retract from the coastline … whatever exists now, incentive to be relocated … having high rise – still something there but in order to reduce potential life and property, should not be.

7. What regional assets (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

   Peoples' safety …

8. Now I want to ask you about the adaptation actions that were modeled and discussed during the second meeting. Would you support the voluntary buyout adaptation option if a regional asset (office building, church, school, etc.) was identified as a flood-prone property? Why or why not?

   So should we spend resources – in my area, voluntary buyout … whether it would be ok to sell if you explain … price … I think it would work … everything is about the market and the market value … if you offer them something marketable, except that trying to get people to volunteer, then you don't have to … insure or insure for flood …

9. Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not?

   Limit growth … kind of like rezoning. By 2020, no one is allowed to develop this close to the coastline … except of a certain style … that … could work.
   In my opinion, the flood proofing … don't think it will work – very costly, when you are talking about sea level rise, this is a different change in the atmospheric conditions – may also come with stronger winds … right now, 150 MPH … even if you elevate, you get a bit of floodproof, you could be facing windstorm … very costly, very uncertain … pile is good but remember that this is a coast … eroding the shore, those parts could be ruined as well. Because of that uncertainty, I don't think it's worth to even try to elevate – when the sea level is risen it may come with stronger winds as well.

10. Other than voluntary buyouts or elevating/floodproofing, were there other adaptation strategies that you would have liked to discuss? Are you familiar with what other regions/cities may be doing? For instance, beach renourishment for better retention of shoreline and property, revising building codes, sea walls, elevating or hardening transportation infrastructure, etc.

11. How does the uncertainty of the COAST models affect your confidence in their predictions? For instance, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone …

    My level of confidence is there, not 100% but maybe 80, 85% which is still good … the fact that there were a lot of factors that weren't included … roadway, structure, drainage … it was more like what will happen to vertical structure … model is not all inclusive … but you don't put for everything you develop software that works and then every year you enhance it … this is the same. The next year, there will be ways to improve that data as well … but for a start, it is …when you use a model, you use factors that works …

12. Given some of those comments as examples of how the COAST model works, Are there other factors that you would have liked to seen accounted for in the COAST models?

    No, because there is an opportunity to improve this data. Later on, you can include more data and see the impact better … for instance, roadways … you will definitely need to take this into account as well … not 100% sure but with data, 70-80% is fairly reasonable … Key West is an example, I see that you can get out of your car and put your foot in the ocean … here we have some areas that are so flat and you can feel the water is taking over …

13. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among decision makers or politicians? What do you think may be "holding up" adaptation planning?

Well, the most contentious here is … for politicians as far as employment – politicians can get elected when their agenda has development … everyone is at work … contentious to do something that they were elected for … cut employment in this area …. People don't think this way, they see I have a good paying job and now I am no longer in this hotel management … not an easy position to be in as a politician … what mechanism can be put in place to show opportunities … also the change, people are really reluctant to change by nature so if they have doubts, they will not change. They have to see the danger for them to accept the change … power of prediction and dealing with the politicians … growth management … contentious to see how they will present this to voters… big huge impact to life and lifestyle … to industry … the coastline brings a lot of tourism and tourism is a big money maker … industry … contentious as far as what areas can you have as touristic places … so you're looking at losing employment, very big impact to peoples' lifestyles … people invest millions in condos by the ocean … for a politician to convince the great majority otherwise … pretty difficult but doable. What happened in Japan with the tsunami … how many it killed, so and so … good examples to use to convince people to do something not wait

14. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

Here, it should be what we call a multi-agency coordination – you have local involved with the state and fed as well … I think it would work if we have the local jurisdiction and state and fed working together … If you leave it to local it won't be successful because of limited power and resources. You have people all over the US coming to South Florida for tourism so it isn't a local impact … it is a national impact … it is not something that can be done at a local level only … it will work if you have the state and then the fed to back it up …. Only if you have multi-agency coordination. For instance, we have the American Association of Highway Officials. We use it to design highways even though highways are managed at a local level … we adhere to a manual … used nationally … we use at local level. So that everyone can use the model … if we do any work on Interstate 95, we have federal aid to do that … federal money can be used for … we get local input … but we do not have the final say … federal government is there as big umbrella to look at best of nation … to figure it out, it has to be the state writing grants, etc. the state can write proposals … 95% of the time they will get the money … as long as we could prove that the money could be used well …

15. What is your level of confidence about a regional approach to adaptation planning? Do you think that regional approaches – similar to the COAST process – are effective ways to approach the adaptation planning process?

On a state level, the Governor should understand talking about loss of life and property … to put politics aside … one of the ways it will work is to constantly have presentations to the commissioners … the commissioners meet regularly and there is room for private citizens to tell them their concerns … making sure to keep the commissioners informed, big investors, we don't want to lose those investments … in 10 years if you have an adverse impact, you don't want to lose. I employed ____ … but now my investment is at risk … commissioners are there to listen to

the people and are all elected and have straight contact with the governor … Look at biggest county and have a task team for them to address this issue … understanding means…. Action and you get citizens involved … all of the media etc … once the commissioner sees …commissioners are in touch with the reality of the region those are the ones we need to be speaking with and updating because they are going to react to that … once they are convinced, then they can reach the ears of the governor … and do something.

Appendix B: Coded In-Depth Interviews

33019-1023

1. [Obtain verbal consent] Do I have your permission to interview you today?

   Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze in my dissertation.

   Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

   330

   10/23

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations? I'm referring to the maps that were shown to you during the first workshop and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts from the second workshop.

   I belong to the Technical Advisory Board of the Water Management District ... and flooding is a major concern ...It [my perspective] did not change – I am still very much concerned about sea level rise. The maps reinforce what I've been hearing – I'm on a committee that goes through this thing on a regular monthly basis. I finally said someone has to know about this – so I called my insurance company and they didn't have a clue – they went over it with me, which reinforced what I had known ... don't do a "v" or "z" [zone] but "b" "c" and "d" [zones] are fine, no "AE"s from the FEMA maps.

5. Did the visualizations affect your level of concern about how sea level rise may affect your community? Did they affect your level of concern about your home/property?

   My property is south of the region that was shown on the map.

6. What concerns you most regarding the potential effects of storm surge and sea level rise?

   I think we're doing too much building in flood zones – unwise building. They are talking about raising buildings and then they're building new ones the same way [as the old ones; without stricter building codes for construction in flood zones]. They're talking about infrastructure but keeping the same building codes. I think they're going to have to restrict development and do more about the barriers – they were talking about sand dunes, mangrove, out there that way [motions toward the bridge] they removed a lot of mangroves .... So I hope I can go somewhere smarter than that.

Commented [kl1]: Flooding

Commented [kl2]: COAST visualizations (maps)

Commented [kl3]: Insurance
FEMA
flooding

Commented [kl4]: COAST visualizations (maps)

Commented [kl5]: Real estate
Development
Building code
Infrastructure

7. What regional assets (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

Well they have talked – of raising where they have the building – the floor – and I know when I lived in the Keys the first level was on stilts. But you can't do that on a condominium. To see those illustrations was fine … that's something they will have to address but on the other hand, what about the road – where is it going to go? A couple years ago they were out there in front of my building taking pictures because A1A was flooded … that floods too … I had missed a couple of concerts because of that flooding … so I want to be in an area where I can go to concerts and not worry about getting home.

Commented [kl6]: COAST visualizations
Elevation and floodprofing adaptation options
Roadways (transportation infrastructure)

8. Now I want to ask you about the adaptation actions that were modeled and discussed during the second meeting. Would you support the voluntary buyout adaptation option if a regional asset (office building, church, school, etc.) was identified as a flood-prone property? Why or why not? Do you see advantages to this option? Do you see disadvantages?

I think you're going to have to – move people out of the flood zones because the water has to go someplace and the more you move out the better off you are in terms of ecological and … property values. Like I say, Sheridan – there is a lot of wetlands there but further on it is a flood zone there. And I'm thinking in terms of the Mississippi river floods …well after having to drive through the water I might be willing to go. But some people just won't move. I haven't spoken to people in this building …

Commented [kl7]: Voluntary buyouts (adaptation option)

Commented [kl8R7]: Place attachment
flooding

9. Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not?

We have to do that – we have to do something now. Some of that is … I have a picture of a house and floodproofing … I don't know how much that will work because depending on how high these sea levels will rise … two foot level, that's going to flood the airport and a few other places too. The new runway and once you get down … it all depends on who you listen to though. Chicago had raised their buildings – well, I'm not sure I have it accurate … but if you can raise a building on a cement slab, but you can't raise a condo building … and they have moved houses around … and they have built new ones.

Commented [kl9]: elevation and floodproofing (adaptation option)
feasibility

Now when I get a chance to, we need to leave these fossil fuels in the ground.

Commented [kl10]: diversion – environmental issue

In some ways, there isn't a way to vote for someone who is not pro-development but that is a foolish way to think. They are thinking in terms that it won't happen until 2100. I'm sorry, but it is happening now. I was kicked out of a green team here… there was a terrific presentation and there was a climate denier there – so even if you have 97 people who say this is going to adversely affect you – at that point, I left … why do people deny reality? They don't want to accept the responsibility … where we absolutely deny what's happening. As Groucho Marx once said … believe me or believe your lying eyes.

They're being told that this isn't happening and they believe it. Even if they're standing in water up to their knees they still don't affect it because of climate change and global warming and I have been a member of different environmental organizations since the 1960s and they said that and it's true. And it is. This is a symptom of that … now we're seeing in the arctic it is melting, the permafrost is releasing more methane gas, and I'm really concerned about the gulf stream – if that happens we'll be in serious trouble. The gulf stream is an engine that drives our climate

Commented [kl11]: development
short-term planning versus long-term planning
responsibility
uncertainty
belief
denial

and it veers to the east, then drops down and comes back as another current. As you get more fresh water in the arctic, it will affect its flow.

10. Other than voluntary buyouts or elevating/floodproofing, were there other adaptation strategies that you would have liked to discuss? Are you familiar with what other regions/cities may be doing? For instance, beach re-nourishment for better retention of shoreline and property, revising building codes, sea walls, elevating or hardening transportation infrastructure, etc.

For us to do here – say that we don't want any more drilling, fracking, we have to wean ourselves off of fossil fuels … but the electric vehicle is a great idea but you're tied to however your electricity is being generated and Elon Musk has come out with the batteries and I'm also in favor of solar energy … every flat roof should have solar panels on it. There are other alternatives that we really need to pursue. I went to a meeting where they talked about wanting to harness the Gulf Stream… for energy. And of course the tides are sufficient so we [could] have energy from that. On the other hand, tar sands in Canada … we have to weigh it – this is where adaptation actions should be inspired as much as we can and have to think out of the grid because if everyone is their own energy generator … I mean there's geothermal energy … so we aren't taking this seriously enough.

Commented [kl12]: "adaptation" options …? Climate Change (in general) not to SLR

Commented [kl13]: Human ingenuity
Inspiration
creativity

11. How does the uncertainty of the COAST models affect your confidence in their predictions? For instance, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors …

I've gone to a number of meetings and I'm not sure … they're having experts over here from Holland and one of the things they've come up with – artificial dunes, parking in the dunes, and water spreading out … because it has to have some place to spread, which is why the buyout programs have to be used. Water has to go someplace. And as far as sea level rise is concerned, it's going to go up … the porous limestone, saltwater comes in under fresh water, and we are having a problem with saltwater intrusion. As we move further west, there is a flooding problem off the Everglades … so we are in a problem area, we are going to have to move the water around but gravity isn't going … pumping out isn't going to work if the water is higher up there. That has to be included in this model – we'll figure this out without gravity … it adds up after a while.

Commented [kl14]: modeling
factors included in/excluded from modeling
regional/local science issue

12. Are there other factors that you would have liked to seen accounted for in the COAST models?

Yes.

13. What is at stake in decision making about adaptation planning in this region?
What seems to be the most contentious or argued about factor among decision makers or politicians? What do you think may be "holding up" adaptation planning?

Mostly infrastructure … buildings, roads, what are we doing about – I haven't heard what we're doing about it. That's another reason for moving to an area where I don't have to wade through the water. What is important to me is the science stuff and I try to religiously go to the museum of science and discovery … I want to be part of that and that's why I think that area where you are [St. Petersburg] is good …

Commented [kl15]: adaptation priorities – roadways, transportation infrastructure

14. Who do you think should take the lead in responding to this region's coastal hazards? Meaning on a regional level, municipal or state-led …

Elected officials – primarily the mayor, commissioners, and legislators … state and federal … that Compact is really good for sure it's Miami Dade, Broward, Palm Beach… I think they have to continue with that the sea levels aren't just rising in Broward. North Broward is better off than south Broward.

15. What is your level of confidence about a regional approach to adaptation planning? Do you think that regional approaches – similar to the COAST process – are effective ways to approach the adaptation planning process?

I am fairly confident in it … I go to these different meetings … are they going to actually follow through … it sounds like they know what they're talking about and now we have to come up with some actions.

16. How would you describe a bottom-up approach to adaptation planning? Bottom up: regionally led initiatives (versus national guidelines or mandates) for policy making that asks citizens and stakeholders to engage with regional leaders in making decisions about policy.

Just talking about the Everglades itself, the Federal government didn't kick in [funding] … it shows the flow of water down into the Everglades down into Okeechobee and if nothing is done … wasting gallons of water that's going to be flooding in that way too so we have to restore the flow of the Everglades and remove the dike and come up with a way of storing water. They're dumping millions of gallons of water and polluting the Kissimmiee and the Peace Rivers … destroying peoples' livelihoods if they have to do with seafood … and I approved of Crist's plan, not the whole thing but the ones that were south of the lake. You have to store and purify that and it has to be fairly shallow because the original Everglades were shallow … we need as much as we are able to restore that – we can't do it entirely … because things have gone way too far and there are certain areas … that will need to be bought out because ….
That's [regional planning] the only way we can do it because no one county can do it … because of funding and because we need help from the state and federal levels so if you have climate deniers in office … not much at all regarding the current state level leadership. They took their ball and went home. That's not how you solve problems. Denying it won't make it go away.
Now that we have climate deniers in charge in the US Congress and Senate, it won't work there either. We will have to get the climate deniers out of office, so it has to be political. We have to put people in office who don't deny the science.

33020-0625

1. [Obtain verbal consent] Do I have your permission to interview you today?

Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze in my dissertation.

Commented [kl16]: governance – preferences for leadership (regional/local/municipal)

Commented [kl17]: regional governance regional approach

Commented [kl18]: regional planning for adaptation denial

Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

   330

   06/25

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

   It didn't change but put into visual perspective the economic impact. We need to convince our decision makers to make plans either moving people off that land or trying some of the water proofing …

5. Did the visualizations affect your level of concern about how sea level rise may affect your community?

   Having a small area to focus on was good – and it was in the … I was outside of the area of the study region …

6. Did they affect your level of concern about your home/property?

   I suppose it helps, long term. I go back and forth … part of me feels like I should sell [my house] in the next five years – if not sooner. At the same time, I attended the University of Miami global warming class for two semesters …. I think it could tip and [sea level rise] will come faster … not as much my house … I have things in my house that I want to keep … you know, things like antiques and things of personal value that I just care a lot about.

7. What concerns you most regarding the potential effects of storm surge and sea level rise?

8. What regional assets (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

   Peoples' safety … you may like historical [assets] but sometimes that isn't possible …

Commented [kl19]: COAST visualizations
Economic impact

Commented [kl20]: COAST visualizations

Commented [kl21]: COAST visualizations
Home/property
Possessions

Commented [kl22]: Prioritizing human lives and safety

9. Now I want to ask you about the adaptation actions that were modeled and discussed during the second meeting. Would you support the voluntary buyout adaptation option if a regional asset (office building, church, school, etc.) was identified as a flood-prone property? Why or why not? Do you see advantages to this adaptation option? Do you see disadvantages?

Assuming that the money would be there, I think it would be feasible and it could be put into place … and quickly … and I would be one of the few to support it … I'm especially concerned about people that are struggling financially… they could be underwater … there is not a lot of talk about that … and there should be.

Commented [kl23]: Social justice
Voluntary buyout

10. Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not? Do you see advantages to this adaptation option? Do you see disadvantages?

For new construction, elevation – certainly. I think Hollywood has that … breakaway walls and residential space starting on the third floor … This is feasible, certainly, to get rid of housing on the first and second floor … They've had a green building ordinance there … but once it passed it was watered down … The Miami Beach chamber is on board … but Hollywood …You should really look into what Scott Robbins is doing … He is a developer in Miami Beach and … also look into the Climate Change task force …

Commented [kl24]: Development
Real estate
Elevation and floodproofing

11. Other than voluntary buyouts or elevating/floodproofing, were there other adaptation strategies that you would have liked to discuss? Are you familiar with what other regions/cities may be doing? For instance, beach renourishment for better retention of shoreline and property, revising building codes, sea walls, elevating or hardening transportation infrastructure, etc.

Seawalls … and we have limestone here … there's also beach re-nourishment going on … and dunes and mangroves help in a smaller way … In Hollywood, they are still attracting developers … and concerning FEMA's support, and the fact that there is no encouragement to build something more resilient because FEMA will rebuild and it will cost the developer more … There is a lot of concern about revenue. The building codes have changed a little – in Hollywood, but in general, they are just putting up the new buildings in the same old code …

Commented [kl25]: Soft adaptation

Commented [kl26]: FEMA
Building codes
Development

12. How does the uncertainty of the COAST models affect your confidence in their predictions? For instance, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone …

I do because the points were well taken … this is just bare bones baseline … there were two variables … and in the end it will be much worse, that is the take-home message as far as economic impact.

Commented [kl27]: COAST visualizations

13. Given some of those comments as examples of how the COAST model works, are there other factors that you would have liked to seen accounted for in the COAST models?

