Use of Science in Gulf of Mexico Decision Making Involving Climate Change

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Table of Contents

Tables & Figures

FIGURES **PAGE**

TABLES **PAGE**

Executive Summary

PROJECT OVERVIEW AND DESIGN

The U.S. Gulf of Mexico is ecologically diverse and economically important. Significant segments of the economies of the states bordering the Gulf are based on activities concentrated in coastal areas. This concentration of resources has helped fuel population growth in counties along the coast. Although climate changes will affect natural and human systems world wide, the Gulf region represents special vulnerabilities because of its population density, the concentrations of economic activity along its length, the age of the infrastructure associated with these activities and the Gulf's fragile ecology.

There are uncertainties associated with estimates of the extent of projected climate changes, such as sea level rise and extreme weather patterns. Nevertheless, the response currently being called for is adaptation at all scales. Policy decisions that reduce demands on resources and mitigate anthropogenic stressors are the kinds of adaptations that can advance the management of environmental risks and reduce vulnerabilities to climate change. However, these decisions can be difficult to make and require both a good information base and receptivity among decision makers.

Project Objectives

Climate change is an issue area that involves a multiplicity of decision makers, ranging from governments to individuals. Decisions to address its impacts also involve a multiplicity of causes and consequences that have implications for almost all population groups. There are also public goods issues associated with both mitigation and adaptation strategies and efforts. This research was undertaken to provide information on how Gulf of Mexico stakeholder groups can be more effectively engaged in making decisions to address potential climate change impacts. In addition, the project was designed to engage "relevant stakeholder communities" in the research process.

The research questions addressed in this project were

- What are the characteristics of the decision process for stakeholders groups that have to make decisions about how to plan for or react to climate change?
- What role does science information play in the decision process?
- What are the perceived climate change information gaps?
- How can the interface between climate science and decision makers be made more effective?

Research Design

In collaboration with EPA, three research locations were chosen: Apalachicola Bay, Florida; Barataria-Terrebonne, Louisiana; and Galveston Bay, Texas. These three locations represent eastern, central, and western portions of the Gulf of Mexico, respectively. They also represent a range of environmental, ecological, social, and economic characteristics. Three endpoints and four stressors were also chosen to focus the study. The endpoints chosen were: water (quality and quantity), ecosystems, and infrastructure. While the three research locations all face water, ecosystem and infrastructure issues, the specifics of these issues differ across the locations. The four stressors that also structured the project were temperature, precipitation, sea level rise and storm frequency and intensity.

Several types of data were used to triangulate on the variables of interest. 1) Unstructured interviews with decision makers representing key stakeholder groups were conducted in each research location. These interviews covered a range of topics, including climate change salience, potential stressor impacts, decision making networks, information use, and information gaps. 2) National and regional newspaper coverage of climate change was examined to provide some sense of the general information available on climate change. 3) Planning documents, reports and other documentary evidence were examined as corroboration of respondents' reports of organizational interest in climate change, and 4) some observations of stakeholder

group meetings were done for the same purpose. 5) Finally, at the end of the project, focus groups were held in each location to reengage stakeholders and test some of the preliminary findings from the data analysis.

Conceptual Frameworks

To organize data gathering and analysis, four theoretical frameworks addressing the ways in which information is communicated and interpreted were used. These were: construction of social problems, agenda setting, communications theory, and social amplification of risk.

Project Planning

Research Team Planning - Choice of Locations, Endpoints and Stressors

The team selected six endpoints and four stressors to focus the research. The endpoints chosen were infrastructure and ecosystems in the Western Gulf, infrastructure, ecosystems and water in the Central Gulf, and ecosystems in the Eastern Gulf. One endpoint was repeated in all locations (ecosystems), an endpoint that is shared by two of the research locations (infrastructure in the West and the Central Gulf), and one endpoint unique to the Central Gulf (water). Over the course of the project, research expanded to all three endpoint categories in all three regions. The team also selected four climate stressors: temperature, precipitation, sea-level rise, and storm frequency and intensity. These decisions were made in consultation with EPA, utilizing existing information including maps and other types of databases. The expertise of the investigators also played a part in these decisions.

Based on input from EPA and the research team, the research locations were chosen: Galveston Bay in the Western Gulf, Barataria-Terrebonne Watershed in the Central Gulf, and Apalachicola Bay in the Eastern Gulf. These locations span the Gulf geographically and also represent a range of economic relationships with the Gulf and a range of ecological profiles. The human populations of these areas are also socio-demographically varied.

Stakeholder-Team Workshop - Workshop Goals and Activities

The purposes of this phase were (1) identification of the plausible range of climate-related stressors or attributes associated with climate change in these specific locations, as well as the probable social, economic, and policy impacts of the stressors in each of the research locations, (2) initial steps in the development of scenarios for communicating climate change impacts during interviews, (3) research team training on location-specific aspects of climate change and sociopolitical dynamics for each specific research location, and (4) initial identification of stakeholder groupings for targeted information gathering during the fieldwork phase of the project.

To achieve these goals, a workshop was held in May 2003, during which the research team, a small group of knowledgeable stakeholders from each area, and EPA representatives met to exchange information. Workshop participants use a combination of GIS mapping and other existing sources of information on the Gulf Coast region as well as documentary evidence of issue salience and stakeholder networks during its discussions. The full ranges of probable climate change and potential social, economic, political and policy impacts in each of the research locations were explored in the workshop. This in-depth discussion was later translated into more limited scenarios for use with stakeholder informants during the unstructured, open-ended interview process. These scenarios emphasized local change in climate-related stressors, such as sea-level rise. They were intended to give concreteness to stakeholder reflection on possible outcomes—particularly for infrastructure, water resources, and ecosystems—and on information use and needs for decisions related to these outcomes.

An essential component of the research project was to develop a series of plausible, scientifically-based climate change scenarios relevant to potential environmental issues of concern to decision-makers and stakeholders and specific to the three case study areas. The scenarios needed to be specific to the climate change-induced stressors for each system that could affect ecological and/or societal systems of concern. They also needed to be sufficiently clear to non-scientists so that they could inform the second phase of the stakeholder-interview process. Such a set of scenarios was developed through a focused workshop involving members of the research team supplemented by a number of regional and national climate experts.

RESEARCH ACTIVITIES AND METHODOLOGY

Interviews

Unstructured interviews were the primary method used to gather information from stakeholders in the three research locations. These interviews were conducted along well-established social science guidelines. A structure of general topic interview prompts allowed interviewers to direct conversations to focus on local problems, stakeholder decision making, and the role of science information in decision making. Interviews were conducted in two waves. Researchers designed Wave 1 to gather information on the general problems facing stakeholders in an area, the extent to which scientific information is used to address those problems, and the decision processes involved. Wave 2 interviews elicited similar types of information after the interviewer introduced the topic of climate change to the stakeholder.

The overall research design called for three groups of approximately 50 respondents in each research location: (1) a group interviewed only during Wave 1 and asked only about general area problems, decision making, and information use; (2) a group interviewed during Wave 1 and during Wave 2, who were asked about general problems during the first interview and about climate-linked problems during the second interview; and (3) a group interviewed during Wave 2 only, whose interviews focused on climate change and the problems that could be exacerbated by or emerge as new problems as a result of climate change and its stressors.

Because the focus of this research was to be on decision making and decision making networks, the critical stakeholders to access during the interview process were different types of decision makers in each research area. The team chose to develop an array of the types of organizations in each research location. For each research area team, the first step in the sampling process was to draw up as comprehensive a list as possible of organizations in the area according to two criteria. First, the organization must have a potential stake in the effects of climate change. Second, the organization must have power to influence decisions relevant to climate change. Researchers' knowledge of their areas and internet and media sources were used to assemble the lists. This strategy was consistent with the realities of agenda setting and policy development in the U.S. and also served to focus the sampling process. In order to insure that the full range of organizational types was represented during sampling, a list of 14 organizational types guided the search. These included agencies of local, state and federal governments, non-governmental organizations, professional organizations, and educational institutions. After an initial search and assembly of various organizational types, we finalized all types of organizations in our sampling list across all three research locations and assigned an organizational code to each category. These labels were later used in our interview coding.

The target was approximately 600 interviews for the project as a whole, including 200 from each research area with 100 of these from Wave 1 and 100 from Wave 2. Fifty of the respondents from Wave 1 would also be interviewed in Wave 2. In each area, the initial step was to select from the assembled list of organizations a random sample of 20-50 interviewees, stratified by organizational type. The top administrative individual in the organization was sought for these interviews to capitalize on his or her broad view of the organization and knowledge of the decision making network. Because there was no assurance that the sampling frame lists were exhaustive of relevant organizations, a snowball technique was also used. Interviewees were asked to refer individuals who would also be knowledgeable about the issues under discussion. The referrals from these initial interviews were added to the sampling frame, repeats of original list entries were eliminated, and the remaining 50 Wave 1 interviews were randomly drawn from the expanded list. During Wave 1, interviewers did not introduce the topic of climate change. The extent to which climate change spontaneously emerged in conversations with stakeholders was one measure of its salience in the different research locations and with particular types of stakeholders. This approach helped to reveal the nature and structure of regional issues toward which climate change research can be addressed and disseminated.

For the Wave 2 panel interviews, Wave 1 respondents were sorted by organizational type, and organizational categories were randomly sampled proportionally to achieve a sample of 50 panelists in each research area. Panelists were re-interviewed using climate change scenarios developed for Wave 2, referred to as Wave 2A interviews. After the climate change discussion, Wave 2A panelists were asked for additional referrals of individuals who would be able to discuss climate change issues. Referrals from 2A respondents

were randomly sampled to achieve a sample of 50 new names. This sample (referred to as Wave 2B) was asked for information about general problems, causes, solutions, and information followed by the introduction of the climate change scenarios (as was done in Wave 2A) and questions about the potential impact of climate change on the mentioned problems.

Wave 2B interviews began by asking the respondent about local problems. The interviewer then introduced the climate change scenarios and the concepts of risk and uncertainty to the stakeholder. After introducing scenarios describing real vulnerabilities of the individual research locations and a range of uncertainties that exist for them, interviewers probed for the perceived effects of climate change on these problems, the roles that risk and uncertainty play in stakeholder decision making, and the stakeholder's perceived need for additional information. The Wave 2 interviews allowed the team to examine whether the introduction of climate change altered the problems and perceptions of risk in a more compressed time frame and whether or not the perception of problems was similar pre- to post-scenario.

Hurricanes Katrina and Rita occurred while Wave 2 interviews were being conducted and Wave 2 interviews in Louisiana were terminated. The research team decided that in addition to the logistical difficulties introduced in Louisiana by the physical destruction and social dislocation, these events would have had significant effects on attitudes regarding climate change, making pre- and post-hurricane interviews incompatible. Fortunately, most of the Wave 2 interviews had been completed in Louisiana before the storm, and only a handful of Texas and Florida interviews were conducted after August 2005.

The research interviews were tape-recorded with the respondents' permission, and field notes were taken. Recordings were transcribed and coded. For each wave of interviews, a coding protocol was developed, based on the interview guide for that wave. Chapter 3, Analytical Methods, provides detailed information on the sampling, scheduling, processing, and coding of the interviews.

Focus Groups

Two focus groups were convened in each location for the purpose of testing some of the conclusions from preliminary analyses of the interview data. This portion of the research process centered on understanding stakeholder attitudes toward climate change rather than measuring them. The following topics were explored with each group: general perceptions of climate change, climate information needs, barriers to information use, best approaches and formats for climate information, and the extent to which the unusual 2005 storm season affected thinking about climate change. This last question was especially important for Louisiana participants. Issues of uncertainty, specifically how uncertainty affects decision making and how uncertainty can be dealt with, were also introduced if they did not surface naturally during the focus group conversations.

Three criteria were used in selecting focus group participants: (1) participants were to be drawn from stakeholders who had been interviewed during Wave 2, because it was during this wave of interviews that climate change was introduced and the scenarios were discussed; (2) good representation of the types of groups that formed the organizational array for the interview sampling; (3) the knowledge base of participants and their ability to articulate positions and ideas formed a third set of considerations. In order to maintain good representation of organizational types, Wave 2 interviewees were sorted into organizational categories, and individuals in each category were assessed for their knowledge of their areas and ability to articulate.

Group sessions were held in easy to reach places in each research location, and each session was limited to two hours. To maximize the consistency of the process, topic outlines were developed for use by facilitators at each location. With the permission of group participants, sessions were tape-recorded and later transcribed. Transcripts of focus group sessions were examined in light of the major questions that guided the discussions. The goal was to do a descriptive, qualitative analysis of focus group responses to the questions around which the discussions were organized. The questions that provided guidelines for the focus group discussions also formed the structure for the descriptive analysis. Key analytical categories were as follows:

- Perceptions of climate change characteristic of the research area
- Effects of Katrina and Rita on changes in salience of climate change as a problem

- Best approaches to delivering information on climate change, including discussions of
  - Who would or should be involved in decision making
  - Framing of the issue
  - Role of uncertainty and how to address it
  - Barriers to decision making
- Kinds of information needed
- Barriers to information use
- Sources of information trusted
- Best formats for information transmission

Newspapers

Analysis of newspaper coverage of climate change-relevant issues took place at two levels: coverage in major newspapers with national circulation and coverage in selected Gulf of Mexico regional newspapers. Researchers selected a sample of newspapers at each level and conducted a review of articles. The goal was to review articles published between 1985 and 2005. However, time periods for individual newspapers varied somewhat and were determined by availability of newspaper archives.

Three newspapers with national circulation selected were *The New York Times*, the *Chicago Tribune*, and the *Los Angeles Times* – each with a circulation, widely distributed in the United States, and representing a geographic location different from the Gulf of Mexico area. Collection of the news articles from these newspapers allowed for comparison of the salience of the climate change issue across the nation. In addition, while local decision makers read newspapers covering the geographical areas they are responsible for, larger newspapers with more extensive circulation are also read by decision makers and, through news service wires, contribute articles to local papers as well.

Three newspapers from the Gulf of Mexico region with relatively large circulations and representing news coverage at a more regional level were singled out for our regional news collection and analysis. These were the *Houston Chronicle* in Texas, the *Times-Picayune* in Louisiana and the *Tampa Tribune* in Florida.

The development of the coding system for news articles was generally guided by the agenda setting framework. In addition to the background information of each article (e.g., newspaper's name, date, month and year when article was published, etc.), we were particularly interested in three basic concepts, which formed the basis for our coding scheme development and codebook construction: Issue Salience, Issue Attributes, and Use of Scientific Information. A complete overview of the concepts, the collection and coding process, and analysis is contained in Chapter 3 of this report.

Stakeholder Group Observation

In each research location, a small number of stakeholder groups were selected for observation. The groups sampled are groups involved in an on-going way in making decisions about issues that could easily be affected by climate change. With the permission of the groups, researchers attended meetings to observe in a real setting the process through which issues are defined, discussed, and resolved. Of particular interest was the role science-based information played in these discussions. When necessary, researchers also gathered additional information from individual members of the groups, using exploratory interview methods. In addition to adding to the information on stakeholder decision making and acting as a means for triangulating on key elements in this decision making, this kind of observational activity also had the potential to add information on data needs and preferences. Finally, electronic reports and web site information generated by the stakeholder groups was gathered for future analysis as to the extent to which climate change was mentioned.

Other Documents

Documentary evidence, other than newspapers, was used as an additional source of information on issue emergence, climate change salience, decision making, and information use. Federal-, regional-, state- and local-level documentary evidence, such as plans, annual reports, and program announcements was sought. The time period over which documents were collected varied somewhat across research locations because of differences in the timing of stakeholder awareness of climate change issues. Initial searches for documents began in the year 1988, our agreed-upon start year, but actual collection began with the emergence of climate change in the documents. During document collection, availability of documents was a limiting factor, and start dates for collection varied somewhat by dates of availability.

RESEARCH FINDINGS

In Chapter 4 of this report, Findings, we examine what kinds of problems dominate stakeholder concerns in the U.S. Gulf region, the character of those problems, and what stakeholders perceive as the causes of those problems. We also examine the kinds of information on climate change currently available to all stakeholders in the research locations. Results from Wave 1 interviews about general problems are compared with Wave 2 interviews, in which climate change scenarios were introduced. This comparison focuses on the potential climate change impacts on local problems as well as on questions about the completeness and believability of information on climate change. Further comparisons of Wave 1 and Wave 2 interview results focus on stakeholder decision making, the use of science-based information, and preferred information formats.

By combining information on use of science, stakeholder processes, and decision making, we hoped to improve our understanding of the way science and technical information about climate change affects stakeholder decision making, policy development, and policy implementation. We have used the following theoretical frameworks to guide the development of interview questions and the coding of interviews and documents: construction of social problems, agenda setting, communications theory, and social amplification of risk. These perspectives also guided the analysis described below. Finally, the discussion is organized around conceptual areas relevant to research questions.

Salience of Climate Change as a Problem in the Gulf of Mexico: Evidence from Interviews and Newspapers - Summary of Wave 1 Evidence

Climate change has not been at the forefront of Gulf of Mexico stakeholder concerns. In spite of regional news coverage of the issue, stakeholders view local problems and their causes as having little connection with climate change. Not surprisingly, the issues stakeholders focus on are issues that visibly affect the lives of people who live in the research locations. Climate change as portrayed in newspaper coverage remains a distant issue, and perceived changes in stressors, such as sea level rise, are more likely to be attributed to weather variations and natural cycles in hurricane occurrence than to effects of climate change. The perceived causes of local problems may include failures on the part of decision makers outside the area (e.g., failure of governmental agencies to enforce existing regulations) or pressures from forces that are beyond local control (e.g., insurers who facilitate coastal building). However, the primary causes of problems identified by stakeholders tend to focus on decisions and activities actually taking place locally, such as population increases and land use changes.

Our analysis of news media indicates that there has been increasing coverage of climate change, both in national and (at a lower level) in major regional newspapers. However, the coverage has not been the kind that would increase local policy focus on climate change along the Gulf coast. National and regional coverage have portrayed climate change as a global issue with possible national implications but not as an issue with regional or local importance. Furthermore, the leading actors in the debate as reported were federal actors: the *U.S. President*, *Congress* and *Federal Agencies*. The relationship of climate change to changes that can be anticipated at more local levels has not been brought to readers' attention in any of the research locations. Admittedly predictions of specific climate change impacts at smaller scales are difficult to develop, as in predictions of whether local average precipitation will rise or fall over a specific time period and by how

much. The absence of this kind of connection has, nevertheless, reduced the likelihood that climate change will be very salient among coastal communities. In addition, adjustments to mitigate climate change or to adapt to it will almost surely mean major changes in both individual lifestyles and in the way commerce and industry conduct business. Any coverage of local implications of climate change will inevitably spark controversy over these issues.

In spite of the fact that climate change rarely surfaced as an issue in these initial interviews with Gulf stakeholders, we believe the news is essentially good. The problems that are foremost in stakeholders' minds are largely problems that will inevitably be affected in some way by changes in climate stressors such as temperature, precipitation, and sea level rise. Furthermore, stakeholders are already sensitized to important endpoints like water quality, water availability, and ecosystem health – endpoints that are also likely to be affected by climate changes. Because infrastructure played less of a role in conversations with respondents than water or ecological issues, the case for climate change effects on infrastructure may be somewhat harder to make.

To summarize the findings from Wave 1:

- Climate change was not a salient issue at the time of the Wave 1 interviews nor is it linked in stakeholders' minds to local problems, in spite of widespread coverage of climate change in regional and national newspapers.

  Implications: Educational efforts may be required to make the global-local link clear.

- While climate change rarely surfaced in Wave 1 conversations, dominant problems in the research locations do focus on issues of the environment and development, and these are problems that will be affected by one or more of the climate stressors.

  Implications: The salience and complexity of local problems are such that climate change cannot be added to them as a separate set of issues, but there is potential to integrate climate change into existing concerns by examining the ways that climate change may exacerbate local problems.

- Specific problems and perceived causes at each location reflect that location's unique natural and social conditions.

  Implications: Introduction of climate science to the local debates over problems will require framing tailored to local concerns and engaging different constituencies at each location. Finding a common meeting ground with regard to goals and values will be an additional challenge.

- National and regional media coverage has exposed stakeholders to the climate change issue but has not assisted in elevating climate change as an aspect of local policy focus.

  Implications: Any efforts to change this situation will require that those interested in bringing the implications of climate change down to the local level engage the regional and local media.

Increasing the Salience of Climate Change for Gulf of Mexico Stakeholders: Evidence from Interviews, Focus Groups, Newspapers and Websites – Summary of Wave 2 Evidence

Even though climate change is not a salient issue among the Gulf of Mexico stakeholders interviewed for this project, most stakeholders have been exposed to information on it, and there is a relatively high level of acceptance that some changes are occurring. The media are the primary source of information on climate change for these stakeholders with government and academic sources as the second and third-most frequently mentioned sources.

The response to the scenarios developed for each location is more mixed. Negative reactions seem to stem from 3 primary sources. (1) The changes projected in the scenarios for the 50 and 100 year periods covered by them are dramatic and difficult for some respondents to accept. (2) While the inclusion of both potential increases and potential decreases in precipitation and temperature reflects the state of the science at this point, this is frustrating and difficult for some stakeholders to understand. (3) A substantial number of stakeholders attributed recent historical changes in precipitation, temperature and storm frequency to normal

weather variation rather than to climate change. Sea level rise is the most readily accepted stressor change and the one most frequently mentioned as having the potential to exacerbate existing problems. It is also the climate-related change that respondents are more likely to have experienced personally and the least likely to be attributed to weather variation.

In spite of a mixed reception, virtually all respondents were able to discuss links between scenario projections and local environmental and/or development problems. Impacts of stressor changes on endpoints were seen by the majority as having the potential to worsen existing conditions, such as water scarcity and coastal erosion. Furthermore, most believe that if scenarios are even reasonably accurate, decisions related to climate change need to be made, and among Louisiana stakeholders there is a strong sentiment that decisions (and action) are long overdue. The responsibility for climate change decision making is perceived as a shared one. Respondents believe that local, state, and federal governments should all be involved and that citizens should have more involvement than special interests. Nevertheless, respondents recognize that there are barriers to making climate change-related decisions. These barriers to the necessary decision making include: possible serious economic consequences of action, the long time frame required for significant changes to occur, and political issues that range from lack of leadership through the influence of special interests to jurisdictional issues.

The solutions most respondents mentioned involved adaptation rather than mitigation. Even though mitigation is the response strategy that has been most often mentioned in the media coverage of climate change. Technical and social/policy approaches to adaptation dominated the suggestions and were primarily focused on the climate change impacts that could be anticipated locally.

The majority of respondents believe that additional information on climate change is required if necessary decisions are to be made. Few organizations are actively involved in discussions of climate change, and the content of organizational websites indicates virtually no cognizance of a link between organizational missions and projects and climate change. No governmental bodies are seriously discussing climate change as part of their decision or planning process. This may be why more respondents believe that information is needed for others than for themselves.

Specific types of information needed in order of importance are (1) predictions of stressor changes at the local level, (2) proof of climate change and/or documentation of local changes in stressors (3) indicators of the economic impacts of action and inaction, and (4) recommendations for effective adaptation or mitigation strategies. The long time frame in which changes in stressors are couched is seen as the primary barrier to using climate change information. Lack of agreement either over the reality of climate change or over the details of the changes themselves is a second kind of barrier respondents see to information use. Finally, understanding the climate change information is the third most frequently mentioned information use barrier.

There is great agreement among stakeholders on the preferred format for information. Respondents would like to see maps and figures similar to those used in the scenarios. Ideally, these maps would show historical change as well as projected changes in the various stressors. Good media coverage was the second-most mentioned format, and workshops that would focus on climate change and its relevance for the area were third.

- Most Gulf decision makers have been exposed to climate change information. We know that the most pervasive form of this information available is newspaper coverage. This tends to be general climate change information. Respondents confirm that the media are an important source for climate change information. However, government and university sources are also important for a small portion of respondents.
- Most of our sample of stakeholders appear to accept the reality of climate change although a significant proportion have questions and/or reservations about the specifics of projected changes at local levels (scenarios).
- With the exception of sea level rise, many respondents attribute stressor changes to weather cycles rather than to climate changes.

- Most respondents are able to (1) discuss the links between scenario projections and local problems and (2) foresee potential impacts of stressor changes on these problems. Furthermore, most believe the changes outlined in the scenarios would worsen existing problems.
- Sea level rise is the stressor most frequently mentioned as having the potential to exacerbate existing problems. This is particularly true in Louisiana. In Florida and Texas sea level rise is also important, but changes in precipitation and temperature also figure in discussions.
- The majority of respondents believe that if scenarios are even reasonably accurate, decisions need to be made and action taken.
- Potential solutions mentioned by respondents are varied because the specific problems important to individual respondents are varied. However, technical solutions and social-policy solutions dominate the responses.
- Perceived responsibility for climate change decision making generally reflects current decision making structures in each location. However, respondents also see more of a role for citizens and less of a role for special interests in climate change decisions/action than exists in current decision networks.
- Most respondents believe that major barriers to decision making exist. The most frequently mentioned barriers were economic consequences of action, the long time frame required for significant changes to occur, and political issues of various kinds. The relative importance of these barriers varies among the research locations.
- Most respondents believe that additional information on climate change is needed. Because relatively few organizations are engaged in serious consideration of climate change, more respondents believe that information is needed for others than for themselves.
- Dominant barriers to the use of information on climate change included the long time frame required for significant changes and consensus/agreement, although this was expressed in different ways. Lack of understanding was the third most frequently mentioned barrier.
- Specific types of information needed include, in order of importance: Predictions of stressor changes at the local level, proof of the reality of climate change and/or documentation or proof of scenario projections, economic impacts of changes, recommendations for effective adaptation or mitigation strategies.
- Preferred information formats stress maximum impact with minimal investment of time. Maps of changes and figures similar to those used in the scenarios were the most preferred. Good media coverage was the second-most mentioned format, and workshops were third.

CONCLUSIONS AND RECOMMENDATIONS

Salience of Climate Change and Relevance to Local Problems

Findings

At the time of the Wave 1 interviews, climate change was not at the forefront of stakeholder concerns. Even though climate change has received increasing amounts of coverage in both regional and national newspapers, it was not seen as contributing to the primary problems of the three research areas studied. Although there was little reference to climate change in any of the research locations, stakeholders in each of them described local problems largely in terms of endpoints, such as availability of fresh water and ecosystem changes like wetland loss. Their views of problems were generally complex and nuanced. By and large, stakeholders identified human activity of various kinds as the primary causes of endpoint changes. However, they also realized that the impacts of these changes extend beyond the human population and that any given solution to them is likely to result in both positive and negative outcomes for human and non-human groups.

Recommendations

1. *The Environmental Protection Agency and other agencies, such as NOAA, should begin to make linkages between potential climate changes and the future scope and severity of problems that are most salient for particular locations.* Research findings suggest that the salience and complexity of local problems are such that climate change cannot be added to them as a separate set of issues and will be ignored if it is. If climate change is to become an integral part of the planning process around the Gulf of Mexico, it needs to dovetail with locally salient problems and conditions, particularly as it affects endpoints through changes in stressors like sea level rise.

2. *Approaches will need to be tailored to each location and based on more than a superficial knowledge of the area.* As stated above, EPA should focus on problems that are already salient, treating climate change as a process with powerful multiplier effects. The problems are not just *Environmental* in nature, they are *Human/Political/Environmental* problems. At all three research locations, stakeholders' concerns include many of the same endpoints (e.g. fresh water). Within these broad categories, however, there are important differences that are associated with environmental characteristics, population characteristics, access to economic resources, and the unique political climate of each place.

3. *Establish a long-term EPA presence in the area.* To be successful at the local level, EPA will need to have a long-term presence at that level. This could be accomplished by EPA personnel being located in what are considered critical areas and/or by bringing locals into frequent contact with EPA regional personnel.

Decision Making to Address Local Problems in a Climate Change Context

Findings

Stakeholders believe that if scenarios are correct, decisions relevant to climate change are needed. What is lacking, according to stakeholders, is leadership. Federal agencies are seen by many stakeholders as having been lax in the rigorous application of existing environmental standards. State and local levels have followed their lead, influenced by special interests. Because climate change is rooted in causes that are beyond the ability of any single location to address and because there is uncertainty about its local effects, most stakeholders responding to questions about this aspect of the issue believe that information and direction on how to proceed must come from the federal level if any action is to be taken, although state and local leadership must be involved in finding local solutions. Communities want to have some control over and participation in their policy destiny, even when the laws and regulations apply only to federal jurisdictional resources and issues. The emphasis that stakeholders put on collaboration and coalition building is illustrative of this partnership.

Land use, water use, and infrastructure placement all emerged in the interviews as endpoints in which decisions are called for. Most suggested solutions were about adaptation to anticipated changes rather than about mitigation of climate causes. Mitigation is seen as beyond the capabilities of local areas acting alone even though some states have taken the initiative to introduce mitigation programs. The respondents' emphasis on adaptation stands in direct contrast to newspaper coverage that has emphasized mitigation.

Respondents were very clear about the barriers that exist to making the necessary decisions. At the top of the list in Texas and Florida are the long *Time Frame*, *Economic Considerations*, and *Political Issues* of various kinds. In Louisiana, *Economics* and *Political Issues* dominated stakeholders' concerns about decision making. It was also in Louisiana that stakeholders expressed the most frustration over delays in acting to address problems while additional studies are done.

Recommendations

1. *Decision making structures that stakeholders are familiar with already exist, and EPA needs to work with and within them.* The same networks and many of the same groups mentioned by respondents as they discussed their *Environmental* and *Development* problems will also take part in climate related decisions. This kind of partnership with local areas will require more knowledge of the area, its decision processes, and its key decision makers than could be provided by this project. The downside to this kind of integration is that existing decision making systems will continue to bear the characteristics that currently act as barriers to effective problem solving, such as lack of coordination, influence by special interests, and budgetary constraints.

2. *Solutions need to be tailored to the needs of the local area and its dominant problems.* Stakeholders identified *Consensus and Coalition Building* as the most important element in evaluating and implementing a solution of any kind. This kind of activity will be especially important to hammering out plans that will inevitably favor some interests over others. It will also be critical given the importance that stakeholders attach to *Value Acceptability* as a factor in the selection of solution alternatives.

3. *Keep the focus on human responsibility.* Currently, Gulf stakeholders tend to see human activity as the root of many of their environmental problems. If the burden of responsibility is shifted to climate change – a process seen by most as beyond our capacity to change – planning and action will seem futile.

4. *Help provide the leadership that is needed at the federal level to address climate change issues.* Because of recent changes, this is a task that should become easier. Unfortunately, part of the task of providing leadership will also involve improving the image of government agencies and of the science enterprise. Many stakeholders expressed skepticism about the "purity" of science, maintaining that science can be bullied and bought.

5. *Understand that each community or locality is unique, socially, ecologically, and politically, and integrate this understanding into outreach approaches and interactions.* This research has highlighted the problem of using a one size fits all approach when dealing with localities. It is necessary for federal agencies to understand more about the context of the localities wherein they seek to influence local policy or implement federal policy. A sensitive and meaningful recognition of the unique aspects of communities would go a long way toward remedying problems of rapport, thereby increasing potential for consensus-building and collaboration.

Information for Decision Making

Findings

Stakeholders saw *Budgetary Considerations* as the factor with the most power to influence whether or not an issue reaches the public agenda. *Feedback* from both inside and outside the government that a problem is important had almost as much power. Objective information that a problem will have significant and widespread impacts is a direct indicator of an issue's importance and critical link between Indicators and Feedback. Consistent and trusted information on the potential impacts to the local area of climate changes is lacking.

When presented with the climate change scenarios, most interview respondents were readily able to extrapolate from them to their implications for local problems. Furthermore, stakeholders were able to talk about the impacts of combinations of stressors. Although there is a relatively high level of acceptance for climate change generally, there were reservations about the scenarios. The criticisms of the scenarios focused largely on one or more of three concerns:

- The accuracy of the scenarios, including a need for more information on the kinds of data used to develop them and the probabilities or error bars involved. For Florida and Texas particularly there was a tendency among some stakeholders to see projected changes in *Precipitation*, *Temperature*, and *Storm* severity as "weather" rather than climate.
- Even among stakeholders who accepted that there might be climate trends in *Temperature* and *Precipitation*, there was frustration over the fact that for these stressors, scenarios included the potential for both significant increases and significant decreases. This compounds the complexities of planning.
- The *Time Frame* in which scenarios were expressed was not seen as useful. Fifty and 100-year periods both exceed the planning frames of most decision making bodies and make it easy to put off its inclusion in decision making/planning activities.

Sea Level Rise was the single most frequently mentioned stressor having the potential to exacerbate important local problems. It is also the easiest stressor to document historically and to project into the future as well as the one most likely to have been experienced personally. It is also the only one that is unidirectional—it only goes up. Finally, it is the only stressor that stakeholders are unlikely to attribute to weather variation rather than to climate changes.