Probably groundwater and saltwater intrusion … those things would affect building foundation … that's a huge emphasis of the Citizens' Climate lobby …

Commented [kl28]: COAST visualizations
Modeling
Factors included in/excluded from model

14. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among decision makers or politicians? What do you think may be "holding up" adaptation planning?

Life and property …

Commented [kl29]: Adaptation planning priorities

15. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

Has to be local government … the counties themselves and the compacts because different areas have different risks. It would be great to have federal and state support but the management of it has to be local … so federal money and state money helping, but local decision makers … making the actual choices.

Commented [kl30]: Governance structure
Regional planning
Local management

16. What is your level of confidence about a regional approach to adaptation planning? Do you think that regional approaches – similar to the COAST process – are effective ways to approach the adaptation planning process?

I think we need some people some other commissioners to be on board … I think some commissioners get it … but they may be being held back by belief, belief in climate science, and in Hollywood, the commissioner on the beach is very pro-business … some of the other districts don't feel like they're vulnerable … they're more inland so they feel like they aren't vulnerable … may need the storm for people to see something and do something about it … during the king tide here you see the water squirting up through the middle of the road … This is an issue of long term planning … unfortunately we may need a big storm to come … when Sandy hit New York it made the city more resilient to another storm … our community has agreed to put in dunes … because of protection.

Commented [kl31]: Regional approach
Leadership
Governance
Belief
Development
Economics

17. How would you describe a bottom-up approach to adaptation planning? Bottom up: regionally led initiatives (versus national guidelines or mandates) for policy making that asks citizens and stakeholders to engage with regional leaders in making decisions about policy.

Commented [kl32]: Certainty (?)
Natural disaster
Motivation to act
Natural adaptation

33020-1009

1. [Obtain verbal consent] Do I have your permission to interview you today?

Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze in my dissertation.

Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

330

10-09

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

I've been to a lot of seminars like this and I was thinking that there isn't much of a huge … there isn't much of a huge difference between something with such a high threshold. Like a building – that isn't something that is going to be near and dear to my heart, although I know it's important and it needs attention and needs to be resilient and such. I just don't think that is going to sway my opinion really because there's already someone taking care of that. There's already someone on that who is supposed to do what they can to make sure it's safe. Our group did talk about other things that were important like what other cities were doing – but those are cities or countries that aren't like us, they have different funding structures … won't work here …

Commented [kl33]: COAST visualizations
Responsibility

5. What concerns you most regarding the potential effects of storm surge and sea level rise?

People getting so used to flooding that they won't think twice about whether it is a long-term issue or not. I think people just work around it but this is probably something that we can't work around, it just isn't going to happen for a long time so I just can't see it being prioritized now. It would be strange to respond to something that wasn't there because we're so used to being reactive. Rebuilding, after the storm, instead of making something better stand against the storm …

Commented [kl34]: Complacency
Flooding
Long-term planning
Proactive v reactive

6. What regional infrastructure (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

We need to really look at peoples' communities and see what is happening there – we know that there are flooding issues in a lot of places and I think that has just become a way of life unfortunately. What if that flooding becomes worse – that isn't going to work for us. The priorities should be roadways and ways out of this region (highways, bridges) instead of trying to fortress it off because with a hurricane, that wouldn't stand.

Commented [kl35]: Flooding
Communities
Roadways, highways, bridges

7. What specific adaptation actions are being discussed in this region?

The Compact is doing a lot to promote change at the state level but that will be a challenge. I think they've made some steps but they don't have a lot of power really, and no funding except for grants. If they want to do anything they can't really. It's like Regional Planning, they can advise. Which is good because they've got some great people there who are doing a good job, I just think that we need conversation about how to protect infrastructure – roads, highways, bridges – so

that they're strong enough for us to depend on when we need to evacuate. Then we can start talking about individual properties – and not everyone is going to be happy about that, but I think it's necessary.

Commented [kl36]: Roads, highways, bridges

8. You all are familiar with the concept of voluntary buyouts as an adaptation option …. Would you support the voluntary buyout adaptation option? Why or why not?

I just don't think that anyone who lives in this area would go for that … I mean maybe some people, who aren't from here or don't have ties here, but that isn't really the majority. I wonder how that would work too – the federal government buys properties? I don't see that money so it … where does it come from? Who else is doing that? What about Virginia? They're having a huge problem so they'd probably be first pick if the federal government said they would do that. And then what, what happens to that land then? What about the market?

Commented [kl37]: Real estate market
Vulnerable property
Voluntary buyout adaptation option

9. You're familiar with elevation and floodproofing as adaptation options … Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not?

Again, this isn't something that this area would go for.

Commented [kl38]: Adaptation options – feasibility

10. How does the uncertainty of climate models affect your confidence in their predictions? For instance, in the models we considered at the COAST meetings, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone … - that weren't included in the models.

That isn't a big thing for me, but I don't need models to tell me that it's flooding or that there are sunny days where water is shooting up out of the sewers. I think to a lot of people it's interesting – and maybe even something to really talk about – but I don't think they're running around looking for proof that that's happening. Whether it's climate change or not, it isn't the point. The point is that there are things that are happening and whether we can measure them for sure or not isn't going to be what the test is. The test will be what … how we can be creative and come up with some sort of money to use to make things better, even if it is just a little at a time to do that …

Commented [kl39]: Modeling
Regional/local science (and implications)
Creativity
Funding

11. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among regional decision makers? What do you think may be "holding up" adaptation planning?

Funding, and a lot of times, it's the fact that there are these lies being spread about the facts. What does it matter – cause etc. It is going to have to be fixed somehow or else there are other tradeoffs which people may not like as much. No one wants to change and no one wants to feel like they don't understand the problem. I can't totally understand it but it doesn't mean that I have to disprove it somehow. I just need to figure out what I should do to be responsible. And to participate.

Commented [kl40]: Funding
Barriers to adaptation
Behavior change

12. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

The state level isn't going to work right now, and do they have enough funding to really help? I wonder how that will start to play out. I think that the regional councils need to get together and try to influence the state level, maybe. Or that they need to be firm about how to involve developers and construction because they're constructing stuff here now that is … at the same code … it's the same as whatever building came before it and that makes all of this null. If there isn't any action … supporting the fact that we feel like we need to make wise adjustments … how are we supposed to convince citizens when the people who are running the city are letting construction go on without changing?

Commented [kl41]: Regional/local governance
Development
Real estate market
leadership

13. What is the most important consideration of facilitating bottom-up approaches to adaptation planning?

Figuring out how to make people interested in what is going on. Well … you can't make them, but you can try to inform as best as you can and then start just making decisions. We can't just wait for whoever to get involved. It has to be making decisions now and even … what if the right decision isn't made? That could be costly and we just don't know. There are more conservative things that we can do before bringing out the big decisions and the big money when we just aren't sure just yet. Let's at least get good at doing some things right and stop arguing about whether – well the weather. Stop arguing about degrees and start figuring out how to really do a service to our citizens.

Commented [kl42]: citizen engagement
governance/democracy
action

33020-1013

1. [Obtain verbal consent] Do I have your permission to interview you today?

Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze in my dissertation.

Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

330

10/13

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

Planning in Broward is different – strict – stricter than in Hillsborough County – city has to be more stringent than the county's. The city is reliant on county for guidance. That is how the scheme works … county is in midst of rewriting comprehensive plan. County will have a --- sea level rise element … something that will be addressing … key issue. County that has to make the first move in Broward because of governmental structure. Functions that cities can't afford … Broward looks to county for environmental stuff … county can go into tell mode … can coordinate … Less storage in ground – and if ocean is rising, water has to get out … Confusion would be – what sea level rise impacts we would have -

Commented [kl43]: Planning
Regional/local science and politics
governance

5. What concerns you most regarding the potential effects of storm surge and sea level rise?

The long-term socio-economic viability of this area – this area's economy is so important to the … state and the international economy. People want to live here – that won't stop – and I'm thinking that we'll be alright for the short term, but in the long term there will be some serious changes that are going to make some people mad. It isn't about trying to appease everyone though, and that isn't what the public wants us to do – they want us to make good decisions about what we think we need to do to keep them safe, functioning, etc. I'm concerned about people not being able to enjoy this special place and not having the experiences that we're having now which are generally good.

Commented [kl44]: adaptation focus – economics
regional economy
decision making
safety
place attachment

6. What regional infrastructure (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

Roadways

Commented [kl45]: transportation infrastructure (roadways, bridges, etc.)

7. What specific adaptation actions are being discussed in this region?

There isn't explicit talk … we are close to Miami Beach so we know a lot about the conversations there and they're spending a lot of money to remedy those issues now … storm water management … pumping … and these are short-term fixes. So they still aren't really addressing the problem. We need to start talking about safety and emergency management – like evacuation and bridges and other infrastructure that we absolutely need in order to assure our safety if there was an event.

Commented [kl46]: Transportation infrastructure
Stormwater management
Pumping

8. You all are familiar with the concept of voluntary buyouts as an adaptation option …. Would you support the voluntary buyout adaptation option? Why or why not?

I don't think that will work here because people are constantly moving to South Florida because of its reputation. South Florida is a great place to be and I genuinely don't think that …. Unless

something is really terrible and it just isn't affordable, which means it was constructed badly … irresponsible … but thinking down the line, I don't think that will happen necessarily.

Commented [kl47]: Place attachment
Voluntary buyout adaptation option

9. You're familiar with elevation and floodproofing as adaptation options … Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not?

Definitely not I just genuinely don't … that isn't feasible and it just doesn't fit with what we think is reasonable down here. Think about the cost of doing that … where has it been done? And what about the roads once you've raised a home … if the road is washed out, which is likely, what good is it to have a home that is habitable?

Commented [kl48]: Elevation and floodproofing – funding
Feasibility

10. How does the uncertainty of climate models affect your confidence in their predictions? For instance, in the models we considered at the COAST meetings, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone … - that weren't included in the models.

We use models all of the time and I just don't know why the politicians and the public are so obsessed with talk of models and modeling. Maybe it was … was it bad to start publicizing this scientific issue? So many people now don't understand how modeling works and they want this easy clear fixes to problems … models can't do that, and they haven't and never will. They won't provide this silver bullet to the issue. I don't think I'm bothered by it but I know that a number of people are. I do think that models need to be situated and specific and tied to … what's actually happening. For those models not to take into consideration something like groundwater or limestone is an oversight because that is our situation – that's our context and if you want to get us to talk about solutions, then we need to be having a real conversation.

Commented [kl49]: Modeling
Uncertainty
Regional/local science
What is included in/excluded from model
COAST process

11. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among regional decision makers? What do you think may be "holding up" adaptation planning?

The problem is that we're spending billions in another country … and not investing in own country … we have infrastructure that is rated so poorly and we are studying it … we aren't doing anything to genuinely … to make it better.

Commented [kl50]: Transportation infrastructure
Funding
Long-term planning and investment

12. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

Local governance is best because they are the guys that know what is really going on. They know what has been tried and failed and what is not going to go over with residents and can make decisions that way … you can have good tools but if those tools don't address what needs to be fixed, they are just accessories, they aren't useful.

Commented [kl51]: Governance

13. What is the most important consideration of facilitating bottom-up approaches to adaptation planning?

33020-1212

1. Obtain verbal consent: Do I have your permission to interview you today?

   Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze in my dissertation.

   Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

   330

   12/12

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

   Any map that puts my house underwater … [shaking head]
   What metrics would influence some of the decisions we would be making … From a utility perspective – already trying to do what we feel is critical – try to prevent stormwater infrastructure – prevent water from coming back in … flood gates … to insure that through those pipes we don't have increasing high tides … the most we can do right now … a lot of people ask about raising infrastructure – because the roadways are still on the same level … the question is about planning and what regulations/codes to put in place so that future development is more resilient.

Commented [kl52]: Place attachment

Commented [kl53]: Development
Resilient
Stormwater infrastructure
Flood gates
Flooding
Transportation infrastructure
Building codes

5. What concerns you most regarding the potential effects of storm surge and sea level rise?

Reduction in tax base … most valuable properties – most valuable properties will be affected most …

6. What regional infrastructure (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

Transportation – major bridges, major roadways for evacuation

7. What specific adaptation actions are being discussed in this region?

A lot of discussion, especially about infrastructure and development, but from a planning perspective, we're just now starting to develop long-term plans for resiliency. A major problem is flooding, which is tied to this issue as a whole …

8. You all are familiar with the concept of voluntary buyouts as an adaptation option …. Would you support the voluntary buyout adaptation option? Why or why not?

It doesn't happen tonight – starts with flooding … water doesn't go back in drain … street is part of tertiary drainage system … that is when those things start to kick in … what are impacts to property values … incremental changes … becomes less debatable … timing issue … people don't do things unless they see evidence … if in your backyard, now you will skip and jump … I don't think you can count on the fed to do the buyout … Mississippi river … government reinsures them through FEMA, etc. … if I stay long enough the government will rebuild my house … they haven't demonstrated that they won't do that anymore … a number of people buying … ocean front property increasing in value … hasn't even stabilized … water issue …

9. You're familiar with elevation and floodproofing as adaptation options … Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not?

I can't see that working here because it isn't … part of the way that people expect coastal homes to look … would be tremendously expensive and hard to do … would it work? Where is that working? I think it's more of an issue of insurance and if insurance costs are higher … maybe that would do some of the eliminating of people … along the vulnerable areas of the coastline … but then there's also inland flooding and saltwater intrusion …

10. How does the uncertainty of climate models affect your confidence in their predictions? For instance, in the models we considered at the COAST meetings, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone … - that weren't included in the models.

Groundwater modeling – USGS to determine how drinking water is affected by SLR … surface water models too … that determine who will be impacted and who should evacuate … recently Broward County changed evacuation zones … those models play useful function …
Models are good to a point – transportation models – models say everything will be fine … but not reality …

Commented [kl54]: taxes
Economics
Real estate market
Property value

Commented [kl55]: Transportation infrastructure

Commented [kl56]: Flooding
Transportation infrastructure

Commented [kl57]: Flooding
Long-term planning
Voluntary buyouts (adaptation option)
FEMA
Real estate market

Commented [kl58]: Floodproofing refers to the use of two strategies: either keeping water out of structures through a system of barriers, or designing the structures to occasionally accommodate floodwater by making the reconstruction process easier. Floodproofing measures can be incorporated into both new and existing construction but are only useful under certain conditions.

Commented [kl59]: Floodproofing and elevation (adaptation option)
Feasibility
Insurance
Regional/local science

Commented [kl60]: Modeling
Uncertainty

11. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among regional decision makers? What do you think may be "holding up" adaptation planning?

Politics – in-fighting over human or natural causes … distracting … isn't a solution-oriented conversation, it's a conversation about who gets blamed and who has to pay …

Commented [kl61]: Climate change causes
Blame
Financial responsibility

12. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

13. What is the most important consideration of facilitating bottom-up approaches to adaptation planning?

Took a natural disaster to create the opportunity to actually move … to make decisions … opportunity to put it back together the same way … OR do it better. What happened a few years ago with A1A is a good example. It had been flooding consistently for years and finally just experienced an insurmountable amount of flooding … was so problematic that the whole road crumbled and buckled and then we really had to do something about it. They built it higher and I think that was necessary and a good thing … they really needed to ….

Commented [kl62]: Natural disaster
Motivation
Action

14. [follow-up question] In conversations about A1A, was climate change part of the conversation?

What will really have an impact is a major storm … then you begin to change your thinking … so for this situation … climate change wasn't the reason it was built that way, the storm was the reason. And the continuous flooding. They built the road a bit higher to account for those factors, but they weren't necessarily using climate models to figure out how to do it, just to account for the flooding it was experiencing at the time.

Commented [kl63]: Natural disaster
Motivation
Flooding
Short-term planning

33020-no DOB

1. Obtain verbal consent: Do I have your permission to interview you today?

Yes

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330

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

As re-development takes place in a coastal areas – are we prepared to take action to increase building heights over and above the limits west of coastal development line? The county is definitely talking about it … We haven't responded to that yet – can we do it as opposed to larger … can we only advocate … a certain critical mass has to occur from development community to buy in … it is understandable that … there is something going on in Miami Beach about the idea of raising everything … interview with the public utilities or head of public works about over time, everything may be lifted there … the idea is … this is conversation now … couple of decades in denial and now the conversation is talking about raising things … certainly Florida … we will be the model for what happens next … we would not be able to move on our own … the whole development on the barrier island … we all have to be on the same page before anyone moves forward …

5. What concerns you most regarding the potential effects of storm surge and sea level rise?

That is not stopping people … 800 people moving to FL – northeast had winter …

6. What regional infrastructure (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

The location of critical utilities … they are located in places where they may be wiped out … and if that happens … won't matter if peoples' homes are protected, there won't be any services for them. It's a security issue … and a safety issue.

7. What specific adaptation actions are being discussed in this region?

Miami Beach is having a lot of discussion about vulnerable infrastructure, probably especially because the money is in development down there … lots of investments ….

8. You all are familiar with the concept of voluntary buyouts as an adaptation option …. Would you support the voluntary buyout adaptation option? Why or why not?

That won't work here because people don't just leave that easily. Especially over something they can't see. How many of these areas would we be talking about? If coastal areas … are vulnerable, and inland areas are vulnerable too … what's …. What's the alternative? There has got to be a better alternative than that and maybe insurance rates will help to alleviate some of the number of coastal or vulnerable homes … but I don't think the voluntary buyout option is typically going to be what people are in favor of, especially not now when the problem is far off and they can't see it. Maybe if a house was continually flooded or had numerous storms … affect it … Then that might be a different story …

Commented [kl64]: Real estate market
Development
Building code
Elevation

Commented [kl65]: Elevation (not floodproofing)
Development
Denial

Commented [kl66]: Place attachment

Commented [kl67]: Adaptation priority – critical utilities (water treatment, etc.)

Commented [kl68]: Real estate market
Development
Transportation infrastructure

Commented [kl69]: Voluntary buyout (adaptation option)

9. Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not?

That just doesn't seem like a cost-effective alternative to me … I can see changing the building codes, even substantially, or using more resilient material or whatever needs to be done … leaving the first few floors empty for storm surge/flooding waters to pass through … but I can't see floodproofing individual homes. Who would want to live in a home like that? And elevating? How much does that cost per home? Can homes in this region even be elevated? All of these things would have to be checked out … as well as the cost … I can't see people taking drastic action like that, especially if they're financially responsible for it, for something that they can't see right now.

10. How does the uncertainty of climate models affect your confidence in their predictions? For instance, in the models we considered at the COAST meetings, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone … that weren't included in the models.

Aside from that, there are limited financial resources and agencies that compete for that … Water Management District s don't necessarily have the same interest in SLR as coastal communities have … so where does government put its resources … the funding … when they have to sacrifice some other services for planning … your voters will … all about priorities. Models can show a lot of things, but those things are always changing and someone has to pull the trigger and move forward. No one wants to do that here in this … case … Modeling doesn't have to be perfect for us to use it effectively. We use imperfect models for tons of things so the fact that these models were imperfect too isn't that surprising.

11. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among regional decision makers? What do you think may be "holding up" adaptation planning?

Social change –this is a huge issue and requires so much coordination that people I think … are reluctant to keep doing what they're already doing. Especially if it involves a financial commitment … that will be a hard sell.

12. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

Regional, but they need a lot of help. Something like the Compact is great but it doesn't have enough actual power. They can't put something before the Senate or the House and get it done or even before the Governor. It is a loud voice and definitely impressive, but regional areas need to determine what their shared vulnerabilities … what … are and figure out how to help themselves. But again, this will require more funding and more of a long-term commitment, versus just giving a little money here and there to do small things that don't seem to have much effect.

13. What is the most important consideration of facilitating bottom-up approaches to adaptation planning?

Funding

Commented [kl70]: Floodproofing (adaptation option)
Feasibility
Funding
Cost
examples

Commented [kl71]: funding
tradeoffs

Commented [kl72]: modeling
uncertainty
decision making

Commented [kl73]: cooperation
collaboration
behavior change

Commented [kl74]: governance
power and decision making

33021-0509

1. [Obtain verbal consent] Do I have your permission to interview you today?

   Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze in my dissertation.

   Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

   330

   05/09

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

   The suggestions that Miami raise everyone's property … when and over what period of time? Having a serious discussion about that for the county – over 50 years, as redevelopment takes place we need to be committed to deciding on what elevation to go with … whether it is 20 … They've just built Margaritaville [Hollywood Beach] … with the existing code. Those at the forefront of looking at policy changes … trying to put in place some level of regulation – from The Compact, Broward taking a first stab at that … regional planning council … really policy wise … umbrella groups have to be on the same page … not an easy question … engineering standpoint – can a building be raised, lot of money and technical proficiency… or are we willing to sacrifice certain things … remediation or moving forward … lot of discussions of putting electrical equipment above whatever flood line is decided on … make sure electrical equip is above certain level … and just cars or parking on the floor level. FEMA requirements … any time new construction goes in … will flood neighboring property … Florida building code – moving so quickly that people are trying to wrap their heads around it now … certain parts of FL where there is still denial. Governor has put … no "sea level." There has to be some kind of consensus that there is an issue … in Broward County, it has been in the forefront … we know we're going to have a problem but the planning is still discussion … what do we DO about it.

5. What concerns you most regarding the potential effects of storm surge and sea level rise?

   Biggest concern – flooding issue … inundation, tides … peoples' properties … big concern … practical effects on people … all going to be local until it is in your backyard …

6. What regional infrastructure (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

Commented [kl75]: Elevation
Feasibility
Building code
Coordination
Tradeoffs
FEMA
Development
Denial
State-level leadership

Commented [kl76]: flooding

We need to really look at peoples' communities and see what is happening there – we know that there are flooding issues in a lot of places and I think that has just become a way of life unfortunately. What if that flooding becomes worse – that isn't going to work for us. The priorities should be roadways and ways out of this region (highways, bridges) instead of trying to fortress it off because with a hurricane, that wouldn't stand.

Commented [kl77]: human lives
communities
transportation infrastructure

7. What specific adaptation actions are being discussed in this region?

Stormwater management (to respond to king tides)

Adaptation action areas

Commented [kl78]: adaptation strategies
short-term planning

8. You all are familiar with the concept of voluntary buyouts as an adaptation option …. Would you support the voluntary buyout adaptation option? Why or why not?

It is too early for that … by 2060 … nobody knows for sure – what we do know is that there is some level … they are not certain as to what that rise is going to be. There is not real evidence … maybe if there is more significant impact or if you have a storm … that really wreaks havoc … at this point in time I don't see it or for the next 10-20 years

Commented [kl79]: voluntary buyouts
feasibility
certainty
natural disaster

9. Do you think they're stronger together or separately?

The way people try to do this is … greenhouse gasses that are triggering … lot of strategizing to reduce greenhouse gasses … idea is … tackling root cause and effects … tackle all of them simultaneously as much … internationally … coordination … people are realizing that we have to rethink the way we do things … and then flooding, higher sea level, deliver it simultaneously …

Commented [kl80]: large-scale/global adaptation strategies
coordination (global)

10. You're familiar with elevation and floodproofing as adaptation options … Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not?

I just don't think that's feasible. It isn't something that people are … willing … there isn't a willingness there because what are they floodproofing at that extreme? If you can't really see the problem it appears silly to make all of these expensive adjustments to your home, and really that type of change just seems like it is so extreme.

Commented [kl81]: visibility
elevation
feasibility

11. How does the uncertainty of climate models affect your confidence in their predictions? For instance, in the models we considered at the COAST meetings, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone … - that weren't included in the models.

We never talk about the consequences – but to me, level of service doesn't suffice … Planning utilities … have to try to be predictive … imperfect as they may be … sense of potential risk. Set of assumptions that you have to put into a model that may not be certain … are we willing to take that chance – people are going to say why weren't you prepared? Why didn't you do anything? Starting – first steps – green building … putting in green building requirements … consuming less energy … push back on 10 things to do … first baby steps are getting push back … always

have to look for best tools to understand the risk … at least mitigate some of them … flood gates …

Commented [kl82]: modeling
uncertainty
risk
blame/expectations
short-term progress

12. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among regional decision makers? What do you think may be "holding up" adaptation planning?

Funding

Commented [kl83]: barrier to adaptation

13. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

14. What is the most important consideration of facilitating bottom-up approaches to adaptation planning?

Took a natural disaster to create the opportunity to actually move … to make decisions … opportunity to put it back together the same way … OR do it better.

Commented [kl84]: natural disaster
action
motivation
situated judgment

33022-0125

1. Obtain verbal consent: Do I have your permission to interview you today?

Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze in my dissertation.

Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

330

01/25

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

It didn't really … I've done a lot of that work before so I'm familiar with those, I knew what to expect … thinking about stuff in Ft. Lauderdale … nothing hugely unexpected. Good data … but nothing new.

Commented [kl85]: COAST visualizations

5. What concerns you most regarding the potential effects of storm surge and sea level rise?

Sea Level Rise is a slow steady creep so dealing with that for me is all about trying to put in controls today that are going to be realized 50 years from now. So what will happen is if I install a pipeline or building … I'm probably figuring its life is at least 50 years … so what you have to avoid doing is installing critical infrastructure and finding that that isn't going to deal with 50 year condition … most water, sewer, stormwater … probably works on 100 year time scale … water mains …

What I'd told Miami Beach [officials], as you plan infrastructure you want to step into the problem … Miami Beach spent 40 million to put in pump … problem with the road is it is two feet above sea level. What about a foot … the only asphalt is good for is protecting base of road… whole idea of drainage systems is keep the base dry … roadways …

Better alternative with $40 million … refuse to acknowledge that there are certain areas that aren't salvageable … but many that are completely salvageable … want to use US 1 Dixie Highway as a corridor … all structures should be on that corridor … use natural lay of land … when we spend the 100 million dollars, they need to be at exactly the right point ….

6. Now I want to ask you about the adaptation actions that were modeled and discussed during the second meeting. Would you support the voluntary buyout adaptation option if a regional asset (office building, church, school, etc.) was identified as a flood-prone property? Why or why not?

Talking to Republicans – little project … broke Florida into 11 regions … the question was – what is political outlook … all boundaries line up with perceived risk – high risk, active. Middle part of state, risk issue with rain, heat … farmers, panhandle, Tallahassee doesn't see it … most Republicans don't see climate change issue because they aren't in the purview of it … Naples/Ft Myers is as vulnerable … viable option – implementation strategy is a problem … here's what you should do – two ways – 1. Offer people money for an option to buy their property you can pay them and give them 30 years lease to stay in property, and pay taxes on it as though they own it, or when they sell back to government. In this scenario, the city says, live in the house … at some point, you will want to move, etc. – I give you $10,000 to have option to buy property at market value. I give you market value today with deed and property comes to me at the time that you wish to dispose of house/die. Those two would work. Trying to go in and sell the property and move in short time frame.

What happens to property … too vulnerable to protect … rent property, section 8 housing, etc. … no tax money comes off of it. There is 4 trillion worth of property in this region … in Southeast Florida … there is way too much value to give away … there is no limit to what we will do to protect South Florida.

The Kresge project shows how socially vulnerable people are vulnerable to SLR … they aren't because until the 30s, people started developing coast, Miami Beach is a manmade project … Reasons so much flooding clay … doesn't drain … sand ridge is porous … Topography – limestone underneath everything … definitely not as favorable as in Tampa … formation collapses …. Competent limestone transmits water easily … Saltwater intrusion is red herring … dropped water levels 4-6 feet so that we could develop … we have no idea how long it has to take to stabilize saltwater intrusion … people try to use those projections … SLR plus groundwater …

Commented [kl86]: Long-term planning

Commented [kl87]: Critical infrastructure
Building lifespan

Commented [kl88]: Transportation infrastructure (roadways, highways, bridges)
Pumping (as adaptation strategy)
Short-term planning
Abandonment
Resiliency planning

Commented [kl89]: Voluntary buyout adaptation option

Commented [kl90]: Real estate market
Development
Place attachment
Investment

Commented [kl91]: Modeling
Uncertainty
Regional/local science

7. Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not? … Do you see advantages to this adaptation option? Do you see disadvantages?

Cities have become entrepreneurial … I don't think a lot of those buildings are accessible if they were floodproofed even …so I'm unsure of the reasoning in floodproofing them.

Commented [kl92]: Floodproofing
Feasibility
Creativity

8. Other than voluntary buyouts or elevating/floodproofing, were there other adaptation strategies that you would have liked to discuss? Are you familiar with what other regions/cities may be doing? For instance, beach renourishment for better retention of shoreline and property, revising building codes, sea walls, elevating or hardening transportation infrastructure, etc.

9. How does the uncertainty of the COAST models affect your confidence in their predictions? For instance, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone …

In the second meeting, I made the comment (as I was sitting next to B.F.) that the problem with these models is that roadway infrastructure isn't taken into account. JT said on several occasions that they didn't factor in infrastructure … the problem is the model fails because most of the time when you get to those pieces of property you can't access them. What good is that? What we have to look at is the infrastructure system has failed to a point that we can't make it accessible … if three feet of sea level rise, the houses are above but three feet of water on the streets … your model doesn't show damage but the house has no value. You can't show – well, there isn't a good way to show how the value will decrease as sea level rise increases … there will be a point that I suspect will occur before models kick in where you will have value of property is zero because the cost of the improvements will exceed the value of the property. 4 million dollars a lane mile to make the kinds of modifications to roadway infrastructure that I'm talking about – this needs federal support. What I think will happen – will be in future – if it was today congress would be opposed to it … no more bailouts. No more debt. All of the arguments … 2009 get people back to work … if you look historically, we only have two examples … we didn't borrow enough money.

Commented [kl93]: Transportation infrastructure
Modeling
Roadways
Feasibility
Real estate market
Property value
Governance – federal support

10. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among decision makers or politicians? What do you think may be "holding up" adaptation planning?

The priority should be roadways because they are symptomatic of all other infrastructure … Florida Power and Light [electric companies] can't get to it [properties that are inundated/affected by extreme flooding or storm damage] …

Commented [kl94]: Transportation infrastructure
Roadways
Flooding
access

11. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

If you want something to happen, local. The compact is a great start … the South Florida Regional Planning Council probably is a created regional entity – but here's the problem: the Compact is great, the South Florida Regional Planning Council is great, the Water Management District (WMD), drainage districts … definitely not great … the problem is that too many entities and not enough coordination. Some people might argue that the WMD might be the right one to take control … appointed by governor, controlled by agriculture and interest on state government

level, funding was cut for those activities and employees dismissed … the WMD is not the right answer. The Compact has no authority to do anything … so they talk – the Planning Council doesn't have authority either but they are the entity that communicates as liaison … but they can't work with metropolitan planning orgs – the transportation guys – but their scope is too narrow. The problem is that there is not really a good local partner to deal with this. What may need to occur is we may need to create the South Florida Regional Service … South Florida Resiliency Service … district … then the Compact could merge into that … create as multiagency GUA, so there is authority to create … I have been involved in creating more than one of those … that would be the way to do it and you define it as the tri-county or quad-county area and you give it authority to issue bonds, create agreement with drainage districts, make agreement with Army Corps of Engineers and the WMD to allow to control stormwater issues, then try to roll up individual community plans … not a bad idea to take FAI and FIU or something similar … people who are embedded in situation and ask them to vet the long-term solution. You don't want a consultant to do it because they have looked for politically acceptable answers or expedient answers. You don't care whether it makes Hollywood and Dania Beach unhappy … you want someone to look at the global issues … maybe it is the climate institute for state … a regional entity – but keep legislature out of it. Some examples of governance for that … have the Regional Planning Council help with how it gets done, etc. – climate Compact – talk to each other and too many policy … they need leverage to get things done. Land use planners, developers, public works and engineering people … and financial entities. Planning council does some … universities give authority to assess taxes … sell bonds … apply rates … purely organized and controlled locally … appoint people and designate what they need to know to serve on the board … completely independent organization … once you have blueprint of this, then you have a potentially viable partner to coordinate this effort.

Commented [kl95]: governance
power
decision making power

33023-no DOB

1. [Obtain verbal consent] Do I have your permission to interview you today?

   Yes

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   Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

   330

4. Thinking about your perspective on coastal hazards and sea level rise, How – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

OK – so what is my change after exposure – my perception is that it is something real, something that if we do not do something about it, it could be there could be potential disaster in near future, if we do not put the mechanism in place to prevent and mitigate that (natural disaster, which is eminent, 5 10 or 15 years from now) if the local government or the state or fed or agencies responsible for property and investment – if all of these groups don't do something about it, it could be very catastrophic. My perception is also that we may not be doing enough as far as getting the word out to the public and the media – it should be a subject of conversation on a day to day basis, on the news more often so that people can become more cognizant about it, amd should also be included in the curriculum so that we can be teaching kids at the undergraduate level so that by the time you graduate you know the aspects of sea level rise and the concern that it presents and how to mitigate the impact and how to … I was less concerned because I didn't know much after the sessions so I became more concerned about it … it becomes a subject of problems and solutions and potential solutions … I believe in science and ….

5. Did the visualizations affect your level of concern about how sea level rise may affect your community?

Yes – because the level when I looked at the 2010 … by 2030, we may have a SLR between 3 -8, 2060, I believe 9-24 inches … so when I saw that chart one thing that came to mind is that it is based on a model – note it is also an approximate. With that sort of visualization, I do not think that those numbers are 100% but it could be within the range. My concern is the method they used to come up with the numbers – has this method been proven before? I believed in it, could be reason …. Concern is that model that they used … has it been used before and do we have the evidence that it works …

6. What concerns you most regarding the potential effects of storm surge and sea level rise?

I see here … they have to reinstate the growth management principle so certain areas by the coastline should be very susceptible to growth management … limit the infrastructure … but it generates revenue, it is political … two reasons – to just go ahead and … demand, pleasure, money … because of this concern we need to find ways to limit this kind of investment in the coastline. Whatever is there is already there … there should be a mechanism to encourage people to invest in … flood plain … versus high rise buildings … retract from the coastline … whatever exists now, incentive to be relocated … having high rise – still something there but in order to reduce potential life and property, should not be. ..

7. What regional assets (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

Peoples' safety …

Commented [kl96]: Natural disaster

Commented [kl97]: Awareness
Education
Reporting
learning

Commented [kl98]: education
citizen engagement

Commented [kl99]: level of concern

Commented [kl100]: modeling
COAST visualizations
Certainty
Trustworthiness
Proof
evidence

Commented [kl101]: population control
population growth

Commented [kl102]: inland development
real estate market
abandonment of coast

Commented [kl103]: adaptation planning priority

8. Now I want to ask you about the adaptation actions that were modeled and discussed during the second meeting. Would you support the voluntary buyout adaptation option if a regional asset (office building, church, school, etc.) was identified as a flood-prone property? Why or why not?

So should we spend resources – in my area, voluntary buyout … whether it would be ok to sell if you explain … price … I think it would work … everything is about the market and the market value … if you offer them something marketable, except that trying to get people to volunteer, then you don't have to … insure or insure for flood …

Commented [kl104]: real estate market
voluntary buyout adaptation option

9. Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not?

Limit growth … kind of like rezoning. By 2020, no one is allowed to develop this close to the coastline … except of a certain style … that … could work.
In my opinion, the flood proofing … don't think it will work – very costly, when you are talking about sea level rise, this is a different change in the atmospheric conditions – may also come with stronger winds … right now, 150 MPH … even if you elevate, you get a bit of floodproof, you could be facing windstorm … very costly, very uncertain … pile is good but remember that this is a coast … eroding the shore, those parts could be ruined as well. Because of that uncertainty, I don't think it's worth to even try to elevate – when the sea level is risen it may come with stronger winds as well.