In weighing action alternatives, stakeholders were convinced that there would be winners and losers, whatever the solution. They were also very concerned about the economic consequences of action or lack of it. Many respondents believed that it was the *Economic Considerations* alone that would tip the balance between action alternatives.

Recommendations

1. Overall, the response to scenarios point out important information gaps. *Stakeholders want more information, and the information most in demand is information on climate change predictions. Furthermore, to be most useful, climate change information needs to be location specific.* We are aware of *Sea Level Rise* maps generated for EPA and of the many difficulties of projecting *Sea Level Rise* for un-surveyed elevations and for shorelines that are in a continual state of change. Nevertheless, this is information stakeholders believe they are most in need of.

2. *Start with Sea Level Rise.* It is the stressor most frequently mentioned as having the potential to worsen important local problems. It is also the easiest to document historically, the most likely to have been experienced, and it is unambiguous in its upward direction. In the absence of highly accurate inundation maps, would historical trends be useful in communicating a sense of incremental change? If so, dissemination of information on long-term historical trends in all the stressors might also assist in illustrating the difference between weather and climate. This is a source of confusion for many stakeholders and one that is a barrier to the acceptance of potential climate changes.

3. *Information also needs to be presented in a time frame more relevant to decision makers today*. If sea level in Apalachicola is expected to rise by 1 inch over the next 15-20 years, it would be ideal if stakeholders had information on expectations that involve this shorter term rise. Even better would be information on what such a short-term rise would mean for important elements in their lives, such as existing shorelines, changes in grass species and salt water intrusion into fresh water wells. The more dramatic changes predicted in the 50-year intervals represented in the scenarios are also relevant, but without some sense of short term, or incremental change, these long-term trends are too distant in time to evoke action now. If tipping points could be identified, they will lend power to shorter-term predictions.
4. *Stakeholder requests for clarification and documentation of scenarios suggest that information needs to be clear, consistent and well-documented.* This kind of presentation might assist in reducing general skepticism about climate change information. Focusing first on the most easily documented stressor – *Sea Level Rise* – could also heighten the sense that greater certainty exists. We assume that as data are accumulated and models improve, projections of *Precipitation* and *Temperature* changes will also become more certain and easier for the lay person to understand. If science were only to establish that the most likely change with regard to *Temperature* is a general increase, it would greatly facilitate stakeholder planning. Given their importance to issues of future *Water Availability* and *Quality*, a better understanding of *Temperature* and *Precipitation* is critical.
5. *Information is needed on the potential economic impacts of (1) doing nothing, as well as on (2) various plans of action.* One of the most important barriers to agenda setting and decision making is an economic one. There is a general sense that any change to address climate trend issues will inevitably have negative economic consequences for an area. This is the case whether the change is a demand for emissions reduction, limitations on coastal building, or re-establishing marshland. However, there is a lack of actual cost-benefit studies for specific areas.
6. *Visual representation of stressor changes and their impacts is the most powerful kind of information and should be utilized whenever possible.* Information formats should also accommodate the time limitations that most decision makers must deal with. Clarity and ease of access are keys, but there must be ample documentation for those who want it.
7. *Work with the media.* The *Media* are obviously an important source of information for decision makers as well as the general public. However, the regional *Media's* portrayal of climate change and action options has emphasized a global, rather than a local, view. It would appear that regional *Media* have been following the lead of newspapers that have a more national audience. Newspapers and other news *Media* want a story and want it to be pertinent to the target audience. Work with local experts and influentials, give them what they want—a climate change story that does not come from the *New York Times*.

RECOMMENDATIONS FOR FUTURE RESEARCH

1. Continue to work on the problems of prediction and representation. For example, utilizing local expertise to identify critical but relatively small geographical areas, EPA could work with local individuals/groups to do the surveying required for modeling potential human-environment interactions and evaluating different approaches for dealing with sea level rise. Even these small scale studies, if widely disseminated could elevate climate change salience and generate more careful assessments in other locations.
2. Do more research into a local population's attitudes toward different aspects of climate change and willingness to make lifestyle changes. These could be meta studies of existing surveys or new ones. Given the importance of feedback from the general population and the fact that efforts to either mitigate or adapt to climate changes will affect them, this kind of information is important background to policy making.
3. Evaluate the effectiveness of mitigation and adaptation strategies currently being put into place: their goals, their short-term impacts, and their economic and social consequences.

Chapter 1

Project Overview

The U.S. Gulf of Mexico is ecologically diverse and economically important. Significant segments of the economies of the states bordering the Gulf are based on activities concentrated in coastal areas. This concentration of resources has helped fuel population growth in counties along the coast. Although climate changes will affect natural and human systems world wide, the Gulf region represents special vulnerabilities because of its population density, the concentrations of economic activity along its length, the age of the infrastructure associated with these activities and the Gulf's fragile ecology.

There are uncertainties associated with estimates of the extent of projected climate changes, such as sea level rise and extreme weather patterns. Nevertheless, the response currently being called for is adaptation at all scales. Policy decisions that reduce demands on resources and mitigate anthropogenic stressors are the kinds of adaptations that can advance the management of environmental risks and reduce vulnerabilities to climate change. However, these decisions can be difficult to make and require both a good information base and receptivity among decision makers.

Project Objectives

Climate change is an issue area that involves a multiplicity of decision makers, ranging from governments to individuals. Decisions to address its impacts also involve a multiplicity of causes and consequences that have implications for almost all population groups. There are also public goods issues associated with both mitigation and adaptation strategies and efforts. This research was undertaken to provide information on how Gulf of Mexico stakeholder groups can be more effectively engaged in making decisions to address potential climate change impacts. In addition, the project was designed to engage "relevant stakeholder communities" in the research process.

The research questions addressed in this project were

- What are the characteristics of the decision process for stakeholders groups that have to make decisions about how to plan for or react to climate change?
- What role does science information play in the decision process?
- What are the perceived climate change information gaps?
- How can the interface between climate science and decision makers be made more effective?

Research Design

In collaboration with EPA, three research locations were chosen: Apalachicola Bay, Florida; Barataria-Terrebonne, Louisiana; and Galveston Bay, Texas. These three locations represent eastern, central, and western portions of the Gulf of Mexico, respectively. They also represent a range of environmental, ecological, social, and economic characteristics. Three endpoints and four stressors were also chosen to focus the study. The endpoints chosen were: water (quality and quantity), ecosystems, and infrastructure. While the three research locations all face water, ecosystem and infrastructure issues, the specifics of these issues differ across the locations. The four stressors that also structured the project were temperature, precipitation, sea level rise and storm frequency and intensity.

Several types of data were used to triangulate on the variables of interest. 1) Unstructured interviews with decision makers representing key stakeholder groups were conducted in each research location. These *interviews* covered a range of topics, including climate change salience, potential stressor impacts, decision making networks, information use, and information gaps. 2) National and regional *newspaper coverage* of climate change was examined to provide some sense of the general information available on climate change. 3) Planning documents, reports and other *documentary evidence* were examined as corroboration of respondents' reports of organizational interest in climate change, and 4) some *observations of stakeholder group meetings* were done for the same purpose. 5) Finally, at the end of the project, *focus groups* were held in each location to reengage stakeholders and test some of the preliminary findings from the data analysis.

Conceptual Frameworks

To organize data gathering and analysis, four theoretical frameworks addressing the ways in which information is communicated and interpreted were used. These were: construction of social problems, agenda setting, communications theory, and social amplification of risk.

PROJECT ORGANIZATION

Phase I. This phase represented the initial planning stage of the project. At a planning workshop, research locations were selected, and regional endpoint categories were chosen to focus the inquiry. In addition the climate change stressors most likely to be associated with the endpoints were specified. GIS mapping, socio-demographic and environmental/ecological data, and investigator expertise all played a role in the selection. This planning phase was accomplished with the collaboration of EPA representatives.

Phase II. Selected stakeholders from the research locations were invited to collaborate with investigators and EPA representatives in a second planning workshop. At this point, the plausible ranges of climate-related stressors for each location, along with probable social, economic, and policy impacts of stressor changes were discussed. Basic information that would inform scenario development was exchanged, and team training in location-specific aspects of climate change took place. Stakeholders also assisted in the initial identification of stakeholder groups for contact during the fieldwork phase of the project, and the sociopolitical dynamics of the research locations were explored.

Phase III. This was the fieldwork phase of the project. Interviews were conducted in two waves. Wave 1 provided baseline information on (1) the local problems that will form the context of any consideration of climate change, (2) the character of the decision making climate and network, (3) the use of science-based information in decision making generally. In Wave 2 interviews, the topic of climate change was introduced via a set of stressor scenarios developed for each location. Responses to climate change generally and the scenarios specifically were noted. Wave 2 interviews also involved questions about the potential impact of climate change on local problems, the kinds of climate change information respondents have access to, the kinds of information they need and the information formats preferred. Simultaneously, data for analysis of national and regional newspaper coverage was gathered, as were planning documents and website content, for each of the organizations that formed part of the interview sample.

Phase IV. This phase represented the analysis phase of the project. All interviews were transcribed, coded and analyzed, utilizing a complex coding scheme to organize the conversational format of the interviews into variable categories. Newspaper articles were also coded and analyzed using coding categories that would mesh with those developed for the interview analysis. Planning documents that had been gathered were examined for sections mentioning climate change. Finally, team members examined websites for all the organizations that were part of the interview sample in each location. Websites' contents were analyzed for the role that climate change and stressors played in organizational mission and programs.

Phase V. During this last phase, stakeholders were reengaged in a series of focus groups. Two focus groups were held in each location, and selected stakeholder representatives were invited to respond to a series of questions designed to test the preliminary findings from the Phase IV analysis. Comments at the focus groups provided greater specificity to some of the conclusions and provided more local context for the final analysis.

Chapter 2

Project Planning

PHASE I—RESEARCH TEAM PLANNING

Choice of Locations, Endpoints and Stressors

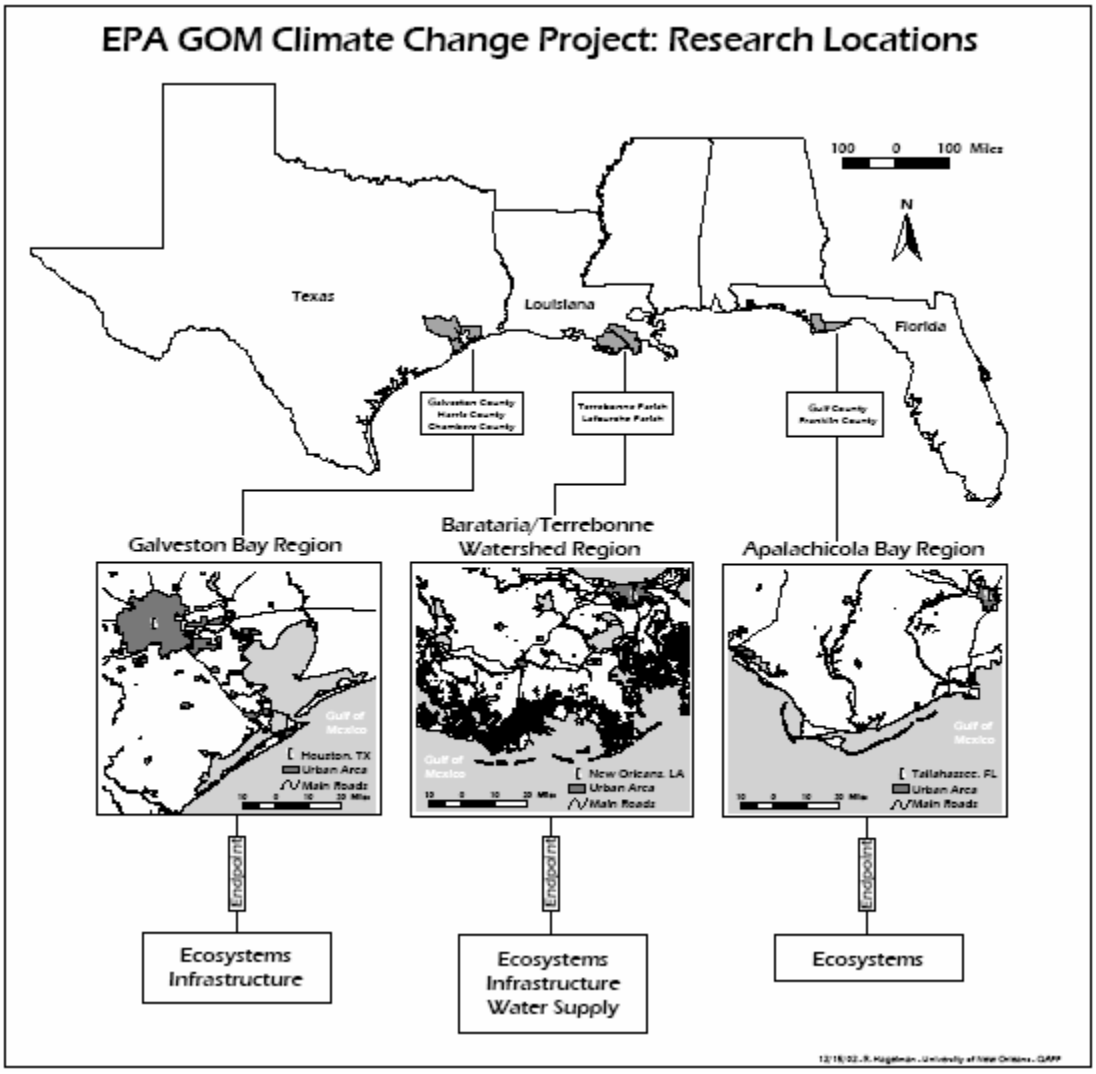
On December 9-10, 2002 the full team and an EPA representative met. At this workshop, six endpoints and four stressors were selected to focus the research. The endpoints chosen were infrastructure and ecosystems in the Western Gulf, infrastructure, ecosystems and water in the Central Gulf, and ecosystems in the Eastern Gulf (see Table 2.1). This selection produced one endpoint that was repeated in all locations (ecosystems), an endpoint that is shared by two of the research locations (infrastructure in the West and the Central Gulf), and one endpoint unique to the Central Gulf (water). Over the course of the project, research expanded to all three endpoint categories in all three regions. The team also selected four climate stressors: temperature, precipitation, sea-level rise, and storm frequency and intensity. These decisions were made in consultation with EPA, utilizing existing information including maps and other types of databases. The expertise of the investigators also played a part in these decisions.

TABLE 2.1
REGIONS AND ENDPOINTS SELECTED FOR STUDY

End Points	Regions		
	Western (TX)	Central (LA)	Eastern (FL)
Infrastructure	X	X	
Ecosystems	X	X	X
Water Supply		X	

Three research locations were also selected based on similar data and input from EPA and investigators: Galveston Bay in the Western Gulf, Barataria-Terrebonne Watershed in the Central Gulf, and Apalachicola Bay in the Eastern Gulf (see Figure 2.1). These locations span the Gulf geographically and also represent a range of economic relationships with the Gulf and a range of ecological profiles. The human populations of these areas are also socio-demographically varied. A discussion of each research location follows. (See also Appendix A for expanded summaries of these three research locations.)

FIGURE 2.1



Descriptions of Research Locations

Florida

The region of interest in Florida includes the eastern Panhandle. Specific attention was given to Franklin, Gulf, and Wakulla Counties, all of which have some portion fronting the Gulf of Mexico. This region of Florida is one of the least densely populated in the state. Aside from Leon County, around 78% of all residents live in rural areas, compared with 11% for the State of Florida. Nevertheless, the coastal region grew between 1990 and 2000. This trend continued into the early 2000s, with only Gulf County experiencing a decline in population. Most people who relocated to the coastal region between 1995 and 2000 came from in-state. Most out-of-state residents who moved to this region of Florida are from the southern United States. The influx of residents has shifted population demographics, with a large group coming from the age 25-54 subset.

In 1998, the National Institutes for Literacy estimated that 25-40% of adults in this region of Florida, varying by county, had achieved only a basic level of literacy (Reder, 1998). However, education levels in Florida have increased over time. Concurrent with an increase in the number of persons with a high school diploma, Florida has seen a decline in the number of persons with less than a 9th grade education.

Additionally, the number of people with an educational level beyond high school has increased statewide (Census Scope, 2007a). In the coastal counties of this region of Florida, the percentage of the population holding graduate or professional degrees has increased markedly. Some of this trend may be attributed to the influx of population into the region in recent years. Yet, growing education levels have not necessarily translated into economic prosperity. Poverty rates in the coastal area are generally higher than the state average, and unemployment rates ranged from 2.3% in Wakulla County to 3% in Franklin and Gulf Counties, compared to 2.9% for Florida as a whole (Agency for Workforce Innovation, 2006).

This region of Florida is represented in both the state legislature and Congress by a bi-partisan delegation. Although local governments retain much authority in Florida, especially in land-use planning, development, and zoning, counties and municipalities must demonstrate conformity to state regulations. Each county and municipality in Florida must complete a Local Government Comprehensive Plan; coastal communities must include a Coastal Management Element in their plan. The Comprehensive Plan is a critical policy document, which has significant bearing on issues like natural resource management and community development. The state may step in and protect resources and facilities when necessary, such as the identification of Franklin County as an "Area of Critical State Concern" (Florida Department of Community Affairs. Division of Community Planning, 2003). County commissions have the power to draft local codes and may work directly with mayors and city councils. It is noteworthy that some municipalities in this region have no governing structure of their own, but rely on governance by county officials. Ultimately, local governments must work with state resource agencies, including the Florida Department of Environmental Protection (FDEP), Florida Department of Community Affairs (FDCA), Florida Department of Agriculture and Consumer Affairs (FDACS), and the Northwest Florida Water Management District (NWFWMD). Federal agencies with a notable presence in the area are the U.S.D.A. Forest Service, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Department of Defense, and the EPA.

The Apalachicola Bay region has historically had a resource-based economy. In terms of real property, a significant amount of land in the region is currently held in public trust by the various local, state, and federal agencies. In addition, there are several private land holders in the region owning significant coastal and inland acreage. Forestry was a critical industry until closure of the last regional lumber mills, which brought serious economic privation to the area. Agriculture is still practiced in the region, along with livestock production and beekeeping. Seafood harvesting is also a traditional industry of great economic and social importance in the region. Shrimp, oysters, blue crab, and finfish species are harvested for commercial purposes. Tourism, particularly natural resource-based recreation, and construction are now becoming important industries.

Several local issues have interfered with the development of industry, including the Tri-State Water Wars, which dates back to the late 1980s (Stephenson, 2000). This dispute arose between Georgia on one hand, and Alabama and Florida on the other, each side claiming significant interest in managing water flow within the Apalachicola-Flint-Chattahoochee system. When the US Army Corps of Engineers attempted to change the flow of the river by withholding water from Alabama, the state sued the agency. Later, Florida also sued the Corps, arguing that the withdrawal of water in Georgia deprived the river and ecological system of freshwater flow. Negotiations among the three states over water allocation are deadlocked (Shelton, 2006). Another issue of significance in this region of Florida is the occurrence of red tide (*Karenia brevis*) blooms, which leads to closures of fisheries and causes health concerns for people and wildlife. There were large outbreaks of red tide in the region in 2003, 2004, and 2005, which led to protracted closures in shell fish harvesting. Finally, hurricanes and tropical storms can be problematic in this area, and it experienced serious storms events during the period of this study. Since 2000, seven hurricanes or tropical storms have landed on or near this region of Florida. The region was heavily impacted by Hurricane Ivan in 2004 and sustained extensive damage from storm surge during Hurricane Dennis in 2005.

Louisiana

The region of interest in Louisiana included Lafourche and Terrebonne Parishes (counties), which border the Gulf of Mexico and are linked by climate and hydrology. Each parish has a lower population density than the state average. Terrebonne and Lafourche Parishes' growth rates are very different from Louisiana's growth rate. The population change in Lafourche Parish between 1999 and 2000 was 4.79%, slightly lower than the population percentage change for Louisiana. At 7.76%, Terrebonne's growth rate was notably high.

Most recent statistics (2000-2004) show higher growth in Lafourche Parish (2.20%) than in Terrebonne Parish (1.87%) or Louisiana (0.60%). Most immigrants to these areas came from other parishes in Louisiana, and many also come from the southern United States.

Both parishes experienced population turnover following Hurricane Katrina in 2005. Although in-state migration to these parishes increased, residents from both parishes also moved to Atlanta, Houston, and other parts of the United States following the hurricane (Louisiana Recovery Authority). Thus, the net change in population is unclear. Following Katrina, many Latino residents immigrated to the area to help in reconstruction (Belsie & Axtman, 2006). Prior to Katrina, the population of these parishes was aging, with the number of children under age 14 decreasing, and the number of adults between the ages of 45-54 increasing.

Literacy rates in Lafourche and Terrebonne Parishes have followed state trends between 1990 and 2000. Educational levels in both parishes are increasing, as the percentage of people with less than a 9th grade education sharply decreased and more people completed associate and bachelor's degrees (Census Scope, 2007b). Median incomes in Lafourche and Terrebonne parishes were similar to the state average (around $30,000), and parish per-capita incomes were only slightly below that of Louisiana. These figures are likely to have fallen following Hurricane Katrina. Louisiana's unemployment rate in 2000 was 5%, lower than that of either parish. While unemployment spiked following Katrina, reconstruction has gradually lowered this rate.

Lafourche and Terrebonne Parishes are represented in the Louisiana state senate by three seats, all held by Democrats. Of the five state representatives in Terrebonne and Lafourche Parishes, three are Democrats and two are Republicans. Louisiana's governor is Democrat Kathleen Blanco, however she opted not to run for re-election in 2007, and in October 2007, U.S. Representative Bobby Jindal, a Republican, was elected as Louisiana's next governor. At the federal level, the United States representative for Louisiana's Third Congressional District is Rep. Charlie Melancon, a Democrat. Louisiana's two U.S. senators are Mary L. Landrieu (D) and the more recently elected David Vitter (R).

Parishes enforce state and federal legislation of public utilities, parks and recreation, regional zoning, agricultural and economic development, and infrastructure. Parish governments include an elected parish president and a parish council. Like a senate, the parish council comprises representatives from each parish district with one or two members at large. While parishes must abide by state legislation (to receive funds and also to stay within the legal constitution of the State of Louisiana), they can still create independent systems of governance. Each parish has an elected sheriff who is in charge of general law enforcement in the parish. The sheriff also oversees tax-collection. Zoning in parishes is governed by the parish Board of Commissioners, who are appointed by the Parish Council. (Lafourche Parish Code of Ordinances, Ch. 19). Due to the small size of many parishes, municipalities do not play a great role in governance; most communities are not incorporated. Parishes are small enough to essentially usurp the powers that municipalities hold in other states.

Natural resources in the region are subject to state and federal agencies. Parishes do not possess much control over mineral resources. The Louisiana Department of Natural Resources (DNR) monitors coastal restoration and management, conservation, and mineral resources. The Office of Coastal Restoration and Management (OCRM), a branch of the Louisiana DNR, maintains the state wetlands and regulates Louisiana's coastal zone. Generally coastal restoration projects must be approved by the Louisiana state legislature, which pays attention to federal guidelines and enforcements. The Louisiana Office of Conservation, which is also a branch of the DNR, issues drilling permits and reservoir construction permits. It also heads Louisiana's surface mining program and pipeline operations.

Louisiana's Department of Environmental Quality enforces federal environmental guidelines and works to combat such things as illegal dumping and other environmental hazards at the local and parish level. The Louisiana DEQ also connects federal programs to parishes.

The economy in Lafourche Parish is strongly tied to the Port of Fourchon as well as the production and distribution of natural gas and oil. Additional economic interests throughout the parish include commercial fishing and sugar cane production.

Residents of Terrebonne Parish have always depended on the area's natural resources for their livelihood. Oysters, shrimp, crabs, and fish contribute their share of wealth to the parish, and trapping of Louisiana muskrat, mink, otter, raccoon, and nutria for their pelts is another form of local commerce. With the discovery of offshore oil, Terrebonne became the gateway to the heaviest concentration of offshore oil

service companies in the state. By the late 1970s, the area's main focus was the oil industry. Those companies not related to oil and gas depended on this industry for their survival. Terrebonne Parish suffered along with the rest of the U.S. oil industry in the downturn of the early 1980s.

The dominant issue facing the Barataria-Terrebonne region is land loss, due to subsidence, sea level rise and storm events. Since the 1930s, Louisiana has lost 1,900 square miles of land. Between 1990 and 2000, wetland loss was approximately 24 square miles per year (Louisiana Department of Natural Resources, 2007). The losses are not uniformly distributed, but rather are concentrated in a few areas, with the lower Terrebonne and Barataria Basins experiencing some of the greatest loss (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority, 1998). The impact of land loss in the Barataria-Terrebonne area has significant economic ramifications. In 1990 passage of the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA), also known as the Breaux Act, signaled the first concerted restoration effort at the national level (Schleifstein, 2002).

Just when efforts to restore the Louisiana coastline were gaining steam, 2005 brought two devastating hurricanes to the area. Because of the catastrophic flooding in New Orleans, Hurricane Katrina will forever be remembered as the more destructive storm, however, compared to their neighboring parishes, Lafourche and Terrebonne suffered less destruction from that storm. Hurricane Rita was responsible for extensive flooding and damage in Terrebonne Parish (Longman & Brick, 2005), and the parish was declared a federal disaster area following both storms. However, the disruption Katrina caused to all aspects of life in the state has created problems for the study area. As a result of these storms, many of the residents of Lafourche and Terrebonne Parishes, who were already struggling, have decided to leave the area and migrate to other parts of the state and nation that offer greater economic opportunity (Barry, 2006; Halfbinger, 2002; O'Brien, 2003). Louisiana researchers in the team were severely affected by the storm, and their contribution to the project following the storm was significantly reduced.

Texas

The project focused on the Galveston Bay region, located in Southeast Texas in the Houston-Galveston area. Galveston Bay is the largest and most biologically productive estuary in Texas and is adjacent to one of the most heavily urbanized, industrialized areas in the nation. Approximately 4.5 million people reside in the five counties surrounding Galveston Bay: Brazoria, Chambers, Galveston, Harris, and Liberty counties (Galveston Bay Estuary Program, 2002).

Education levels generally rose in the Galveston Bay area as part of a greater trend of increased educational attainment throughout Texas, yet little economic uniformity exists among the project counties. (Census Scope, 2007c). Brazoria, Chambers, Galveston, and Harris Counties have higher median incomes than the rest of Texas; however Liberty County has a higher unemployment rate (Texas Workforce Commission).

All of the elected offices in the state's executive branch are currently held by members of the Republican Party. In addition, Texas' two U.S. senators are Republicans. Texas has 32 representatives in the U.S. House of Representatives, with nine representing the counties of the Galveston Bay area. Of these, five are Republicans and four are Democrats. In the state legislature, the Galveston Bay counties are represented almost equally by members of the two major parties (Texas Legislature Online).

Counties in Texas do not have as much autonomy as cities (House Research Organization, 2002). Cities in the state are classified as either "general law" or "home rule." Incorporated cities in Texas have limited authority for various purposes in areas beyond their city limits. The five counties in the study are also part of a larger regional organization, the Houston-Galveston Area Council (H-GAC), a voluntary association of local governments and elected officials.

Over 90% of Texas' 176 million acres of land is privately owned (Texas Environmental Profiles; Governor's Task Force on Conservation, 2000). In the Galveston Bay region, the federal government manages three national wildlife refuges, one national preserve, and several reservoirs and lakes. The Texas Parks and Wildlife Department oversees a number of properties in the region and the five individual counties have their own parks, recreation, and nature facilities. Other state agencies with interest in the natural resources of the region are the Texas Commission on Environmental Quality (TCEQ) and the Texas General Land Office, which manages 20.4 million acres of state property.

The economy of the Houston-Galveston region is primarily based on the energy industry, particularly oil. However, biomedical research and aerospace are also large parts of the region's economic base. The Houston metropolitan area comprises the largest petrochemical manufacturing area in the world and includes oil and gas, synthetic rubber, insecticides, and fertilizers. The city is home to 5,000 energy-related establishments, including many of the top oil and gas exploration and production firms and petroleum pipeline operators (Greater Houston Partnership). Other major employers in the region are the Texas Medical Center and the Johnson Space Center.

Galveston Island has experienced a great deal of growth in the past decade, including industries such as health care, life sciences/biotechnology, tourism/hospitality, off-shore oil, maritime, services, retail, education, and government. The Port of Galveston ranks as the eleventh-largest cruise port in the world and the number-four U.S. cruise port in world rankings (Galveston Chamber of Commerce). Galveston Bay's environmental resources provide a major source of income for the region, through commercial fishing and shrimping, recreational fishing, hunting, and ecotourism, particularly bird watching. Galveston Bay contributes one-third of the state's commercial fishing income and one-half of the state's recreational fishing income (Lester & Gonzalez, 2005).

The Houston-Galveston region is expected to grow by 2 to 3 million people over the next 25 to 30 years. The pattern of growth in the region has been increasingly decentralized (Envision Houston + Region, 2006; Greater Houston Partnership; House Research Organization, 2002). Transportation infrastructure has been unable to keep up with this growth and the region's air quality is compromised. Since 1990, the eight-county Houston-Galveston metropolitan area has been classified as a nonattainment area by the U.S. Environmental Protection Agency. In addition to the pollution resulting from vehicle exhaust, the region's air quality is also affected by its industries and weather patterns (TCEQ).

The other issues and events of regional significance have been the tropical storms and hurricanes that affect the region by virtue of its location on the Gulf Coast of Texas. In June 2001, Tropical Storm Allison dumped over 36 inches of rain on the Houston area, causing 22 deaths and over $5 billion in damage, primarily due to flooding. In August 2005, Hurricane Katrina struck the U.S. Gulf coast. The hurricane's impact has been felt in the Houston area with the resulting influx of evacuees from Louisiana. Estimates are that the region absorbed 160,000 refugees from Katrina, many choosing to stay in Texas rather than return to the devastated New Orleans area. In September 2005, a second major storm, Hurricane Rita, threatened to make landfall at Galveston but veered north and did minimal damage to the Houston area. Nevertheless, nearly 2.5 million residents attempting to evacuate created massive traffic jams stretching from Galveston to Houston and points much farther north. The problems resulting from the mass evacuation in advance of Hurricane Rita highlighted major flaws in emergency preparedness and response in the region (Berger, 2006).

PHASE II—STAKEHOLDER-TEAM WORKSHOP

Workshop Goals and Activities

The purposes of this phase were (1) identification of the plausible range of climate-related stressors or attributes associated with climate change in these specific locations, as well as the probable social, economic, and policy impacts of the stressors in each of the research locations, (2) initial steps in the development of scenarios for communicating climate change impacts during interviews, (3) research team training on location-specific aspects of climate change and sociopolitical dynamics for each specific research location, and 4) initial identification of stakeholder groupings for targeted information gathering during the fieldwork phase of the project.

To achieve these goals, a workshop was held in May 2003, during which the research team, a small group of knowledgeable stakeholders from each area, and EPA representatives met to exchange information. Information exchange comprised a combination of presentations by experts in ecology, climate science, and social science, group discussions involving researchers, experts and stakeholders and small group discussions.

Workshop participants use a combination of GIS mapping and other existing sources of information on the Gulf Coast region as well as documentary evidence of issue salience and stakeholder networks during its discussions. The full ranges of probable climate change and potential social, economic, political and policy

impacts in each of the research locations were explored in the workshop. This in-depth discussion was later translated into more limited scenarios for use with stakeholder informants during the unstructured, open-ended interview process. These scenarios emphasized local change in climate-related stressors, such as sea-level rise. They were intended to give concreteness to stakeholder reflection on possible outcomes—particularly for infrastructure, water resources, and ecosystems—and on information use and needs for decisions related to these outcomes. Details of the discussion of plausible stressor ranges follow.

An essential component of the research project was to develop a series of scientifically based plausible climate change scenarios that are relevant to potential environmental issues of concern to decision-makers and stakeholders and that are specific to the three case study areas: Apalachicola Bay in Florida, Barataria-Terrebonne area in Louisiana, and Galveston Bay in Texas. The scenarios needed to be specific to the climate change-induced stressors for each system that could affect ecological and/or societal systems of concern. They also needed to be sufficiently clear to non-scientists so that they could inform the second phase of the stakeholder-interview process. Such a set of scenarios was developed through a focused workshop involving members of the research team supplemented by a number of regional and national climate experts (see Chapter 2: Workshops).