Commented [kl105]: population growth
population control
resilient building
abandonment of coast

Commented [kl106]: elevation and floodproofing feasibility

10. Other than voluntary buyouts or elevating/floodproofing, were there other adaptation strategies that you would have liked to discuss? Are you familiar with what other regions/cities may be doing? For instance, beach renourishment for better retention of shoreline and property, revising building codes, sea walls, elevating or hardening transportation infrastructure, etc.

11. How does the uncertainty of the COAST models affect your confidence in their predictions? For instance, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone …

My level of confidence is there, not 100% but maybe 80, 85% which is still good … the fact that there were a lot of factors that weren't included … roadway, structure, drainage … it was more like what will happen to vertical structure … model is not all inclusive … but you don't put for everything you develop software that works and then every year you enhance it … this is the same. The next year, there will be ways to improve that data as well … but for a start, it is …when you use a model, you use factors that works …

Commented [kl107]: modeling
factors included in/excluded from model
improvement
transportation infrastructure
critical infrastructure

12. Given some of those comments as examples of how the COAST model works, Are there other factors that you would have liked to seen accounted for in the COAST models?

No, because there is an opportunity to improve this data. Later on, you can include more data and see the impact better … for instance, roadways … you will definitely need to take this into

account as well … not 100% sure but with data, 70-80% is fairly reasonable … Key West is an example, I see that you can get out of your car and put your foot in the ocean … here we have some areas that are so flat and you can feel the water is taking over …

Commented [kl108]: transportation infrastructure

13. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among decision makers or politicians? What do you think may be "holding up" adaptation planning?

Well, the most contentious here is … for politicians as far as employment – politicians can get elected when their agenda has development … everyone is at work … contentious to do something that they were elected for … cut employment in this area …. People don't think this way, they see I have a good paying job and now I am no longer in this hotel management … not an easy position to be in as a politician … what mechanism can be put in place to show opportunities … also the change, people are really reluctant to change by nature so if they have doubts, they will not change. They have to see the danger for them to accept the change … power of prediction and dealing with the politicians … growth management … contentious to see how they will present this to voters… big huge impact to life and lifestyle … to industry … the coastline brings a lot of tourism and tourism is a big money maker … industry … contentious as far as what areas can you have as touristic places … so you're looking at losing employment, very big impact to peoples' lifestyles … people invest millions in condos by the ocean … for a politician to convince the great majority otherwise … pretty difficult but doable. What happened in Japan with the tsunami … how many it killed, so and so … good examples to use to convince people to do something not wait

Commented [kl109]: barrier to adaptation – politics

Commented [kl110]: behavior change

Commented [kl111]: economy/local economy
tourism
development

Commented [kl112]: fear
proactive or reactive

14. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

Here, it should be what we call a multi-agency coordination – you have local involved with the state and fed as well … I think it would work if we have the local jurisdiction and state and fed working together … If you leave it to local it won't be successful because of limited power and resources. You have people all over the US coming to South Florida for tourism so it isn't a local impact … it is a national impact … it is not something that can be done at a local level only … it will work if you have the state and then the fed to back it up …. Only if you have multi-agency coordination. For instance, we have the American Association of Highway Officials. We use it to design highways even though highways are managed at a local level … we adhere to a manual … used nationally ... we use at local level. So that everyone can use the model … if we do any work on Interstate 95, we have federal aid to do that … federal money can be used for … we get local input … but we do not have the final say … federal government is there as big umbrella to look at best of nation … to figure it out, it has to be the state writing grants, etc. the state can write proposals … 95% of the time they will get the money … as long as we could prove that the money could be used well …

Commented [kl113]: governance
multi-agency coordination

15. What is your level of confidence about a regional approach to adaptation planning? Do you think that regional approaches – similar to the COAST process – are effective ways to approach the adaptation planning process?

On a state level, the Governor should understand talking about loss of life and property … to put politics aside ... one of the ways it will work is to constantly have presentations to the commissioners … the commissioners meet regularly and there is room for private citizens to tell them their concerns … making sure to keep the commissioners informed, big investors, we don't want to lose those investments … in 10 years if you have an adverse impact, you don't want to lose. I employed ____ … but now my investment is at risk … commissioners are there to listen to the people and are all elected and have straight contact with the governor … Look at biggest county and have a task team for them to address this issue … understanding means…. Action and you get citizens involved … all of the media etc … once the commissioner sees …commissioners are in touch with the reality of the region those are the ones we need to be speaking with and updating because they are going to react to that … once they are convinced, then they can reach the ears of the governor … and do something.

Commented [kl114]: state-level leadership priorities of human life and property value regional leaders

Commented [kl115]: regional/local governance

33139-0615

1. [Obtain verbal consent] Do I have your permission to interview you today?

   Yes

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze in my dissertation.

   Yes

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

   331

   06/15

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations (the maps that were shown to you during the first meeting and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts)?

   No – perspective didn't change – there wasn't anything new in the second meeting … I would say that perspective changed by attending the meetings – I didn't have a clear idea of how close we are to potentially dramatic sea level rises … between the two meetings, no.

Commented [kl116]: COAST visualizations

5. Did the visualizations affect your level of concern about how sea level rise may affect your community? Did they affect your level of concern about your home/property?

Visualizations – for me, money is not primarily the issue … seeing extremely luxurious building – would be affected … more value … that is not relevant … residents of both buildings would be affected – more interested in the human aspect than the wealth aspect. In the workshops, they took high-income buildings … to show value … to me that is not relevant. Would be more relevant to see how many people lived there … than … one building of lower value than another. You lose your second home … that is a small loss for them … but what about people whose primary home is threatened – without anywhere else to go … they lose everything … because of no social net to buy something else … that is the thing of more value than the buildings. The human aspect was absent … gives you the extent of flooding … red patches showed how far the water could come inland … but not who was there. We were only looking at water from above – presumably these maps … if you mapped water seeping in … and put them together, showing the impact to the human aspect too, a fuller picture of the impact … probably would show more destruction (shows hand motion layering maps on top of one another).

6. What concerns you most regarding the potential effects of storm surge and sea level rise?

The loss of habitat for people who have nowhere else to go. Or people whose life investment goes into a house ….would be a huge loss …

7. What regional assets (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

Vital interest – infrastructure – road, electrical … main services are still available for those who can stay … on the one hand some will lose their homes … that would be my priority … Samantha said… at the first meeting, she talked about futuristic visions … that is very interesting – the work that they do on elevating, parking, I think the city should prioritize the vision of how buildings should be built from now onwards – more than building code … vision for future … how do we envision our cities to become and how do we want others to see it too? Cities and counties should be starting campaign with presenting that vision so that they aren't just trying to enforce a stricter code on few members of society … people don't understand …no idea … probably not. Feeling from the meetings is that the communities aren't getting together – lot of very strong opinioned people who are trying to ring the alarm bell but they aren't trying to collaborate with one another … a few very strong characters [are the loudest voices] … but they are more the aggressive type … angry people but not the kind of people that could really touch a community … lots of confusion about what to do …. Or they keep silent …others are just unaware … younger people need to be involved … "youth" … I guess 30-40 is youth … but schools should be involved – high schools … opportunities to participate, to create a vision … get them involved in what it is going to look like. A lot of people who were in the room were way over 60 so even if sea level rises in their lifetime, it may not affect them really … so it is a generational thing where those who participate today … high school, design schools, colleges with architecture should be

Commented [kl117]: Social justice
COAST process

Commented [kl118]: Adaptation priority – human lives
Social justice

Commented [kl119]: Social justice

Commented [kl120]: Creativity
Design
Resilient design
Transportation and other critical infrastructure

Commented [kl121]: Building code

Commented [kl122]: Alarmism vs indifference

at forefront of creating this vision and working with the students. The county and the city should allow for this – space, funds … make it a research project … you have this idea … and you need someone who takes these ideas forward and makes them into reality … you have to have a few different levels of participation and a few different age groups – even you still get a lot of awareness and interest. Some of these ideas build into something that actually works … you have a base that five years later will be the architects of the future … investments based on what they know …

Commented [kl123]: Citizen engagement
Youth engagement
Creativity
Situated judgment

8. Now I want to ask you about the adaptation actions that were modeled and discussed during the second meeting. Would you support the voluntary buyout adaptation option if a regional asset (office building, church, school, etc.) was identified as a flood-prone property? Why or why not? Do you see advantages to this adaptation option? Do you see disadvantages?

9. Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not?

We live in a culture of discard rather than use and reuse … not sure if people would floodproof … let me buy something that is already floodproofed … I haven't seen a lot of floodproofed buildings being built. But I haven't seen that – it depends on the investment that is required – and it also depends on whether the floodproofed house would be useable if there is a flood. If you elevate and … then you expect to be able to be able to inhabit it. Of course you would have less damage to your home … but then the other issue is the water seeping in from below. Does floodproofing also help with that … I think people don't know enough. When you make that investment, you need to know … community is not only made of buildings – the services, the neighbors … if you lose one part of that community it disintegrates that community … if you see abandoned homes on each side of your dwelling or you see that people move out … it just isn't the same so the shops that you used to shop in … they have to go … do you stay … the fabric the financial purely financial analysis is very limiting. I live here on the beach and am thinking about this all of the time … we need a bigger space for our family and we are waiting just a little more for the prices but it breaks our heart because we love our neighbors, proximity … a lot of flooding … even when there is no storm surge … market has gone up now … but even if we make a low investment we should … insurance has gone up. We received a (March) letter saying they have to purchase flood insurance it is more expensive but you take a package. Insurance, taxes, everything is more expensive because that is what you accept. My husband and his friends don't take me seriously because there is no information about flooding … it is progressive flooding … the maps don't show you the progression … red spots are completely inundated …. The maps aren't really realistic … human nature – will we invent something? Combination of all of those things – media, denial, human nature – articles about how bad it is … sporadic news coverage … when there is nothing dramatic happening, no it doesn't take something drastic for things to change in Miami Beach – spoke to real estate agent… we live in Miami, that is part of what it life here … people deal with things and then they move on … lots of good sides to living here … if people were fully informed about the threat, it would drive the prices of property down … if you are well aware, you won't be willing to invest as much … it may not drive people away but it would affect the market … OK for those who bought at low prices … tourism will not be affected

Commented [kl124]: Elevation/floodproofing adaptation option
Floodproofing – retro-fitting …

Commented [kl125]: Floodproofing (adaptation option)
Feasibility
Regional/local science

Commented [kl126]: Community
Human lives
Social justice
Abandonment

Commented [kl127]: FEMA (maps/zones)
Insurance
Taxes

Commented [kl128]: Place attachment
Flooding
Mapping
Complacency

as much, might just be aware of when to come … if you look at weather forecast for Miami Beach, you need to have more accurate weather warnings … you think it is always stormy, always alerts of storms etc … need a more accurate picture day by day … tourism wouldn't be affected. That will not change – foreign investments …

Commented [kl129]: Real estate market
Tourism
Local economy
Investment
Fear

10. Other than voluntary buyouts or elevating/floodproofing, were there other adaptation strategies that you would have liked to discuss? As examples, are you familiar with what other regions/cities may be doing? For instance, beach re-nourishment for better retention of shoreline and property, revising building codes, sea walls, elevating or hardening transportation infrastructure, etc.

Abandonment would not be an option … if you lower the cost of the building you can then … keeping prices down … the cities or the counties wouldn't lose anything because they base their taxes on appraised property value not market value …

Commented [kl130]: Abandonment
Place attachment
Real estate market

11. How does the uncertainty of the COAST models affect your confidence in their predictions? For instance, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors – like groundwater, porous limestone …

Starting point – that is what it stays – but if you don't include the other elements, the erosion from water seeping in etc., then it just doesn't … people can't do anything with it because it isn't so much about the money but if this building is going to be flooded … you have to calculate both … it is misleading a bit.

Commented [kl131]: Modeling
Baseline
COAST process/approach
Factors included in/excluded from model

12. What is at stake in decision making about adaptation planning in this region? What seems to be the most contentious or argued about factor among decision makers or politicians? What do you think may be "holding up" adaptation planning?

I don't see any … but may … they have the money, and something is about having the funds. They have funds … it may be that if they do too much people might start being aware and would maybe affect investments … you would have to listen in to the meeting and figure out … could be anything.

Commented [kl132]: Funding
Politics
Barriers to adaptation

13. Who do you think should take the lead in responding to this region's coastal hazards? Regional, municipal, state-led … Why?

Municipal – they are very active and the Mayor's office … it is a highly efficient city in the way that they manage everything … they are independent financially … so they have their bits and pieces of money from the residents and they can actually plan for what they can afford as opposed to someone coming from outside and telling them what to do – they are creative and practical ….

Commented [kl133]: Governance
Funding
Creativity
pragmatism

14. What is your level of confidence about a regional approach to adaptation planning? Do you think that regional approaches – similar to the COAST process – are effective ways to approach the adaptation planning process?

Full confidence in bottom up planning … I'm a communication specialist but I spend my career working with non-government human agencies … the last employer I worked for funds grassroots organizations … for planning and actually doing the work- I know it works. I don't see why it wouldn't work here .they work with people who earn less than $1 a day and even the World Bank doesn't want to fund … the results are … giving people the opportunity to voice their concerns and ideas and giving them the means to improve them … they are finally being heard – giving them a voice – and the poorest don't have anything to work with … if you give them the tools – education, training, creating an organization within the community with a leadership that can actually talk to the authorities … I've seen changes … the way in and the means to implement their ideas.

Commented [kl134]: social justice
governance
citizen engagement

15. How would you describe a bottom-up approach to adaptation planning? Bottom up: regionally led initiatives (versus national guidelines or mandates) for policy making that asks citizens and stakeholders to engage with regional leaders in making decisions about policy.

The other question I have is how do they get the participants – I got an email from a university … for the next one … how would I know about it … how did they select? The public in general … they need to find a way to find those who … creative minds who haven't been exposed to that yet – another way to create the network … if you always reach the same people … it will stay that small.

Appendix C: Codebook

Name of Code	Abbreviation	Short Description	Long Description
Barrier to Adaptation	**(BA)**	[commentary responding to the proposed adaptation options (elevation/ floodproofing and voluntary buyouts) as well as other situations inhibiting action toward adaptation]	Obstacles that temporarily delay/impede the process of adaptation, but which can be overcome with cooperation, alternative approaches to policymaking, etc.
Anger, alarmism, and environmental problems	**(A/EP)**	[references to large, transformational, or global-scale solutions (i.e., mitigation); "gloom-and-doom" framing about implications of climate; resentment about inaction]	In many instances throughout the workshops, participants shifted the conversation about the adaptation actions being discussed (elevation/floodproofing and voluntary buyouts) to mitigation, global solutions (e.g., The Netherlands' water management strategies) or international climate policy. In other instances, they expressed anger and resentment about inaction at the state level or pointed to environmentalists as primarily responsible for leading action on adaptation.
Context	**(C)**	[comparison of proposed adaptation options with regional situation/vulnerabilities]	"Context" was a significant and common concern for many participants. References to context include participants' comparison of Southeast Florida with other global adaptation efforts, funding of large-scale adaptation solutions, and the absence of the "human factor" as part of the context of conversations about adaptation options.

Invisibility and Timing	**(I/T)**	[references to the slow rate at which sea level rise occurs (sea level rise occurs at a rate that is imperceptible to the human eye); the large time frame in which substantial/perceptible change occurs]	Sea level rise is very slow to see/realize; it will, as one participant suggested, "take a natural disaster for people to see the problem." Some participants alluded to a fear of scaring away tourists and potential real estate investors because of evidence of adaptation – suggesting that implementing visible adaptation actions may be construed as evidence of a problem.
Funding	**(F)**	[participants' references to concerns about the substantial/high cost of large-scale adaptation options; existing municipal debt; limited financial resources at local/state level]	References to funding primarily pertained to the difficulty of making investments in large-scale adaptation options (e.g., floodproofing/elevation). It also pertained to transportation infrastructure: retrofitting existing transportation and raising standards for new projects and the difficulty of obtaining enough funding for adaptation measures (or the possibility of relocating existing funding).
Leadership	**(L)**	[Lack of leadership, power, and funding to initiate changes]	A number of participants suggested that lack of leadership was a significant barrier to implementing adaptation measures. They suggested that there were "too many entities and not enough coordination," and that there was extreme pressure on politicians to promote land development (not restrict it) and that a "good local partner" that had the power (and funding) to make decisions may be necessary.

COAST Approach	**(CA)**	[Participants' responses to the cost/benefits analyses generated for the two adaptation options discussed during COAST Workshop One.]	This code indicates stakeholder references to the COAST models/maps and facilitators' explanations of COAST software (the process of generating cost/benefits analyses of adaptation options). It includes facilitators' responses to stakeholder questions about the COAST process as well as references to the COAST models in relation to the prediction imperative.
Value	**(V)**	[Comments about economic value and, in contrast, the value of human safety]	Value was defined in a variety of ways: economic, humanistic, and environmental. Although the primary purpose of the COAST workshops was to model/discuss economic value (cost/benefits of adaptation options) COAST Survey One asked participants about environmental values as well as economic/funding preferences. Additionally, throughout the workshops and during the in-depth interviews, some participants pointed to environmental values as justification for initiating adaptation action.
Prediction Imperative/Modeling	**(PI/M)**	[References to the need for certain knowledge/ data for decision making about adaptation]	Many participants commented about the "human factor" of adaptation and suggested that consideration about human safety ought to be a factor in adaptation planning (in addition to estimates of cost/benefits of action). This code also pertains to the other challenges of determining how to make decisions about modeling factors and the pressure to establish certainty before engaging in decision making.