The primary basis for developing climate change scenarios for the three case study areas was the broad understanding of the climate of the larger area of the Southeastern United States and Gulf of Mexico and the climate change projections developed for the Southeastern United States. The basic understanding of climate change at the time of the scenario workshop was the latest report of the Intergovernmental Panel on Climate Change (Houghton, 2001; Watson & Albritton, 2001). This provided outputs and discussion based on a series of existing general circulation models (GCMs) that had been simulated for various greenhouse gas emission scenarios, including aspects that could be interpreted for the US and the Southeast. Considerable work had also already been done to characterize more specifically Gulf Coast climate change scenarios (Fiedler, Mays, & Siry, 2001; Scavia et al., 2002; Twilley & Reed, 2001; Twilley et al., 2001; Zimmerman & Siemann, 2001). These studies provided a strong point-of-departure for our case study-specific scenarios. Our task was to go the next step insofar as possible to develop climate change scenarios at a smaller spatial scale for the three specific coastal regions.

The initial discussion was to articulate the specific climate change-relevant stressors that might affect ecological and/or societal systems in the three regions. The team of experts decided to focus on three stressors: (1) temperature changes (means and variability); (2) precipitation changes (means and variability); and (3) sea-level rise increases. The second step was to select a range of changes that could be expected for each of these stressors over various time periods (near-term, mid-century, and end of century), taking into account the various uncertainties in such projections. Finally, the group addressed the vulnerabilities of ecosystems to such changes to inform the study on those aspects that might be most at-risk from climate change stressors.

In general, while mean global or regional temperature increases are commonly metrics of climate change, and temperature projections are often the central focus of climate models, the group agreed that for the Gulf Coast systems, changes in the precipitation regime may well pose a much greater risk. On the other hand, the uncertainty about precipitation changes is much larger than the uncertainties about temperature or sea-level rise. Moreover, the group decided that in some parts of the Gulf Coast, the more local-scale issue of sea-level rise could be of dominant concern.

The climate change scenario workshop began with a discussion on the driving factors controlling the climate in the region and sources of natural variability. For example, while many people are familiar with the nature and effects of the El Nino-Southern Oscillation (ENSO) phenomenon, less is known about the Atlantic Multi-Decadal Oscillation (AMO) but it may have a critical role to play in climate variability (Enfield & Mayer, 1997). The location, strength, and movement of the Bermuda High system fundamentally controls the precipitation regime of Florida and to a lesser degree further west along the Gulf Coast (Chen & Gerber, 1990). For instance, the Bermuda High system, which responds to ENSO and AMO forces, can cause prolonged and intense droughts if it prevents the normal development of convective precipitation (thunderstorms) so typical of the summer, rainy season in the eastern Gulf region. It also can profoundly affect the steerage currents of hurricanes and tropical storms, as experienced in the 2004 season with four hurricanes striking Florida (Charley, Frances, Ivan, and Jeanne), and the 2005 season with Hurricanes Dennis,

Katrina, Ophelia, Rita, and Wilma devastating the central Gulf Coast and striking elsewhere in the Gulf of Mexico.

Next the IPCC report (Houghton, 2001; Watson & Albritton, 2001) was considered, with attention to the specific outputs of GCMs for the region. Increases in temperature can lead to shifts in species distributions, invasion of more tropical species, outbreaks of diseases and pests, and impacts on agricultural production and crop selection. Extreme temperature excursions, such as the number of days per year exceeding 100°F, can have important health consequences for people while increasing energy demand. Ecologically extreme temperatures can also enhance the frequency of fires. However, while there seems to be convergence of the temperature projections from the GCMs, precipitation is much more difficult to project yet may well be much more important. Not only is there uncertainty about the magnitude of precipitation changes across models, there is even disagreement on the direction of the effect, i.e., whether precipitation would increase or decrease. Yet the scientists noted the critical importance that the precipitation regime, especially extreme events of prolonged drought and intense flooding, has on the natural and human systems of the region. Gulf Coast ecosystems are linked by the flow of water from the uplands through freshwater lakes, rivers, and wetlands to the coastal and marine systems downstream. In many parts of the Gulf Coast, especially critical to coastal Louisiana, wetland areas require some duration of flooding to maintain healthy habitats and sustain food webs. Altered precipitation regimes can directly lead to changes in the frequency and intensity of fires, and while some ecosystems in the region are adapted to fire, others are very vulnerable. Another important example of effects of altered precipitation is the requirement of the Apalachicola Bay ecosystem to have periodic low-salinity events to protect the primary resource of concern, oysters, from marine-based invasive predators. Moreover, independent of any climate variability or change issue, the large increase in the human population in the region makes it certain there will be more human consumption of water resources in the future and more competition between human usage needs and environmental requirements. This is clearly demonstrated by the current intense, prolonged drought over much of the Southeast conflicting with the increased water consumption demands from the almost uncontrolled growth of metropolitan Atlanta.

Finally, the participants at the scenario workshop discussed at length the regional and location-specific projections for sea-level rise. There is a general pattern of continuous sea-level rise over the past few millennia in the Gulf region, which seems to have suddenly increased in rate in the early 20th century. For example, in Florida sea-level rise averaged 1.5 inches per century from about 3200 years ago until 1930, then suddenly increasing to a rate of 12-14 inches per century. This has resulted in accelerated erosion of shore margins, saltwater intrusion into surface and ground waters, and landward movement of marine wetlands (Wanless, Parkinson, & Tedesco, 1994). In other areas, especially coastal Louisiana, the effects of local-scale subsidence are dominant. This subsidence contributes to the decrease in land elevation, that together with increase in sea levels, results in greater relative rise in water level than that experienced in other Gulf Coast regions. Wetlands can counter this decrease in elevation (subsidence) by soil formation from both deposition of inorganic sediments or organic matter (particularly root production) from plant growth. Yet the inability of wetlands to adapt to the combined effects of subsidence and sea level rise has been driven by the loss of much of the natural sediment inputs to the coastal wetlands from the Mississippi River watershed. Already Louisiana's rate of relative sea-level rise is the highest in the United States: water levels along its coast have risen by up to 40 inches over the past 100 years (Twilley & Reed, 2001). Consequently, adding an enhanced climate change-induced sea-level rise signal on top of the subsidence puts that system even more at-risk. Coastal wetlands help retain and purify water, stabilize sediments, and protect coastal areas by reducing storm surge impacts. Enhanced rates of sea-level rise significantly increase coastal systems' vulnerability to storms, especially hurricanes, and can change coastal salinity regimes, allowing more marine species to invade and replace estuarine communities. Sea-level rise also puts at-risk groundwater and other sources of drinking water. Continuing subsidence and human interference with coastal processes, such as dam and levee building and river diversions, combined with sea-level rise, are likely to lead to wetland degradation and losses and could undermine wetland restoration efforts, affecting wildlife species and recreational opportunities (Hendry, 1993).

Chapter 3

Research Activities & Methodology

INTERVIEWS

Design

Unstructured interviews were the primary method used to gather information from stakeholders in the three research locations. These interviews were conducted along well-established social science protocols. An interview guide with general topic interview prompts allowed interviewers to direct conversations to focus on local problems, stakeholder decision making, and the role of science information in decision making. The sections following this introduction provide greater methodological detail on the interviews.

Interviews were conducted in two waves. Researchers designed Wave 1 to gather information on the general problems facing stakeholders in an area, the extent to which scientific information is used to address those problems, and the decision processes involved. Wave 2 interviews elicited similar types of information after the interviewer introduced the topic of climate change to the stakeholder.

At the Wave 1 stage, researchers were interested in identifying (1) issues that compete with climate-related problems for attention, (2) proposed solutions to those problems, (3) the level of importance that stakeholders attach to science-based information in decision making, and (4) the general shape of the decision making processes in each region. During Wave 1, interviewers did not introduce the topic of climate change. The extent to which climate change spontaneously emerged in conversations with stakeholders was one measure of its salience in the different research locations and with particular types of stakeholders. This approach helped to reveal the nature and structure of regional issues toward which climate change research can be addressed and disseminated.

Midway through Wave 1 the research team modified the design that would be used in Wave 2 in order to increase the kinds of comparisons that could be done. Because climate change was so rarely mentioned during the Wave 1 discussions of general problems, researchers concluded that climate change was of minimal interest to the majority of Wave 1 respondents. The new design specified that a stratified, random sample of respondents interviewed in Wave 1 would be re-interviewed in Wave 2 to serve as a panel of individuals who had already considered and been able to articulate the problems facing the local area. These panel participants are identified as Wave 2A. These respondents were reminded that they had already talked about problems facing the area, and then the climate change scenarios were introduced. Interviewers next asked for the respondent's general reaction to the scenarios and what he/she would now say in light of this climate change information. At the end of each Wave 2A interview, respondents were asked to refer individuals who would be able to discuss similar climate change issues, and a second sample, Wave 2B, was drawn from these referrals to serve as a comparison group. This modification produced a sample for which climate change issues were more salient and resulted in more productive interviews.

Wave 2B interviews began by asking the respondent about local problems. The interviewer then introduced the climate change scenarios and the concepts of risk and uncertainty to the stakeholder. After introducing scenarios describing real vulnerabilities of the individual research locations and a range of uncertainties that exist for them, interviewers probed for the perceived effects of climate change on these problems, the roles that risk and uncertainty play in stakeholder decision making, and the stakeholder's perceived need for additional information. The Wave 2 interviews allowed the team to examine whether the introduction of climate change altered the problems and perceptions of risk in a more compressed time frame and whether or not the perception of problems was similar pre- to post-scenario. Interview guides for all interview waves can be found in Appendix B.

Sampling

The overall research design called for three groups of approximately 50 respondents in each research location: (1) a group interviewed only during Wave 1 and asked only about general area problems, decision making, and information use; (2) a group interviewed during Wave 1 and during Wave 2, who were asked about general problems during the first interview and about climate-linked problems during the second interview; and (3) a group interviewed during Wave 2 only, whose interviews focused on climate change and the problems that could be exacerbated by or emerge as new problems as a result of climate change and its stressors. A general description of the sampling process follows.

Because the focus of this research was to be on decision making and decision making networks, the critical stakeholders to access during the interview process were different types of decision makers in each research area. The team chose to develop an array of the types of organizations in each research location. For each research area team, the first step in the sampling process was to draw up as comprehensive a list as possible of organizations in the area according to two criteria. First, the organization must have a potential stake in the effects of climate change. Second, the organization must have power to influence decisions relevant to climate change. Researchers' knowledge of their areas and internet and media sources were used to assemble the lists. This strategy was consistent with the realities of agenda setting and policy development in the U.S. and also served to focus the sampling process.

In order to insure that the full range of organizational types was represented during sampling, the following list of organizational types guided the search:

- Federal government departments, agencies, programs, labs, and research centers
- State government departments, agencies, programs, labs, research centers, and elected legislative officials
- County or Parish level government departments, agencies, programs, administration, and elected or appointed officials
- Municipal level administration, departments, and programs
- Levee board members and levee district administration
- Port commission/river authority members and administration
- Non-governmental organizations with broadly defined environmental goals
- Non-governmental organizations with narrow interest focus and specific mandate
- Professional associations organized around specific occupations and occupational interests
- Industries and groups immediately dependent on extraction of natural resources, specifically: agriculture, fisheries, timber, and mining
- Profit-seeking organizations with economic function other than extraction of a natural resource
- Affiliations and associations organized around Native American ethnic membership and culture
- Educational institutions including K-12 schools, higher education institutions, and university affiliated research centers and programs [1]

[1] This organizational type was not part of the initial sampling frame, but it was added later into the interview sampling frame when university scientists were referred.

After an initial search and assembly of various organizational types, we finalized all types of organizations in our sampling list across all three research locations and assigned an organizational code to each category. Table 3.1 represents the organizational types and corresponding organizational labels in our interview sampling. These labels were later used in our interview coding.

TABLE 3.1
ORGANIZATION LABELS & DEFINITIONS

ORGANIZATION CODE	DEFINITION OF ORGANIZATION TYPE
ASSN	Associations organized around specific occupations and occupational interests
EDUH	Higher education institutions; university affiliated research centers and programs
EDUS	K-12 schools and school districts
GOVF	Federal government departments, agencies, programs, labs, and research centers
GOVS	State government departments, agencies, programs, labs, research centers, and elected legislative officials
GOVP	Parish/county level government departments, agencies, programs, administration, and elected or appointed officials.
GOVC	Municipal level administration, departments, and programs
HARV	Economic organizations directly dependent on extraction of natural resources
LEVE	Levee board members and levee district administration
NGOE	Non-government organizations with broadly defined environmental goals
NGOS	Non-government organizations with narrow interest focus and specific mandate
PORT	Port commission members and port administration; river authority members and administration
PRFT	Profit-seeking organizations with economic function other than extraction of a natural resource
TRIB	Affiliations and associations organized around Native American ethnic membership and culture
OTHE	Other Organizations

Wave 1 Sampling

The target was approximately 600 interviews for the project as a whole, including 200 from each research area with 100 of these from Wave 1 and 100 from Wave 2. Fifty of the respondents from Wave 1 would also be interviewed in Wave 2. In each area, the initial step was to select from the assembled list of organizations a random sample of 20-50 interviewees, stratified by organizational type. The top administrative individual in the organization was sought for these interviews to capitalize on his or her broad view of the organization and knowledge of the decision making network. Because there was no assurance that the sampling frame lists were exhaustive of relevant organizations, a snowball technique was also used. Interviewees were asked to refer individuals (and by extension, their organizations) who would also be knowledgeable about the issues under discussion. The referrals from these initial interviews were added to the sampling frame, repeats of original list entries were eliminated, and the remaining 50 Wave 1 interviews were randomly drawn from the expanded list. Because of the unique features of each location, there were some variations on the sampling methodology for each research area. These are explained in detail below.

Florida's Technique in Wave 1

Initially, stakeholder groups were classified into four broad categories including: federal interests, state interests, local interests, and commercial/NGO interests. These categories were further refined to guide the identification of particular groups that might be of importance in the Apalachicola Bay and watershed region, as shown in Table 3.2.

TABLE 3.2
STAKEHOLDER GROUPS IN FLORIDA

CATEGORY	STAKEHOLDERS
Federal	▪ National Estuarine Research Reserve ▪ US Fish and Wildlife Service ▪ US Coast Guard ▪ US Army Corps of Engineers ▪ US Department of Agriculture-Forest Service
State	▪ Florida Department of Environmental Protection ▪ Florida Department of Natural Resources ▪ Florida Fish and Wildlife Conservation Commission ▪ Northwest Florida Inland Navigation District Officials ▪ Florida Water Patrol ▪ Florida Department of Agriculture & Consumer Services Division of Forestry Division of Aquaculture ▪ Elected Officials
Local	▪ City mayor (sitting and former) ▪ City council members ▪ County commission members ▪ Planning and Zoning commission ▪ Local tourism office or agency ▪ Other city/elected officials ▪ School superintendents ▪ Port authority ▪ Tribal councils or leadership
Commercial and NGO	▪ Chamber of Commerce ▪ St. Joe timber/paper company ▪ Local newspaper editors/science writers ▪ Stakeholder interest groups ▪ Commercial, public, or environmental groups owning/managing large tracts of property ▪ Boating or tourism interest organizations ▪ Realtor associations ▪ Recreational fishing groups or associations ▪ Franklin County Seafood Workers Association ▪ Unorganized stakeholders (e.g. individual oyster fishers)

Potential organizations for the seed lists were identified by searches or referrals. Initial searches were conducted by team members to identify organizations that might be important in the region in the realm of resource use and management. Potential organizations were identified from newspaper articles and government reports, along with internet resources. Researchers attempted to identify state and local government organizations by searching the homepages of cities, counties, and the State of Florida. A few potential groups were identified via referrals from stakeholders who participated in the project workshops or by members of the Florida A&M University (FAMU) research team.

The study site was defined ecologically in relation to the Apalachicola watershed, as opposed to adhering strictly to political boundaries, such as a city or county. Our goal was to ensure that representatives from the above categories would be identified for any number of localities that had an interest in the Apalachicola Bay and watershed region. As a result, an effort was made to identify organizations from a number of cities/towns (e.g., Apalachicola, Port St. Joe, St. George Island, Eastpoint, Carabelle, etc.), as well as counties (e.g., Franklin, Gulf, and Wakulla). In order to ensure that representatives from these localities would be incorporated into the sample, we made sure to include prospective respondent organizations that encompassed the entire region. Northwest Florida is not densely populated and, concerns were initially raised about FAMU's ability to meet a sample size of even 150 organizations during both waves of data collection. By bounding the study site ecologically, we attempted to reduce the likelihood of encountering limitations in sampling. Nearly 70 prospective respondent organizations were identified with close to 100 individuals who could be interviewed (for example, a Board of County Commissioners might have five or six members).

Expansion of the seed list was discouraged once interviewing started so that the advantage of the snowball sampling methodology might be realized. Consequently, the decision was made to compile a seed list identifying multiple potential respondents in each category so as to ensure a healthy, diverse seed list at the outset. At this point, researchers selected potential respondent organizations from the following categories: Federal Government-Agency, Federal Government-Elected, State Government-Agency, State Government-Elected, Local Government-Agency, Local Government-Elected, Commercial or Business, NGO-Environmental, NGO-Trade, NGO-Recreation, and Academic. These categories were utilized so as to ensure a broad and diverse cross-sample within the decision-making and stakeholder communities.

The number of respondents selected from each category varied with the total number of potential respondents identified for each group. For example, there were more potential respondents in the government categories than in the Commercial or Business category. In addition, some potential organizational respondents were held back because so few were identified during initial searches for particular categories; this was the case for the Commercial or Business, NGO-Recreation, and Academic categories. As Table 3.3 demonstrates, a total of 36 potential respondents were included in the active seed list. The remaining twelve organizations were held back in anticipation of the Wave 2 interview process.

TABLE 3.3
ORGANIZATION TYPE BY CORRESPONDING NUMBER OF SEEDS IN FLORIDA

Organization Type	Number on Seed List (W1-Active)	Number on Seed List (Held Back)
Federal Government-Elected	1	1
State Government-Agency	3	1
State Government-Elected	2	1
Local Government-Agency	3	0
Local Government-Elected	4	1
NGO-Environmental†	7	1
NGO-Trade†	7	3
NGO-Recreation	1	1
Commercial or Business	2	2
Tribal Government*	0	0
Academic	1	0
Total	**36**	**12**

†The NGO-Environmental and NGO-Trade categories are slightly larger because of inclusion of local groups that operate on a small scale (in one city, for example), as well as organizations that operate on a regional, state, or national scale.

*No Tribal governments were identified for the study area.

After compilation of the active seed list for Wave 1 data collection, researchers made attempts to contact potential respondents. After interviews were completed, the respondents were asked to refer the interviewer to additional potential respondent organizations, as well as the appropriate person to interview within that organization. The names of possible respondents were subsequently added to the respondent management database.

Researchers attempted to contact potential respondents by phone and, when possible, via email until: (1) an interview could be scheduled, (2) a positive refusal was issued by the potential respondent, or (3) contact information was found to be nonviable without any means of updating the information.

At the end of Wave 1 data collection, 190 persons, representing approximately 120 unique organizational units, had been identified as potential respondents. As indicated in Table 3.4, at the conclusion of Wave 1 data collection, a total of 84 interviews were completed. Twenty-seven respondents were in the original seed list and resulted in completed interviews. The remaining 57 interviews were a result of referrals during the process of snowball sampling. However, the referral and seed list categories were not mutually exclusive; ten of the 57 referrals had also been identified as a part of the original seed list. Eight potential respondents were deemed ineligible for participation in the study, 21 respondents were still eligible for Wave 1 interviewing, four potential respondents refused to participate in the study, three were unreachable, and 70 respondents had been held back in anticipation of Wave 2.

TABLE 3.4
STATUS OF FLORIDA INTERVIEWS AT THE END OF WAVE 1

	Frequency	Percent	Cumulative Percent
Complete	84	70.0	70.0
Not Eligible	8	6.7	76.7
Outstanding	21	17.5	94.2
Refused	4	3.3	97.5
Unreachable	3	2.5	100.0
Held Back	70		
Total	**190**		

Some respondents refused to be audio-tape recorded. Five out of the 84 complete interviews were not entered into the final database either because respondents refused to be taped (N=2) or because poor tape quality made transcription impossible (N=3). Table 3.5 describes the final Wave 1 sample from Florida by type of organization.

TABLE 3.5
FLORIDA WAVE 1 RESPONDENTS BY TYPE OF ORGANIZATION

	Frequency	Percent	Cumulative Percent
ASSN	6	7.6	7.6
EDUH	3	3.8	11.4
GOVC	7	8.9	20.3
GOVF	11	13.9	34.2
GOVP	8	10.1	44.3
GOVS	19	24.1	68.4
HARV	5	6.3	74.7
NGOE	9	11.4	86.1
NGOS	4	5.1	91.1
OTHE	2	2.5	93.7
PORT	3	3.8	97.5
PRFT	2	2.5	100.0
Total	**79**	**100.0**	

See Table 3.1 for a description of the organization code

Louisiana's Technique in Wave 1

From a master list of known organizations compiled largely from print and internet sources, organizations were categorized as illustrated in Table 3.6.

TABLE 3.6
STAKEHOLDER GROUPS IN LOUISIANA

CATEGORY	STAKEHOLDERS
Federal	▪ Federal government departments ▪ Federal agencies ▪ Federal programs
State	▪ State government departments ▪ State agencies ▪ State programs ▪ Elected officials
Local	▪ Parish level government departments ▪ Parish level government agencies ▪ Parish level programs ▪ Parish level administration ▪ Municipal level administration ▪ Local elected officials ▪ Levee board members ▪ Levee district administration ▪ Port commission members and port administration ▪ Tribal council or leadership
Commercial and NGO	▪ Non-government organizations with broadly defined environmental goals ▪ Non-government organizations with narrow interest focus and specific mandate ▪ Trade associations ▪ Profit-seeking organizations with economic functions

Twenty seed interviews were selected from the master list so that all organizational categories were represented. In categories having broad scope and/or multiple layers or categories (e.g., state government, parish governments), more than one seed was selected to increase organization coverage. Based on referrals obtained from the seed interviews, a snowball sample was created. Starting with the seed generation, the first generation consisted of those referrals given by seed interviews. The second generation consisted of referrals given by interviewees selected from the first generation, and so on (Table 3.7). Using Excel, a referral diagram provided a visual aid in tracking the distribution of interviews and referrals across generations. After each interview, the diagram was updated with the interviewee name, organization, code number, and date of interview. The referrals were then entered as the next generation. Repeat referrals were often obtained. As was done with all other referrals, these were coded and entered into the next generation corresponding with the interview source.

TABLE 3.7
DESCRIPTION OF GENERATIONS IN SNOWBALL TECHNIQUE

Generation	Interviewed	Not Interviewed	Total	Percent Interviewed
Seed	20	0	20	100
1	28	26	54	52
2	32	46	78	41
3	17	67	84	20
4	5	27	32	15
5	2	7	9	22
6	0	4	4	0
	104*	177	281	

*5 interviews eliminated. Adjusted total interviews: 99

Referral interviews were selected using several criteria, including organizational representation (both within and between categories), strength of referral (priority assigned and comments by seed), regional fit (located or networking within the designated regions, e.g., estuary), and availability. Following Glazer and Strauss (1967) and Strauss and Corbin (1990), snowball sampling continued until issue saturation was reached. That is, sampling continued until new issues no longer emerged. In most instances, issue saturation occurred within the third generation.

From the 20 seed interviews, a total of 261 referrals were obtained. A total of 104 interviews were conducted, including the seed interviews. Of these, five were eliminated from the sample; one interviewee had participated in a pre-research workshop, thereby spoiling the interview, and others were eliminated due to inappropriate substitution, death, and poor quality of audio tape. Table 3.8 describes the final Wave 1 sample from Louisiana by type of organization.

TABLE 3.8
LOUISIANA WAVE 1 RESPONDENTS BY TYPE OF ORGANIZATION

	Frequency	Percent	Cumulative Percent
ASSN	10	10.1	10.1
EDUH	7	7.1	17.2
EDUS	1	1.0	18.2
GOVC	1	1.0	19.2
GOVF	11	11.1	30.3
GOVP	17	17.2	47.5
GOVS	9	9.1	56.6
HARV	5	5.1	61.6
LEVE	2	2.0	63.6
NGOE	2	2.0	65.7
NGOS	4	4.0	69.7
OTHE	1	1.0	70.7
PORT	2	2.0	72.7
PRFT	18	18.2	90.9
TRIB	9	9.1	100.0
Total	**99**	**100.0**	

See Table 3.1 for a description of the organization code

Texas' Technique in Wave 1

Following the general sampling guidelines, the Texas A&M University (TAMU) research team assembled an initial list of potential stakeholder organizations in the Galveston Bay area. Researchers' knowledge of their areas, phonebooks, internet search, media sources, and information gathered from organization websites were used to assemble the list. An organization was considered a potential stakeholder and entered into the stakeholder organization list based on the same criteria that were used in the other two research locations: (1) the organization must have a potential stake in the effects of climate change; and (2) the organization must have power to influence decisions relevant at some level to climate change. Organizations were categorized as described in Table 3.9.

TABLE 3.9
STAKEHOLDER GROUPS IN TEXAS

CATEGORY	STAKEHOLDERS
Federal	▪ US Geological Survey in Texas ▪ US Army Corps of Engineers ▪ National Marine Fisheries Service-Galveston Laboratory
State	▪ Texas Legislature ▪ Texas Railroad Commission ▪ Texas Department of Public Safety ▪ Texas Department of Transportation ▪ Texas General Land Office ▪ Texas Parks and Wildlife ▪ Texas Commission on Environmental Quality ▪ Various Texas river authorities ▪ Elected officials
Local	▪ Houston Port Authority ▪ Harris County Office of Emergency Management ▪ Galveston County Office of Emergency Management ▪ Galveston Bay Estuary Program ▪ Local appraisal districts ▪ County extension offices ▪ School Districts

Commercial and NGO	▪ Major employers in Brazoria, Chambers, Galveston, and Chambers Counties
	▪ Chambers of Commerce
	▪ Stakeholder interest groups:
	  ▪ Conservation and environmental action groups operating in the Texas Gulf Coast Region
	  ▪ Local economic development organizations

The assembled list consists of 123 stakeholder organizations from state agencies, interest groups, non-profit organizations, counties, cities, and top employers in each of the four counties located in the Galveston Bay area. Fifty organizations were randomly selected from the assembled list of 123 potential stakeholder organizations in the Galveston Bay area to form the seed. Four organizations among the 50 seed organizations could be not be reached or refused to be interviewed. We went back to the remaining set of unselected 73 organizations and randomly selected another four to replace them.

The overall response rate for the seed was 92.6% (50/54). For each randomly selected organization, our interviewer first contacted the top administrative individual in the organization and described the study in general from a scripted introduction. A face-to-face interview was then requested. In a few cases, a face-to-face interview was inconvenient for the interviewee, and the interview was conducted by telephone, but the majority of the interviews (92%) in the seed were conducted face-to-face. We completed all 50 seed interviews. Seed interviews were conducted from January 13, 2004, through June 29, 2004. Of the 50 interviews, 46 were recorded, transcribed, and coded into our interview database. The other four were either recorded incompletely due to technical reasons or the interviewees refused to be audio-taped.

At the end of each seed interview, respondents were asked for recommendations of organizations/individuals to interview on the interview topics. The purpose was to construct a referral list.

Respondents were asked for names of others who were also knowledgeable about area problems. A total of 147 organizations/individuals were recommended by the seeds. Among these 147 recommended organizations/individuals, some were not qualified to be in the referral list for the following reasons: already interviewed, already in our original sampling list of organizations, within the interviewee's organization, located outside Texas, and/or recommended by more than one respondent. Eliminating all these disqualified recommendations yielded a referral list with 77 organizations.

A set of 50 organizations was randomly drawn from the referral list for the remaining Wave 1 interviews. During our contact with the 50 referred organizations, six were not available or refused to be interviewed. We used the same replacement strategy and went back to the remaining set of the referral list and randomly selected another six organizations/individuals to replace them.

The overall response rate for referral interviews was 89.3% (50/56). We completed all 50 interviews during the period July 27, 2004, through November 15, 2004. Among the 50 interviews, 44 were conducted face-to-face (88%), and the other six by telephone. Among the 40 interviews, 47 were audio recorded, transcribed, and coded into our interview database; the other three were not included in our final dataset either because the interview was recorded incompletely due to technical reasons or because the interviewees refused to be audio-taped. Table 3.10 describes the final Wave 1 sample from Texas by type of organization.

TABLE 3.10
TEXAS WAVE 1 RESPONDENTS BY TYPE OF ORGANIZATION

	Frequency	Percent	Cumulative Percent
ASSN	2	2.2	2.2
EDUH	6	6.5	8.6
EDUS	2	2.2	10.8
GOVC	12	12.9	23.7
GOVF	3	3.2	26.9
GOVP	12	12.9	39.8
GOVS	11	11.8	51.6
NGOE	19	20.4	72.0
NGOS	17	18.3	90.3
PORT	2	2.2	92.5
PRFT	7	7.5	100.0
Total	**93**	**100.0**	

See Table 3.1 for a description of the organization code

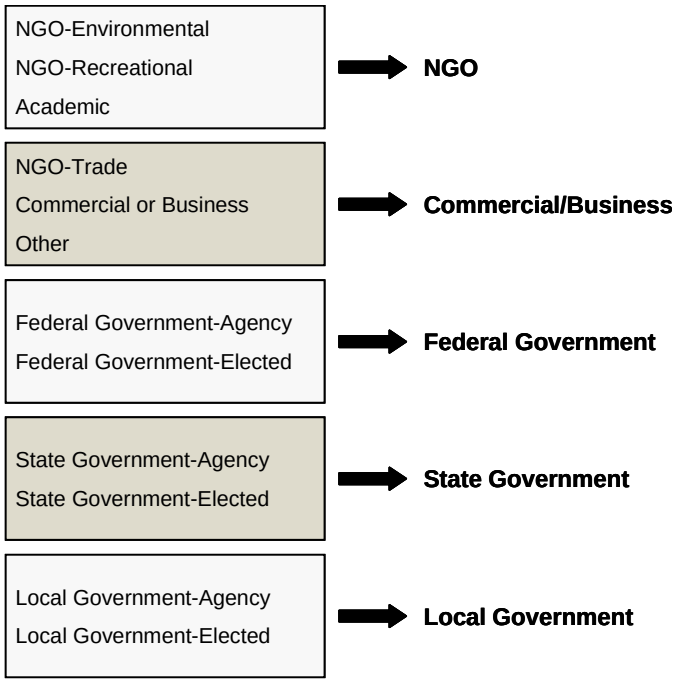
Wave 2 Sampling

Wave 2 interviews were conducted in a similar manner. For the Wave 2 panel interviews, Wave 1 respondents were sorted by organizational type, and organizational categories were randomly sampled proportionally to achieve a sample of 50 panelists in each research area. Panelists were re-interviewed using climate change scenarios developed for Wave 2 (These interviews will be referred to as Wave 2A interviews). After the climate change discussion, Wave 2A panelists were asked for additional referrals of individuals who would be able to discuss climate change issues. There was to be no direct request for referrals of individuals known to be interested in or sensitive to climate change. However, this was inconsistently followed. Referrals from 2A respondents were randomly sampled to achieve a sample of 50 new names. This sample (referred to as Wave 2B) was asked for information about general problems, causes, solutions, and information followed by the introduction of the climate change scenarios (as done in Wave 2A) and questions about the potential impact of climate change on the mentioned problems.

Florida's Technique in Wave 2

After the conclusion of Wave 1, data contained in the respondent management database was imported into SPSS V13. At this time, the original 12 organization categories were collapsed into five categories to increase the *n* for each type of organization, thereby enabling a more appropriate sample for randomly selecting the panel for Wave 2A. Figure 3.1 illustrates the recoded organization categories.

Figure 3.1
Apalachicola Bay, Florida Study Area
Recoded Organization Categories Prior to Wave 2



The resulting frequencies for each organizational category are reported in Table 3.11.

TABLE 3.11
WAVE 1 RESPONDENTS BY TYPE OF ORGANIZATION CATEGORIES COLLAPSED & WAVE 2 SELECTION

	Frequency	Percent	Cumulative Percent	Number Selected for W2A
NGO	16	19.0	19.0	8
Commercial/Business	18	21.4	40.5	9
Federal Government	13	15.5	56.0	7
State Government	18	21.4	77.4	9
Local Government	19	22.6	100.0	9
Total	**84**	**100.0**		

To draw a stratified-random sample, panelists for Wave 2A were selected using the random case selection feature in SPSS V13 by organization type in the proportion corresponding to the final sample for Wave 1 interviews. This process yielded 42 potential respondents.