Elevation/ Floodproofing	**(EF)**	[Participants' comments about the feasibility of the elevation/ floodproofing option]	During Workshop One, the COAST workshop facilitators provided participants with a cost/benefits analyses of the elevation/floodproofing adaptation option. During the deliberative session about this option, participants were asked to discuss the feasibility of this option for homes in their communities. During Workshop Two, the majority of participants suggested that transportation infrastructure ought to be a priority before an option like elevation/floodproofing may be considered feasible.
Judgment	**(J)**	[Participants' explanations for how citizens/residents make decisions about living in vulnerable/coastal areas and COAST facilitators' references to judgments about adaptation options]	During Workshop One, the COAST workshop facilitators asked participants to "make a judgment" about their preferred adaptation option, given the cost/benefits analyses/tradeoffs. This code also pertains to instances where participants expressed difficulty making this judgment (e.g., needing more information about the nuances of implementing an adaptation option before making a good judgment about which option would be preferable).
Voluntary Buyout	**(VB)**	[Reactions to the voluntary buyout adaptation option]	This code identifies instances where participants deliberated about the pros/cons of the voluntary buyout option. Although the majority of participants indicated that this was not a viable option, some participants thought it may be worth considering in the longer-term future, given that "the water has to have some place to go."

Place Attachment	**(PA)**	[Participants' comments about their extreme loyalty to the region, despite its (coastal) vulnerabilities and/or in-conveniences]	This code was extremely common throughout the data; place attachment was a recurring theme throughout participants' deliberation about the two adaptation options. An example of place attachment is, as one participant explained, "If I have to swim to it, I'll swim to it." Participants' emphasis on the value of real estate/real estate investments was another prominent instance of place attachment.
Visualization	**(Viz)**	[Participants' comments about the degree of influence of the COAST visualizations (i.e., simulated images of buildings at various levels of inundation)]	One of the premises of the COAST process is that visualizations are effective for encouraging participants to more seriously consider adaptation options. This code identifies instances where participants provided opinions about whether the visualizations influenced their perception of the problem or not.
Governance	**(G)**	[Opinions about leadership regarding adaptation planning, funding, and implemen-tation]	Stakeholders' preferences for leadership and management of adaptation strategies.
Autonomy	**(Au)**	[Comments about preferences for leadership/management of adaptation policy]	This code pertains primarily to preferences for governance: municipal/regional, and/or federal (or a collaboration of federal support of regional governance).

Responsibility	**(R)**	[Participants' opinions about who/which entities are responsible for acknowled-ging/acting to address coastal vulnerabilities]	"Responsibility" was a prominent code throughout the data. In some instances, this code referred to citizens' safety. In others, it referred to local governments' obligation to respond/act even under uncertain conditions. In one instance, a Workshop One participant suggested that citizens also need to take personal responsibility for the vulnerability of their real estate/property and not simply "rely on the government to take care of you."
Action	**(A)**	[Barriers to action; opportunities to motivate action toward making decisions about adaptation]	"Action" pertains to barriers and motivations for adaptation action. For instance, some participants cited concerns about funding as a primary barrier to action while others suggested that belief in climate change was impeding action. Others suggested that a "big storm" was necessary for provoking substantial action to make the region more resilient.
Development/ Construction/ building code	**(D/C)**	[References to land developers as stakeholders in adaptation planning]	This code identifies participants' suggestions that land developers be included in conversations about adaptation planning. From this perspective, substantial change, in terms of building codes and/or resilient building, isn't possible without support from land developers.
Innovation	**(I)**	[Futuristic visioning about a resilient community]	Stakeholders' ideas about how to creatively approach coastal vulnerabilities through incremental adaptive action, promoting/supporting resilient design projects, and developing holistic models that integrate community residents and local geologic challenges (e.g., porous limestone, saltwater intrusion).

Coordination/ Leadership	**(C/L)**	[Participants' opinions about which entities should lead the adaptation effort]	The "Coordination/leadership" code identifies participants' deliberation about who should lead adaptation efforts. More specifically, it pertains to calls for a good "local partner" and cites criticism about "too many entities and not enough cooperation."
Models	**(M)**	[References to modeling factors, especially in terms of COAST modeling factors]	Many participants suggested that the factors that were included in the COAST model ought to have included some recognition of human life/safety and regional scientific factors (e.g., saltwater intrusion, limestone, groundwater models). This code identifies instances of commentary where participants ask questions or make comments about modeling factors and the reliability/validity of modeling data.
Applied/Innovative research	**(R/V)**	[Suggestions to shift the emphasis of conversations about adaptation solutions from "the problem" to futuristic visioning about creative solutions]	The "applied/innovative research" code indicates instances where participants suggested a more positive, pragmatic framing of climate adaptation messaging and communication. As an example, one participant suggested that instead of dwelling on the existing problem, cities and regions ought to engage university educators and students in pragmatic research projects to address local/regional vulnerabilities.
Design/Resilient design	**(D)**	[Comments about building, resilient construction, and stakeholder engagement in decision making about preferences for city style/ aesthetics]	The "design/resilient design" code pertains to participants' ideas about future development/design and how to incorporate adaptation planning into new construction.

Development/Real Estate Market	**(D/REM)**	[Comments about how land development may be implicated by adaptation planning]	Stakeholders' references to real estate, development/developers, Florida Building Code, flooding/flood prevention, place attachment, and cooperation.
Flooding/Flood insurance	**(Fl)**	[Concerns about frequent/ persistent flooding and flood insurance rates]	Flooding is a major concern in Broward County/the Southeast Florida region; therefore, many participants explained that they were more concerned about the more immediate problem (flooding) over the longer-term problem of sea level rise. This code also indicates areas of the data in which participants discussed the effects of flooding on the real estate market, federal efforts to rebuild properties that had been damaged by flooding, and the issue of repetitive loss (i.e., any insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program within any rolling 10-year period since 1978; https://www.fema.gov/txt/rebuild/repetitive_loss_faqs.txt).
Building in flood zones/Building code	**(BC)**	[References to county building codes and controversy over building per existing regulations or above the existing code]	Much conversation in Broward County is centered on existing regional building codes and whether new construction should be built above code. During the COAST workshops, participants discussed the elevation/floodproofing option and suggested that new construction ought to be restricted (especially in flood zones) and that the building lifespan be taken into account to determine the level at/above code that a structure be developed.

Revenue/Economic value of land	**(R/EV)**	[Participants' conversations about how/whether adaptation efforts will affect development, insurance, and foreign investments in real estate]	This code identifies commentary about real estate as an intrinsic part of the economic development of Southeast Florida. It also identifies participants' concerns about how risk projections (e.g., coastal flooding) may negatively affect the real estate market/foreign investments.

Appendix D: List of Workshop Attendees

Name	Title	Organization
S.	-	citizen
P.	-	Friends of Hollywood FL Inc
C.	Green Team Advisory Committee	City of Hollywood Green Team
A.	-	City of Fort Lauderdale
L.	Natural Resource Specialist	BC Environmental Planning & Community Resilience Division
R.	Commissioner	Commissioner, City of Hollywood
F.	-	FAU
S.	Assistant Director	BC Environmental Planning & Community Resilience Division
F.	-	HBBA
A.	Environmental Analyst	City of Fort Lauderdale
B.	-	County Commissioner
H.	-	County Commission
T.	-	HLCA
M.	-	Hollywood
J.	Urban Planner	City of Fort Lauderdale
J.	Natural Resource Specialist	BC Environmental Planning & Community Resilience Division
S.	-	Hollywood
J.	-	Catalysis Adaptation Partners

C.	Natural Resource Specialist	BC Environmental Planning & Community Resilience Division
P.	-	BC Environmental Planning & Community Resilience Division
C.	-	Hallandale Beach
R.	Capital Project Manager	BC Highway Construction and Engineering Division
A.	-	Hollywood
K.	Engineer	BC Environmental Planning & Community Resilience Division
T.	-	BC Water Advisory Board - Technical Advisory Committee
J.	Environmental Projects Coordinator	BC Environmental Planning & Community Resilience Division
J.	-	Catalysis Adaptation Partners
A.	International Communications Advisor	NSU Oceanographic Center
L.	Director of Parking and Intergovernmental Affairs	City of Hollywood
B.	-	Dania Beach
R.	Environmental Project Manager	Port Everglades
M.	-	Marine Advisory Board, City of Deerfield Beach
H.	-	Broward County
A.	-	HLCA
E.	Parks and Recreation Manager	Broward Co. Parks and Recreation Division
M.	Natural Resource Specialist	BC Environmental Planning & Community Resilience Division
C.	-	O.R. Colan Associates; resident
T.	Senior Management Fellow	City of Fort Lauderdale
N.	Principal Planner	Port Everglades
B.	-	citizen
P.	-	Pompano Beach
K.	-	South Florida Regional Planning Council
P.	-	Dania Beach
J.	-	USGS
P.	CEO	The Energy Store
B.	Chair, Green Team Advisory Committee	City of Hollywood

A.	Executive Director	American Planning Association - Florida
D.	Economic Development Manager	City of Dania Beach
E.	-	City of Dania Beach
E.	-	Hollywood
E.	Urban Design & Planning Manager	City of Fort Lauderdale
E.	-	Hollywood
R.	Planner	City of Fort Lauderdale
B.	Transportation Planner	Broward MPO
G.	-	Florida Dept. of Transportation
J.	-	Hollywood
H.	-	USF
D.	-	Hollywood Gazette
L.	-	BC Emergency Management
K.	Administrative Coordinator	Broward County Commission - Dist. 4
W.	-	City of Hollywood

Appendix E: Survey One

JANUARY 29, 2015

Dear Community Leader:

This survey is part of an international research study called METROPOLE: An Integrated Framework to Analyze Local Decision Making and Adaptive Capacity to Large-Scale Environmental Change.

The study is led by the University of South Florida College of Marine Science, and funded by the National Science Foundation. This project is engaging stakeholders in communities in Brazil, the UK, and the US to help understand perceptions about hazards and preferences of adaptation options and funding sources in different communities.

The questions, issues and adaptation options in this survey do not necessarily reflect the views, ideas or plans of Broward County or of the participating cities.

The information derived from the surveys will be shared with you and other community leaders. All responses will be anonymous and held in strict confidence. The data will be reported in an aggregate manner.

Your perspective is very important. Thank you for filling out this survey.

SECTION 1: YOUR EXPERIENCE WITH HAZARDS

1. Which of the following natural hazards that seriously and negatively affected your household or town in the past ten years have you experienced? (Please circle either or both for each item, or No Experience).

	IMPACTED MY HOUSEHOLD	IMPACTED MY TOWN	NO EXP.
a. Storm surge			
b. Extended flooding			
c. High winds in storms			
d. Rising sea levels			
e. Coastal or beach erosion			

2) How concerned are you that the following natural hazards might seriously and negatively AFFECT YOUR TOWN in the next 10 years in terms of physical and economic damage? Please circle one answer for each hazard. Scale: 1 = Not concerned to 5 = highly concerned, 9 = Don't Know, 0 = Not Applicable.

						Don't Know	Not Applicable
a. Storm surge	1	2	3	4	5	9	0
b. Extended flooding	1	2	3	4	5	9	0
c. High winds in storms	1	2	3	4	5	9	0
d. Rising sea levels	1	2	3	4	5	9	0
e. Coastal or beach erosion	1	2	3	4	5	9	0

3) Thinking about the next 10 years, how concerned are you that these natural hazard may seriously and negatively affect YOUR PRIMARY HOUSEHOLD in terms of physical and economic damage? Please circle one answer for each hazard. Scale: 1 = Not concerned to 5 = highly concerned, 9 = Don't Know, 0 = Not Applicable.

						Don't Know	Not Applicable
a. Storm surge	1	2	3	4	5	9	0
b. Extended flooding	1	2	3	4	5	9	0
c. High winds in storms	1	2	3	4	5	9	0
d. Rising sea levels	1	2	3	4	5	9	0
e. Coastal or beach erosion	1	2	3	4	5	9	0

SECTION 2: QUESTIONS ABOUT POTENTIAL ADAPTATION ACTIONS

4. There are a variety of programs and actions a city or county could implement to reduce the potential for physical and economic damage caused by climate-related hazards. Which planning activities or programs do you think your local government(s) should implement, and when. For each item, please circle a number for the timeframe.

	Now	10 Years	25 Years	100 Years	Never	Unsure
A. Build new or higher seawalls	1	2	3	4	5	6
B. Build levees and use pumps to maintain dry areas	1	2	3	4	5	6
C. Require new buildings to be elevated above minimums required by National Flood Insurance Program to reflect expected local conditions	1	2	3	4	5	6
D. Use innovative or green technology to reduce flooding due to increased rains (ex. permeable surfaces, other storm water management systems)	1	2	3	4	5	6
E. Raise the height of canal flood gates	1	2	3	4	5	6
F. Create a plan to purchase vulnerable land and structures from residents	1	2	3	4	5	6
G. Create a plan to purchase vulnerable land and structures from small businesses	1	2	3	4	5	6
H. Restrict new building in highly vulnerable locations	1	2	3	4	5	6
I. Restrict rebuilding in highly vulnerable areas after major damage has occurred	1	2	3	4	5	6
J. Elevate or harden coastal transportation infrastructure — roads, bridges	1	2	3	4	5	6
K. Relocate vulnerable public facilities such as water and wastewater treatment plants	1	2	3	4	5	6
L. Conserve existing natural areas (such as wetlands or mangroves) to protect coastal areas	1	2	3	4	5	6
M. Restore/increase amount of natural areas (such as wetlands or mangroves) to protect coastal areas	1	2	3	4	5	6
N. Nourish beaches and build dunes	1	2	3	4	5	6
O. Climate proof ongoing infrastructure improvements and development efforts	1	2	3	4	5	6

P. Move public water supply/well fields away from the coast	1	2	3	4	5	6

SECTION 3: QUESTIONS ABOUT POSSIBLE FUNDING SOURCES

Like other large-scale public infrastructure projects, local governments will need to consider new funding sources to implement new hazard protection efforts. The next three questions ask your opinion about funding options.

5. Do you agree or disagree with the following statement: Implementing projects to reduce potential impacts of climate-related hazards in our community should be a local or regional government priority, even if it will require a slight increase in taxes or new fees? (Please circle one answer.)

1. Disagree strongly
2. Disagree somewhat
3. Agree somewhat
4. Agree strongly

6. Please consider the following funding options that local government and agencies could use/offer and tell us whether you think they are acceptable. Please CIRCLE a number for each funding option. Scale: 1=Not at All Acceptable, 2=SOMEWHAT ACCEPTABLE, 3=MODERATELY ACCEPTABLE, 4=HIGHLY ACCEPTABLE, 5=TOTALLY ACCEPTABLE

	Not	**Somewhat**	**Moderately**	**Highly**	**Totally**
A. Create a new county-wide resiliency fund based on property taxes	1	2	3	4	5
B. Develop a special district assessment which applies to properties in areas designated as highly vulnerable	1	2	3	4	5
C. Issue a bond (long-term borrowing) to finance public infrastructure improvements	1	2	3	4	5
D. Create a low-interest loan program for flood proofing	1	2	3	4	5

	and elevating residences					
E.	Add a flood resiliency surcharge on the monthly water utility bill (ex: specific to storm water drain improvements)	1	2	3	4	5
F.	**RAISE THE LOCAL SALES TAX SLIGHTLY. (OPTIONS UNDER THE LAW ARE EITHER ½ CENT OR 1 CENT PER DOLLAR.**)	1	2	3	4	5

7. If a referendum was put on the 2016 ballot to create a Community Resiliency Bond (a long-term loan) that would generate $100 million by 2036 to support multiple adaptation projects, how likely would you be vote for it?
(Please circle one answer.)

1. Would not vote for it
2. Somewhat likely
3. Moderately likely
4. Very Likely
5. Would vote for it

SECTION 4. PERSPECTIVES ABOUT ADAPTATION AND THE ENVIRONMENT

8. Some people in your community might NOT want to support local government adaptation plans. What do you think are some the most common reasons for NOT supporting plans? (Please CIRCLE up to 3 reasons.)

a. Lack of knowledge/understanding of future hazards and local consequences.
b. Adaptation actions will need funding – people are generally opposed to new fees and taxes.
c. Climate change is a distant issue. Other social/economic issues are more important now.
d. Distrust the media and news reports.
e. Uncertain about scientific data – no one really knows how bad it will get.
f. Local government doesn't have technical expertise to solve the problems.
g. Denial. People don't want to believe their homes will be impacted/don't want to move.
h. Businesses are concerned about the impact on real estate investments.
i. Concerns that tourism businesses and jobs will decline.

9. Are there other reasons why people in your community might NOT support local government adaptation plans? Please tell us your thoughts.

_____

_____

10. People have different views about managing and adjusting to the environment around us. We want to know if you agree or disagree with the views below. Please circle one answer for EACH item. Scale: 1 = Strongly Disagree to 5= Strongly Agree.

	STRONGLY DISAGREE	SOMEWHAT DISAGREE	UNDECIDED	SOMEWHAT AGREE	STRONGLY AGREE
A. We are approaching the limit of the number of people the earth can support.	1	2	3	4	5
B. Humans have the right to modify the natural environment to suit their needs.	1	2	3	4	5
C. When humans interfere with nature it often produces disastrous consequences.	1	2	3	4	5
D. Human ingenuity will insure that we do not make the earth unlivable.	1	2	3	4	5
E. Humans are seriously abusing the environment**.**	1	2	3	4	5
F. Earth has plenty of natural resources if we just learn how to develop them.	1	2	3	4	5
G. Plants and animals have as much right as humans to exist.	1	2	3	4	5

H.	The balance of nature is strong enough to cope with impacts of modern industrial nations.	1	2	3	4	5
I.	Despite our special abilities, humans are still subject to the laws of nature.	1	2	3	4	5
J.	The so-called “ecological crisis” facing humankind has been greatly exaggerated.	1	2	3	4	5

SECTION 5: DEMOGRAPHIC QUESTIONS

11. **What is your home zip code or postal code? _____**

12. **Please circle the Month and Day you were born.** (We need this to anonymously compare your responses in the second survey at the second meeting.)