Each of these potential respondents was contacted by one of two interviewers. We were forced to drop six respondents from our original sample because these persons left the organizations they had represented during Wave 1 (leaving behind no contact information) or because the person failed to respond to repeated attempts to make contact and secure a second interview. Two additional individuals refused to participate in the study during Wave 2A. These refusals were a consequence of one respondent's own poor health and another's having a family member with a terminal illness. In order to reach our sample target of 42, we randomly selected replacements from the Wave 1 pool, by organization category. The total number of interviews completed was 42.

Respondents in Wave 2A were asked by interviewers to provide referrals for new potential respondents. These respondents would be pooled for selection of the Wave 2B sample. In addition, interviewers also asked Wave 2A respondents to recommend people or organizations who were specifically interested in climate change issues.

In Florida, the research study area is a relatively poor, rural region of the state with no significant population centers. Therefore, the policymaking community for this region is somewhat limited in terms of actual numbers of people and quantity of organizations/agencies compared with the study sites in Texas and Louisiana. The potential respondent pool for Wave 2B reflected smaller organizational networks and the low diversity of governing/interest organizations in this region of Florida.

During Wave 2A, we received 25 referrals to people who were members of an organization or agency (or a division of an organization/agency) not represented in Wave 1 or Wave 2A of the study. These referrals are hereafter termed "innocents." Three of these innocent referrals were unique in terms of the individual respondent, but were actually referrals to a duplicate agency/organization. In other words, we were referred to three different people from the same organization.

In addition to the 25 innocents, we received 11 referrals to persons who had not participated as respondents in Wave 1, but who belonged to an agency/organization that had been represented in the first wave of interviewing. An additional 11 referrals were not respondents in previous phases of the study, but their agency or organization had already been represented in *both* Wave 1 and Wave 2A. A total of 15 individuals who had been referred to us for Wave 2B had already participated as respondents in either Wave 1, or in both Wave 1 and Wave 2A. Ten referrals were not useful for purposes of the research study because they were:

- private citizens/persons who were not affiliated with organizations;
- those who had been previously dropped from W2A for inability to contact or non-response;
- persons who had participated and/or were involved in the formulation of the research project in early stakeholder meetings; and
- individuals/organizations not within the boundaries of the study area geographically or organizationally.

The remaining six referrals collected during Wave 2A were too vague or general for researchers to follow up on in terms of identifying a specific respondent, such as a referral to "NOAA" or "local policy-makers." Table 3.12 provides a tabular classification of referrals from Wave 2A respondents, who made up our respondent pool for Wave 2B.

TABLE 3.12
CLASSIFICATION OF REFERRALS FROM WAVE 2A SAMPLE POOL FOR WAVE 2B

Classification	Frequency
New Person and New Organization	25
Incidence of multiple persons referred for one organization	3
New person, but organization in W1	11
New person, but organization in W1 & W2A	11
Person and organization in W1	3
Person and organization in W1 & W2A	12
Person referred, but not eligible	10*
Referral too vague for follow up	6**

*This category refers to people who were not affiliated with organizations, were dropped from W2A for inability to contact, participated and/or were involved in the formulation of the research project in early stakeholder meetings, or who were geographically or organizationally out of the range of the study area.

**This includes general referrals to large-scale organizations (e.g. NOAA) or vague categories of people (e.g., local policy makers).

Early in the study it was determined that if a research team compiled less than 50 new people representing new organizations for Wave 2B, the entire sample would be included in Wave 2B. Consequently, in selecting the sample for Florida Wave 2B interviews, all innocents—25 persons/organizations in the category of "new person and new organization"—were included in the sample. To select a full sample of 42, researchers in Florida also randomly selected a total of 17 additional, potential respondents from among the 22 individuals in the "new names-old organization" categories.

During the course of interviewing for Wave 2B, researchers in Florida received six refusals and dropped five potential respondents because of chronic non-response. Two additional potential respondents were dropped, one because of his participation in stakeholder meetings associated with the research project and the other because he worked for an organization whose focus was completely outside of the geographical boundary for the study site in Florida. When respondents were dropped from the study, for whatever reason, we randomly selected alternates from the Wave 2B potential respondent sample. The final breakdown of respondents in Wave 2B is provided in Table 3.13.

TABLE 3.13
FLORIDA WAVE 2 RESPONDENTS BY TYPE OF ORGANIZATION

	Frequency	Percent	Cumulative Percent
ASSN	5	5.9	5.9
EDUH	4	4.7	10.6
GOVC	6	7.1	17.7
GOVF	13	15.3	32.9
GOVP	7	8.2	41.2
GOVS	22	25.9	67.1
HARV	6	7.1	74.1
NGOE	14	16.5	90.6
NGOS	7	8.2	98.8
PORT	1	1.2	100.0
Total	**85**	**100.0**	

See Table 3.1 for a description of the organization code

Louisiana's Technique in Wave 2

The data obtained in Wave 1 demonstrated that there was strong network and conceptual overlap between the Ports and Levee categories, and further that there were few referrals within those categories. Municipal Government was another category with very few referrals. Because these three categories shared broad characteristics with Parish Government and were connected to Parish Government at some level, they were collapsed into Parish Government (GOVP). There was also considerable overlap among non-government organizations with broadly defined environmental goals (NGOE) and non-government organizations with a narrow focus and specific mandate (NGOS). The definitional lines that discriminated between the two categories were found to be less empirically clear, and these were collapsed together into non-government organizations. This left a total of nine adjusted and discreet categories: federal government (GOVF), state government (GOVS), parish government (GOVP), non-government organizations, schools and higher education institutions (EDUH), profit-seeking organizations with economic function other than extraction of a natural resource (PRFT), associations organized around specific occupations and/or occupation interests (ASSN), Native American entities or affiliations (TRIB), and economic organizations dependent upon extraction of natural resources (HARV).

The overall research design called for three groups of approximately 50 respondents: (1) a control group interviewed during Wave 1; (2) a group that was interviewed for both Wave 1 and Wave 2; and (3) a group interviewed for Wave 2 only. To ensure comparable representation between the first and second groups, a

stratified random selection across organization types was used to draw a pool of subjects from a master list of interviewees. The 99 individuals interviewed in Wave 1 were numerically listed according to organizational type in an Excel spread sheet. Each new organization category began at 1. Using Excel, a list of random numbers was generated from 1 to 22 (22 being the largest interviewee population within any category). Subjects for the second group (those interviewed in Wave 1 and Wave 2), were selected by working down the list of random numbers, and selecting the corresponding subject from the master list of interviewees. If the random number generated exceeded the population number in any category, the next workable number was selected. Similarly, if a repeat number within a category came up, the next workable number was used. From the master list of 99 subjects, 49 were selected in this manner. The remaining 50 became the control group. There were four categories with an uneven number population. Because category populations were small anyway, subject selection alternately over-selected by one and under-selected by one in uneven number categories, thereby maintaining the overall target sample population and between category representation. Of the 49 selected for Wave 2A interviews, two respondents could not be contacted; the response rate was 95.9% (47/49). Two of the 47 interviews were not transcribed because they were incomplete or because of technical difficulties. The final Wave2A data includes 45 complete interviews.

There were several things to consider in deciding the selection methodology for Wave 2B. Because there was a new issue focus in Wave 2, one consideration was to achieve as close a representation of the interview process in Wave 1 as possible, thereby increasing the comparativeness between Wave 1 and Wave 2 sampling methods. A second consideration was the number of referrals not interviewed in Wave 1 and how best to capture this component. Still another consideration was achieving representative organizational presence in Wave 2B of roughly 50 new subjects. A snowball sampling procedure using a seed from each category in the second group accommodated these considerations.

As the random number subject selection proceeded through each category, the next workable number at the end of the category draw was used to select that subject within the second group, who would be used as a seed. The drawn subject list was renumbered and the next workable number was used to select the seed for group three. The "seed" from each organizational category in the second group would be asked at the end of the interview to give referrals. The interviewer took into the field for Wave 2, the master list of interviewed subjects with which to compare the referral list. Referral names present on the master list were rejected immediately. Where there was an insufficient number (less than three) of unused or "fresh" referrals, the next individual within that category was asked for referrals. The same procedure was used throughout all organizational categories, to create another snowball sample for the third group. Because the sample was focused on one issue, sampling until issue saturation was reached was not relevant, and snowballing only needed to occur until the target sample population was reached at forty-nine individuals.

Hurricane Katrina interrupted the Wave2B interviews with only 22 complete. One refusal was replaced by an alternate, so the response rate was 95.7% (22/23). The team decided that the remaining 27 interviews would be canceled due to the difficulty of contacting Louisiana residents at that time and the potential effects of the Hurricane Katrina on attitudes toward climate change. All 22 Wave2B interviews were transcribed and entered into the database. In all, the Wave 2 dataset includes 45 panel and 22 non-panel interviews for a total of 67 complete and transcribed interviews. Table 3.14 illustrates the breakdown of Louisiana's Wave 2 respondents.

TABLE 3.14
LOUISIANA WAVE 2 RESPONDENTS BY TYPE OF ORGANIZATION

	Frequency	Percent	Cumulative Percent
ASSN	5	7.5	7.5
EDUH	13	19.4	26.9
GOVF	7	10.5	37.3
GOVP	8	11.9	49.3
GOVS	8	11.9	61.2
HARV	2	3.0	64.2
LEVE	2	3.0	67.2
NGOE	2	3.0	70.2
NGOS	2	3.0	73.2
PORT	1	1.5	74.6
PRFT	12	17.9	92.5
TRIB	5	7.5	100.0
Total	**67**	**100.0**	

See Table 3.1 for a description of the organization code

Texas' Technique in Wave 2

At the end of each Wave 1 interview, we asked the respondent about his/her willingness to be re-interviewed at a later time. All 100 respondents agreed to be re-interviewed. We used a stratified random sampling method to draw a panel of 50 from the 100 organizations. This stratified random sampling method is appropriate because it ensures that the proportion of each organization type (stratum) in the sample (panel) was the same proportion in the population (i.e., the 100 organizations). Due to percentage rounding across each organization type, 49 panelists were drawn from these 100 organizations; 24 were from the seed and 25 from referrals. Table 3.15 shows the components of the 49 sampled panelists for Wave 2A.

TABLE 3.15
TEXAS PANEL RESPONDENTS
BY WAVE 1 CLASSIFICATION

Organization Type	Drawn from W1 Seed	Drawn from W1 Referrals	Total Panelists in Wave 2A	Percent
ASSN	1	0	1	2.0
EDUH	2	1	3	6.1
EDUS	1	0	1	2.0
GOVC	3	4	7	14.3
GOVF	0	2	2	4.1
GOVP	2	4	6	12.2
GOVS	4	3	7	14.3
NGOE	6	4	10	20.4
NGOS	3	4	7	14.3
PORT	1	0	1	2.0
PRFT	1	3	4	8.2
Total	**24**	**25**	**49**	**100.0**

All of the 49 panel interviews were conducted face-to-face. The response rate for Wave 2A was 100% (49/49). We completed all 49 interviews during the period from September 1, 2004, to February 7, 2005. All Wave 2A interviews were audio recorded and later transcribed and coded into our final interview database.

At the end of each Wave 2A interview, respondents were asked to recommend others who might have insights "into theses issues." A total of 93 organizations/individuals were recommended to us for interviews. From these 93, we excluded those that were either within the same organization (i.e., internal referrals), outside of Texas, had already been sampled, or were interviewed in previous interview stages, and came up with a final "fresh" referral list with 49 organizations which constituted the base for our Wave 2B interviews.

We then contacted these 49 organizations and requested interviews. Our response rate was 95.92% (47/49), as two organizations could not be reached after multiple attempts. Among the 47 organizations that we were able to reach, three refused our request for interview and 44 completed interviews with us.

The overall interview rate was 93.62% (44/47). All 44 interviews were conducted face to face. Of the 44 interviews, 42 interviews were audio taped with respondent's permission and then transcribed and coded into our interview database. Two interviews were not included in our interview dataset (one interview was recorded, but incomplete due to audio taping equipment problems; the other interviewee refused to be audio taped). Table 3.16 shows the frequency and percentage of each organization type interviewed during Wave 2.

TABLE 3.16
TEXAS WAVE 2 RESPONDENTS BY TYPE OF ORGANIZATION

	Frequency	Percent	Cumulative Percent
ASSN	1	1.1	1.1
EDUH	6	6.6	7.7
EDUS	1	1.1	8.8
GOVC	9	9.9	18.7
GOVF	6	6.6	25.3
GOVP	9	9.9	35.2
GOVS	18	19.8	55.0
NGOE	16	17.6	72.5
NGOS	13	14.3	86.8
OTHE	3	3.3	90.1
PORT	2	2.2	92.3
PRFT	7	7.7	100.0
Total	**91**	**100.0**	

See Table 3.1 for a description of the organization code

Respondent Recruitment

For the Wave 1 interviews, interviewers made the initial contact with potential respondents primarily by phone, although email was used when it seemed the most effective method for contact. Letters of introduction and descriptions of the project were faxed or mailed as additional information. Contact information was corrected in the mail database as needed. If the individual selected during the sampling process was no longer with the organization, the new person in the position was recruited and added to the database. All recruitment materials can be found in Appendix B.

For Wave 2 interviews, panel respondents were recruited by phone. Because they were familiar with the project, less explanation was required. Nevertheless, a letter of explanation and a project description was faxed to the potential respondent. The non-panel respondents represented a naïve sample. These individuals were recruited in the same manner as Wave 1 respondents. All recruitment materials used in Wave 2 can be found in Appendix B.

All interviewees were asked for referrals. Any referrals were entered into the database as the next generation. Often repeat referrals were obtained. As was done with all other referrals, these were coded and entered into the next generation corresponding with the interview source. When a repeated referral was selected for interview, the issue arose as to where referrals obtained from that interview should be placed on the referral diagram. A characteristic that could be applied consistently throughout the process and across generations was time. Therefore, referrals from interviewees who had been referred more than once were entered into the diagram at the place where the subject's name was first mentioned. Sometimes, repeat referrals were only hours apart. Scrupulous field records of date and time of interview were kept. In order to prevent the unlikely occurrence of simultaneous repeat referrals, close contact between field interviewers was maintained and scheduling adjusted accordingly.

Hurricanes Katrina and Rita occurred while Wave 2 interviews were being conducted, and Wave 2 interviews were terminated in Louisiana. The research team decided that in addition to the logistical difficulties introduced in Louisiana by the physical destruction and social dislocation, these events would have had significant effects on attitudes regarding climate change, making pre- and post-hurricane interviews incompatible. Fortunately, most of the Wave 2 interviews had been completed in Louisiana before the storm, and only a handful of Texas and Florida interviews were conducted after August 2005.

Interviewer Training

At all locations, interviewers were project team members; most already had interviewing experience. Given the similarity of disciplines and levels of experience among the Texas and Louisiana researchers, these locations assumed responsibility for the training of their own interviewers. Louisiana trained the primary Florida interviewer. Training took the following form: senior and junior interviewers attended formal sessions in interviewing technique following discipline standards (see Jordan, Marcus, & Reeder 1980; Peabody et al., 1990; U.S. Bureau of the Census, 1986). All team members were thoroughly versed in the interview guidelines. Given the lack of a standardized interview schedule and the anticipation of free-flowing conversations with stakeholders, it was important for all interviewers to have the key points to be covered in each interview firmly in mind. A series of practice interviews were held with junior and senior researchers exchanging roles. Once interviewing started, senior members of the team conducted the initial interviews with junior members observing. This gave junior interviewers additional experience and senior researchers a basis for anticipating any problems that interviewers might have. Finally, tapes of early interviews done by junior interviewers were reviewed, and further instruction was undertaken where needed.

Description of Data and Scenario Instruments

Two types of information were available to researchers from the interviews: a rich qualitative database formed by the interviews themselves and a more quantitative database that aggregated stakeholder responses on specific topics. The quantitative database allowed researchers to focus on discrete variables and their relationships. Access to the qualitative aspects of the interviews allowed researchers to explore interviews for verification of findings based on the quantitative database, as well as for material to illustrate findings.

Wave 1 interviews provided baseline information on local problems considered most salient by stakeholders, as well as general information on the decision making process vis-à-vis these problems, the role of scientific information in decision making, and the sources of information used. This information provided a context in which any consideration of climate change could take place and also provided some gauge of the salience of climate change for stakeholders.

Wave 2 interviews were designed to introduce climate change into the context of existing area problems. In addition to questions about general problems, probing for scenario consequences was used. Scenario-consequence analysis is the use of specific scenarios of stressors affecting specific endpoints in specific regions. A scenario is defined as a set of internally consistent physical conditions that could occur for a particular location in response to an event, in other words, a projection of how climate change would be experienced in a particular place at a particular time in the future. The scenario-consequence approach allowed climate change to be placed in the context of present scientific uncertainties at regional and local levels. Introducing the scenarios provided a common basis for discussions of climate change and a baseline from which to explore concepts of scientific understanding, risk, and uncertainty. The groundwork for scenario development formed part of Phase 2 and was described in Chapter 2.

Each scenario identified climate change stressors unique to the research location and physical changes expected to accompany climate change. Stressors specified in the scenarios included changes in air temperature, changes in precipitation, changes in the rate of sea level rise, and changes in the frequency or intensity of tropical storms. The specific scenarios for each case study were characterized in terms of the ranges of each stressor for the three different time periods. For example, since the precipitation could increase or decrease, the decision was made to do a range of values, recognizing that if it is a drier future, there is likely to be a concomitant enhanced value for the temperature increase; this combination is referred to here as the "hot-dry" scenario. If the future is to be wetter, then the temperature increase might be ameliorated somewhat, leading to the "warm-moist" scenario. The physical changes, or vulnerabilities, expected to accompany climate change and more specific changes in stressor levels were made as location

specific as possible. Respondents were invited to reflect on if and how the changes described in the scenarios would affect the local area and on decision making relevant to those changes. Discussions also touched on the various aspects of uncertainty and information. The scenario projections and vulnerabilities that were used in each location are presented here. Figure 3.2 shows an example of the scenario graphic and story line used in Florida during Wave 2 interviews. Scenario materials used for each location can be found in Appendix C, and interview guides used in all locations can be found in Appendix B.

Apalachicola Bay Regional Climate Change Scenarios and Vulnerabilities

Projections

Here we focus on climate changes that might affect the Apalachicola Bay region in the near- (year 2020), mid- (year 2050), and long-term (year 2100) futures. Global climate change may be felt locally through changes in temperature, changes in precipitation, changes in sea level, and effects from tropical storms and hurricanes.

Temperature changes — Scientists expect that average annual temperatures in the research area in 2020 will be the same as today, although temperature extremes may increase (e.g., more frequent episodes of very hot days). By 2050 average annual temperatures are expected to increase by 1-3˚F. By 2100 the increase could be as much as 3-7˚F. There will likely be longer periods of heat waves, higher daily temperatures, and less frequent occurrences of very cold days when average annual temperatures increase by a degree or more.

Precipitation changes — Scientific predictions for the area are uncertain; it may get wetter or drier. If it gets wetter this would occur by having a longer rainy season, more days with rain during the rainy season, or more rainfall on those days when it does rain. If it gets drier, this would occur by having a shorter rainy season, more drought years, or longer drought periods.

Because scientists cannot now tell which situation will occur in the Gulf Coast of Florida, we have developed two possible rainfall scenarios:

1) if it is wetter there could be up to 10% more rainfall, and
2) if it is drier there could be up to 20% less rainfall on average each year.

Drier conditions are likely to occur along with hotter conditions, so we have combined the temperature and precipitation changes into two possible climate scenarios for the region:

1) *Warm-moist future*: a 1^{o} F increase in temperature and a 5% increase in rainfall by 2050; a 3^{o} F increase in temperature and a 10% increase in rainfall by 2100.
2) *Hot-dry future*: a 3^{o} F increase in temperature and a 10% decrease in rainfall by 2050; a 7^{o} F increase in temperature and a 20% decrease in rainfall by 2100.

Sea-level rise — Sea level has risen slowly along the Florida Gulf Coast for the past few thousand years through natural processes. However, there will be a more rapid rise in sea level as a result of the gradual expansion of water that will increasingly occur with the warming of the ocean's surface. The current rate of natural sea-level rise will continue through 2020 resulting in sea levels that are about 1.3 inches higher than today. By 2050 climate change will raise sea levels even more, most likely by 8 inches above present levels and possibly as much as 1.5 feet. By 2100 sea-level rise is likely to be 1.4 feet, but could be as much as 3 feet above today's levels.

Tropical storms and hurricanes — Tropical storms and hurricanes varied greatly in our area over the 20th century, with some years and some decades having many more intense hurricanes than others. This situation is expected to continue through the 21st century.

Vulnerabilities

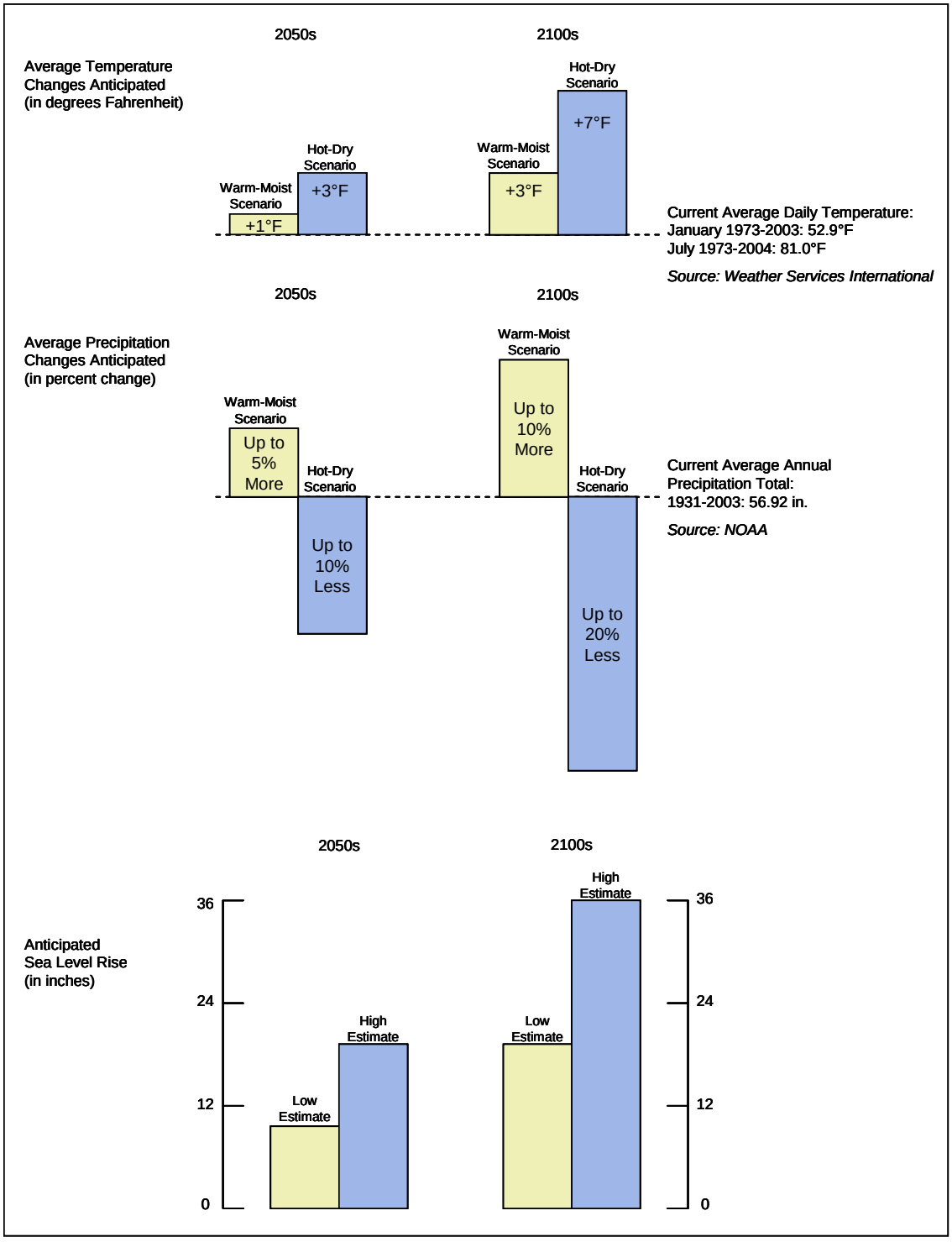
Both natural and social systems may be affected by climate change. Because the area has a subtropical climate, the environment and people are reasonably well adapted to warm temperatures. However, the Apalachicola Bay area is quite vulnerable to changes in precipitation. Increased rainfall in the region can cause major flooding, while prolonged droughts can have major effects on crops, estuaries, and water supply. Sea-level rise can also have a major impact because so much of the region is in low-lying areas. Here we illustrate some of the most important vulnerabilities for people and the environment from the scenarios for the area.

The greatest threat from global climate change to the area is from sea-level rise. If the sea level increases by a foot or more, then many types of habitats would have to move inland or be destroyed. For example, freshwater marshes are extremely vulnerable to sea water. With sea-level rise these areas would be inundated with salt water, which would kill the plants and animals. Because the State of Florida owns much of the marsh and adjacent land around the Apalachicola Bay region, the freshwater marshes could move inland. However, at the higher levels of sea-level rise, the increase may happen too quickly for the freshwater marshes to keep up. Similarly, beaches in the region would have to migrate inland. This may not be a problem on the publicly owned parts of the barrier islands around the Bay. However, there are many privately owned homes and businesses on St. George Island, for example, which would limit where the beaches could go. Mainland beaches would also be at risk, being forced against the coastal highway and armored shorelines. The inter-tidal mudflats could disappear entirely under the higher sea-level scenarios. Sea-level rise would also affect the oyster beds; sediment in the Bay would prevent the oyster bars from moving to more favorable depths. Finally, as sea level increases, the effects of storm surges from tropical storms and hurricanes will be more severe, causing much more coastal flooding and damage than the same storm would cause today.

The next greatest threat to the area is from lack of rainfall. Under the hot-dry scenario we could expect much less flow from the Apalachicola River into the Bay, in part because of less rainfall in the region and higher temperatures causing more evaporation, but also because there would be an even greater demand on the water supply for human uses. Reduced river flow would make the Bay more salty more of the time, and with higher water temperatures. The oyster beds are quite vulnerable to this because they require occasional periods of fresher water to protect them from predators. They could be hurt by water temperatures that are too warm also. Reduced freshwater flow into the Bay could also trigger harmful algal blooms, as well as hurt saltwater marshes by reducing the flow of nutrients and sediments from upstream, possibly causing the "brown marsh" disease. Finally, regional agriculture is also very vulnerable to hot-dry conditions, and we could expect more frequent fires and pest outbreaks in local forests because of drier conditions.

Under the warm-moist scenario, the danger is from too much water. This would result in more frequent or extreme flooding events. Increased runoff from the River could cause the water in the Bay to become more turbid and this would harm sea grasses and submerged aquatic vegetation. On the other hand, this scenario could lead to more freshwater marsh and oyster bar habitat.

Figure 3.2
Sample Scenario Graphic
Climate Change Effects Anticipated in the Apalachicola Bay Region



Barataria-Terrebonne Regional Climate Change Scenarios and Vulnerabilities

Projections

Here we focus on climate changes that might affect the Barataria Terrebonne region in the near- (year 2020), mid- (year 2050), and long-term (year 2100) futures. Global climate change may be felt locally through changes in temperature, changes in precipitation, changes in sea level, and effects from tropical storms and hurricanes.

Temperature changes — Scientists expect that in this area, average annual temperatures in 2020 will be the same as today, but temperature extremes may increase (e.g., more frequent episodes of very hot days). By 2050 average annual temperatures are expected to increase by 1-3˚F, and by 2100 by 3-7˚F. When average annual temperatures increase by a degree or more, that increase is likely to be felt in longer periods of heat waves, higher daily temperatures, and less frequent occurrences of very cold days.

Precipitation changes—Scientists believe that in many places around the world climate change will cause less rainfall on average over a year, while in other places there will be more rainfall, but in our area the scientific predictions are uncertain. It may get wetter or it may get drier. In addition, the amount of precipitation in the Mississippi River Basin, particularly Ohio, will also influence the amount of river water in the area. Thus, available water in the region is influenced by both local precipitation patterns, and the flow of the Mississippi River. If it gets wetter locally, that would occur by having a longer rainy season, or more days with rain, or more rainfall on those days when it does rain. If it gets drier, that would occur by having a shorter rainy season, or more drought years, or longer droughts. Since scientists cannot tell now which would occur in the Gulf Coast of Louisiana, we developed two rainfall possibilities: If it is wetter, there could be up to 10% more rainfall, and if it is drier, there could be up to 10% less rainfall on average each year.

The drier conditions are likely to occur along with hotter conditions, so we combined the temperature and precipitation changes into two scenarios:

1) *Warm-moist future*: +1˚F and + 5% rainfall by 2050; + 3˚F and +10% rainfall by 2100

2) *Hot-dry future*: +3˚F and –5% rainfall by 2050; +7˚F and –10% rainfall by 2100.

Predictions of precipitation in the Ohio River basin are also in the range of +10% and –10% for the moist and dry scenarios of climate change. That could mean that in addition to the increased local change in climate, river flow could increase by 10% and during drier conditions, river water would be less by 10%.

Sea-level rise — Louisiana's rate of relative sea-level rise is the highest in the United States. Water levels along our coast have risen by up to 40 inches over the past 100 years due to a combination of globally rising seas and substantial local sinking of the land (subsidence). Global warming will cause a more rapid rise in sea level because warming of the ocean's surface will lead to gradual expansion of the water. The current rate of natural sea-level rise will continue, and by 2050 climate change will increase sea level by 8 inches above present, and possibly as much as 1.5 feet higher. Given the rate that land is sinking, this will mean a relative increase in water levels by 21-44 inches compared to today in 50 years.

Tropical storms and hurricanes — There has been a great deal of variability in tropical storms and hurricanes in our area over the 20th century, with some years and some decades having many more intense hurricanes than others. This situation is expected to continue through the 21st century.

Vulnerabilities

Both natural and societal systems may be affected by these climate change scenarios. In general, the Barataria-Terrebonne area has a subtropical climate, and the environment and people are reasonably well adapted to warm temperatures but are quite vulnerable to changes in relative rise in water levels along the coast. It is certain that water levels will rise with increased ocean levels from sea level rise and decrease in land elevation due to subsidence. Increased rainfall in the region and in the upper Mississippi River Basin can increase chances of major flooding, whereas prolonged droughts can have detrimental effects on crops, estuaries, and ground water supply. Here we illustrate some of the most important vulnerabilities for people and the environment from the scenarios for the area.

The greatest threat from global climate change to our area is how relative sea-level rise will amplify human impacts on coastal wetlands and social communities. If relative sea level increases by a foot or more, many types of habitats would have to migrate inland or else face complete loss. In many areas around

Barataria-Terrebonne, coastal wetlands are already stressed by lack of river resources and sediments. As sea level increases, the effects from storm surge from tropical storms and hurricanes will be more severe, causing much more coastal flooding and damage than the same storm would cause today. Under the warm-moist scenario, the definite danger from higher coastal waters may be increased with frequent or more extreme river-flooding events. In addition, increased river flooding will increase the formation of an oxygen-poor (hypoxic) zone off the coast, an area called the "dead zone." The productive fisheries of coastal Louisiana rely on a balance of marsh habitats, barrier islands, and good water quality.

Encroachment of Gulf waters along the Louisiana coast also makes it more vulnerable to lack of rainfall. Under the hot-dry scenario, we could expect much less flow from the upland freshwater sources, in part because of less rainfall in the region and higher temperatures causing more evaporation, but also because there would be greater demand on the water supply from urban and agricultural usage upstream. Less river flow will increase salt content of ground water resources and threaten many drinking water supplies. The hot-dry scenario could also hurt saltwater marshes of our area, because of reduced freshwater and sediments coming in from the river, possibly causing more frequent "brown marsh" diebacks. Agriculture is also very vulnerable to hot-dry conditions, and fires as well as pest outbreaks could be expected to occur more frequently in the coastal wetland forests of the area.

Galveston Bay Regional Climate Change Scenarios and Vulnerabilities

Projections

The climate in Texas has always been variable and sometimes extreme – and climate change may intensify this historical pattern. Here we focus on climate changes that might affect the Galveston Bay region in the mid- (year 2050) and long-term (year 2100) futures. Global climate change may be felt locally through changes in temperature, changes in precipitation, changes in sea level, and effects from tropical storms and hurricanes.

Temperature changes — Scientists expect that in this area average annual temperatures in 2020 will be the same as today, but temperature extremes may increase (e.g., more frequent episodes of very hot days). By 2050 average annual temperatures are expected to increase by 1-3°F, and by 2100 by 3-7°F. When average annual temperatures increase by a degree or more, it is likely to be associated with longer periods of heat waves, higher daily temperatures, and less frequent occurrences of very cold days.

Precipitation changes — Scientists believe that in many places around the world climate change would cause less rainfall on average over a year, while in other places there would be more rainfall, but in our area the scientific predictions are uncertain. It may get wetter or it may get drier. If it gets wetter, that would occur by having a longer rainy season, or more days with rain, or more intense rainfall on those days when it does rain. If it gets drier, that would occur by having a shorter rainy season, or more drought years, or longer droughts. Since scientists cannot tell now which would occur in the Gulf Coast of Texas, we have developed two rainfall possibilities: If it is wetter, there could be up to 5% more rainfall, and if it is drier, there could be up to 20% less rainfall on average each year.

The drier conditions are likely to occur along with hotter conditions, so we have combined the temperature and precipitation changes into two scenarios:

1) *Warm-moist future*: +1°F and minor increase in rainfall by 2050; + 3°F and +5% rainfall by 2100

2) *Hot-dry future*: +3°F and –10% rainfall by 2050; +7°F and –20% rainfall by 2100.

Sea-level rise — Sea level has risen slowly along the Texas Gulf Coast for the past few thousand years through natural processes. Global warming will cause a more rapid rise in sea level because warming of the ocean's surface will lead to gradual expansion of the water. The current rate of natural sea-level rise will continue through 2020 to about 1.3 inches higher than today. By 2050 climate change will increase sea level even more, most likely by 8 inches above present, and possibly as much as 1.5 feet higher. By 2100, sea-level rise is likely to be 16 inches but could be as high as 3 feet above present levels.

Tropical storms and hurricanes — There has been a great deal of variability in tropical storms and hurricanes in our area over the 20th century, with some years and some decades having many more intense hurricanes than others. This situation is expected to continue through the 21st century.

Vulnerabilities

Fresh water is critical for the state's nearly 21 million residents—85% of whom live in cities. As the state's population grows to a projected 34 million by 2030, aquaculture, fisheries, and industry will continue to require reliable freshwater resources to remain productive. Competing demands on limited water resources due to population and economic growth alone will increase freshwater management challenges with or without climate change. For example, saltwater intrusion in coastal groundwater sources—a problem already occurring periodically during droughts—is likely to increase as sea level rises. Rice production in coastal areas would be particularly sensitive to an increase in water salinity.

Galveston Bay and the international seaport of Houston have long been critically important industrial sites and transportation hubs. As development and economic activity in coastal areas has increased, so has societal vulnerability to coastal hazards. Sea-level rise will increase the rates of erosion—an already significant threat to homes, roads, and other infrastructure along the shorefront. Sea-level rise will also increase storm surges, even if hurricanes and tropical storms do not become more intense. Thus, greater economic losses from storms and higher repair and maintenance costs (e.g., for maintenance of port and industrial facilities or beach replenishment) must be expected in the future.

In the bays and estuaries behind the barrier islands separating the Texas mainland from the Gulf of Mexico, freshwater and saltwater combine to create the environment that shrimp and oysters need to live and flourish. The state's aquaculture industry—11th in the nation in producing food fish, baitfish, ornamental fish, shrimp, crawfish and oysters—is particularly sensitive to adequate amounts of freshwater and increases in salinity. If freshwater flow into lagoons and bays permanently declines, then higher salt concentrations, less nutrient input, and less frequent flushing result in lower water quality overall. Drier conditions in the immediate coastal zone will increase the risk of wild fires, which in turn would help maintain coastal prairies and grazing lands by suppressing the permanent establishment of invasive species such as Chinese tallow.

Global warming can affect tourism and recreation in multiple and often synergistic ways. Wetland loss due to increased rates of sea-level rise and limited ability of wetlands to migrate inland could reduce habitat for waterfowl and other wildlife essential to hunting and recreational fishing. Rising sea levels will increase coastal erosion, leading to beach loss where sediment supplies are low, and to increased risk of damages from severe coastal storms. Bird watching, canoeing, and other outdoor activities may be affected by higher temperatures and/or wildfires or through changes in species communities or loss of habitat, thus undermining the ecotourism industry.

Health concerns related to global warming result from a complex interaction of human and environmental factors. They are particularly serious for the elderly, but air and water quality, seafood safety and storm-related risks are of great concern for all residents and visitors. The greatest increase in the July heat index is projected for metropolitan areas such as Houston, making it particularly vulnerable to more heat waves. Higher temperatures also lead to increased production of ground-level ozone and smog, exacerbating asthma and other respiratory diseases and making it even harder for urban areas such as Houston-Galveston to attain federal air quality standards. Also, the risk of water-borne illnesses can increase with warmer temperatures and extreme rainfall and runoff. Microorganisms associated with diseases in coastal waters—such as toxic algae, red-tide dinoflagellates, *Vibrio vulnificus* (a pathogen contaminating shellfish), and others—can damage habitat and shellfish nurseries and be toxic to both marine species and humans.

After the introduction of the climate change scenarios, Wave 2 respondents were asked about their belief in the reality of climate change, potential climate change impacts on the area, and their information needs. The variable groupings unique to Wave 2 are detailed in Table 3.18. Wave 2B interviews gathered information on general problems as well as on climate change. They were coded using a protocol comprised of key variables from Wave 1 and also introduced new variables unique to Wave 2 (Appendix B).

Analytical Methods

Processing

Interviews were tape-recorded with the permission of respondents and field notes were also taken. More extensive notes were taken in the few cases where individuals refused to be taped or taping equipment malfunctioned. After each interview, the spreadsheet tracking the sampling was updated with the date of the interview and any updated contact information. Snowball referrals were also added to the database. If the interviewee had not provided contact information for the referrals, this information was located and added to the spreadsheet as well. This information included referral name, organization, and date added.

As interviews were completed, tapes from Louisiana and Florida were backed up and the originals were mailed to TAMU where the recordings were digitized using Audacity, a free open-source audio editor, saved as .wav and mp3 files, and made part of a central data file. The Texas team used digital recorders from the beginning of the project, so the digital conversion step was eliminated for the Texas recordings. The Florida and Louisiana teams eventually switched to digital recording devices for interviews. These digital audio files were sent via email or saved to an audio disc and shipped to TAMU for storage and transcription. Each interview was assigned an identifier that included codes for research location, interview wave, a number unique to each individual respondent, and type of organization represented.

Once converted, interviews were transcribed for later coding. In the interest of time, each location agreed to transcribe its own interviews, using a standardized transcription format. However, in-house transcription proved to be too slow, largely because there was no staff that could focus exclusively on this task. Mid-way through this process, the transcription task was shifted to professional transcription organizations. To facilitate their work, these professionals were provided with glossaries of terms and place names unique to each of the research locations, as well as the standardized transcription format that had been created. As transcriptions were completed and returned to TAMU, they were checked against the tapes for accuracy by TAMU staff members and entered into a database of finalized interview transcripts.

Initially it was believed that a widely-used content analysis software could be employed to analyze the interview data. This program (Practical Extraction and Report Language, or PERL) was tested on a sample of interviews at the Texas location. These tests indicated that PERL only performs well for the content analysis of text in which issues and variables are referred to in a consistent way (e.g. discussions captured in the Congressional Record). It is not suitable for capturing the more free-wheeling content of conversations. For example, an interviewer might ask about "problems in the area." However, a respondent could respond with a long discussion of area problems without ever mentioning the word, "problem" again, and PERL would not be able to pick up this discussion without an extensive list of alternate key words. Comprehensive lists would require human reading of all interviews, greatly reducing PERL's ability to facilitate the coding process. After investigating several types of software, the team decided to use NVivo, a computer assisted qualitative data analysis software developed to enable social scientists to do a finer grained analysis of interview data.

For each wave of interviews, a coding protocol was developed, based on the interview guide for that wave. A sample of interviews from the wave was used to elaborate and refine the expected list of responses for each variable type. Using this coding protocol, NVivo nodes were created for each question category (variable) and for possible responses to it. Human coders read each interview transcript and coded it by inserting interview text in the appropriate node-response location. For example, if an interviewer had asked a respondent what kinds of climate change information would be useful to have, the coder pulled respondent replies out of the interview and inserted them into nodes corresponding to the reply categories established for this variable. Single coders were used for each interview phase (Wave 1, Wave 2A, and Wave 2B), and all coders conferred daily with the senior researcher who developed the coding protocol. The full protocols for coding the three interview waves can be found in Appendix B along with the interview guides that focused the interviews.

An iterative process was used to train coders. The open-ended and free-flowing nature of the interviews made coding challenging. The coding protocol was discussed at length, and interpretations of the various coding concepts were established. Coding of the first ten interviews was checked for accuracy by the coding supervisor, additional instruction was undertaken as needed, and re-coding done. This process was repeated until coder performance was consistent with that of the coding supervisor. Nevertheless, there was daily

interaction between the coder and the coding supervisor, and problems of ambiguity were resolved as a team. There was a single coder for Wave 1 interviews. However, to shorten the time involved in coding, an additional coder was brought in to code 2A. One coder was assigned to Wave 2A and another coder to Wave 2B. The Wave 1 coder also coded Wave 2B. Both coders received identical training and conferred with the coding supervisor daily.

Wave 1 interviews were coded for general problems, policy decision processes, and uses of scientific information. The policy decision process coding was completely based on Kingdon's (1995) work on the policy process. The Wave 1 variable groupings are outlined in Table 3.17.

Coding

Interview guides from each interview wave were used to set up coding protocols representing all the variables that could be touched on in an interview. In addition, an array of logical response categories for each variable was created and then modified after a reading of a sample of interviews in each wave. Each wave of qualitative interviews was then uploaded into individual NVivo databases, and each of these databases contained nodes that represented the above variable categories. The Wave 1 dataset contained 816 nodes. Wave 2A and 2B contained 1740 and 2100 nodes respectively. During the coding process, when a piece of interview text fit the protocol specifications for a particular node, the text was highlighted and coded under that node. This created a binary data point. For instance, if an interviewee said that the biggest problem in his/her area was an environmental problem, the node "P1 – Environment" would be switched on. This process produced three raw datasets that together contained more than 600,000 1s and 0s.

Because of the unstructured nature of the interviews, not every variable was touched on by every interviewee. The raw datasets, therefore, contained a number of missing values that had to be dealt with. Whenever possible, binary variables were combined into categorical and ordinal variables. Variables that were never coded were omitted from the datasets. Categories of variables were collapsed as needed to produce a dataset that would be sufficient for quantitative analysis. The final datasets include binary, categorical, and ordinal variable as well as attributes of the interviewees. Datasets exist for Wave 1 (n=271) and for Wave 2B (n=243). A third dataset comprises the panel interviewees (n=135), who were interviewed in both Wave 1 and Wave 2. For the panel dataset, only attribute variables and variables for which the responses would be directly compared between Wave 1 and Wave 2 were included. This allowed for analysis of the effect of introducing climate change. Tables 3.17 and 3.18 show major variable categories for each interview wave.

TABLE 3.17
WAVE 1 VARIABLE GROUPINGS

General Problems	Policy Decision Processes	Use of Science Information
• Issue Type • Endpoints relevant to problem • Causes of problem, including any stressors that act as causes • Breadth of recognition of the problem • Populations affected by problem • Levels of risk associated with the problem • Types of solutions in place or under discussion	• Important participants • Attention factors • Solution alternatives and their feasibility, acceptability, and constraints • Elements of the policy decision process: national mood, balance of forces, personnel turnover, jurisdictional change and consensus-coalition building	• Information type used • Sources of information used • Problems with information • Unmet information needs • Preferred information formats • Barriers to acquiring information • Barriers to using information • Organization's role in the flow of information

TABLE 3.18
WAVE 2 VARIABLE GROUPINGS

General Responses to Climate Change Scenarios	Impacts of Climate Change on Existing Problems	Climate Change and Scientific Information
• Positive, negative or mixed responses • Perceived risk of occurrence • Comments and questions about the scenarios • Exposure to climate change information. This general variable category included coding for sources for prior exposure to information, who else in the area is known to be talking about climate change, and who is known to be acting on climate change information	• Stressors most relevant to problem • Populations affected • Decisions required in response to impacts, including types of decisions, important actors, and role of the respondent's organization • Barriers to making these decisions	• Potential applications of climate change information • Barriers to information use • Preferred sources of information • Information needed before acting • Preferred time frame for information, i.e. historical, current, projections. • Preferred information formats • Most trusted sources for information

Based on research hypotheses, a variety of statistical analyses were conducted to examine the relationships between the variables in the three datasets. For Wave 1 and Wave 2, this included simple univariate and multivariate summaries, tests for homogeneity between categorical variables, and logistic regressions. Fisher's Exact and Chi-Squared procedures were used to test homogeneity. Logistic regressions were used with binary and binomial responses in order to address more complicated research hypotheses that depended on more than two variables and/or both scalar and categorical variables. The veracity of the regressions was tested using outlier/leverage analysis and marginal model plots.

FOCUS GROUPS

Two focus groups were convened in each location for the purpose of testing some of the conclusions from preliminary analyses of the interview data. This portion of the research process centered on understanding stakeholder attitudes toward climate change rather than measuring them. The following topics were explored with each group: general perceptions of climate change, climate information needs, barriers to information use, best approaches and formats for climate information, and the extent to which the unusual 2005 storm season affected thinking about climate change. This last question was especially important for Louisiana participants. Issues of uncertainty, specifically how uncertainty affects decision making and how uncertainty can be dealt with, were also introduced if they did not surface naturally during the focus group conversations. The question outlines that guided focus group facilitators in each research location can be found in Appendix D.

Sampling and Recruitment

Three criteria were used in selecting focus group participants: (1) Focus group participants were to be drawn from stakeholders who had been interviewed during Wave 2, because it was during this wave of interviews that climate change was introduced and the scenarios were discussed. Limiting the participants to Wave 2 interviewees guaranteed that all had at least the same general exposure to climate change and, therefore, facilitated a more focused discussion. (2) Another criterion was good representation of the types of groups that formed the organizational array for the interview sampling described above. (3) Because verification of preliminary conclusions and further exploration of issues were central to this process, the

knowledge base of participants and their ability to articulate positions and ideas formed a third set of considerations. In order to maintain good representation of organizational types, Wave 2 interviewees were sorted into organizational categories, and individuals in each category were assessed for their knowledge of their areas and ability to articulate. In order to facilitate discussion and inclusion of all participants, researchers sought to include no more than eight participants in a given focus group, for a maximum total of sixteen participants in each research location. To the degree possible, candidates for focus group participation were drawn from across all organizational categories. Because the issues to be explored were neither as personal nor sensitive as those terms are usually defined, researchers allowed a mix of gender and age in each group. However, researchers attempted to maintain homogeneity with regard to organizational type. Agency/career government personnel comprised one group in each location and citizens holding elected offices or positions in businesses or NGOs comprised the second group.

Potential participants were contacted by phone and explanatory letter. Documentation of these contacts can be found in Appendix D. Willingness to participate in focus groups was generally high. However, finding dates and times that were convenient for everyone proved to be difficult, and last minute emergencies and obligations also prevented participation for some.

Session Management

The project contracted with two experienced focus group facilitators to lead the sessions. One of these facilitators is based in Texas and the other in Louisiana. Because the hurricanes experienced in Louisiana had such social and psychological impacts on people in the Louisiana research area, it seemed important to have a facilitator who had also had direct experience with the storms.

Facilitators were familiarized with the project, and each was provided with a copy of the project proposal as well. When focus group participant lists were finalized, copies of Wave 2 interviews done with these individuals were also provided. Group sessions were held in easy to reach places in each research location, and each session was limited to two hours. To maximize the consistency of the process, topic outlines were developed for use by facilitators at each location. However, facilitators created an open and informal atmosphere that encouraged interaction among group participants. Facilitators were also sensitive to the importance of allowing new and important issues to surface while making sure that topics of interest were covered, as well. With the permission of group participants, sessions were taped. Sessions were transcribed from these tapes, after which tapes were destroyed. No formal coding of these data was considered necessary.

Processing

Taped focus group sessions were transcribed by staff at the Texas location, and researchers at each location reviewed transcripts for accuracy. Final transcripts were stripped of names and other identifiers before analysis began.

Analytical Methods

Transcripts of focus group sessions (see Processing) were examined in light of the major questions that guided the discussions. The goal was to do a descriptive, qualitative analysis of focus group responses to the questions around which the discussions were organized. The questions that provided guidelines for the focus group discussions also formed the structure for the descriptive analysis. Key analytical categories were as follows:

- Perceptions of climate change characteristic of the research area
- Effects of Katrina and Rita on changes in salience of climate change as a problem
- Best approaches to delivering information on climate change, including discussions of
    - Who would or should be involved in decision making
    - Framing of the issue
    - Role of uncertainty and how to address it
    - Barriers to decision making
- Kinds of information needed
- Barriers to information use
- Sources of information trusted

- Best formats for information transmission

The facilitators and a member of the Texas research team reviewed focus group transcripts independently and drew up summaries of the responses to the key questions. These summaries were then pooled and refined for each of the research locations. There were no disagreements over the major findings from the groups. Refinements to the summaries were limited exclusively to additions of detail and references to key participant statements that might be used as illustrative material in the final report text. The full summaries and question guidelines can be found as Appendix D.

NEWSPAPERS[2]

According to Kingdon (1995, p. 5), agenda is defined as "the list of subjects or problems to which governmental officials, and people outside of government closely associated with those officials, are paying some serious attention at any given time." Due to the limited attention span and limited information-processing capacity of any individual and collective decision making bodies, the list of subjects or problems is very short (Jones, 1994; Jones & Baumgartner, 2005). Agenda setting is a process in which problems are identified and defined, and solutions or alternatives are proposed, specified and attached to these problems. In agenda setting, a particular public problem that gains serious attention and achieves relatively salient status in the short list of agenda items is more likely to be processed than others with less prominent status. More importantly, a public problem can be portrayed, characterized, and defined in numerous ways by different actors using various frames. How an issue is framed and defined in the agenda setting process affects how people think about the issue and what kinds of alternatives or solutions they think ought to be pursued, proposed, or supported (Baumgartner & Jones, 1993; Cobb & Elder, 1983; Rochefort & Cobb, 1994; Stone, 1989).

Guided by the agenda setting framework, the newspaper analysis was designed to (1) trace the changes of issue salience in media attention to climate change over time by examining relevant news articles published in a number of sampled U.S. national and Gulf of Mexico regional newspapers; (2) identify patterns and variations in the news coverage on climate change issue over time by analyzing the content of the news articles in terms of various issue characteristics or attributes (issue image, scope, linkage, participant, proposed solution and treatment strategy); and (3) examine the use of science and scientific information sources cited in the news stories.

Sampling and Search Procedures

Analysis of newspaper coverage of climate change-relevant issues took place at two levels: coverage in major newspapers with national circulation and coverage in selected Gulf of Mexico regional newspapers. We selected a sample of newspapers at each level, and the retrieval of relevant news articles was exhaustive within a period of years determined by the availability of newspaper archives.

For the news collection of major newspapers at national and Gulf of Mexico regional levels, several online searchable newspaper archives such as Lexis-Nexis and Pro-Quest greatly facilitated the search and retrieval for relevant news articles on climate change, but these archives also introduced limiting factors. One limitation is that no single online newspaper archive includes all the national and regional newspapers that we sampled. For example, Lexis-Nexis has the news archives of all three Gulf of Mexico regional papers and one national paper that we selected for the study, but does not include the other two national newspapers that we needed; Pro-Quest contains several major U.S. newspapers, including the two national newspapers that we could not find using Lexis-Nexis, but does not have the collection of any Gulf of Mexico regional newspaper. Another limiting factor is that the time range of newspaper collections in these online archives varies across newspapers. For instance, Lexis-Nexis provides a longer collection coverage period for one regional paper, but its coverage periods for the other two regional newspapers are relatively shorter.

Our initial collection of relevant newspaper articles from these two online archives was conducted in 2004 and ran through the end of 2003. News articles published in 2004 and 2005 were added to our collection when they became available in Lexis-Nexis and Pro-Quest. Both Lexis-Nexis and Pro-Quest provide their news collections up to current date. Since our final round of article search and retrieval was

[2] Some of the material presented in the Newspapers section was drawn from Liu, Vedlitz, and Alston (in press).

conducted in early 2006, the news collection for all the national and regional newspapers selected for this study covers up to the end of 2005. Specific newspaper selection criteria, article search and retrieval procedures and sampling methods are described below.

National Newspapers

Three newspapers with national circulation were selected. These were *The New York Times*, the *Chicago Tribune*, and the *Los Angeles Times* – each with a circulation, widely distributed in the United States, and representing a geographic location different from the Gulf of Mexico area.[3] Collection of the news articles from these newspapers allowed us to compare the salience of the climate change issue across the nation. In addition, while local decision makers read newspapers covering the geographical areas they are responsible for, larger newspapers with more extensive circulation are also read by decision makers and, through news service wires, contribute articles to local papers as well.

For the reason described above, two online searchable newspaper databases that archive electronic versions of major US newspapers were used in our article search: Lexis-Nexis online search database was used for search and retrieval of *The New York Times* articles, and Pro-Quest were used to collect relevant articles published in the *Chicago Tribune* and the *Los Angeles Times*.

The search for relevant articles was done using three key words: "climate change," "global warming," and "greenhouse gas." These three key words were chosen in our article search for two reasons. First, in preliminary trial searches utilizing a number of additional terms, such as "sea level rise" and "Kyoto protocol," it was found that the additional words did not yield a significant number of additional articles. Thus, we are confident that our search results based on these three key terms captured the majority of the news articles on global warming and climate change. Second, previous studies of news coverage on the issue of climate change (e.g., Shanahan & McComas, 1999) used similar key terms (i.e., global warming, climate change, greenhouse) to collect news articles from newspaper archives, and the use of similar key terms makes it easier for cross-study comparisons in this research area.

By using the three key words, any article that contains one of the key words was retrieved from the online databases.[4] Depending on the availability of archived news articles in Lexis-Nexis and Pro-Quest, the collection periods for the three national newspapers were as follows: *The New York Times* (1965 to 2005); the *Chicago Tribune* (1985 to 2005); the *Los Angeles Times* (1985 to 2005).

These searches yielded a large number of articles from each of the three national newspapers. We randomly selected 10% of the search results and reviewed all 1027 sampled articles (416 from *The New York Times*, 243 from the *Chicago Tribune*, and 368 from the *Los Angeles Times*). Because of the indiscriminate nature of the electronic search process in Lexis-Nexis and Pro-Quest, some articles in the key-word-based search results were actually irrelevant articles, in which the story was mainly about something else and the key words, "climate change," "global warming" or "greenhouse gas," were only occasionally mentioned. We treated these articles as invalid articles and excluded them from our collection. Excluding these invalid articles from the search results yields a final national news database with 529 articles from the three national newspapers: 268

3 These three newspapers are among the top 10 daily newspapers in the U.S. by circulation (Source: Audit Bureau of Circulations figures for six month period ending March 31, 2007).

4 As of January 17, 2006, Lexis-Nexis search engine can be found at http://web.lexis-nexis.com/universe/form/academic/index.html. Specific search procedures in Lexis-Nexis are as follows: Under "Guided News Search", we selected "General News Search" for "Step One: Select a news category," and "Major Papers" for "Step Two: Select a news source." Under "Source List," we selected "Houston Chronicle." Under "Step Three: Enter search terms," there are three boxes to enter search terms. Leaving the box reading "Headline, Lead Paragraph(s), Terms" as is, and changing the relational box "and" to "or," we entered "climate change" in the first box, "global warming" in the second, and "greenhouse gas" in the third. Under "Step Four: Narrow to a specific date range," we specified the search date range. Pro-Quest search engine is located at http://proquest.umi.com/pqdweb?RQT=403&TS=1136237741&clientId=2945, as of January 17, 2006. Search procedures in Pro-Quest are as follows: Under "advanced search," we entered "global warming," "climate change," and "green house gas" in each of the key word search box and changed the relations among the key word search from "AND" to "OR," then changed the all three search fields to "Citation and Document Text." In the database field, we chose "Pro-Quest Newspapers" and selected Chicago Tribune and Los Angeles Times; finally we specified the date range of the search.

articles from *The New York Times*, 101 articles from the *Chicago Tribune*, and 160 articles from the *Los Angeles Times*. These articles were then coded into our national news dataset by "when" (date, month, year) they were published in these papers.

Regional Newspapers

Three newspapers from the Gulf of Mexico region with relatively large circulations and representing news coverage at a more regional level were singled out for our regional news collection and analysis. These were the *Houston Chronicle* in Texas, the *Times-Picayune* in Louisiana and the *Tampa Tribune* in Florida.

These three newspapers were chosen for several reasons. First, each newspaper represents one of the three states in which the research was done (i.e., Texas, Louisiana, and Florida, respectively). Second, they are daily newspapers with relatively large circulations in their areas. Finally, all three papers are electronically archived in Lexis-Nexis, and article searches can be conducted systematically and consistently by using the three key words discussed above.

Because of the limited availability of archived news coverage, collection periods in Lexis-Nexis vary for each newspaper: the *Houston Chronicle* collection in Lexis-Nexis starts September 15, 1991, the *Times-Picayune* collection starts January 1, 1991, and the *Tampa Tribune* collection starts November 2, 1994. We ran our article search in Lexis-Nexis for all available collection dates, from the beginning of each archived newspaper through the end of 2005.[5]

Our search retrieved 1,218 articles for the *Houston Chronicle*, 452 articles for the *Times-Picayune*, and 237 articles for the *Tampa Tribune*. Upon review of these search results, invalid articles, as defined above, were discarded from the search result. Following the procedures and methods described in the section below, all the remaining climate change-related articles were coded into our regional newspaper database, which contains a total of 1,322 article entries from the three regional newspapers – 804 from the *Houston Chronicle*, 368 from the *Times-Picayune*, and 169 from the *Tampa Tribune*.

Coding Procedures and Coder Training

The initial plan was to conduct content analysis of newspaper coverage using the software program, PERL (Practical Extraction and Report Language). Several rounds of experimentation with PERL showed it to be less effective at content analysis than human coders. This led us to a decision to use human coders and develop a codebook that specifies coding variables, definition of each variable, and coding procedure. Coders were trained to conduct the coding of news articles and inter-coder reliability tests were implemented to insure consistency of coding results.

The unit of analysis in our study of newspapers was the news article. For the three national newspapers, two research assistants coded each article's publication date (date, month and year), as the main purpose for collecting these national news articles was to trace the salience of climate change issue in the news media at the national level. For the three regional newspapers, we followed standard content analysis procedures (see for example Neuendorf, 2002), conducted a pilot-coding, and developed a comprehensive Regional News Article Codebook (see Appendix E: Regional News Article Codebook).

The pilot-coding started with fifty sample articles randomly selected from one of the three regional newspapers, the *Houston Chronicle*. Two research scientists then thoroughly examined these sample articles and developed a preliminary coding scheme with a list of variable categories, a definition of each individual variable, and general coding procedures. Next, the two research scientists coded these sample stories independently according to the preliminary coding scheme. During the pilot coding, the two research scientists had routine meetings to compare coding notes, identify and resolve areas of disagreement, and refine the coding scheme and procedure. Based on the pilot-coding and numerous rounds of refinement of the coding scheme, we finalized the codebook for the three regional newspapers.

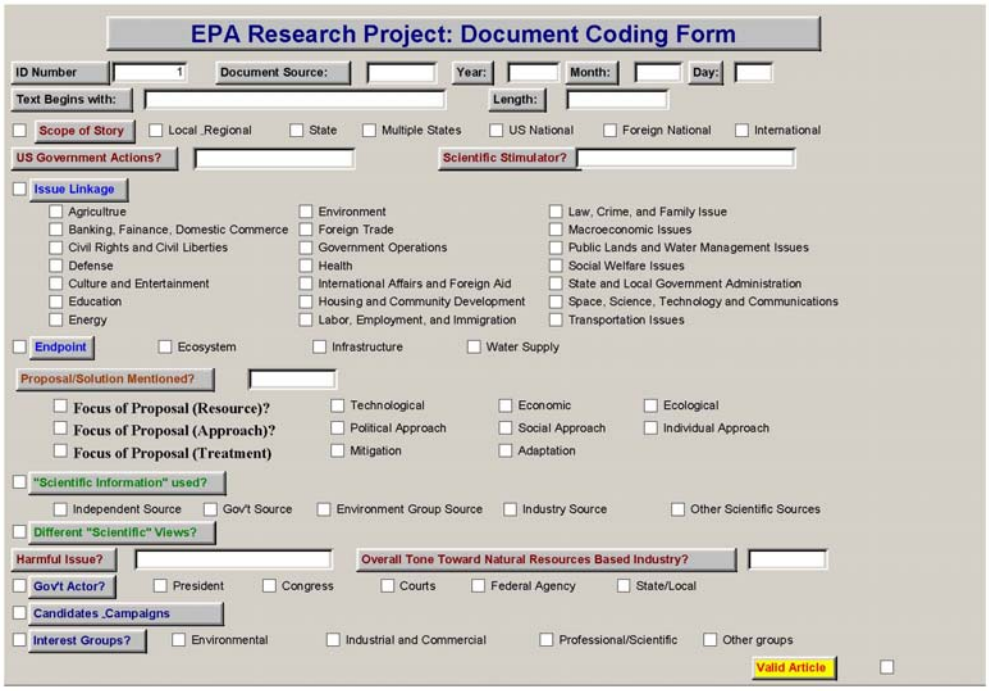
To facilitate the coding process we used Microsoft Access and constructed a Document Coding Form (see Figure 3.3 below). The Coding Form listed all the coding items/variables. Related items/variables were grouped together. Most variables in the Coding Form were constructed as either a pre-set checkbox or a

5 We first collected all articles up to the end of 2003. Additional article collection for the years 2004 and 2005 were added to our database when they became available in Lexis-Nexis in the early months of 2006.

drop-down list, so the coders could click relevant checkbox or choose one item from a drop-down list. Checkboxes and drop-down lists were developed to reduce data entry errors.

Finally, we trained two research assistants in the use of the final codebook, and these two coders worked independently and completed the formal coding of all the regional news articles—coder 1 completed the coding of 804 articles from the *Houston Chronicle* and 169 from the *Tampa Tribune*, and coder 2 coded all 368 articles from the *Times-Picayune*. Before the formal coding started, the coders were thoroughly versed in the meanings of the coding categories and variables. Intensive pre-coding training and test coding were performed to assure that the coders and the supervising researcher in charge were interpreting news article content in similar ways. The supervising researcher was also available for consultation on ambiguous cases.

FIGURE 3.3
Document Coding Form



When all regional news articles were coded, we conducted a formal inter-coder reliability test. To construct the sample for the inter-coder reliability test, we randomly drew roughly 10% of the articles from each of the three regional newspaper collections. More specifically, seventy-five articles were drawn from the Houston Chronicle, nineteen from the Tampa Tribune, and thirty-seven from the Times-Picayune. Coder 1, who previously coded the Houston Chronicle and the Tampa Tribune articles, re-coded the thirty-seven articles from the Times-Picayune, and Coder 2 re-coded the seventy-five articles from the Houston Chronicle and nineteen articles from the Tampa Tribune. The results of inter-coder reliability tests showed that overall average agreement rate/coefficient between the coders was 0.96 for the Houston Chronicle, 0.87 for Times-Picayune, and 0.88 for the Tampa Tribune. In content analysis, according to Reinard (2001) and Neuendorf (2002), agreement rates/coefficients of 0.90 or greater are highly reliable and 0.80 or greater are acceptable in most situations. In addition, the two coders also recorded the publication information (date, month, and year) for all the national news articles we collected.

Our original dataset of the regional newspapers includes 1,341 article entries – 804 from the *Houston Chronicle*, 368 from the *Times-Picayune*, and 169 from the *Tampa Tribune*. As indicated in Table 3.19 (summary of the news collection and coding), our collection coverage periods vary for the three regional newspapers, and only some of the articles published in the *Houston Chronicle* in 1991 and some of the articles published in the *Tampa Tribune* were available in the Lexis-Nexis archive. Excluding the partial coverage of 1991 *Houston Chronicle* article entries and 1994 *Tampa Tribune* article entries from our original dataset yields a working dataset with a total of 1,314 article entries. In this final working dataset, 61% appeared in the *Houston Chronicle* covering the period of 1992-2005, 28% in the *Times-Picayune* for the period of 1991-2005, and 11% from the *Tampa Tribune* with a coverage frame of 1994-2005. Since there was no climate change articles found in 1991 for the *Times-Picayune*, the actual time span of our analysis covers 14 years—from 1992 through 2005.