    Jan Feb March April May June July August
    September October November December
    1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
    20 21 22 23 24 25 26 27 28 29 30 31

13. **What is your gender?** (Please circle one.) female male transgender

14. **How old are you?** (Please circle your age group)

    21-25 45-54
    26-34 55-64
    35-44 65+

15. **Do you have children or grandchildren under the age of 18 living with you?** (Please circle one.)
    Yes No

16. **What is your race/ethnicity?** (Please circle one.)

    Asian Indian/Native-American
    Black/African-American White/Caucasian
    Hispanic/Latino Other_____

17. **What was your total household income last year** (the income of yourself and everyone who contributes to your household and lives with you)? Please select one.

    - Less than $20,000
    - $20,000 to $39,000
    - More than $39,000 up to $63,000
    - More than $63,000 up to $102,000
    - More than $102,000 up to $150,000
    - Greater than $150,000

18. **Do you currently own a home or condo?** Yes__ No__

19. **In politics today, do you consider yourself a Republican, Democrat or Independent or other?** (Please circle one or write in.)
    Republican Democrat Independent Other_____

SECTION 5: DEMOGRAPHICS continued.

20. **What is the highest level of school you have completed?** (Please choose one.)
    - o DID NOT FINISH HIGH SCHOOL
    - o HIGH SCHOOL GRADUATE OR GED
    - o SOME COLLEGE OR ASSOCIATE DEGREE OR TECHNICAL SCHOOL
    - o 4 YEAR COLLEGE DEGREE (BA, BS)
    - o POST-GRADUATE DEGREE

21. **Finally, which of the following describes your role in your community AT THIS MEETING?** (Please choose all that apply to you.)

    - o Elected official (local, state, federal)
    - o Appointed official (board/task force member)
    - o Government staff (local)
    - o Government staff (state, national)
    - o Represent environment organization
    - o Represent neighborhood organization
    - o Represent business organization
    - o Technical professional (engineer, planner, economist, geologist, etc.)
    - o Research scientist (university, institute, government)
    - o Business owner in the local area
    - o Interested citizen
    - o Other _____

****

Thank you for completing this survey.
This information will be very helpful for developing future adaption planning efforts and community outreach and engagement programs.

Appendix F: Survey Two

March 26, 2015

METROPOLE Broward County Stakeholder 2nd Survey

Dear Community Leader:

Thanks for participating in the second Broward County workshop. This is the last survey that is part of an international research study called: METROPOLE: An Integrated Framework to Analyze Local Decision Making and Adaptive Capacity to Large-Scale Environmental Change. The study is led by the University of South Florida College of Marine Science and funded by the National Science Foundation.

The information will help us to understand local perceptions of coastal hazards and preferences for how to develop adaptation actions. The results will be shared with your community, but all individual responses will be anonymous and held in strict confidence. The data collected here will only be reported in aggregate.

The questions, issues and adaptation options in this survey do not necessarily reflect the ideas or plans of Broward County or the cities participating in the today's meeting.

Please be sure to include your zip code and birth day and month, in order for us to match your surveys.

Your perspective is very important. Thank you for filling out this survey before you leave.

SECTION 1: Matching information

1. **What is your home zip code or postal code? _____**

2. **Please circle the Month and Day you were born.** (We need this to anonymously compare your responses to the survey from meeting one.)

Jan Feb March April May June July August
September October November December
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
20 21 22 23 24 25 26 27 28 29 30 31

SECTION 2: YOUR CURRENT VIEWS ON THE HAZARDS

3. **Thinking about the next 10 years, how concerned are you that these natural hazards may seriously and negatively <u>AFFECT YOUR TOWN</u> in terms of physical and economic damage?** Please circle one answer for each hazard.

Scale: 1 = Not concerned to 5 = highly concerned, 9 = Don't Know, 0 = Not Applicable

						Don't Know	Not Applicable
a. Storm surge	1	2	3	4	5	9	0
b. Extended flooding	1	2	3	4	5	9	0
c. High winds in storms	1	2	3	4	5	9	0
d. Rising sea levels	1	2	3	4	5	9	0
e. Coastal or beach erosion	1	2	3	4	5	9	0

4. **Thinking about the next 10 years, how concerned are you that these natural hazards may seriously and negatively affect <u>YOUR PRIMARY HOUSEHOLD</u> in terms of physical and economic damage**? Please circle one answer for each hazard.

Scale: 1 = Not concerned to 5 = highly concerned, 9 = Don't Know, 0 = Not Applicable

						Don't Know	Not Applicable
a. Storm surge	1	2	3	4	5	9	0
b. Extended flooding	1	2	3	4	5	9	0
c. High winds in storms	1	2	3	4	5	9	0
d. Rising sea levels	1	2	3	4	5	9	0
e. Coastal or beach erosion	1	2	3	4	5	9	0

SECTION 3: QUESTIONS ABOUT POTENTIAL ADAPTATION ACTIONS

5. **There are a variety of programs and actions a city or county could implement to reduce the potential for physical and economic damage caused by climate-related hazards. Which planning activities or programs do you think your local government(s) should implement, and when?** For each item, please circle a number for the timeframe.

	Now	10 Years	25 Years	100 Years	Never	Unsure
A. Build new or higher seawalls	1	2	3	4	5	6
B. Build levees and use pumps to maintain dry areas	1	2	3	4	5	6
C. Require new buildings to be elevated above minimums required by National Flood Insurance Program to reflect expected local conditions	1	2	3	4	5	6
D. Use innovative or green technology to reduce flooding due to increased rains (ex: permeable surfaces, other storm water management systems)	1	2	3	4	5	6
E. Raise the height of canal flood gates	1	2	3	4	5	6
F. Create a plan to purchase vulnerable land and structures from residents						
G. Create a plan to purchase vulnerable land and structures from small businesses	1	2	3	4	5	6
H. Restrict new building in highly vulnerable locations	1	2	3	4	5	6
I. Restrict rebuilding in highly vulnerable areas after major damage has occurred	1	2	3	4	5	6
J. Elevate or harden coastal transportation infrastructure — roads, bridges	1	2	3	4	5	6
K. Relocate vulnerable public facilities such as water and wastewater treatment plants	1	2	3	4	5	6
L. Conserve existing natural areas (such as wetlands or mangroves) to protect coastal areas	1	2	3	4	5	6
M. Restore/increase amount of natural areas (such as wetlands or mangroves) to protect coastal areas	1	2	3	4	5	6
N. Nourish beaches and build dunes	1	2	3	4	5	6
O. Climate proof ongoing infrastructure improvements and development efforts	1	2	3	4	5	6

P. Move public water supply/well fields away from the coast	1	2	3	4	5	6
COAST Meeting #1 Community Chosen Options						
Q. Require buildings (new and rebuilds after storms) in Broward County to be elevated to 100-year flood height plus 3 feet, to protect against a 100-year storm surge plus expected sea level rise	1	2	3	4	5	6
R. Create a plan to purchase vulnerable land and structures predicted to be permanently lost to sea level rise, from property owners in flood zones	1	2	3	4	5	6

SECTION 4: QUESTIONS ABOUT POSSIBLE FUNDING SOURCES

Like other large-scale public infrastructure projects, local governments will need to consider new funding sources to implement new hazard protection efforts. The next three questions ask your opinion about funding options.

6. **Do you agree or disagree with the following statement: Implementing projects to reduce potential impacts of climate-related hazards in our community should be a local or regional government priority, even if it will require a slight increase in taxes or new fees.** Please circle one answer.

1. Disagree strongly
2. Disagree somewhat
3. Agree somewhat
4. Agree strongly

7. **Please consider the following funding options that local government and agencies could use/offer and tell us whether you think they are acceptable.** Please CIRCLE a number for each funding option. Scale: 1=Not at all Acceptable, 2=Somewhat Acceptable, 3=Moderately Acceptable, 4=Highly Acceptable, 5=Totally Acceptable

	NOT	SOME-WHAT	MODER-ATELY	HIGH-LY	TOTALLY
A. Create a new county-wide resiliency fund based on property taxes	1	2	3	4	5
B. Develop a special district assessment which applies to properties in areas designated as highly vulnerable	1	2	3	4	5
C. Issue a bond (long-term borrowing) to finance public infrastructure improvements	1	2	3	4	5

D.	Create a low-interest loan program for flood proofing and elevating residences as modeled in the COAST analysis	1	2	3	4	5
E.	Add a flood resiliency surcharge on the monthly water utility bill (ex: specific to storm water drain improvements)	1	2	3	4	5
F.	Create a local optional surtax	1	2	3	4	5
		1	2	3	4	5
G.	Create public funding to buy out at-risk properties in the V-zone as modeled in the COAST analysis					

8. **If a referendum was put on the 2016 ballot to create a Community Resiliency Bond (a long-term loan) that would generate $100 million by 2036 to support multiple adaptation projects, how likely would you be to vote for it?**

Please circle one answer.

1. Would not vote for it
2. Somewhat likely
3. Moderately likely
4. Very Likely
5. Would vote for it

SECTION 5. PERSPECTIVES ABOUT ADAPTATION AND ENVIRONMENT

9. **Some people in your community might NOT want to support local government adaptation plans. What do you think are some of the most common reasons for NOT supporting plans?** Please CIRCLE up to 3 reasons.

a. Lack of knowledge/understanding of future hazards and local consequences.
b. Adaptation actions will need funding – people are generally opposed to new fees and taxes.
c. Climate change is a distant issue. Other social/economic issues are more important now.
d. Distrust the media and news reports.
e. Uncertain about scientific data – no one really knows how bad it will get.
f. Local government doesn't have technical expertise to solve the problems.
g. Denial. People don't want to believe their homes will be impacted/don't want to move.
h. Businesses are concerned about the impact on real estate investments.
i. Concerns that tourism businesses and jobs will decline.
j. None of the above

10. **To keep improving the process of community exploration of adaptation choices, please tell us what you think about the information that was presented and discussed today.** Please circle a number for each of the following statements on a scale of 1= Strongly disagree, 2=Somewhat disagree, 3= Neutral, 4 = Somewhat Agree, 5= Strongly Agree.

	Strongly Disagree	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**
A. The technical information was presented in a clear and understandable manner.	1	2	3	4	5
B. The technical information was credible.	1	2	3	4	5
C. The cost/damage information was credible.	1	2	3	4	5
D. I am more knowledgeable about local risks and impacts of long-term hazards than	1	2	3	4	5

	before the meeting.					
E.	I am more knowledgeable about different adaptation options than before the meeting.	1	2	3	4	5
F.	I think it is likely that my local government(s) will need to implement some of the adaptation options discussed.	1	2	3	4	5
G.	I agree with the group's general judgments about the adaptation options in the group keypad polling.	1	2	3	4	5

11. **Please tell us what reasons (i.e., factors, beliefs, information) most influenced your thoughts about supporting or not supporting the adaptation options presented at the workshop.** Write your comments in the box or on the next page if needed.

12. **Lastly, please help us understand what you/your organization might do with this information in the next three months.** Circle ALL that apply.

1. Share information with community members at next neighborhood or homeowner association meeting.
2. Contact my local elected official to inquire about existing plans and ask that attention be given to this issue.
3. Schedule departmental or interagency meetings to discuss information and determine next steps.
4. Schedule meeting with my leadership/senior management to discuss information and determine next steps.
5. Conduct an internal review of plans and budgets.

6. Update/incorporate information into existing plans.
7. None of the above/Other_____

Thank you for completing this survey.
This information will be very helpful for developing future adaption planning efforts and community outreach and engagement programs.

Appendix G: In-Depth Interviewing Instrument

1. [Obtain verbal consent] Do I have your permission to interview you today?

2. Do I have your permission to access your survey to cross-compare survey results with interview? This would just provide me with more data to analyze in my dissertation.

3. In order to anonymously keep track of your identity, please provide the first three numbers of your zip code, and the month and day of your birth.

4. Thinking about your perspective on coastal hazards and sea level rise, how – or did - did your level of concern about sea level rise change after seeing the COAST visualizations? I'm referring to the maps that were shown to you during the first workshop and the maps showing inundation and adaptation actions, elevation and floodproofing and voluntary buyouts from the second workshop.

5. Did the visualizations affect your level of concern about how sea level rise may affect your community? Did they affect your level of concern about your home/property?

6. What concerns you most regarding the potential effects of storm surge and sea level rise?

7. What regional assets (buildings, homes, cultural – like museums, etc.) do you think should be prioritized in adaptation planning discussions? Why?

8. Now I want to ask you about the adaptation actions that were modeled and discussed during the second meeting. Would you support the voluntary buyout adaptation option if a regional asset (office building, church, school, etc.) was identified as a flood-prone property? Why or why not? Do you see advantages to this option? Do you see disadvantages?

9. Would you support the elevation/floodproofing adaptation option if a regional asset was identified as a flood-prone property? Why or why not?

10. Other than voluntary buyouts or elevating/floodproofing, were there other adaptation strategies that you would have liked to discuss? Are you familiar with what other regions/cities may be doing? For instance, beach re-nourishment for better retention of shoreline and property, revising building codes, sea walls, elevating or hardening transportation infrastructure, etc.

11. How does the uncertainty of the COAST models affect your confidence in their predictions? For instance, there were a number of factors that participants at the first meeting identified as being absent from the modeling factors …

12. Are there other factors that you would have liked to seen accounted for in the COAST models?

13. What is at stake in decision making about adaptation planning in this region?
What seems to be the most contentious or argued about factor among decision makers or politicians? What do you think may be "holding up" adaptation planning?

14. Who do you think should take the lead in responding to this region's coastal hazards? Meaning on a regional level, municipal or state-led …

15. What is your level of confidence about a regional approach to adaptation planning? Do you think that regional approaches – similar to the COAST process – are effective ways to approach the adaptation planning process?

16. How would you describe a bottom-up approach to adaptation planning? Bottom up: regionally led initiatives (versus national guidelines or mandates) for policy making that asks citizens and stakeholders to engage with regional leaders in making decisions about policy.

Appendix H: 50 Most Frequently Used Words within Data Sources

Word	Count	Similar Words
floods	175	flood, flooded, flooding, floods
level	172	level, levels
think	164	think, thinking
adaptation	159	adaptation, adapting
concerned	155	concern, concerned, concerning, concerns
people	145	people, peoples'
buildings	140	build, building, buildings
plans	135	plan, planning, plans
highly	134	high, highly
property	126	properties, property
models	125	model, modeled, modeler, modeling, models
areas	122	area, areas
years	120	year, years
regional	116	region, regional, regionally, regions
elevation	112	elevate, elevated, elevating, elevation, elevations
rising	110	rise, rises, rising
water	105	water, watered, waters
storm	102	storm, storms
local	98	local, locally
likely	88	like, liked, likely
coastal	84	coastal
agree	83	agree, agreed
participant	83	participant, participants, participate, participated, participating, participation
damage	81	damage, damaged, damages
option	80	option, optional, options
just	79	just
need	79	need, needed, needs
community	77	communicate, communicates, communication, communities, community
hazards	76	hazard, hazards
support	76	support, supporting
next	75	next
vulnerable	75	vulnerabilities, vulnerability, vulnerable
natural	73	natural, nature
infrastructure	72	infrastructure
acceptable	71	accept, acceptable
making	71	make, makes, making

government	70	governance, government
impacts	69	impact, impacted, impacting, impacts
create	68	create, created, creating
affect	66	affect, affected
meetings	66	meet, meeting, meetings
coast	65	coast
want	65	want, wanted, wanting, wants
strongly	64	strong, strongly
beach	63	beach, beaches
county	60	counties, county
development	55	develop, developed, developer, developers, developing, development
climate	54	climate
funding	54	fund, funded, funding, funds
floodproofing	54	floodproof, floodproofed, floodproofing

Appendix I: Final Comparison of Cost-Benefits Analysis of Adaptation Action

Costs and Benefits of Action	Floodproof and Elevate		Voluntary Buyouts	
	Low SLR	High SLR	Low SLR	High SLR
Damages (with no action)	$1.677	$2.388	$1.677	$2.388
Damages (with action)	$0.420*	$0.597*	$1.469*	$2.210*
Avoided damages	$1.257*	$1.791*	$0.208*	$0.178*
Cost (low estimate)	$0.057	$0.057	$0.351	$0.351
Benefit-Cost Ratio	**22**	**31**	**0.6**	**0.5**
Cost (high estimate)	$0.117	$0.117	$0.526	$0.526
Benefit-Cost Ratio	**11**	**15**	**0.4**	**0.3**

Appendix J: Workshop One Field Notes

COAST workshop host/organizer one:

Today we're going to investigate compounded impacts of storm surge and sea level rise and brainstorm adaptation strategies and use models. To all of the agency employees, staff, residents, forget who you are today and think of yourself as residents and think through this process without your preconceived notions of what we're doing or what we should be doing.

Here's an aerial of what pre-developed south Florida looked like [aerial of pre-developed, pre-1950s South Florida]. Here's an aerial of post-development Broward County. In the 1950s … we tried to restrict the flow of water, to protect ourselves from flooding …

Today … coastal hazards and their implications such as storms and hurricanes, severe winds, flooding, loss of service and property, erosion, nuisance flooding, and a predicted increase in storm frequency and intensity all factor into our environment. We'll be looking at models today … the value of modeling is to help understand connections, future scenarios, test strategies, see trends, compare, but "data in and data out" does not account for everything …

Currently, we are active in implementing adaptation strategies, these are being incorporated into our land use plan. The Southwest Florida Water Management District has installed pumps, gates, levees, C4 impoundment (storage), and is working on Everglades restoration – increased flow …

At the city level, base flood elevations plus one to five feet … adaptation action areas … tide valves … and some property owners are raising their seawalls (~1.5 feet).