TABLE 3.19
Summary of Newspaper Article Collection

Level	Newspaper	Source	Key Words in Article Search	Collection Coverage	No. of Valid Articles and Sample Size	Total No. of Articles	Coded Variables	Inter-Coder Reliability Sample	Average Agreement Rate
National	*New York Times*	Lexis-Nexis	climate change global warming greenhouse gas	01/01/1965-12/31/2005	268 (10% Sample)	529	Only Publication Date (Date, Month, Year)	N/A*	N/A*
	Chicago Tribune	Pro-Quest		01/01/1985-12/31/2005	101 (10% Sample)				
	Los Angeles Times	Pro-Quest		01/01/1985-12/31/2005	160 (10% Sample)				
Regional	*Houston Chronicle*	Lexis-Nexis		09/15/1991-12/31/2005	804 (100% Sample)	1,341	Publication Date and Content Variables in the News Article Codebook	75	0.96
	Times-Picayune	Lexis-Nexis		01/01/1991-12/31/2005	368 (100% Sample)			37	0.87
	Tampa Tribune	Lexis-Nexis		11/02/1994-12/31/2005	169 (100% Sample)			19	0.88

*Not applicable because only publication date information was coded for national news articles.

Coding Categories

The development of our coding system was generally guided by the agenda setting framework. In addition to the background information of each article (e.g., newspaper's name, date, month and year when article was published, etc.), we were particularly interested in three basic concepts, which formed the basis for our coding scheme development and codebook construction.[6] These were Issue Salience, Issue Attributes, and Use of Scientific Information. A brief description of the three basic concepts and their components are as follows (For detailed information on all variables in our coding, see Appendix E: Regional News Article Codebook).

Issue Salience

Issue salience refers to the importance of the issue and was measured by the number of articles on climate change that appeared in each year of the news collection. This measure has been used in numerous news media agenda setting studies (Baumgartner & Jones, 1993; Soroka, 2002).

To measure the salience of the issue of climate change in the news media, we calculated the annual number of climate change articles published in the three national newspapers (*The New York Times*, the *Chicago Tribune*, the *Los Angeles Times*) and three regional newspapers along the Gulf of Mexico coast (the *Houston Chronicle*, the *Times Picayune*, and the *Tampa Tribune*). This method of using the annual number of articles to measure issue salience in the print media has been used in general policy agenda studies (Baumgartner & Jones, 1993; Soroka, 2002) and specific studies on the rise and fall of news media's attention to global warming and climate change issues (Liu, Lindquist, & Vedlitz, 2006; Mazur & Lee, 1993; McComas & Shanahan, 1999; Trumbo, 1996; Ungar, 1992).

Note that news collection period vary for different newspapers: *The New York Times*–1965-2005, the *Chicago Tribune*–1985-2005, the *Los Angeles Times*–1985-2005, the *Houston Chronicle*–1992-2005, the *Times Picayune*—1991-2005, and the *Tampa Tribune*—1995-2005.[7] Also note that the sample size for the three national newspapers was 10% and our article collection of three regional newspapers was 100% sampling.

Issue Attributes

Issue Attributes refers to the ways in which a particular public issue may be framed. Different issue attributes can significantly affect how the climate change issue is defined and how the agenda is set, and issue attributes sometimes may lead to different policy outcomes (Dearing & Rogers, 1996; Iyengar & Kinder, 1987; Kingdon, 1995; McCombs & Shaw, 1972; Rochefort & Cobb, 1994; Soroka, 2002; 2003). A particular public issue can be portrayed and framed in various ways based on different attribute dimensions, and different issue attributions can significantly affect the agenda setting process and lead to different policy options (Baumgartner & Jones, 1993; Cobb & Elder, 1983; Iyengar & Kinder, 1987; Kingdon, 1995; McCombs & Shaw, 1972). We coded articles for evidence of the following issue attributes: issue image, issue scope, issue linkage, issue participants, proposed solutions and treatment strategies.

Issue Image. The issue of climate change has been debated among members of the public, political decision makers and climate scientists. Perhaps the most critical question in this debate is whether, how, and to what extent global climate change is harmful. In our coding system, one of the variables is "issue image." Issue image is the fundamental impression of an issue and has powerful influence in shaping public understanding and policy agendas (Baumgartner & Jones, 1993; Jones, 1994). In coding the regional news articles, we asked our coders to evaluate the overall view of each article to discern whether the issue was portrayed as harmful, not harmful, somewhere between (mixed and/or neutral), or undetermined/unknown. Articles clearly indicating real or possible negative consequences of climate change (such as "environmental disaster," "health risk," "loss of life," "threat to infrastructure," "land degradation," "greater severity and frequency of tropical storms," "drought," etc.) were coded as "harmful." Articles indicating that climate change is not dangerous or arguing that global warming may actually benefit human beings (i.e., greater agricultural productivity) were coded as "not harmful." Articles holding a neutral perspective or presenting both negative and positive views

6 There were additional variables in our codebook and coding form other than the three basic concepts.
7 We did not include the year of 1991 for Houston Chronicle data because the Houston Chronicle news collection did not cover the entire year of 1991. We also did not count 1994 for Tampa Tribune for the same reason.

on the effects of climate change were coded as "mixed/neutral," and those lacking a clear indication of whether climate change is good or bad were coded as "undetermined/unknown."

Issue Scope. Issue scope refers to the fact that an issue may have a broad or narrow range of effect that can ultimately be tied to issue ownership, issue responsibility, and policy jurisdiction. How the scope of the climate change issue is specified in the news media may affect the thinking about the level of authority responsible for dealing with the issue. In our coding system, the issue scope variable measures the governmental jurisdiction level(s) at which these news articles portrayed climate change and its possible effects. Issue scope was coded at five scope-specified sub-categories: Local, State, Multi-State, U.S. National, and International-Global.[8] Since one article may simultaneously discuss climate change and global warming at several levels, multiple checks were allowed in our coding among the five "scope-specified" subcategories. For example, if an article discussed global warming and sea level rise around the world, and then discussed possible consequences of sea level rise for the Galveston Bay area, we coded the issue scope of this article as both "International-Global" and "Local."

Issue Linkage. Issue linkage is defined as the linking of climate change with other social, economic, or public issues. A particular public issue can be associated with other public issues. For example, civilian use of nuclear energy can be linked with the cost of energy consumption or with public safety and health, or with both. Different issue linkages may affect the thinking about how the issue should be addressed with what kind of appropriate measures. In the codebook provided with this report, twenty-one public issue categories that climate change might be linked to in the news reports are specified. Some examples of the issue linkage categories include agriculture, defense and security, public health, housing and community, international cooperation, macroeconomics, science research and development (R&D), land and water management, energy, and transportation. For the climate change issue, Smith (2005) showed that it has directly been linked to a large array of other issues ranging from international affairs to health. Since one article could associate climate change with many other issues, multiple checks were allowed in coding the issue linkage category. For example, if an article stated that climate change had to be handled by all countries and required more scientific research, then both "international affairs & cooperation" and "science R&D" would be coded.

Issue Participants. Schattschneider (1960) noted that the essence of policy conflict over a public issue is the scope of participation. Cobb and Elder (1983, p. 82) wrote that a public issue is "a conflict between two or more identifiable groups over procedural or substantive matters relating to the distribution of positions or resources." Kingdon (1995) continued this line of inquiry and found that identifying "the visible participants" in a policy process is a key to understanding the dynamics of agenda setting. In our coding system, we identified various interest groups and governmental participants in these news stories in order to present a snapshot of the key forces in the debate over climate change as portrayed by the media. Each article in the regional news collection was examined and coded to identify whether certain interest groups, including environmental, scientific-professional, industry, and others, were mentioned in this story and what governmental actors (the president, Congress, federal agency, court, and local-state government) were involved in the climate change debates. Again, multiple checks were allowed in the coding as one article could mention several interest groups or several governmental actors.

Proposed Solutions. The print media are not only discussion sites for various public issues but are also places to propose solutions to policy problems. Proposed solutions and treatment strategies attached to a particular issue comprise another key dimension of issue attributes. For this variable we identified articles that proposed solutions and strategies to address climate change. To do so, we first identified how many articles in our sample proposed solutions calling on governmental and non-governmental sectors to take action on climate change issues. In coding these climate change articles, we classified each article into one of the following categories: "governmental solution," "non-governmental solution," or "no solution proposed." If an article clearly called on the U.S. government to take responsibility or action for handling the climate change problem (e.g., calling on the U.S. government to develop alternative energy sources for greenhouse emissions reduction), this article was coded as "governmental solution." Those articles not mentioning governmental

8 "International-Global" is a re-coded variable that combines the following two subcategories in our original codebook and coding system: "Foreign National" and "International."

solutions but calling on private citizens, businesses, or other non-governmental sectors or entities to take action on climate change (e.g., calling people to carpool or calling automakers to produce fuel-efficiency vehicles) were coded as "non-governmental solution." Articles without proposing either governmental or non-governmental solutions were coded as "no solution proposed." The focus of the proposed solution was further coded in terms of Resources (Technological, Economic, Ecological); Approaches (Political, Social, Individual); and Treatment Strategies (Mitigation, Adaptation).

Use of Science. Use of Science is a variable that was central to this research project. In our coding, we were interested in uncovering the relationship between the media and scientific information, in learning how the media utilize scientific information, and in determining the major sources of scientific information for news coverage on climate change. The first coded variable in this section was whether scientific information was cited or referred to in the news article. Scientific information is broadly defined as empirical evidence rather than normative argument or belief. The second variable in the use of science section was on the sources, or the origins, of scientific information presented in the news article. Four sources of scientific information were coded. These include Academic Source, Government Source, Environmental Source, Industry Source, and Other Source. The third variable in this section was whether different scientific views on the climate change issue with regard to its causes, processes, and/or consequences were presented in the same article.

STAKEHOLDER GROUP OBSERVATION

In each research location, a small number of stakeholder groups were selected for observation. The groups sampled are groups involved in an on-going way in making decisions about issues that could easily be affected by climate change. With the permission of the groups, researchers attended meetings to observe in a real setting the process through which issues are defined, discussed, and resolved. Of particular interest was the role science-based information played in these discussions. When necessary, researchers also gathered additional information from individual members of the groups, using exploratory interview methods. In addition to adding to the information on stakeholder decision making and acting as a means for triangulating on key elements in this decision making, this kind of observational activity also had the potential to add information on data needs and preferences. Finally, electronic reports and web site information generated by the stakeholder groups was gathered for future analysis as to the extent to which climate change was mentioned.

Sampling

In each research location, a small sample of stakeholder groups was observed during decision making. The selection of these groups depended on a number of factors. The most important of these was the availability of groups that were actively involved in decision making during Phase III of the project. If researchers had a number of groups to choose from, the choice was focused on maximizing variation. That is, if two neighborhood groups and three business groups qualified in terms of being actively involved in decision making with climate change implications, one residential and one business group would be chosen for observation. Another limitation on the sampling of these groups was the availability of research personnel with the time required for such observation. A breakdown of the organizations observed can be found in Table 3.20. In each location, the meetings attended represent considerable variety in organizational type. Multiple levels of government were observed, as were various types of non-governmental organizations.

TABLE 3.20
TYPES OF ORGANIZATIONS OBSERVED

Organization Type	Florida	Louisiana	Texas
GOVC (P)	Franklin County Commission	Plaquemines Parish Council Lafourche Parish CZM Advisory Committee	Harris County Commissioners Court Houston-Galveston Area Council
NGO	Alligator Point Taxpayers Association	Barataria-Terrebonne National Estuary Program	Coastal Bend Bays & Estuaries Program Galveston Bay Foundation
GOVS	FL DEP – Office of Coastal and Aquatic Management FL DEP – Community Planning Workshop	LA DNR Local Coastal Program (no write up)	Galveston Bay Estuary Program
PORT			Port of Houston Authority
TRIB		Houma High School Reunion	
LEVE		Terrebonne Levee District	

Analysis

Observers were instructed to participate in meetings as observers only. Notes were to be the only records of the observations. For each group observed, special attention was to be paid to issues that were salient, the ways decisions were made about them, and the role (if any) that science-based information played in the decision process. No formal coding or analytical procedures were employed, but observers were asked to add their general impressions to the notes of the proceedings.

OTHER DOCUMENTS

Documentary evidence, other than newspapers, was used as an additional source of information on issue emergence, climate change salience, decision making, and information use. Federal-, regional-, state- and local-level documentary evidence, such as plans, annual reports, and program announcements, was sought. The time period over which documents were collected varied somewhat across research locations because of differences in the timing of stakeholder awareness of climate change issues. Initial searches for documents began in the year 1988, our agreed-upon start year, but actual collection began with the emergence of climate change in the documents. During document collection, availability of documents was a limiting factor, and start dates for collection varied somewhat by dates of availability.

Sampling

Document types that were examined for relevance included but were not limited to:

- Documents from local bodies such as planning commissions
- Meeting notes from relevant bodies
- Literature/reports from interest groups (such as chambers of commerce)
- Web content for organizations in the interview samples

We also sought documents that directly reflected stakeholder decision making. These included minutes of stakeholder meetings, reports and/or recommendations, and plans produced by such groups in each of the research locations.

A number of sources were utilized to uncover relevant documents.

- Websites for the organizations in our interview sample were examined for reference to documents and other types of information. Those documents were also examined for additional references.
- During interviews, respondents were also directly asked about their sources of information on climate change and about important policy documents that guide decision making in the organization. The Florida location also employed email solicitation of documents from the interviewed organizations.
- Local planning documents were systematically gathered for each location on the assumption that if climate change were a salient issue in a geographical area, community plans covering such topics as land use planning and emergency management would address climate change stressors such as sea level rise, temperature, and changes in precipitation.
- Finally, an effort was made to obtain minutes of meetings held by selected decision making bodies in each location.

There was no target number for the documents to be analyzed in each location. The goal was to uncover documents that indicate how/if science-based information is being utilized in decision making – particularly information on climate change. Within these categories of documents, appropriate numbers and types of documents were sampled. The guide for terminating document collection was the point at which no new information was emerging.

In addition to searching for documentary evidence on organizational websites, the project also undertook a website analysis to corroborate information obtained from stakeholder interviews on organizational attitudes/position with regard to climate change. The website for each of the organizations that formed the interview dataset was visited. Two types of data were sought and coded: (1) the web links (no more than two layers deep) that appear on the organization's website and (2) information on the organization's own mission, goals, and current programs/projects. The variables coded are briefly described below. More detailed information is available in the Coding Instructions for Website Information (Appendix F). Web links found at each site were considered indications of types of information considered important on the assumption that an organization would only link to others it deems useful for its users. Links were also viewed as indicators of social alignment on the assumption that an organization will only post links to others it identifies with.

Processing and Analytical Methods

Collected documents were electronically sent to the centralized Texas location where they were stored in searchable electronic form. Records were placed into electronic format and can be analyzed for the salience of climate change and mention of endpoints, using content analysis. The initial goal was to trace the use of scientific information through stakeholder networks in order to determine how scientific information is transmitted and who is influential in the process, as well as to gain insight into how to facilitate the use of science. The agenda setting and social construction of problems frameworks were to guide this portion of the investigation. Initial examination of documents indicated virtually no mentions of climate change. The team decided to focus instead on planning documents and websites. The former were seen as potential indicators of how often area planners took notes of potential climate change impacts. The latter were seen as indicators of organization awareness of climate change.

Planning Documents

Planning documents were reviewed, and coders tagged any plan sections or chapters that included any substantial discussion of climate change or climate change stressors. Coders used the following list of key words to assess climate change or stressor content:

- Climate change, global warming, regional warming
- Temperature- temperature extremes, heat waves, hot days
- Precipitation-rainfall, drought, soil moisture

- Sea Level Rise-higher waters or tides, erosion, salt water intrusion
- Storms-hurricanes, tropical storms, storm surge, storm winds, storm rainfall

For each plan, the coders also identified any impacts of endpoint vulnerabilities mentioned in conjunction with discussion that explicitly contained any of these key words. Coders then searched for any formally stated policies, goals, objectives or actions that clearly delineate specific solutions or strategies in terms of climate change adaptation. Only those passages expressing a concern for long-term worsening or climate conditions were considered. Each plan was also analyzed for an explicit discussion of sustainable development strategies or tactics.

Website Links

The web sites for each of the organizations represented in the interviews were also systematically examined for several types of information. The organization was the unit of analysis. Websites for all the organizations in our interview samples were examined. There were 271 organizations contacted for the Wave 1 interviews and 104 organizations contacted for the Wave 2 interviews. A total of 246 organizations had websites, and this number forms our sample. The purpose of the website analysis was twofold. First, the website represented an additional indicator of the extent to which organizations in our interview samples are concerned with (1) climate change, (2) the stressors associated with climate change (temperature, precipitation, sea level rise, storms), and/or (3) the perceived effects of these stressors on selected endpoints. To achieve this, the mission and goals of the organization were coded for any mention of these variables. In addition, information was gathered on the organization's current programs and/or projects as an indicator of what organizations may actually be doing that is relevant to climate change.

Second, the websites also represented an additional source of data on the kinds of information each organization utilizes or has access to. This was explored via the links that the organization has with other websites. Three types of data were collected on organizations' links: (1) the scope of the information, or whether it was national, regional, state, or local in its origins; (2) the types of information provided at the linked site, or whether it was environmental, economic, social/demographic, technical, or other; and (3) the types of organizations being linked, or whether they were government, education, non-profit or business organizations. The relevant levels of analysis are summarized below.

- **Concern with Climate Change:** To assess the organization's orientation toward climate change, the organization's mission and goals were examined for any mention of climate change and any mention of the stressors of temperature change, precipitation change, sea level rise, and changes in storm frequency and intensity. In addition, mission and goals were examined for mention of the endpoints that formed one of the focuses of this research—water quality and quantity, ecosystems, infrastructure.
- **Current Projects/Programs:** The website was examined and coded for any current programs or projects that address climate change stressors, such as sea level rise, and/or endpoints as they might be affected by climate change.
- **Scope:** This variable indicated the proximity to the research location. All the interviewed organizations were considered "Local."
- **Type of Information:** This variable referred to the type of information provided—if only through links—to site users.
- **Type of Organization:** The primary categories were governmental, education, non-profit, business and other.
- **Role of Interviewed Organization:** This variable refers to the dominant orientation of interviewed organizations toward environmental protection and economic growth.
- Information for each website was coded in an Access database according to the Coding Instructions for Website Information (Appendix F).

Chapter 4

Findings

In this section, we first examine what kinds of problems currently dominate local stakeholder concerns, the character of those problems, and what stakeholders perceive as the causes of those problems. We also examine the kinds of information on climate change that are currently available to all stakeholders in the research locations. In a second analysis, results from interviews about general problems (Wave 1) are compared with interviews in which climate change scenarios were introduced (Wave 2). This comparison focuses on the potential climate change impacts on local problems as well as on questions about the completeness and believability of information on climate change. Further comparisons of Wave 1 and Wave 2 interview results focus on stakeholder decision making, the use of science-based information, and preferred information formats.[9]

By combining information on use of science, stakeholder processes, and decision making, we hoped to improve our understanding of the way science and technical information about climate change affects stakeholder decision making, policy development, and policy implementation. We have used the following theoretical frameworks to guide the development of interview questions and the coding of interviews and documents: construction of social problems, agenda setting, communications theory, and social amplification of risk. These perspectives also guided the analysis described below. Finally, the discussion is organized around conceptual areas relevant to research questions. Rather than describe findings from each data source in separate sections, data from different sources (e.g., interviews, focus groups and newspapers) are brought to bear as they contribute to a fuller understanding of decision making and information use in the research locations.

Salience of Climate Change as a Problem in the Gulf of Mexico: Evidence from Interviews and newspapers

Wave 1 Identification of Problems and Causes

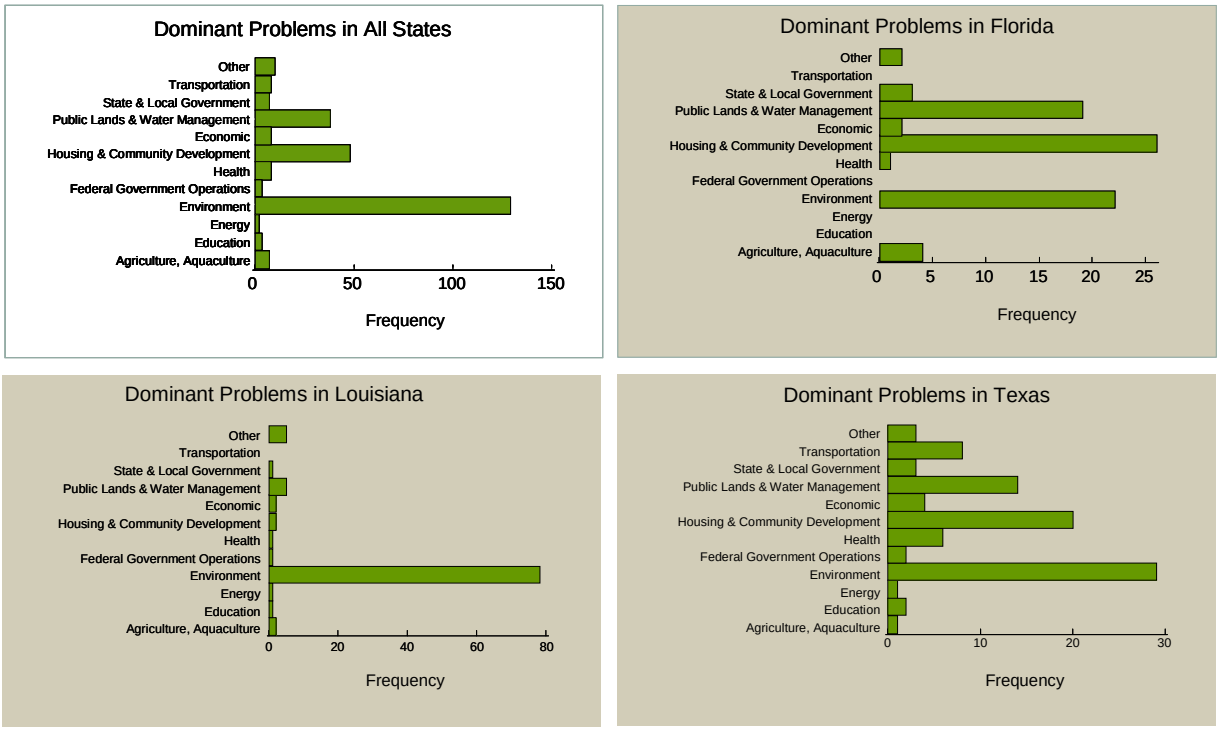
Stakeholder Perceptions of General Problems in Each Research Location

The literatures on problem definition (Best, 1989; Hilgartner, 1992; Hilgartner & Bosk, 1988; Rochefort & Cobb, 1994; Tzoumis, 2001; Wood & Vedlitz, 2007), on risk assessment (McDaniels, Gregory & Fields, 1999), and on agenda setting (Baumgartner & Jones, 1993; Kingdon, 1995) all indicate that new issues or problems may receive less attention when in competition with existing problems. Interview data from our research locations indicate that Gulf stakeholders readily identify a number of problems in their areas, but climate change is not among them. There was considerable variation in the specific problem that any given stakeholder identified as the dominant one. To introduce more coherence to this list, problems were reclassified according to the issue scheme developed by Jones and Baumgartner (2005) and widely used in the agenda setting literature. When this reclassification was done, it was evident that the majority of these problems could be viewed as either *Environmental* problems or problems of *Housing and Community Development*. For Texas and Florida, *Public Lands and Water Management* issues also comprised an important problem area, reflecting a heightened public sensitivity to the management, access to, and use of common natural resources in those research areas. Consistent with its larger, more varied, and more urban population, interviewees in

[9] The study was designed to allow maximum variance across Gulf regions and endpoints. The base numbers used in the figures and tables below are the numbers of stakeholders interviewed in a particular interview wave. Because information was gathered in the form of open-ended conversations with stakeholders, not every question was explored with every stakeholder, and this resulted in smaller response categories than would have been the case had we based figures only on the numbers of stakeholders who addressed a particular issue. It should also be noted that all relevant responses were coded so as not to lose information. Many interviewees had more than one response to a question. For example, when asked about causes of problems, an individual might mention one cause, several causes or no causes. During the coding, it seemed more important to capture the full content of conversations with these local experts than to focus on numbers of individuals. Therefore, columns seldom total 100%.

the Texas location reported more different types of problems than either of the other locations. It should be noted that in advance of the interviews, all respondents knew this project was being funded by the Environmental Protection Agency. We believe that this knowledge may have prompted many respondents to discuss the environmental problems in their areas. Nevertheless, respondents spoke fluently and convincingly about these problems, and we believe that they do, indeed, represent salient problem categories for Gulf coast residents. Figure 4.1 shows variations across research locations in the type of problem identified by respondents as the dominant one. The complete listing of problems as stated by respondents and the reclassification of those problems can be found in Appendix G Table 1.

Figure 4.1
Dominant Problems Identified in Each Research Location: Interviews



N = Wave 1 respondents = 271 (All); 85 (FL); 67 (LA); 91 (TX)

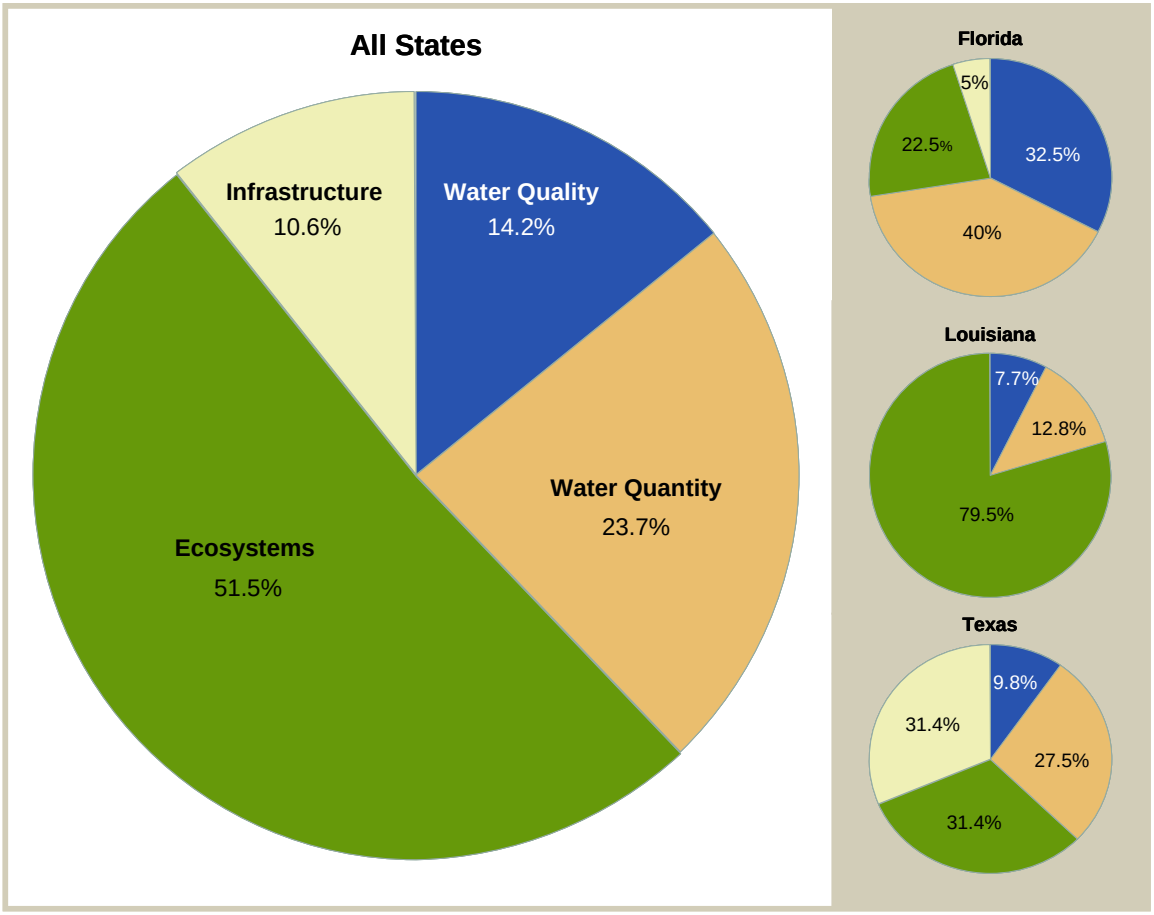
Stakeholder Perceptions of Endpoint Problems and Populations Affected

Wave 1 respondents also typically mentioned one or more endpoints associated with the problem they identified as the primary one. Mention of an endpoint was especially likely if the problem could be categorized as an environmental or a public lands and water management issue. Endpoints such as *Ecosystems*, *Water Quality*, *Water Quantity*, and *Infrastructure* all figured in the Wave 1 conversations with respondents. *Environmental* problems ranged across all the water and ecosystem endpoints with a concentration in the wetland and marsh categories. As could be expected, *Public Lands and Water Management* problems focused much more on various water issues while *Housing and Community Development* problems tended to focus almost exclusively on *Infrastructure*. In Texas, *Infrastructure* concerns frequently involved the negative impact of development and hardscape on vulnerability to flooding and damaging run-off.

Figure 4.2 more clearly shows the relative salience for each location of *Ecosystem*, *Water Quality*, *Water Quantity*, and *Infrastructure* endpoints for dominant problems regardless of type. The most frequently mentioned endpoint for all states was *Ecosystem* (51%), followed by *Water Quantity* (24%). In Florida, the most important endpoint identified by respondents was *Water Quantity* (40%), followed closely by *Water Quality* (33%). Interviews revealed that the focus of this concern was primarily on the impact of pollution and low freshwater inflows on the health and productivity of the coastal bays and estuaries. *Infrastructure* was rarely

mentioned (5%). In Louisiana, *Ecosystems* were by far the most important endpoint as reflected by the frequency of mention by respondents there. *Water Quantity* (12.8%) and *Water Quality* (7.7%) were a distant second and third. It should not be assumed, however, that these water-related endpoints were unimportant to Louisiana stakeholders. Examination of the interview content shows that issues of *Water Quantity* are important in so far as they are implicated in land loss and coastal erosion. *Water Quality* is mentioned less frequently and generally in association with *Ecosystem* problems, such as salt water intrusion and its effects on grasses. In Texas, the endpoints associated with all the problems identified were fairly evenly distributed among *Infrastructure* (31%), *Ecosystems* (31%), and *Water Quantity* (27.5%). *Water Quality* (<10%) was of much less concern. As in Louisiana, the *Water Quality* issues tended to focus on salt water intrusion and to some extent on pollution in run off to the various research area water bodies.

Figure 4.2
Wave 1 Environmental Problem Endpoints: Interviews



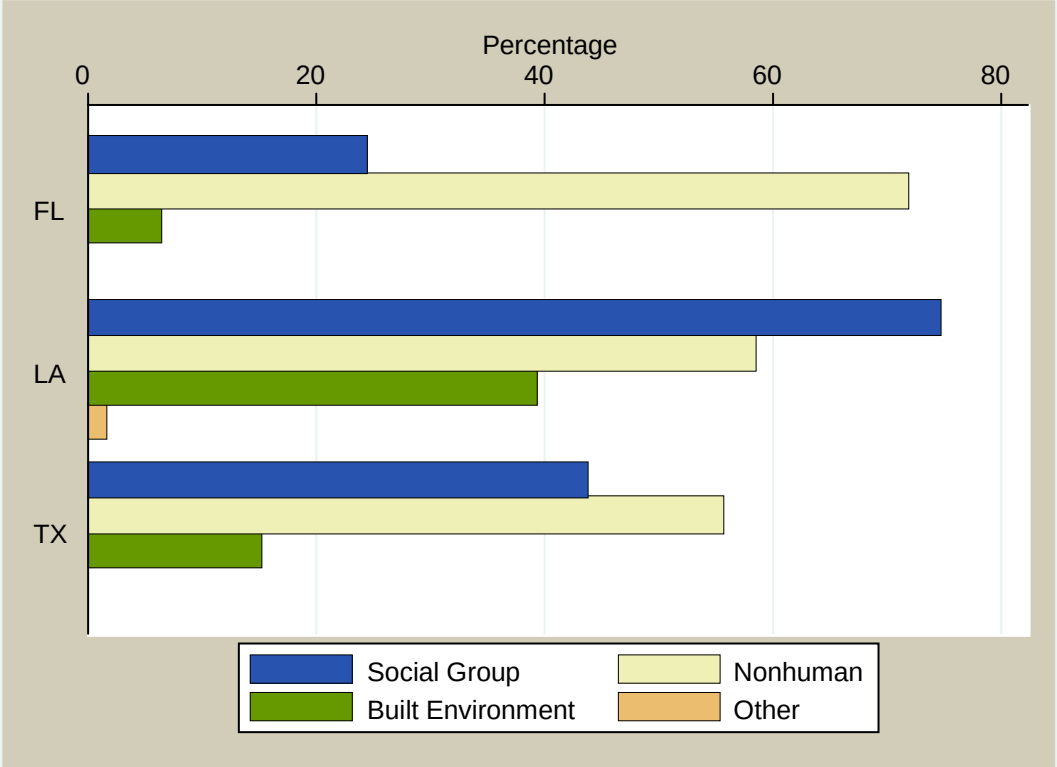
N = Wave 1 respondents = 271 (All); 85 (FL); 67 (LA); 91 (TX)

Figure 4.3 narrows the focus to environmental problems and shows the populations that respondents in the different locations identified as being the most affected by this type of problem. Three coding categories were used. *Social Groups* refers to any human population and included populations as diverse as the general public, fishermen, and agriculturalists. *Non-humans* included both non-human animal and plant species; these were often discussed together. *Built Environment* refers to any structure built by humans and includes a variety of structures from roads and bridges to seawalls. There is obviously interaction among these categories. For example, many of the impacts on the *Non-human* populations of a bay can also affect human groups, such as

commercial and recreational fishermen. However, impacts on populations were coded according to the emphasis given to them by the respondents themselves.