I'm going to warn you that today's going to be a little scary. A lot of effort went into developing different tools – assessment tools, grant-funded decision support tools, USGS inundation modeling, 3-D flood visualizations, a vulnerability map, infrastructure replacement cost estimates, etc.

One of the innovation strategies we might want to consider is beginning with resilient redesign workshops, where experts from international water management, architects, and engineers, planners … from Netherlands … and creatively developed innovative strategies to respond to coastal hazards.

Locally, there is a lot that is already being done to research and address these issues. The county climate change action plan, which was developed about five years ago and which we are revising now, is moving forward "thoughtfully" with plans and implementation and is also focused on GHG emissions.

There is a government operations workgroup on local mitigation strategy …

Also, a grant from Environmental Protection Agency to develop decision support tool …

We've also started to do cost estimates – things like transportation infrastructure, critical infrastructure within county, what it would cost to fortify these systems.

The next phase will be developing models of resilience that can be copied by other counties …

So let's celebrate the innovation and ingenuity of where we are going! In the 1950s, we did the impossible … developed the Everglades … so this should be easy, right? Adapting to climate change and protecting ourselves from hazards and storm surge requires us to be innovative …

COAST workshop organizer two:

The METROPOLE grant is a three-country research initiative …

This meeting is funded by NSF regarding coastal vulnerability …

The knowledge that we're going to gain from you about this kind of information will help us to develop resources and tools for communities with similar vulnerabilities …

We've decided to reach out to Broward County because here there is a lot of proactive cooperation among different levels of government.

The information that we will gather from this study will turn into professional documents to be used in planning, etc.

Florida has one of largest groups of urban planners in the country

Figuring out how to turn this into useful, technical information for planners (economic development, community engagement, citizen groups, determining what these groups need to know to make decisions) is the purpose of our time here.

COAST workshop organizer three:

The approach that you will be involved in helping with today is one that is aimed at long-term coastal adaptation to coastal hazards like storm surge, sea level rise and flooding. You will be asked to choose parameters or figuring out what aspects of coastal change will be modeled between this meeting and next meeting. Our survey is trying to get a handle on how different people's backgrounds, perceptions of environment, etc. affect our judgments about what are our highest values and priorities.

Participant question [question asked by a solar industry professional]:

In the survey, there is no mention of ocean acidification, mercury, and most dramatic impacts …

COAST workshop organizer three:

The survey has to zero-in on the… not a study of ocean health, but mostly the impact on the coast … but if you try to compact a survey to the most salient information …

Help us understand how this information is judged, how people respond to it, etc. and set us up for the second COAST workshop.

Participant question:

Saltwater intrusion is missing from the survey, too.

COAST workshop organizer three:

Saltwater intrusion is big problem … in this particular case, we can't cover all of that because the COAST approach really deals with the impacts of sea level rise and storm surge on property and on the economic resiliency and sustainability of an area as affected by those impacts – it is more spatial and doesn't deal with intrusion. Please take the survey now – it should take about 20 minutes – thank you for engaging in this participatory process where you will determine major parameters, etc. …

COAST workshop facilitator:

First I'm going to talk about what the COAST software does. In general, it predicts dollar damages from various amounts of sea level rise … many organizations in the US have come up with sea level rise viewers … but what differentiates COAST is that it is used to calculate dollar damages to buildings in flooded areas. This is ratcheting up a step.

We use this tool to try to calculate the cost of damage from a one-time event in future (100-year storm in 2030) or to count up cumulative damage over time from all different-sized storms that might appear.

The calculator inside the software will throw storms every year for a scenario and come up with cumulative damage over time.

Then we look at which parcels are low enough that with two feet of sea level rise …. how many parcels of land we might lose to sea level rise.

What would happen if no action is taken? What would happen if today's pattern … how that would look in the future?

For 2030 and 2060, we did a one-time damage assessment of cumulative damage to infrastructure.

This is important – what the model does and doesn't do. It is more than just a model with damage numbers. We can work together to explore and create positive options. The reason why we're showing potential damage numbers is to have a good discussion about what can be done and what makes sense to do. We want to make sure that our tax dollars are spent wisely and that the model results are a way to get action started: modeling is a way to get action started.

There are limits to this model – caveats. For this project, the only assets we looked at were buildings. We didn't look at damage to roads, drains, sewers, or other infrastructure.

The model only tallies damage from flood water levels and does not include wind or wave action that would probably come with surges; building contents were not considered; and building values based on tax assessment numbers that are often lower than market rates.

All these factors make the model damage numbers relatively conservative.

Participant 33022-0125:

The biggest problem is groundwater – the model doesn't take into account groundwater … We've modeled this and you'll find in SE FL that groundwater is a bigger driver and you see far more flooding inland than you see on the coast …. If you don't include that that is a bit of a problem … looking at surges …

COAST workshop facilitator:

You're right, we didn't do groundwater modeling or include groundwater modeling results.

Participant 33022-0125:

So you really ran a surge, not sea level … ?

Participant question:

I went through the Hurricane Wilma in the Keys … a number of the properties that were ground level … damage is one thing but uninsurable … these properties are no longer viable in conventional markets.

COAST workshop facilitator:

The model assumed that if the building gets damage, it will be fixed and put back in service.

This model does not take into account abandonment and it looked at both public and private buildings.

Participant question:

Is there a plan in place to do more studies to include all of these things that haven't been included here? And has building lifespan been factored in …?

COAST workshop facilitator:

Here's what is in the model. High and low sea level rise estimates from the county compact unified sea level rise assumptions. At 2030, three to seven inches. At 2060, nine inches. Surges heights from all storms with sea level rise.

For cumulative damages, we used surges from the 10, 50, and 100-year storms using 2014 FEMA flood study and maps and SLOSH models from other studies. For one-time damages, we used today's nuisance flood level at 1.05 feet and a Wilma-sized event at six feet. Then we added the sea level rise values over time …

COAST virtually flooded the land, measuring the depth of flooding at the center of each parcel. Property appraiser records were used to classify buildings as elevated or not, according to the year the building was built. COAST uses LiDar – light detection and ranging … but can't assess peat or limestone in ground … We used USACE tables for predicted percentage damage to a building based upon how deep the floodwaters get at its base.

There were ten one-time damage estimates – for the year 2015, nuisance flood and no SLR. For the year 2030, nuisance flood and low sea level rise of three inches. For the year 2030, the model calculated high sea level rise of seven inches. In 2060, it was calculated with a low sea level rise of nine inches.

There were four cumulative damage estimates …

Participant 33022-0125:

This model does not take into account that our porous limestone … damage to buildings with certain amount of surge and sea level rise and depth of water seeping in … and how much damage … there is more than one thing operating here and you're only showing us one thing – It almost seems like it isn't valid.

COAST workshop facilitator:

The level of effort involved in this type of modeling, which is relatively simple … the retail value of the product we're providing you with today is about $30-50K, so if you were to do hydrologic modeling … that sort of modeling is at a different level of cost … Looking at a surge and surface water depth will be useful to you … but yes you're right, it doesn't include groundwater damage and we've just focused on building damage and not on infrastructure, contents, drains, sewers, utilities, etc.

Participant question:

I don't know what your connections are, but I'm really concerned about this but from what I'm reading in the survey we're trying to do something that may cost billions … $100 thousand compared to billions …

COAST workshop facilitator:

Have the cities ever gotten any kind of cumulative assessments of damage? Believe me, you can spend a lot more time and get a lot more information, but this is a good first step or if you can't think of it as that, just a first step

COAST workshop organizer four:

The county has actually worked with USGS to start to do very sophisticated modeling of surface water and groundwater and it's at a point that we're starting to be able to use that … but we need to build on pieces we're starting to assemble but JT's [Lockman] group is cutting edge and we're not at a point where we can generate perfect models … of course that doesn't give you the whole picture but we're trying to get a fuller picture, so we already know that we don't have good elevation data for particular parcels, and FEMA can help us to improve that level of information but maybe we need to look at that and collate that information so that when we do modeling exercises, we have more inputs and can have a better and fuller picture. This is a slice of the full picture and is dependent on a lot of data that we aren't super confident in … this is a thought experiment to give us indications of areas we might really need to focus attention on … we want to caution you that this is not a future prediction this is information so that we can plan better, and make better investments.

Participant four:

This is a great first step but we have three different counties that we need to look into regarding maritime docks, piers, etc. and our county is quite different than others… if we want to determine the damage to our area, we need to factor that into this model …

-Break-

Participant question:

As a frame of reference, what is the total value of the property … What was dollar amount of damage done by Wilma?

Have you considered the Gulf Stream, which has a strong north wind, we get more erosion without a king tide if the winds are right …?

Participant question:

The frequency of nuisance tides increases proportional (directly) to sea level rise, so with two feet of sea level rise, it will reach 1.05 about 40 times a year … so MUCH more frequently.

COAST workshop facilitator:

What you get at 6 foot surge, increased by three feet, 2030 low sea level rise. Now you can see a lot more damage … see the difference between three and seven inches … [graphical representation of pattern of damage.] You can learn a lot from patterns of damage: despite the factors that weren't included, you CAN see the differences – spatially – given different depths of sea level rise and flooding. The airport terminal/runways seem to be in good shape, but hangers, maintenance buildings, offices … those are incredibly vulnerable – terminal building is more protected … at risk of damage. $9.4 billion is the value of area today. In this visual [Wilma-sized flood in 2060 with low sea level rise]. The land value isn't included in damage …

Now let's look at the Broward County South study area.

Participant question:

Since immediately south of study area is a more expensive area … how will the impacts and coastal vulnerabilities there differ from the study area used here?

[Facilitator invites questions/discussion/comments …]

Participant 33020-0625:

It would be interesting to know the effect of whether these properties were removed from tax rolls, what would the impact be on tax revenues for these areas? That would be really helpful for people who are making decisions to know that. Can you break up data sets by municipality?

COAST workshop facilitator:

It could be done …

Participant question:[1]

Has anyone checked to see how these numbers correlate with insurance companies' assessments?

COAST workshop facilitator:

CoreLogic – a reinsurer of insurers … has been doing studies on east coast in FL up through Boston, (pre-Sandy), they are using a similar system and they determined that in six foot surge, 25% of damage would occur outside of FEMA flood zones.

Question from private citizen/participant:

My daughter lives on the beach in a duplex built in 1993, to elevation of six feet and her flood insurance is six times what it would have been and she's higher than surrounding properties …

COAST workshop facilitator:

It is very difficult because a lot of times … we get involved with people who are upset about FEMA and flood insurance rates and premiums.

Participant question:

My concern has to do with infrastructure which your model doesn't include … but let's say that water is rising and sewer and water systems aren't functioning properly … the fact that we're occasionally going to have damage to buildings isn't as important as the fact that if we don't have support systems that we take for granted …

COAST workshop facilitator:

We're really at cutting edge of trying to figure all of this out with GIS … we've been doing network analysis because there are certain places where if you can't get in … but if you can't get there, it's worthless … what we're offering you here is a look at building structures …

[1] This participant also made the comment above regarding Hurricane Wilma.

Participant question:

How did you determine study area?

COAST workshop facilitator:

Catalysis [his company][2] offered to evaluate $10,000 of parcels so we looked at maps and … looked for vulnerable area … and then drew boundaries around areas that reflected different types of buildings … most vulnerable in Broward County, different features, commercial residential, infrastructure types, etc. and including other studies that were currently going on in those areas … so layering those existing models with this model would provide a fuller picture.

Participant question:

You told us about what's going to happen but you can't tear the buildings down, and you can't raise them up, but you can probably get people to stop building east of the construction line … and that may help alleviate the problem …

Deliberation Session One: Adaptation Option One (elevation and floodproofing)

COAST workshop organizer three:

What can we do to lower damage numbers? Adaptation action one is to elevate and floodproof (accommodate). This suggestion would model elevation in V-zones, floodproofing in A-zones to different levels of heights, which is all subject to your input. So this is a thought experiment: let's pretend that 100% of all eligible buildings were protected … "subject to your input" We're going to ask you folks … if there was a grant program or subsidized program where people in your community could "get elevated," what would the participation rates be?

Participant comment:

Who owns all this land? This is where the new Publix is? All the green buildings are Hollywood buildings …"

Participant one:

Does everyone know where they're looking? Port Everglades, I can see that where I live, you all live on this map!

Participant two:

I live on one of the green spots [pointing out/familiarizing with buildings and where group members live …]

COAST workshop organizer three:

[2] The COAST tool developers and consultants were initially employed by Catalysis Adaptation Partners, LLC (CAP); however, during year two of the grant, CAP was acquired by Geotechnical Engineers, Inc. (GEI). For simplicity, Chapter Three, Part One of this project explains that the COAST tool is a GEI consulting product.

We are going to discuss elevation … purpose is to share thoughts about this, some of you have experience with this … so we want to have an open discussion about elevation as an option and then that will lead to keypad polling where everyone weighs in on what parameters should be used for the next stage of modeling.

The primary question here is, what percentage of eligible property owners who aren't elevated yet in areas noted on map … there will be a little bad data in there but that's everything … do you think would voluntarily participate in elevating – the question at this time is not about funding sources, it's about what percentage would agree to participate.

What elevation do you think such a program should be set to?

What are your experiences with the various elevations?

Participant 33020-0625:

… feasibility of elevation – I live on the far side of that green area and almost all of those houses were built on concrete slabs – can you elevate a house that is on a concrete slab? Do we have any engineering people who can answer that?

Houses that are multi-storied – is it possible to take out the first floor and use that as the elevation?

What about houses on slabs with embedded utilities …

Participant two:

We're concerned about the water coming in from the ocean … it seems to me like you should protect by the ocean …why aren't more properties shown as vulnerable along the coastline?

Participant three:

What about flood gates erected? At the beach, you'll have six-foot sea walls …

Participant four:

I'm with Dania beach and we recently had an issue where the airport put a runway and the houses were getting too much noise … in some cases they're putting $125,000 of sound proofing the houses … the residents didn't want to leave … my assumption is that these neighborhoods have been there for years … those people aren't going to want to move. People just put up to it and move forward … but is weather proofing an option too? To elevate those houses you have to knock them down and raise them up …?

COAST workshop organizer three:

Aside from utility and slab issue - I've been in New England too long to know about foundations and basements - it's possible to lift up small structures … with respect to the floodgate question …

Participant two:

Year after year the federal government rebuilds … if they are damaged, the government pays for it and then they live there again …federal government has paid for repetitive losses. For "us" though we don't have repetitive loss, we have the most policies, but actually repetitive two or more, we don't have enough to buy out from NIP because we don't have that amount of repetitive loss from storms …

COAST workshop organizer three:

This action is a planning option, not specifically NFIP … [cites numerous statistics]

Participant five:

I see we have study area north and south … the properties in red?

COAST workshop organizer three:

It's cumulative for both study areas … these properties aren't elevated but might be affected.

COAST workshop organizer three:

… in some cases with this approach, an option may be well thought out and judgments may be made about vulnerable properties … but the cost benefits ratio … turns out that might not be the best payout. Other factors are avoided costs … so the he right question is, who would be willing to do this and who wouldn't … ? The primary question here is, what percentage of eligible property owners who aren't elevated yet in areas noted on map do you think would voluntarily participate in elevating – the question at this time is not about funding sources, it's about what percentage would agree to participate.

Participant six:

We need more parameters to make those decisions. [making a judgment about the percentage of people who would support the elevation/floodproofing option].

What is the context … this question is hard to answer if we're talking about hotels and other properties, which would be very open to participating dependent on who is paying, versus homes, where the homeowner may be financially responsible.

We just don't know that. We can help you figure out the factors that would affect people choosing to or not to participate but we can't tell you if they will or won't. It's not just funding – it's other things … given my house and the way it's constructed, it might be … my decision will change depending on the funding structure … so we have to know that.

Participant seven:

We need to assume that all conditions are the same but we are looking at which scenario is likely to be more successful … in general people are going to do the least amount possible versus … people just don't like change

Participant four:

You have the most valuable land right there in Florida … and the same is true in Dania Beach … if I have to swim to it I will swim to it … "

Participant six:

When we're voting on what percentage of people would go for a buyout? Is there any assumption that we support it? We should also guess a percentage of people who would support such a program … that's a big deal for where the money is coming from?

Participant 33020-0625:

Are we assuming that there is a big pile of money somewhere for doing this?

COAST workshop organizer three: The reason is to model choices. We don't know yet. We want to look at avoided damage costs versus having to fund the level of mitigation and hazard that is chosen. You have to take it on faith that this is a step to explore what might happen if we made this decision …

Participant 33020-0625:

As a property owner, do I pay to stay or …

COAST workshop organizer three:

Very rarely does this action take place without higher levels of funding … but there is owner money being put into these things but you just have to make your own judgment about what percentage of these properties might choose to elevate … you're just being asked to make a judgment.

Participant five:

Could we assume that the properties in red … will be more likely to relocate whereas the green properties are more likely to pick a program of elevate or relocate?

Participant 33020-0625:

I just want to make a point of how high … these are older homes or properties that were built a long time ago all my neighbors tell me that their properties never flooded until they were elevated … and it's like a dam so when we think about how high, the water has got to go somewhere so that will affect the properties located near them … they're going to be the ones that flood as a result of elevation in another area … am I negatively impacting my neighbor?

Participant five:

Yes, if you're doing fill, you're just offsetting that water to someone else …

Participant four:

At this level here, 5th Ave, that's a height of 6 feet. You've got ocean front, us 1, at about 11 feet so there's no danger here, so these properties would just have to be weather-proofed to withstand the impacts.