When environmental problems are singled out, Texas responses indicate that direct affects on *Social Groups* are almost as likely to be mentioned as direct affects on *Non-human groups* despite the large human population of the Galveston Bay area. In the Texas interviews for example, water-related issues were almost as likely to be linked to problems of fresh water inflows to the bay as to the availability of water for use by human populations. In the less densely populated Apalachicola Bay area, direct affects on *Non-human* populations clearly dominate respondents' concerns. In the Lafourche and Terrebonne Parishes area of Louisiana, however, where the implications of land loss include loss of ancestral property, livelihood, and extreme vulnerability to storms, as well as effects on resident and migratory bird populations and fisheries nurseries, perceived effects on human populations (*Social Groups*) are relatively more important to stakeholders than they are in the other locations. In addition, Louisiana respondents are somewhat more likely than those in other locations to identify *Infrastructure* as an affected category. Many types of *Infrastructure* were seen as affected by land loss and coastal erosion, including houses, businesses, and docks. Highways and bridges, however, were the most frequently mentioned types of *Infrastructure* affected, particularly Highway 1. This main highway connects Port Fourchon at the tip of Bayou Lafourche northward to the state highways and Interstate system.

Figure 4.3
Populations Affected by Environmental Problems: Interviews



N = Wave 1 respondents with environmental problems = 327 (All); 78 (FL); 130 (LA); 119 (TX)

In spite of many similarities in problems facing the three research locations, there are also important differences among them that have implications for the way climate change information is framed and used. The Louisiana location showed the most consistency in identification of the primary problem. The dominant problem as identified by respondents was overwhelmingly environmental in nature (Figure 4.1), and there was a great deal of consensus over the specifics of the environmental problems identified (Appendix G Table 1.) Land loss (also expressed as wetland loss and coastal erosion) was mentioned by virtually every respondent in Louisiana as an important problem, and in Louisiana it is perceived as a human problem as much as it is an *Ecosystem* problem. The general vulnerability of this area to storms and the increase in vulnerability caused by land loss cannot be overstated. While land loss is obviously a preoccupation of stakeholders in the southernmost part of Louisiana, it is a problem that respondents did not associate with climate change and sea level rise during the Wave 1 interviews.

Ecosystems was by far the most frequently mentioned endpoint in Louisiana. Seventy-nine percent of respondents talked at some point about the impact of land loss on *Ecosystems* (Figure 4.2). More specifically, wetland loss and its effects on commercial and recreational fisheries were frequently mentioned. The reduction in storm protection produced by wetland loss is also a major concern as indicated above. The erosion of coastline and the disruption of wetlands and barrier islands force important changes in *Ecosystems* and also have implications for human safety. *Water Quantity* was mentioned by 13 percent of the Louisiana respondents, generally in terms of there being too much water in some locations or significantly more water than before. When *Water Quality* (8%) was mentioned, it was primarily in terms of industrial pollution and often brought the discussion back to *Ecosystem* impacts.

In Florida, problems classified as *Public Lands* or *Community Development* dominated the Wave 1 interviews. The emphasis on problems of *Public Lands* reflects the prominence of parks, recreational areas, and conservation areas to this particular part of the Gulf and frequent social debates about the regulation and management of these common resources. Examination of specific interview content revealed that the concern with *Community Development* stems primarily from effects that residential development and recreational development are having on endpoints. In this regard, respondents expressed concern about the degradation or destruction of *Ecosystems* (e.g., wildlife habitat, wetlands, sea grass beds), along with social and economic impacts of rapid social change on local people and traditional culture. Concern with water was by far the dominant concern with 72.5% of respondents citing *Water Quantity* and/or *Water Quality* as the endpoint affected by the primary problem. In Florida as in Louisiana, water issues are extraordinarily important. However, in Florida, the issue is maintaining adequate fresh water inflows to the bay without inundating the bay with freshwater. While the impacts are overwhelmingly stated as impacts on the *Ecosystem* or *Non-human* communities, interviews indicate that for most respondents the population ultimately affected is the human one. Although there are some respondents who are concerned only about the integrity of the ecosystem, for most respondents, the ultimate beneficiaries of ecosystem health are human groupings such as oystermen, the ecotourism industry, and landowners with freshwater wells near the coast.

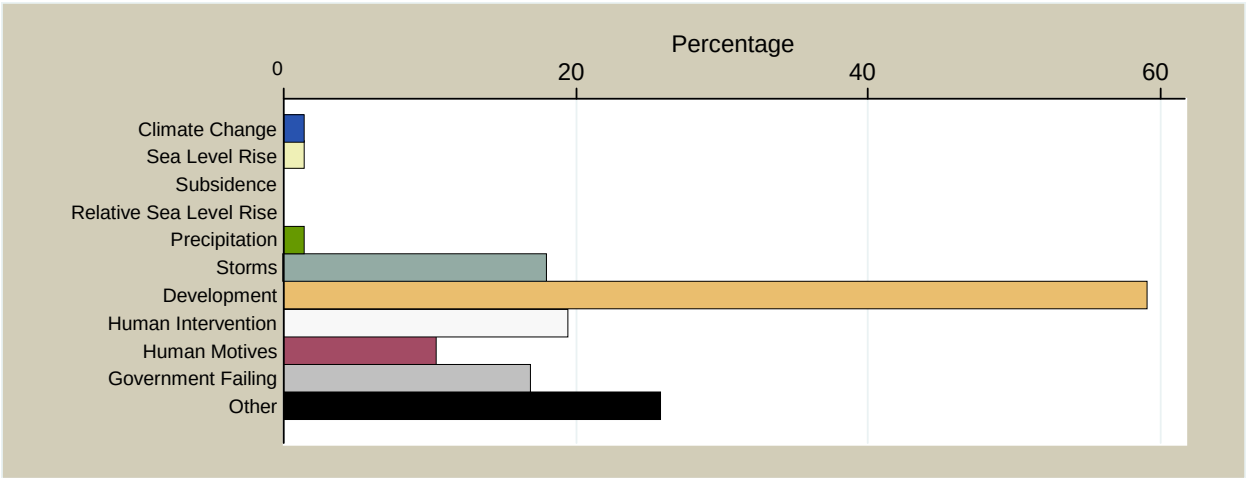
The problems, endpoints, and affected populations that characterized the interviews with Texas stakeholders also reflect the unique aspects of this research area. The Texas research area is more highly urbanized, more densely populated, and characterized by many more competing interests. Among these interests are ones that center on Galveston Bay and air quality. The bay provides recreational and various quality of life services. It is also a resource that contributes to the economic well being of the area through the fisheries, through the ports, and through land development. Because of its status as a non-attainment area, air quality is also a type of environmental concern for many respondents. While not all stakeholders recognize the importance of balancing the many interests and uses of resources like Galveston Bay, the more even distribution of concern about the various endpoints and the more equal concern with *Social* and *Non-human* populations expressed by the stakeholders as a group point to the balance required to sustain a viable social-environmental system.

Perceptions of Problem Causes

During Wave 1 interviews, these problems and endpoint impacts were never linked to climate change. It was originally thought that even if respondents did not link problems to climate change, they would attribute at least some of them to actions of climate stressors such as sea level rise, temperature changes, and precipitation. This was generally not the case. For example, although hurricanes and tropical storms were seen by some respondents as a cause of the primary problem, increases in the severity and frequency of storms (i.e., a climate change) were never mentioned. Changes in water level along coastlines were part of some conversations—particularly in Louisiana—however, sea level rise as a climate change stressor causing problems received little or no comment. Figure 4.4 shows that among stressor categories, more respondents mentioned *Development* as causes of problems than any other single stressor. As important as storm events are to Gulf Coast residents, they played an extremely small role in interview discussions of causal factors.

Instead, perceived causes of problems comprise a wide variety of elements that tended to vary from state to state. These non-climate related causes were examined for each state, and we found that as varied as they were, most of these causes could be comfortably grouped under one of four headings: *Development*, *Human Intervention*, *Individual Motives*, and *Government Failings*. Events or processes that stakeholders think are at the root of their most pressing environmental problem are discussed for each state in Figures 4.4, 4.5, and 4.6. It should be stressed here that these four categories of cause are not cleanly differentiated from one another. For example, an individual motive such as economic gain may find its expression in real estate development along the coast, and the failure of a local government to impose needed zoning regulations may ultimately stem from the profit motive. Rather than impose our own view of these interactions in the coding process, we allowed the stakeholder's perception to dominate. If a stakeholder stated a cause in terms of *Human Intervention* in environmental/ecological processes, that is how it was coded—even if other parts of the conversation made it clear to us that economic gain was driving the interference.

Figure 4.4
Perceived Causes of Environmental Problems in Florida



N = Wave 1 respondents with environmental problems (Florida) = 78

Causes in Florida

In Florida (Figure 4.4), stakeholders were generally less likely to implicate stressors like *Precipitation* and *Sea Level Rise* as causes of environmental problems. *Sea Level Rise* received the least mention. *Precipitation* received somewhat more mention, and *Storms* were seen as the stressor most linked to environmental problems. Nevertheless, of all the causes mentioned, even *Storms* were mentioned by less than 10 percent of respondents. Instead, the overwhelming majority of causes mentioned were causes linked directly to human action. At the Florida location, stakeholders saw their dominant problem stemming largely from increased residential and recreational development in the area.

Over and over again *Development/More People* was the reason given for the problem under discussion. Negative consequences of *Development* included building along the Gulf Coast and urban development upstream, particularly in Atlanta. Figure 4.4 also shows responses falling under *Human Intervention, Human Motives*, and *Government Failings*. *Human Intervention* refers to human action on the environment that has had negative consequences. In Florida, this included actions as varied as water extraction from aquifers for bottled water and Army Corps of Engineers projects such as dredging projects that have kept waterways open but have also produced more sediment in the waters. *Human Motives* refers to individual preferences that can have negative consequences, especially if they represent common preferences. In this category, stakeholders frequently mentioned economic motives (making money off the land or development of the land) and the preference that many people have for waterfront living-a preference that makes coastal development so profitable. *Government Failings* is a category of cause that referred most frequently to either the failure of government bodies and agencies to: (1) enforce existing regulations; or (2) to exercise leadership and manage development in ways that would protect the environment that makes this area so attractive to potential residents.

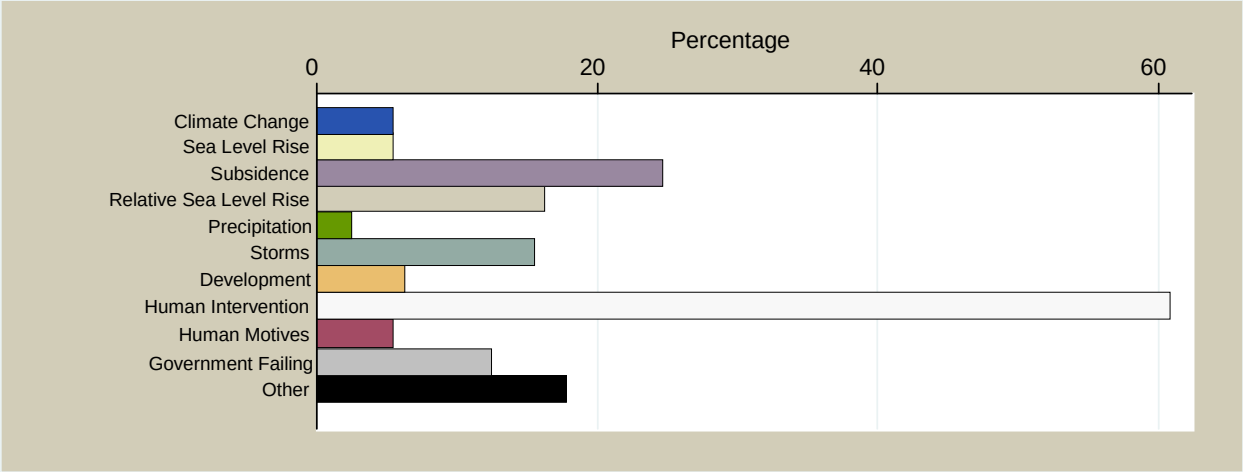
The Apalachicola Bay area is one that is still thinly populated and has traditionally depended on timber and fisheries for much of its economic base. It remains one of the least developed and most environmentally pristine areas in the state. However, human residents and ecosystems are feeling the pressure of rapid development and social change, resulting in wetland loss, ground and surface water pollution, habitat loss, disputes over prescribed burning, and other problems that are characteristic of areas in which human desires and environmental needs come into conflict. A general lack of environmental awareness was frequently cited as an underlying problem, as was the tension between land owners' rights to modify their property and the common good that is often badly served by these modifications (e.g., sea walls and lawns).

A problem specific to the region that entered many of the conversations with respondents was the fresh water supply issue that is at the heart of the "Tri-State Water Wars." EPA is familiar with this complex issue that involves water allocation for human and ecosystem use in Florida, Georgia, and Alabama. While two river basins are involved, one is of particular interest to Florida – the Apalachicola-Chattahoochee-Flint (ACF) River Basin. The importance of this issue is also reflected in the frequency with which the various endpoints were mentioned. In Florida, *Water Quantity* (40%) and *Water Quality* (33%) dominated most of the conversations. Fresh water inflows to Apalachicola Bay are critical to the oyster beds there, and upstream water use along the ACF River System, particularly in Georgia, is a major cause of inflow problems. *Water Quantity* has also been affected by increased use of ground water in the face of residential development and agriculture. It was often impossible to separate *Water Quantity* and *Water Quality* since fresh water inflows is a quality as well as a quantity issue and one that is complicated by critical timing.

Salt water intrusion into both ground water and wetland areas dependent on brackish water were also specific *Water Quality* issues mentioned as was pollution from septic systems in the growing resident and vacation population. Surface water run-off, a source of non-point water pollution, was an important point of concern, particularly given the rapid development of coastal areas. Many different types of impacts on *Ecosystems* (mentioned by 23%) were mentioned by Florida stakeholders. Residential development and recreational development were both cited as endangering the sustainability of some species (e.g., nesting sea turtles and beach mice). The effects of poor freshwater inflows and pollution (both from septic systems and sheet flow run-off) were mentioned as having impacts on commercial sea life. Seawalls that often accompany coastal development, along with the construction of docks, were also cited as negatively affecting the ability of important sea grasses and marsh vegetation to follow coastline changes. The variety of impacts mentioned reflects the *Ecosystem* complexity of the area and the diversity of stakeholder interests captured in the interviews.

In this location, the category most affected by the environmental problems outlined by respondents was clearly *Non-Human* populations (Figure 8.3). Even here, however, there are human impacts of different kinds. For example, the fates of some *Non-Human* populations (e.g., oysters) are intertwined with the economic well-being of those who still make a living from the bay. Developers and those looking for a new economic base for the area tend to be positive about changes taking place, even though the allure of Apalachicola Bay is its natural environment. Some balance between development, economic interests of resident populations, and the natural environment will be increasingly needed as development goes forward.

Figure 4.5
Perceived Causes of Environmental Problems in Louisiana



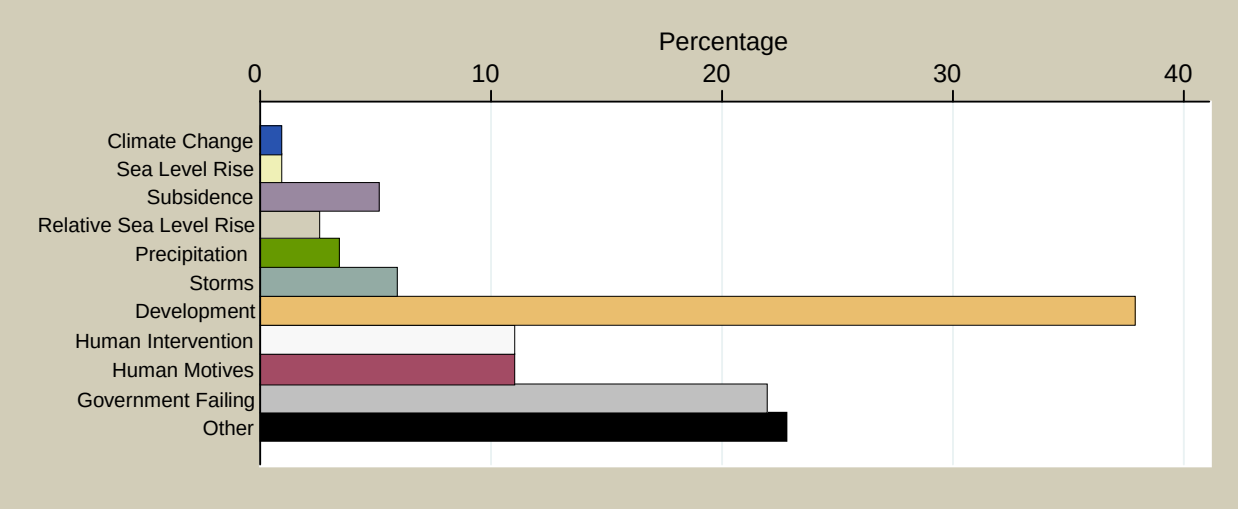
N = Wave 1 respondents with environmental problems (Louisiana) = 130

Causes in Louisiana

Land loss/coastal erosion dominates perceived problems in Louisiana, and the causes of that problem are variously listed as *Subsidence*, changes to the Mississippi that have reduced natural *Sedimentation*, and *Storms* that have destroyed barrier islands. *Relative Sea Level Rise* is a term that was unique to Louisiana stakeholders and was used to communicate an increase in the water level because the land is sinking. In spite of more focus on water level changes in southern Louisiana than in the other research locations, *Development*, *Human Intervention, Human Motives*, and *Government Failings* also comprise important causal categories. As in Florida, climate change was not spontaneously mentioned as figuring into the problems of the Louisiana research location. In Louisiana (Figure 4.5), stressors as a group were more likely to receive mention as causes of environmental problems, with *Subsidence* being most frequently mentioned, followed by *Sea Level Rise* and *Storms*, in that order. Although *Subsidence* was important in the minds of many Louisiana stakeholders, it figured less often as the cause of the primary environmental problem than causes linked to human actions and decisions. Even *Subsidence* received less than one-fifth of the mentions of cause. Figure 4.5 shows, that in contrast to Florida stakeholders, those in Louisiana do not see *Development* as an important causal element. This is true in spite of the fact that there were negative comments scattered through the interviews about the large fishing camps being built in some of the coastal areas, including on an inhabited barrier island.

Instead, *Human Interference* was the single largest category of cause cited. Flood control mechanisms added over many years to the Mississippi basin were most frequently cited as the root cause of land loss. Specifically, interference with the natural processes of *Sedimentation* has allowed other processes, such as *Storms* and normal wave action, to result in significant erosion. The second most commonly cited example of *Human Interference* could be called "the facilitation of commerce." The dredging of navigation channels, canals, and installation of pipelines (usually laid in canals dug through the wetland) have produced more saltwater intrusion, greater water-land interface, and increased erosion. Together, these changes have exacerbated land loss. In the U.S., economic gain is generally seen as a legitimate motive for doing business, and Louisiana stakeholders rarely cited the profit motive or greed as a causal element. Instead, the focus was on *how* business is done rather than on why it is done. *Government Failings* was the second most cited cause of the dominant problem. Economic and/or power considerations were obviously seen as fueling these failures in some cases (policy decisions influenced by economics and decisions in favor of special interests), and specific comments with regard to permitting and regulatory problems seemed to emphasize a failure to critically review applications for their environmental impacts.

Figure 4.6
Perceived Causes of Environmental Problems in Texas



N = Wave 1 stakeholders with environmental problems (Texas) = 119

Causes in Texas

The Galveston Bay area that comprised the Texas research location is more varied in its economy, more densely populated, and more urban in its composition than either of the other locations. This variety is represented in the range of problems identified by respondents there (Appendix G Table 1). Nevertheless, environmental problems dominated the problem identification exercise (Figure 4.1). These environmental problems ranged from air pollution, through coastal erosion and flooding issues, to the increasing danger of water scarcity in the area. *Housing and Community Development* was also a varied category of problem, ranging from municipal concerns with garbage pickup and community communication issues to broader issues of urban sprawl and traffic congestion. This variation is also reflected in the way Texas respondents talked about endpoints. I*nfrastructure*, *Ecosystems*, and *Water Quantity* shared almost equal time in the conversations taken as a whole.

As in the other locations, climate change stressors played minor roles as causes of Galveston Bay problems (Figure 4.6), but non-stressor causes loom large in the minds of stakeholders. Figure 4.6 shows that population growth and *Development* was the most frequently cited cause of Galveston Bay area problems, with many references to urban sprawl, "too many people" and resulting pressures on the natural environment. Water supply issues for humans and non-humans, habitat degradation, and air pollution were seen as important consequences of this growth. *Human Interference* as a cause was cited with less frequency. Perceptions of poorly managed upstream water use along the Trinity River, effects of hard surfaces on flooding, industrial pollution, and the effects of oil and gas extraction on problems of subsidence all contributed to this category as did extraction of ground water for agricultural purposes. However, most of the respondents who mentioned *Subsidence* as a cause of rising sea level and salt water intrusion also said that this problem had been largely solved by a switch from ground to surface water for agricultural uses. The Harris-Galveston Coastal Subsidence District, created in 1975, did effect this change from groundwater to surface water supplies along the eastern coastal plain of Houston and significantly arrested *Subsidence* there (Galloway, Jones, & Ingebritsen, 1999).

The causal category, *Government Failings,* was also varied. It included references ranging from poor planning and coordination on the part of municipalities and the Texas Water Development Board, through lack of enforcement of existing regulations by local, state, and federal entities, to the detrimental influence of "politics" and special interests on policy and regulatory decisions. As a distinctly coded category of causes, *Government Failings* is second only to *Development*. Among the most frequent comments in this category were

comments to the effect that adequate protective regulation exists but is either poorly enforced or ignored in the service of special interests or values that emphasize economic considerations. *Human Motives*/values that were seen as having a direct causal link with dominant problems tended to be economic motives, lack of environmental awareness, and general population preferences for private transportation and living on or near the coast.

The *Other* category comprises the many causes that were mentioned by stakeholders but were too few to be grouped in meaningful coding categories.

Newspaper Coverage of the Issue[10]

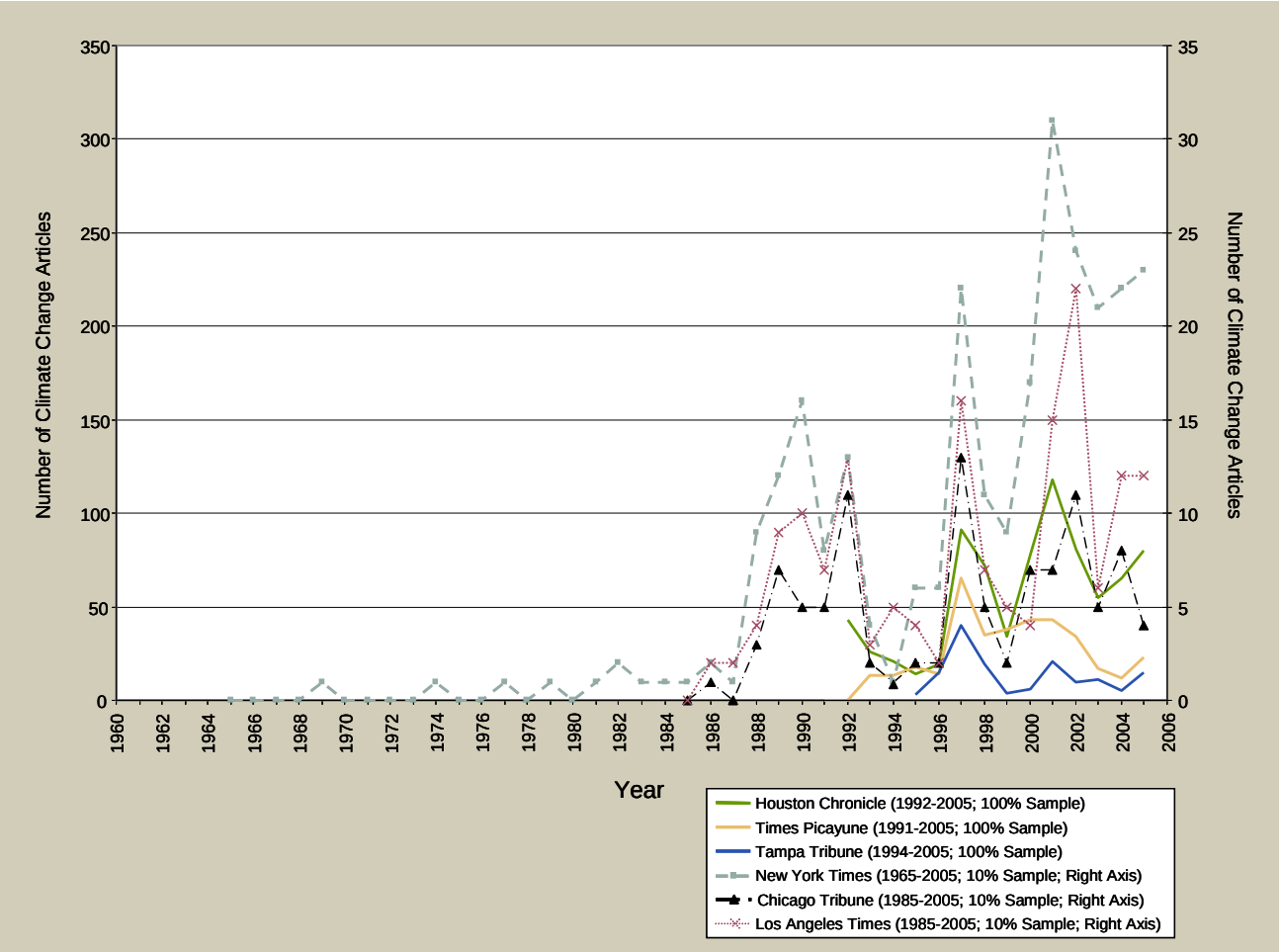
Data from the Wave 1 interviews described above are an indicator of what is going on in the minds of stakeholders with regard to area problems and the possible salience of climate change at the local level. In contrast, data from the analysis of newspaper coverage are an indicator of the information on climate change that was commonly available between 1995 and 2005. Guided by the agenda setting framework, two of the purposes of the newspaper analysis were to (1) trace the changes in the salience that the media gave to the climate change issue over time by tracking the numbers of newspaper articles dedicated to it; and (2) identify patterns and variations in the news coverage on climate change by examining the content of the articles in terms of various issue characteristics or attributes (image, scope, linkage, and participants). Evidence from the newspaper analysis (Liu, Vedlitz, & Alston, in press) generally corroborates the findings from the Wave 1 interviews and strengthens our belief in the reliability of those findings. As will be seen during the course of the discussion that follows, the salience of climate change as a national and global issue has increased over time in both national and regional newspapers. However, the importance of climate change to the Gulf of Mexico, as indicated by references to links in regional newspapers, is much lower.

Salience of Climate Change

Communications theory and the social amplification of risk frame the communication process as a series of signals sent to the public about risks. The media form an important part of that transmission network. First, we compared climate change coverage in newspapers with national circulation (*The New York Times*, *Chicago Tribune*, and *Los Angeles Times*) to climate change coverage in newspapers with regional circulation in the Gulf area (*Houston Chronicle*, *Times Picayune and Tampa Tribune*). The salience of the climate change issue was measured by the number of articles on climate change that appeared in each year. Figure 4.7 shows the changes in the salience of climate change over time.

[10] Some of the material presented in this section was drawn from Liu, Vedlitz, and Alston (in press).

Figure 4.7
Issue Salience: Annual Number of News Articles on Climate Change



First, the salience of this issue ebbed and flowed over time and in a similar way for all six newspapers. The three national papers show an almost identical pattern of issue coverage from 1985 to 2005. The three regional papers show remarkably similar patterns from 1995 to 2005. (The limited data available for regional papers prevented a full 1985-2005 comparison.) Figure 4.7 also indicates that news media attention to climate change has a pattern marked by peaks followed by sharp drops in coverage. *The New York Times* provided the most coverage over the longest period, and the time series for that paper (Figure 4.7)[11] indicates there was little or no attention paid to climate change in the 1970s and 1980s. In 1988, there was a dramatic increase in coverage of the issue in all three national papers. This coverage remained at relatively high levels from 1989 through 1992. From 1993 to 1996, coverage leveled off, but all newspapers, including the three regional papers, significantly increased coverage in 1997, only to have it drop off again in the last years of the 1990s. Coverage reached new highs in 2001 and 2002 and dropped once more in 2003, only to show increases in more recent years of this decade. This overall cyclical pattern of issue salience is consistent with the observations from other studies on the U.S. media attention to climate change for the late 1980s and 1990s (Ungar, 1992; Mazur & Lee, 1993; Trumbo, 1996; McComas & Shanahan, 1999; Williams, 2001). In addition to the cyclical nature of climate change coverage, it should be noted that the long-term trend has been toward

[11] To present both national and regional coverage levels together and make them comparable, we scaled the time series in Figure 4.7 according with two Y-axes: the left axis is for the three regional newspapers with 100% sampling, and the right axis for the three national papers with 10% sampling.

more and more coverage, suggesting greater salience of this issue. During the 1985-1989 period, national papers published an average of 11 articles on climate change per year, but in the period from 1990 to 1999 the average number of articles increased to 22 articles per year. In the first half of this decade (2000-2005), there was an average of 42 articles per year.

The peaks in climate change coverage shown in Figure 4.7 coincide with real world events, or "focusing events" in Kingdon's term (1995). In a recent analysis of climate change coverage by *The New York Times* and the *Congressional Record*, Liu, Lindquist, and Vedlitz (2006) demonstrate that U.S. news media climate change coverage is significantly affected by milestone international events such as the creation of the Intergovernmental Panel on Climate Change (IPCC), the release of the IPCC First Assessment Report on Climate Change, the World Conference in Geneva in 1990, the establishment of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, and the Kyoto Conference in 1997. In a related study of climate change coverage by the *Houston Chronicle* in this period, Liu, Vedlitz, and Alston (in press) find that the attention surge that occurred in the *Chronicle* in 2001 was stirred by the Bush administration's decision in that year to abandon the Kyoto Protocol.

In addition to international and domestic policy events, natural climate events and extreme weather conditions can also contribute to surges in media attention to climate change. After analyzing scientific journals and books as well as newspaper articles and network newscasts on climate change in the late 1980s, Ungar (1992) argues that the enormous increase in attention to climate change in 1988 was caused by the extremely hot temperatures and drought conditions in the summer of that year. In another study, Shanahan and Good (2000) find that local newspapers are more likely to discuss global climate change during the periods when local temperatures are unusually warm. Liu, Vedlitz, and Alston (in press) also suggest that disastrous climate extremes, such as hurricanes, may also attract more regional media attention to global warming and climate change. Note that in Figure 4.7, all three regional newspapers show an upward swing in attention to climate change in 2005, the year when hurricanes Katrina and Rita caused severe damage throughout much of the central Gulf region.