Participant 33020-0625:

I live in an area with concrete slabs that were built in the 50s but now it floods so I get flooded … so something like this has to bring people together on an area basis because whoever holds out and doesn't do it …

Participant two:

What about just sucking the water out of there?

Deliberation Session Two: Adaptation Option Two (Voluntary Buyouts)

COAST workshop facilitator:

… to address the question of modeling flood gated Port Everglades, I guess so but we're staged up to model this sort of elevation then we have to do that in a separate project … as far as what to do about

houses on slab … when I run the model, I run it for high and low cost estimates for elevation … $160,000 to raise a house on a slab because it's heavier … we run cost estimates to capture the variety of consequences of raising … green properties will be flood proofed and I will virtually cause them to have no damage until 9 feet.

Participant 33020-0625:

That won't work … water comes in differently than that … you can look in the storm drain and see water when it isn't flooding …

COAST workshop facilitator:

Floodproofing means you have windows/doors retrofitted so that they're sealed water tight … shutters that can go over openings … walls treated so everything battened down up to height of 8 feet. The infrastructure in the red area would go on stilts. Infrastructure in the green area would be flood proofed. This is a thought experiment.

COAST workshop facilitator:

Each one of these is a parcel – 44 red, 155 green, what GIS mapping does is that if 6 are in a row, they look as though they're run together … what we're going to talk about is voluntary buyouts – the basic scheme is that property owners are offered property buyouts … if they are red, their property is predicted to become overrun by SLR by 2045 and if green, they are in area where predicted that SLR would take property between 2030 and 2060. That would be daily high tide washing over property … the red properties would be in phase one of program where we predict they'll be flooded out by daily tide … we'd offer them payment now and the property would transfer in 2020 (so the resident still has five years on the property) and after that time, the owner would be gone and they could revert building to natural state.

In phase two, green properties – overtaken by sea level rise between 2030 and 2060, we would offer payment in 2025 and title of property would transfer five years later in 2030. There are other parameters of this idea, too. It would not be offered on undeveloped land, and there isn't money out there for this now, but we want you to assume that if this were to occur, they would get money somehow. Imagine that we're not going to worry about where the money will come from but … we're just exploring here, this is a thought experiment so I don't want you to feel like you're endorsing this idea, we're just doing a what if idea …

COAST workshop facilitator:

We're going to ask you to vote on … what you would like to see modeled. We'll vote on the specifics like whether you prefer for us to model building elevation above the FEMA minimum requirements and overall, whether you want us to even model the elevation/floodproofing and voluntary buyout options.

Participant four:

We have people that are ready to invest $50 million in those spots right now …

COAST workshop facilitator:

We would pay people for their building and land … let me explain data issues … if the property said it had a building …

Participant 33020-0625:

Do you assume 100% of appraisal value or is there a fraction of that?

COAST workshop facilitator:

Take the assessed value of land and buildings, they get to live on that for five years, you discount 3.3% a year for five years … take out 3.3% a year for five years … reflecting fact that they get five years on property …

Participant 33020-0625:

You know that if we had a significant event, those numbers would change dramatically.

Participant four:

It really depends on property owner breakdown of how this recommendation comes together …

COAST workshop facilitator:

In a real buyout situation, a property appraiser would be called to determine real appraisal …

Participant six:

If you have a hotel you assume operations over next few years … so it's hard to determine how that would play out …

Participant seven:

Do you know what this is here?

Participant four:

That's Harbor Town.

COAST workshop facilitator:

Would you believe that in the other group, people were looking at properties in red and green were saying that those properties were low value …?

[group is attempting to determine what homes or businesses are on what red and green areas] …

Voting/Poll

-Meeting Concludes-

Appendix K: Workshop Two Field Notes

Participant One:

What about floating cities?

Participant Two:

Surge and wind issues here – that Amsterdam and Denmark don't have to deal with … we have to think about wind damage. The problem I have is with the infrastructure – how will people get to their homes? You haven't put this into your scenarios yet … even if we waterproof and raise the homes, the road are still vulnerable – The cost you're coming up with is just a fraction of what it really is. I don't see it being cost effective if you can't get there …

COAST workshop organizer three:

I have seen cases in the east coast where there's been floodproofing of the first floor and pedestrian infrastructure on the second floor … those are limited areas so you're talking about the big picture …

Participant Three:

The Department of Transportation has given up on Dania Beach boulevard … it would be cost prohibitive … it may someday be underwater because of its elevation - that's a main access road.

Participant Four:

Has there ever been a community that says "enough already" and just abandoned their community?

Participant One:

Look at Bangladesh – you have entire communities having to move to the city … farmers, fishers … living an entirely different lifestyle in the cities … Vice does a really interesting segment on this.

Participant Five:

Areas around the Mississippi are like this …

Participant 33022-0125:

What about "final loss" scenario – where as soon as property is inundated or completely lost, they won't insure that piece of property again. Pay out the owner, but don't insure the property again.

COAST workshop organizer three:

These are some of the more dire consequences of sea level rise around the world … what about elevation and floodproofing … we do have a policy that started in 1968 … the basic approach of NFIP is based on elevation …

Participant Two:

After a property has repetitive loss … its rules have not denied providing public assistance to federal assistance to … to identify our hot spots and determine how to respond … storm water comes in from the sewage system and floods it … I was at an Everglades meeting a month ago and several of the barrier

islands were trying the concept of floating homes but unfortunately, with sand and limestone as a base, there is nothing to hold it in place … trying to raise A1A and raise their communities … the geology …

Participant four:

My thinking in confronting any problem or issue is to think very comprehensively … worse case and best case … on one extreme we have to use models and projections into the far future. If we commit to mitigation of plans that end up being mandates …

Years ago I worked very hard to mandate ethanol … as an example … now it turns out that it is very costly, whenever you have a problem … now we have a ship that we cannot steer … we're trying to change that and we can't. It's too big, too many interests … so my question is on the one hand to make commitments before they become mandates … but on the other hand we could have a very dire situation that could prove so dire that all our expenditures will prove to be insufficient that may have been more productively spent in a different form to deal with it. So here we are in a spread of uncertainty how to deal with that – where we are today in that spread of uncertainty I would say that the preservation of flexibility should be called for. What's a consequence of this? My daughter lives on the beach in a duplex so they run into the water. Her duplex was built in 1993 but it wasn't built to the high storm requirement – she has paid thousands … for flood insurance – so now let's say that we're moving in the direction of getting … how will this affect residents of the beach … so it will be so costly that only the very wealthy will live on the beach …

Participant one:

We're being pushed out but you're saying far off into the future … we're seeing flooding now … we're talking 10 years from now … 2020 isn't that far away.

Participant five:

New York or Chicago did a challenge for ideas and concepts … a Harvard team submitted an idea and took an incremental approach … we look at first elevation and floodproofing … and maybe it doesn't look like a buyout is not a good thing right *NOW* but this really needs to be a *process* where we make steps toward the same direction … look at strategies and connect them to a greater vision … yes we can't take care of the whole problem but we can start to create links to see how this step fits in with the next step …

What about scaffolding adaptation with points (on a city report card) so that the city would … buyout first floor, etc. and use for markets … and once everyone has participated in "giving up" their first floor the city buys the whole street.

COAST workshop organizer three:

The Thames River has a plan based on different long-term planning increments … the principle they use to deal with uncertainty is to try and look for robust/no regrets decisions which are things that make sense in general and that we should do anyways.

Participant six:

When it comes to insurance, FEMA has doubled their rates – last year … this year … that's FEMA and I also just read an insurance industry report that says by 2020 you won't be able to buy insurance if you live on the coast of Florida

Participant two:

I'm with the Sierra Club. A world-renowned climate scientist says that by 2020 because of the acceleration of ice melt, the water will be one foot higher than it is today. Right now coastal action task force is trying to plan what we can do on the coast about this problem … we have a canal system here in Broward … difference between west and east was about 1.5 feet. The runoff ran into the ocean.

"Obey" from the Water Management District [Jayantha Obeysekera, Chief Modeler, South Florida Water management District] says we expect by 2020 for it to be even so that it won't be able to drain … so what's going to happen to the inland communities when we get summer rain? Where is that water going to go?

That's why FEMA has sent out letters who live in Tamarac [city in Broward County, FL] saying that you don't have to have flood insurance again … here in Broward County our ground is sand and limestone which is why we have saltwater intrusion … the wells are brackish and they [residents] can't use their water anymore. What's going to happen … If you have a house that's six feet in the air and … infrastructure problems.

COAST workshop organizer three:

We've touched on some of the things that we addressed today so it's clear that things aren't going to get better …

Participant four:

In this entire picture I would like to see cities reserve some degree of autonomy to respond – some cities are very much under financial crisis and I believe that they should have … I'd rather not see an umbrella solution …. Each city should have some degree of autonomy to decide its strategy for responding.

Participant six:

I was at a Hollywood Beach Civic Association meeting – I was told that this city is a billion dollars in debt and this is because of contracts that were signed with the fire and police department – we're in a nearly bankrupt situation to begin with. The City of Hollywood. The second thing is that a lot of this insurance is false security – look at what happened with Sandy … you have people in New Jersey that are still without a home … you have a lot of people not in their homes … we're saying that we can't get insurance but what's the likelihood that we'll get paid off if something happens?

COAST workshop organizer three:

How does this come back to our focus on flood proofing or elevation - should we have a strategy?

Participant two:

We need to do a study on the infrastructure. The numbers don't add up unless you factor in the infrastructure.

COAST workshop organizer three:

Think of this exercise as something that was free of cost and …

Participant five:

Floodproofing … is actually a good idea but it has to be done in phases of thinking … by 2020 this will get worse… more extensive flooding … so the floodproofing should be like a band-aid for some areas but we have to think in terms of long term to avoid the inundation … phase 1: floodproofing. Phase 2: potential relocation …

COAST workshop organizer three:

I'm hearing that elevation and floodproofing are elements but by themselves, they're too limited.

Participant four:

It seems to me that if you're going to elevate you need to elevate a lot higher … 25 feet … so that … down the road that may not be the whole problem – I don't know where you would get it or how you would do it … consideration that they're undoing these canals and now the water is going further down toward Broward and Dade and they said that they don't know what kind of flooding that will cause … when will the city buy out homes that people are ok with buying out now? We had a resilient redesign workshop where we had architects and it was amazing to see how many of those strategies could work here… designing solutions for communities like Dania Beach … so that's inspiring look up resilient redesign to see some of these options.

Participant two:

saltwater intrusion coming up … and erosion … eventually those pilings … where are you going to get water to drink when there's no wells left… they're going to Sunrise [city in central-western Broward County] to buy water because SFWMD has good water for them but what about everyone else? This is a major, massive problem … people are curious about why construction – these developers know what's happening and they know that soon they won't be able to build and right now in Miami 96% of properties are being sold to people from south America. Americans aren't buying because they know what's going on. Right now these cities are looking for alternative sand and they're banging their heads against the wall … because now cities further west.

COAST workshop organizer three: Let me try and redirect – now we have to stick to elevation and floodproofing and then we're going to switch the topic to the idea of buyouts … It sounds like you've already talked about that already … one of the interesting things we were discussing in the other group is that offering people money for their properties is probably going to work

COAST workshop facilitator:

The other group was talking about municipalities, which would identify certain neighborhoods where they would no longer elevate the road or provide wastewater service – they would announce that they wouldn't be able to provide the service … what do you think of an idea like that? Could we talk about these ideas …?

Participant six:

There are two things that need to happen here – you have to take personal responsibility at some point – you can't always be looking for … government to take care of you … we need to identify certain parcels and identify their useful life – that's really a model that's sustainable … it's not realistic to support someone else's lifestyle if they choose to live somewhere that is so vulnerable … there are certain things that come along with living in certain locations.

COAST workshop facilitator:

The other thing we talked about in the other group is that this project is an ice breaker to determine whether it is necessary to tie together a plan … that can address these things …

Participant six:

In terms of real estate, we need to open dialogue with the real estate community that there is something going on and that as the buyers they need to be open to that… it's going to happen at some point because right now it's musical chairs.

Participant seven:

No matter what comprehensive plan we agree upon unless you have public support …anything needs … education and as much information as they can get … or else nothing is going to happen.

Participant two:

You just noted, it's Jared Diamond's book of collapse [*Collapse: How Societies Choose to Fail or Succeed*, 2005] even if you perceive the problem, you don't do anything about it and if you try to do something about it the solution is unsuccessful and then the solution is still unsuccessful … half-baked solutions. That's what we have. Versus Holland, where they realized the SLR and they realized their environment and geographic issues and did something about it … but we're not in Holland. We have our heads in the sand … look at our own state – anyone who works for him [Governor Rick Scott] or the state can't mention sea level rise or global warming … they had a round table the other day where everyone was laughing because he can't even say the words … is this report [COAST modeling data] going to our state because we need this to go to Tallahassee.

COAST workshop facilitator:

It would be up to the staff and commissioners of Broward County to decide that … if you think they ought to do something …

[*general discussion among the group that they want to contact their commissioners*]

COAST workshop host/organizer one:

Obviously we do a lot of work here locally on the county level so this study is part of a much larger resiliency effort and I've been doing this for 10 years and all of this has gone on before the state implemented that rule about sea level rise …

Participant six:

The sea level rise happened two years ago but we're just hearing about it now.

COAST workshop host/organizer one:

The state has funded several of our vulnerability assessments… the federal government is also funding …

COAST workshop facilitator:

One of the things that I've seen successful is different environmental groups and public events where they'll mark lines on the street, on the walls … marking where 100 year flood is/ will go … and then they get the picture – art to communicate.

Participant four:

I think one of the things the group talked about was fixing infrastructure and access … and another thing is the idea of funding or who pays for it … these analyses are valuable … next step is creating a flow chart to show who pays and who benefits especially if we're talking about buyouts … by understanding the funding mechanisms more we can understand better about what to do on a meta, individual level. What I'm hearing is that infrastructure and funding are the main concerns.

COAST workshop facilitator:

Zero in on what is an idea of this, then you have to identify … elevation and target certain neighborhoods, and really start talking about eligibility, etc.

Participant four:

In Hurricane Sandy they … buyouts if people wanted to just sell … number of buyouts they average $160,000 so if your home is worth more than that, how did they …

COAST workshop facilitator:

In Sandy, the numbers you see really depend on where you look and certain neighborhoods … there are certain areas near the water that got completely nailed … millionaire row … so sometimes you see … waterfront doesn't always mean millionaires.

Participant seven:

Education is a very important concept about this … they are an important part of that discussion.

There was a great article in the Miami Herald recently … the information is out there…

Participant two:

Can anyone explain to me why the property values aren't going up …

That's why there is so much construction and that is why the prices are going up. When people start to realize that this million dollar house is something that I can't afford the insurance … a lot of people when we started talking about this in Florida in 2003 they said, "Nah, it's not going to happen you're an alarmist" … and now we've got a senator [Governor] who doesn't believe in climate change. The *insanity* you've got – this is what's destroying … when you have this kind of environment to deal with this is what makes it so difficult to educate the public … now you guys are educated, and now it's frightening you … you realized that you should have been doing this 25 years ago, but you didn't. When you start to realize that guys like this … you can't raise houses high enough … this gentlemen talked about increments … the increment is … by 2100 they're predicting to a four meter rise in the ocean … this is what it's going to look like down here …

All the people that are going to be flooded out … to some of the poorest neighborhoods in Broward … be aware that it is … the whole county is faced with the problem. When the storms start to come that water needs a place to go … so when it has no place to go … the federal government has scientists that plan and have the scientific information …

Participant one:

Reality check – there is a community that is dealing with that… elected officials were pointing fingers … the community is saying we don't see it and we don't hear it … and no one wants to sit down and have a frank conversation about the problem *today*. The reality is that no one wants to deal with the reality … people who are directly affected will wake up some day. It's time to start doing things. The time has worn out to stop studying and to do something.

Appendix L: IRB Exempt Certification Letter

RESEARCH INTEGRITY AND COMPLIANCE
Institutional Review Boards, FWA No. 00001669
12901 Bruce B. Downs Blvd., MDC035 • Tampa, FL 33612-4799
(813) 974-5638 • FAX (813) 974-7091

March 27, 2015

Karen Langbehn
English
4202 E Fowler Ave
CPR 107
Tampa, FL 33620

RE: **Exempt Certification**
IRB#: Pro00021481
Title: Science, Policy, and Decision Making: A Case Study of Deliberative Rhetoric and Policymaking for Coastal Adaptation in Southeast Florida

Dear Ms. Langbehn:

On 3/26/2015, the Institutional Review Board (IRB) determined that your research meets criteria for exemption from the federal regulations as outlined by 45CFR46.101(b):

(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless:
(i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

Approved Items:

Karen Langbehn. Science, Policy, and Decision Making: A Case Study of Deliberative Rhetoric and Policymaking for Coastal Adaptation in Southeast Florida

Informed Consent Form

As the principal investigator for this study, it is your responsibility to ensure that this research is conducted as outlined in your application and consistent with the ethical principles outlined in the Belmont Report and with USF IRB policies and procedures.

Please note, as per USF IRB Policy 303, "Once the Exempt determination is made, the application is closed in eIRB. Any proposed or anticipated changes to the study design that was previously declared exempt from IRB review must be submitted to the IRB as a new study prior to initiation of the change."

If alterations are made to the study design that change the review category from Exempt (i.e., adding a focus group, access to identifying information, adding a vulnerable population, or an intervention), these changes require a new application. However, administrative changes, including changes in research personnel, do not warrant an amendment or new application.

Given the determination of exemption, this application is being closed in ARC. This does not limit your ability to conduct your research project. Again, your research may continue as planned; only a change in the study design that would affect the exempt determination requires a new submission to the IRB.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

John Schinka, Ph.D., Chairperson
USF Institutional Review Board