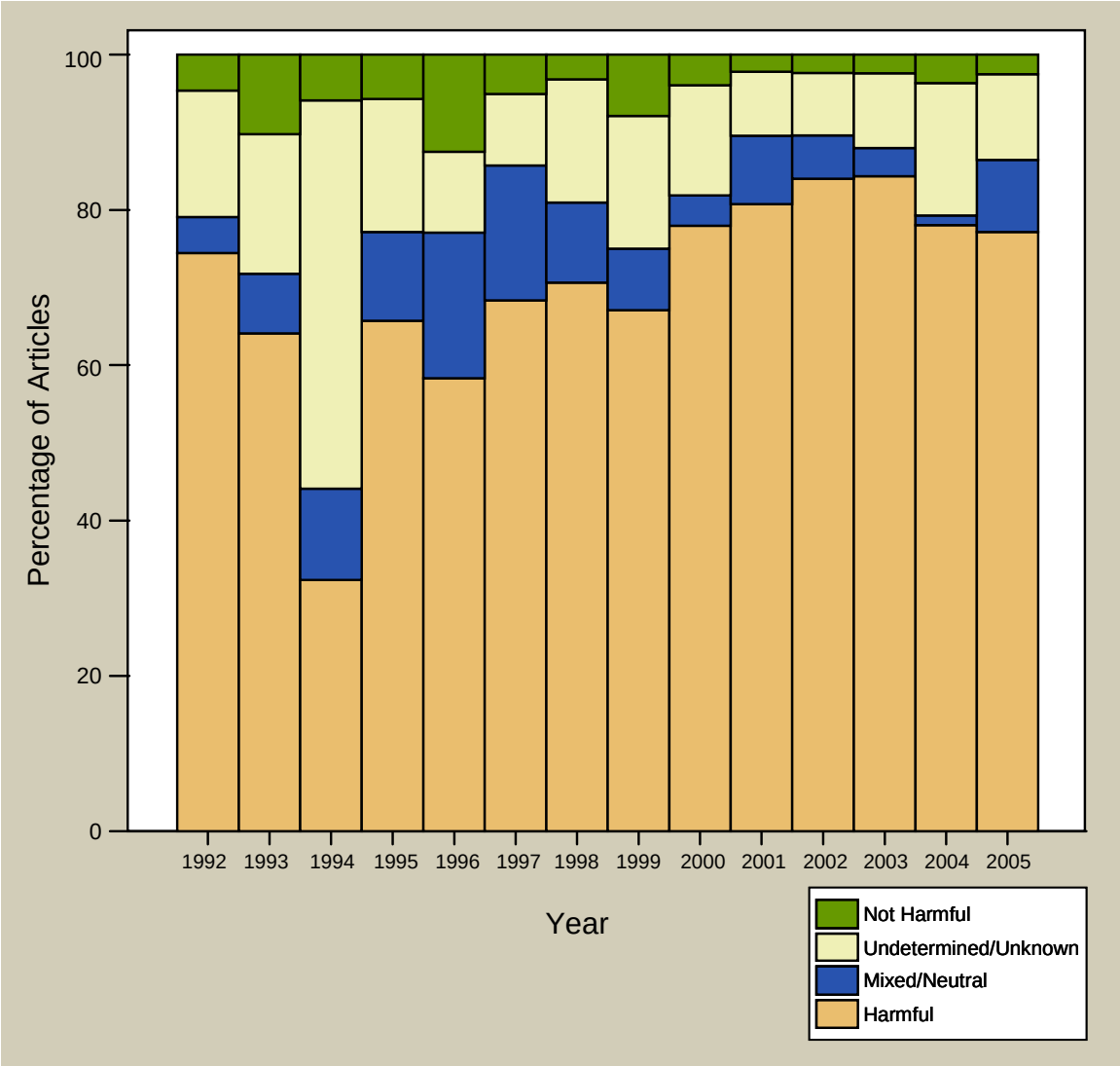
Attributes of the Climate Change Issue

For this project, media coverage of climate change at the national level is less interesting than the details of how climate change has been portrayed to Gulf of Mexico populations via regional news coverage. For that reason, the following analysis is limited to three regional newspapers and does not include a comparison with national coverage. This finer grained examination of news coverage by regional newspapers was undertaken because a particular public issue can be portrayed and framed in various ways based on different attribute dimensions. These different issue attributes can significantly affect the agenda setting process and lead to different policy options. (McCombs & Shaw, 1972; Cobb & Elder, 1983; Iyengar & Kinder, 1987; Baumgartner & Jones, 1993; Kingdon, 1995). We examined 1992-2005 climate change coverage in the *Houston Chronicle*, the *Times-Picayune,* and the *Tampa Tribune* for the following issue attributes: image, scope, linkages with other issues, participants, proposed solutions, and treatment strategies. A total of 1,314 articles were examined. (See the section on Research Design and Methodology for more detail on selection and distribution of articles across the three papers.) Findings are as follows.

Issue Image

Issue Image is the fundamental impression of an issue and has powerful influence in shaping public understanding and policy agendas (Best 1989; 1995; Baumgartner & Jones, 1993; Jones, 1994). Because one of the critical questions in the climate debate has been whether, how, and to what extent global climate change is harmful, we asked coders to evaluate the overall view of each article as harmful, not harmful, or mixed/neutral. Articles clearly indicating real or possible negative consequences of climate change (e.g. health risk, loss of life, threat to infrastructure) were coded as "harmful." Articles indicating that climate change is not dangerous and arguing that global warming may actually benefit human beings (e.g. greater agricultural productivity) were coded as "not harmful." Articles projecting a neutral perspective or presenting both negative and positive views on the effects of climate change were coded as "mixed or neutral." An overwhelming majority of the news coverage in the Gulf of Mexico region discussed real or possible negative consequences of climate change (Figure 4.8).

Figure 4.8
Issue Images Portrayed by Regional News Media—Changes Over Time

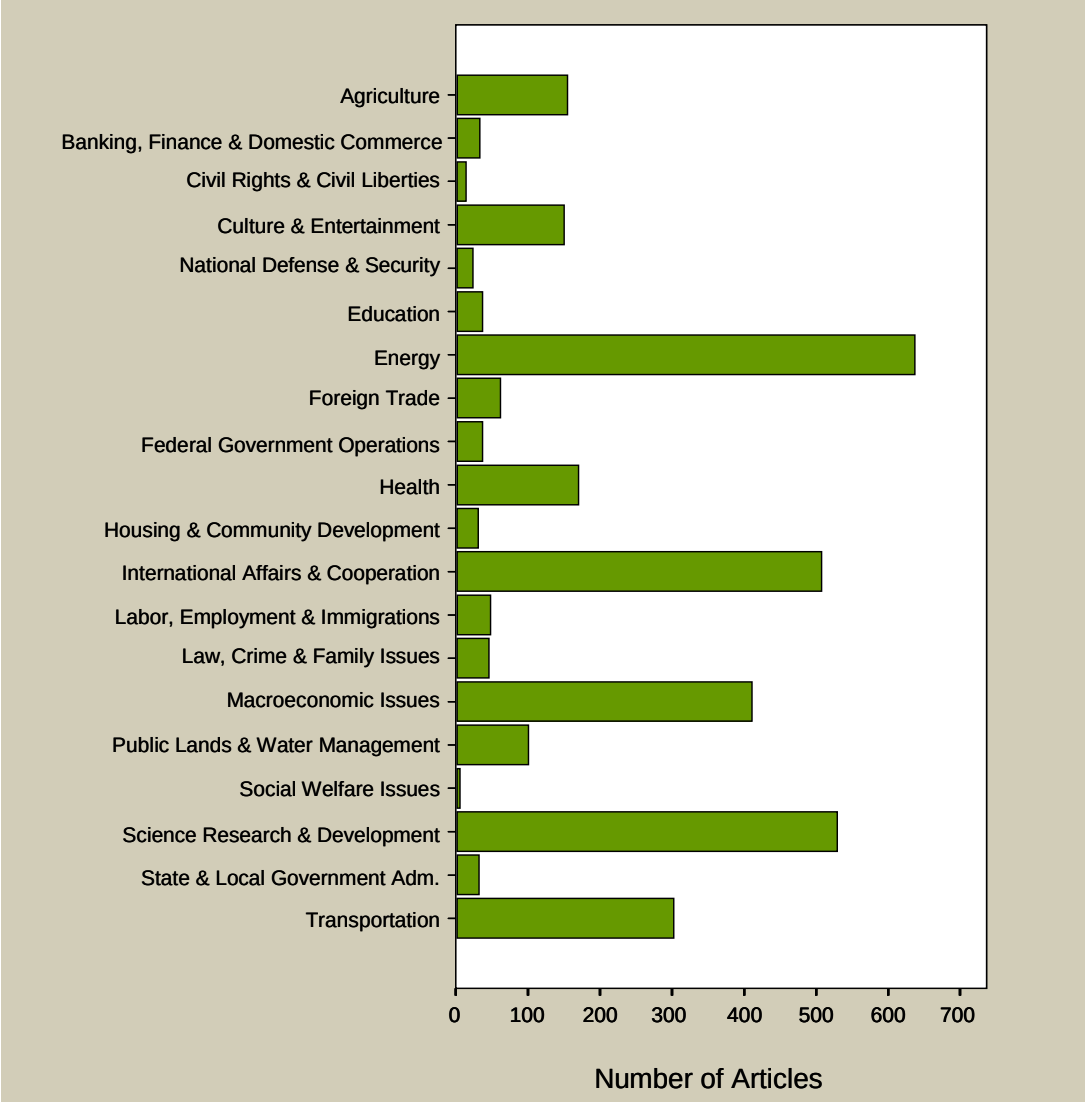


Furthermore, over the years examined, the harmful image dominated newspaper articles in every year except 1994. That was also the year coverage dropped to an extremely low point. Dating from the year 2000, the harmful image of climate change tends to increase. The percentage of articles presenting climate change as a non-harmful issue never comprised more than 10% of the articles in any given year, and the trend was that the percentage of non-harmful articles gradually declined over the 14 years examined. Mixed and undetermined categories were relatively strong in some years. Although the majority of articles projected a harmful image of climate change, the approximately 25% of articles projecting a non-harmful, neutral, or undetermined image prevented climate change from becoming a "valence issue." A valence issue is defined by agenda setting literature as a social problem that elicits "…a single strong, fairly uniform emotional response and does not have an adversarial quality." (Nelson, 1984, p. 27). When there is no question about whether an issue is good or bad, attention and debate surrounding the issue will primarily focus on appropriate solutions rather than other characteristics of the problem itself. This was not the case for climate change.

Issue Linkage

The findings for issue image and their implications for the regional salience of climate change are strengthened by the findings on *issue linkage* (Figure 4.9). A policy issue can always be linked to or associated with other public issues. For example, unemployment can be associated with health insurance; it can also be linked to poverty as an issue. Civilian use of nuclear power can be linked to energy costs, air quality and/or to public health. The linkages that are made can have quite different agenda-setting implications and policy consequences (Baumgartner & Jones, 1993). For the climate change issue, Smith (2005) showed that it has been directly linked to a large array of other issues, ranging from international affairs to health.

Figure 4.9
Number of Regional Newspaper Articles Linking Climate Change to Other Issues



We examined issue linkages established by regional newspaper coverage of climate change (see Research Design and Methodology section for more detail on coding). By its nature, climate change is commonly perceived as an environmental-ecological problem. This "pre-set" issue nature is clearly reflected in our coding results. Among 1,314 articles examined, 1,287 of them indicated climate change is an environmental issue. However, climate change has also been associated with a large number of other public issues. Figure 4.9 shows the variety and numbers of linkages found and suggests that climate change is perceived and portrayed as a complex and multifaceted issue. Although climate change will probably always be viewed as an environmental-ecological issue, its additional association with energy, science research and development, international affairs and cooperation, and transportation will probably also exert strong influence on debates, public agenda setting, and policy formulation processes. The emphasis on energy (and to a lesser extent on transportation) captures the focus of much of the issue debate on fossil fuel consumption and reflects the scope of the issue as a global one that can only be effectively mitigated at the international level.

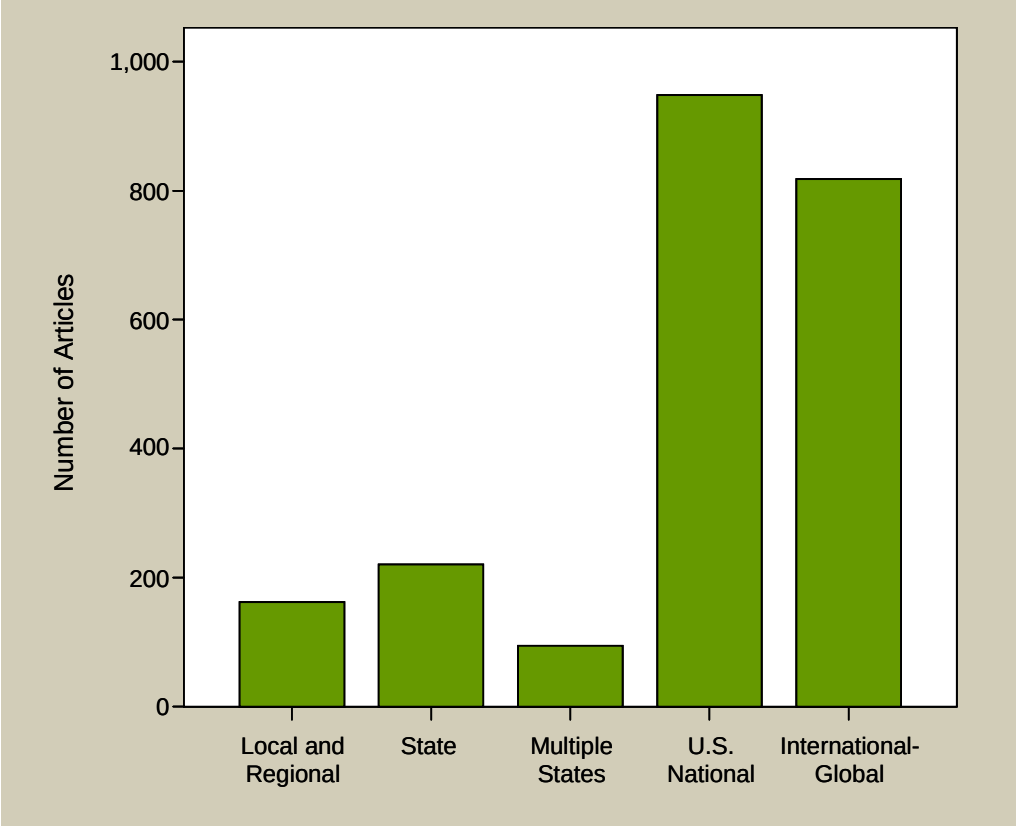
From the perspective of salience and valence, however, one of the most interesting findings shown here is the strong linkage between climate change and science research and development. It is the second most frequent linkage made in these articles and is driven in large part by reports of climate science uncertainty. Previous studies have also shown that scientific uncertainty plays a large role in journalistic reporting of climate change. For instance, Boykoff and Boykoff (2004) found that news media gave disproportionately more attention to climate change skeptics than to indicators of consensus and overemphasized the uncertain aspects of the climate change issue in their stories. Furthermore, in his examination of climate change coverage in four major newspapers, Zehr (2000) found that the dominant response to uncertainty was to assert that policy and action should wait until research is complete and uncertainties have been resolved. It, therefore, seems to be the case that in the regional newspaper coverage of climate change is an information source that tends to reduce any sense of urgency about climate change and its local effects, through its emphasis on uncertainty and the need for more research as well as through its portrayal of climate change as an issue with both beneficial and harmful consequences.

Issue Scope

Our findings on *issue scope* (Figure 4.10) and on *issue participants* (Figure 4.11) also indicate that climate change is viewed as a problem remote from the region and of little or no relevance to local decision makers. Figure 4.10 shows the findings on scope. An issue's scope may be narrow or broad, and this scope is relevant to assigning policy responsibility and jurisdiction. In our coding system, issue scope was defined as the governmental jurisdiction portrayed as the appropriate one for addressing climate change. Five scope-specified subcategories can be seen in Figure 4.10: Local, State, Multi-state, U.S. National, and International-Global.[12] Figure 4.10 represents a simple count of articles in each of the five subcategories of issue scope and shows that climate change and its effects were rarely discussed at the local (7.2% of all mentions of scope), state (9.8% of all mentions of scope), or multi-state (4.2%) levels. Instead, the majority of the news articles in our sample portrayed climate change as an issue with U.S. National and International-Global levels. This portrayal of issue scope implies that major climate change solutions and policy responsibilities are expected to lie with the federal government or with international decision making bodies. It is true that many of the ways to address climate change—particularly mitigation efforts—can only be effective if addressed at larger scales. However, climate change effects will be felt at more local levels where actual changes need to take place, whatever the scope of the leadership on the issue. In addition, adaptation efforts need to be tailored to local conditions and addressed at that level, although the agenda-setting framework indicates that national and regional leadership will also be critical.

[12] "International-global" is a re-coded variable that combines the following two subcategories: "Foreign-National" and "International."

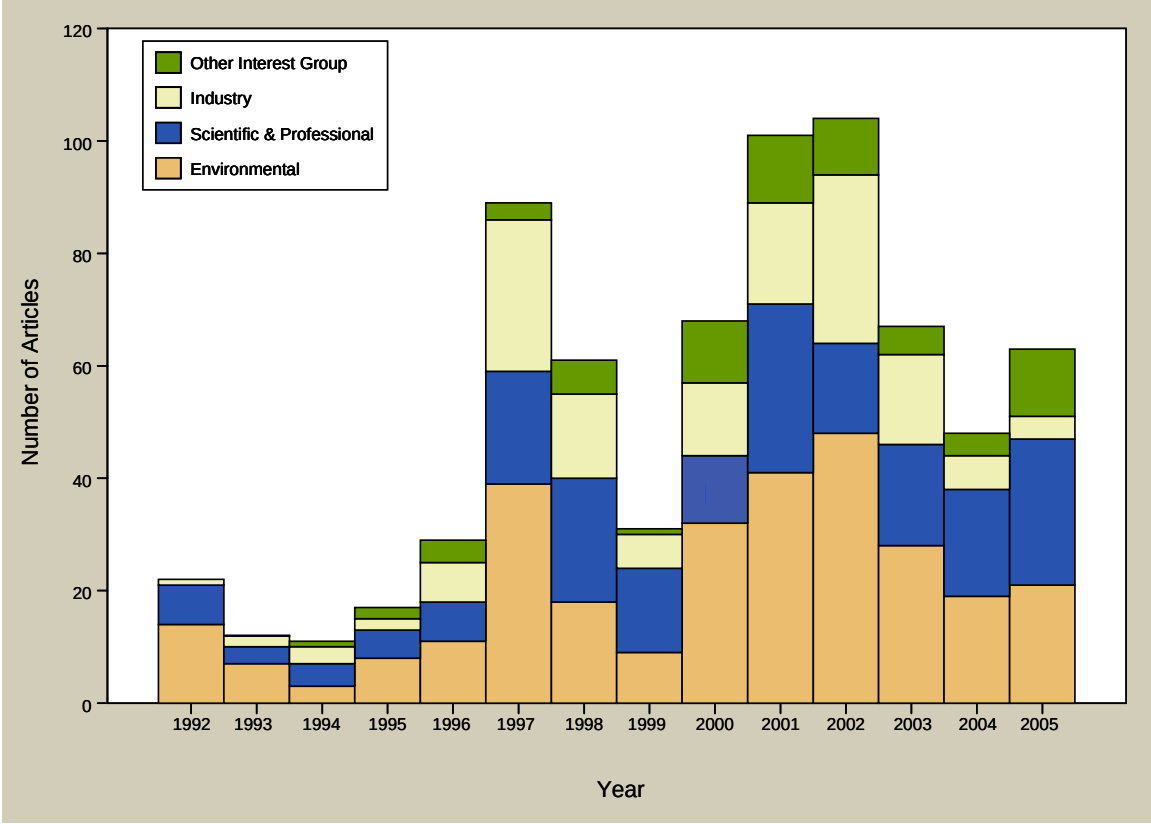
Figure 4.10
Number of Regional Newspaper Articles Indicating Issue Scope, 1992-2005



Issue Participants

The types of *issue participants* identified in newspaper articles on climate change give some additional perspective on the media portrayal of climate change to Gulf of Mexico residents. Schattschneider (1960) noted that the essence of policy conflict over a public issue is the scope of participation. Cobb and Elder (1983, p. 82) wrote that a public issue is "a conflict between two or more identifiable groups over procedural or substantive matters relating to the distribution of positions or resources." Following this line of inquiry, Kingdon (1995) found that identifying the "visible participants" in a policy process is an important key to understanding the dynamics of agenda setting.

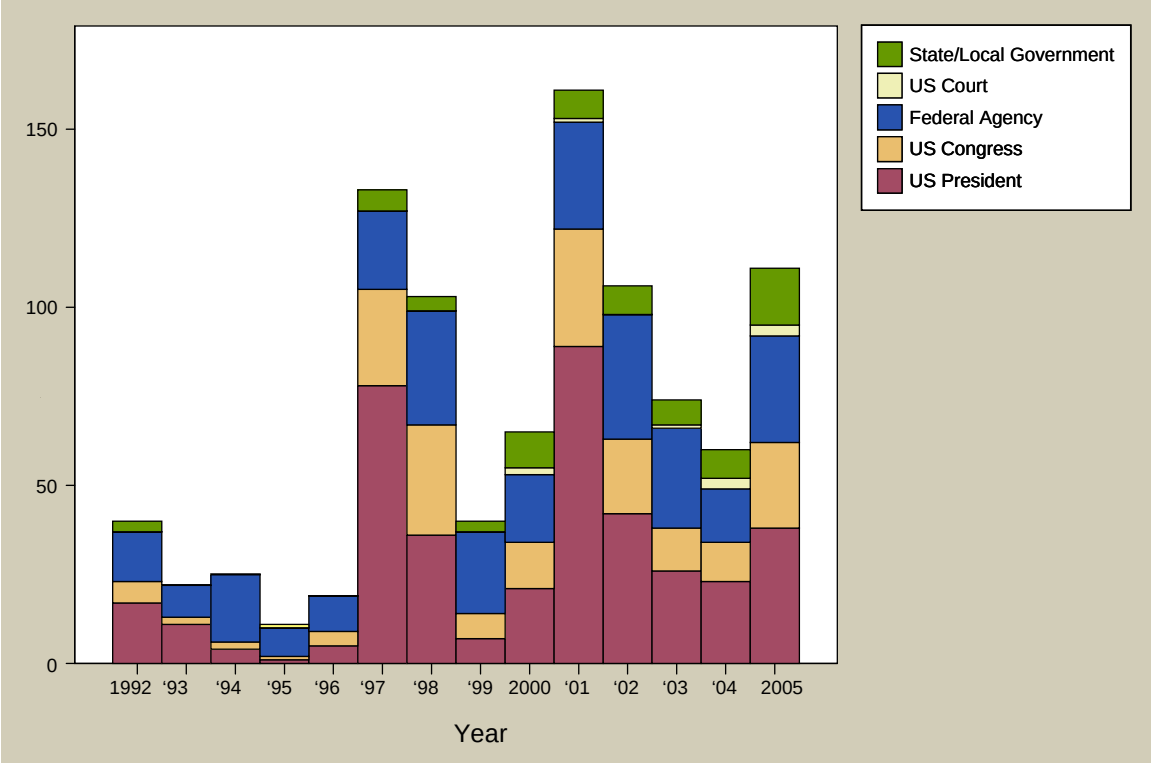
Figure 4.11
Activity Levels of Interest Groups Indicated in Regional News Articles, 1992-2005



Interest Groups. We identified various *interest groups* and *governmental participants* mentioned in regional climate change news coverage in order to acquire a snapshot of the key forces in the debate. Figure 4.11 depicts the activity of 4 major groupings as measured by the number of articles mentioning them. The *Environmental Group* was most frequently mentioned, followed by the *Scientific-Professional Group*, and the *Industry Group*. All other types of interest groups (e.g. consumer rights, home owner associations) received far fewer mentions and were aggregated into a residual, *Other Interest Group* category. Figure 4.11 also shows changes in activity among the groups over time (1992-2005). The relative activity of these groups changed little over time with the *Environmental* grouping remaining the most frequently mentioned in most years and, of the major three groupings, the *Industry* group the least mentioned. However, an interesting transformation in activity patterns began to occur in the mid-1990s. At this time, the *Other Interest* category began to join in the debate and became a "visible issue participant," suggesting the increased relevance of climate change to a wider variety of interests and the expansion of the issue as one of interest to a larger public.

Public Officials. Finally, news coverage was examined for mention of specific types of public officials. The literature on agenda setting points to the important role played by public officials at various governmental levels in establishing the salience, framing, and agenda status of policy issues like climate change. For that reason, we examined mentions of local, state, and national officials in climate change news articles appearing in the regional newspapers and coded them into the following subcategories: *U.S. President*, *U.S. Congress*, *U.S. Court*, *Federal Agency*, and *State/Local Government*. Figure 4.12 below presents the aggregated annual number of articles mentioning these types of actors in the 14-year period characterized by climate change coverage.

Figure 4.12
Annual Number of Articles Mentioning Governmental Actors in Regional Newspapers



In the 14 years in which climate change was covered by regional newspapers, three governmental actors played leading roles in the reports: *U.S. President* (mentioned in 41% of articles), *Federal Agencies* (mentioned in 30.3% of articles), and *U.S. Congress* (mentioned in 20% of articles). *State/Local Government*, mentioned in less than 10% of all articles (74 articles, or 7.6% of all articles), was a distant fourth. *U.S. Courts* (10 articles or 1%) showed little participation in the debates. Figure 4.12 also shows evidence of the kind of issue expansion seen among interest groups. While the three primary actors (*President*, *Congress* and *Federal Agencies*) continued to dominate the news references throughout the 14-year period, in recent years, *State/Local Governments* and the *U.S. Court System* have shown more involvement in the issue debates and policy development. More specifically, *State/Local Governments* became more prominent in the news reports in the 2000s than they had been in the 1990s. The *U.S. Court System*, which showed no involvement in the 1990s, joined the debates with a first reference in 2000.

Our analysis of organizational websites corroborates the low salience of climate change as an issue among Gulf stakeholders at the time of the Wave 1 interviews. All the organizations represented in our Waves 1 and 2 interview samples, were included in a website search of the 375 organizations in our samples, 246 had websites. Among these, 128 had mission statements. Not one mentioned climate change, global warming, or greenhouse gases, including the organizations that were classified as having an environmental focus (40% of the total number of organizations with websites). Current organizational activities were also examined; 116 of the organizations had website information on recent and current projects. Among them, 46.6% referred to projects with an ecosystems focus, 31% to projects with water quality or water quantity projects, and 46% to projects with infrastructure projects. This suggests that endpoints of interest do figure in the activities of these organizations in roughly the same hierarchy of importance shown by the interviews. However, conceptual links between endpoint problems and climate change were non-existent.

Summary of Wave 1 Evidence

Climate change has not been at the forefront of Gulf of Mexico stakeholder concerns. In spite of regional news coverage of the issue, stakeholders view local problems and their causes as having little connection with climate change. Not surprisingly, the issues stakeholders focus on are issues that visibly affect the lives of people who live in the research locations. Climate change as portrayed in newspaper coverage remains a distant issue, and perceived changes in stressors, such as sea level rise, are more likely to be attributed to weather variations and natural cycles in hurricane occurrence than to effects of climate change. The perceived causes of local problems may include failures on the part of decision makers outside the area (e.g., failure of governmental agencies to enforce existing regulations) or pressures from forces that are beyond local control (e.g., insurers who facilitate coastal building). However, the primary causes of problems identified by stakeholders tend to focus on decisions and activities actually taking place locally, such as population increases and land use changes.

For example, in Apalachicola Bay the dominant issues are environmental in nature, but within that general category there are a variety of issues. Dominant problems expressed by Florida stakeholders were coded as environmental or housing and community development depending on how the individual stakeholder talked about the problem. However, our analysis of the Florida interviews indicates that coastal development and environmental changes are closely intertwined in stakeholders' minds. Respondent emphasis on development and population growth as the primary causes of problems was accompanied by examples dealing largely with environmental issues. Long-term residents have witnessed changes in the coastline and noted changes in the productivity of the Bay and the availability of ground water. Further, they have watched significant alterations in the economic base and cultural fabric of their communities and those surrounding. Most of these changes are attributable to the influx of residential and recreational development, which is transforming the area ecologically, economically, and socially. Residents who are more likely to benefit from increased development and a changing economy tend to be less concerned with the incremental changes that affect things like water purity, but they are very concerned with issues like coastal erosion and extreme weather events, such as hurricanes, that have the potential to damage structures and erode property. Newcomers are most focused on preserving the aesthetic and pristine quality of the region as a whole, including preservation of non-commercial species and "habitat." Long-time residents, particularly fishermen and seafood business owners, are most likely to be concerned with incremental and cumulative changes to the bay that will have negative impacts on commercial seafood resources and hinder user access to them.

For the residents of Barataria-Terrebonne, Louisiana, land loss is something that has happened in their lifetimes; they can see changes from year to year in the land and the activities it will support. These changes have had effects on the way they live and, in some cases, on the way they make a living. While this area of Louisiana has many social and environmental issues to deal with, land loss dominates them all. National media coverage and regional newspaper coverage of climate change have exposed Louisiana residents to the climate change issue. However, although land loss could be explained in part by sea level rise stemming from climate change, these issues rarely came up during Wave 1 interviews. Instead, land loss is attributed largely to the negative effects of human intervention that have transformed the natural geography (e.g. navigation canals) and altered natural processes (e.g., sedimentation).

Decision makers in the Galveston Bay area report a more varied array of problems and are more likely than other locations to recognize problem implications for infrastructure, even though water and ecosystem issues were more important endpoints. Climate change rarely figured in interviews with stakeholders. Instead, causal categories emphasized development and government failings, with a large number of causes that did not lend themselves to coding. We interpret the more even distribution of concerns over endpoint and affected population categories among Texas stakeholders as indicating the more varied population of that area and the multitude of interests that exist among them.

Our analysis of news media indicates that there has been increasing coverage of climate change, both in national and (at a lower level) in major regional newspapers. However, the coverage has not been the kind that would increase local policy focus on climate change along the Gulf coast. National and regional coverage have portrayed climate change as a global issue with possible national implications but not as an issue with regional or local importance. Furthermore, the leading actors in the debate as reported were federal actors:

the *U.S. President*, *Congress* and *Federal Agencies*. The relationship of climate change to changes that can be anticipated at more local levels has not been brought to readers' attention in any of the research locations. Admittedly predictions of specific climate change impacts at smaller scales are difficult to develop, as in predictions of whether local average precipitation will rise or fall over a specific time period and by how much. The absence of this kind of connection has, nevertheless, reduced the likelihood that climate change will be very salient among coastal communities. In addition, adjustments to mitigate climate change or to adapt to it will almost surely mean major changes in both individual lifestyles and in the way commerce and industry conduct business. Any coverage of local implications of climate change will inevitably spark controversy over these issues.

In addition, although an image of climate change as harmful is the dominant image portrayed in news reports, this coverage has also included suggestions that scientific discussions of climate change are characterized by lack of consensus and that more research is called for. There is emerging evidence that, in fact, claims of lack of scientific certainty and need for further research, is used as a powerful strategy to avoid addressing what many define as problems (Freudenburg, Gramling, & Davidson, 2007). At the time of the Wave 1 interviews, this was also the position taken by the U.S. President. The suggestion that there is a lack of consensus on the seriousness, or even the existence of, a problem changes its valence. Without a more uniform stand on whether climate change exists and whether its effects are likely to be positive or negative, discussions at all levels are unlikely to converge around potential solutions and constructive actions.

In spite of the fact that climate change rarely surfaced as an issue in these initial interviews with Gulf stakeholders, we believe the news is essentially good. The problems that are foremost in stakeholders' minds are largely problems that will inevitably be affected in some way by changes in climate stressors such as Temperature, Precipitation, and Sea Level Rise. Furthermore, stakeholders are already sensitized to important endpoints like Water Quality, Water Availability, and Ecosystem health – endpoints that are also likely to be affected by climate changes. Because Infrastructure played less of a role in conversations with respondents than water or ecological issues, the case for climate change effects on Infrastructure may be somewhat harder to make. The Texas location was the one where respondents were more likely to discuss Infrastructure as an important endpoint. In Louisiana, mentions of Infrastructure elements were more likely to arise in conversations as one class of problem causes. For example, pipeline construction (in canals dug through the coastal wetlands) and the channeling of the Mississippi were two kinds of Infrastructure implicated in many conversations as causes of land loss. Highway 1 and the levee systems were the two infrastructure elements mentioned as both inadequate and in danger from extreme storm events. In the less densely settled Florida location, when Infrastructure was mentioned, Infrastructure was also more likely to be implicated as a contributor to problems (e.g., sea walls, roadways on or near beaches, outdated wastewater treatment systems, structures built on the beach). Bringing the implications of climate change down to at least the state level will be critical. This became even clearer during the Wave 2 interviews, which will be discussed in the next section. A bulleted form of the Wave 1 summary follows.

- Climate change was not a salient issue at the time of the Wave 1 interviews nor is it linked in stakeholders' minds to local problems, in spite of widespread coverage of climate change in regional and national newspapers.

  Implications: Educational efforts may be required to make the global-local link clear.

- While climate change rarely surfaced in Wave 1 conversations, dominant problems in the research locations do focus on issues of the environment and development, and these are problems that will be affected by one or more of the climate stressors.

  Implications: The salience and complexity of local problems are such that climate change cannot be added to them as a separate set of issues, but there is potential to integrate climate change into existing concerns by examining the ways that climate change may exacerbate local problems.

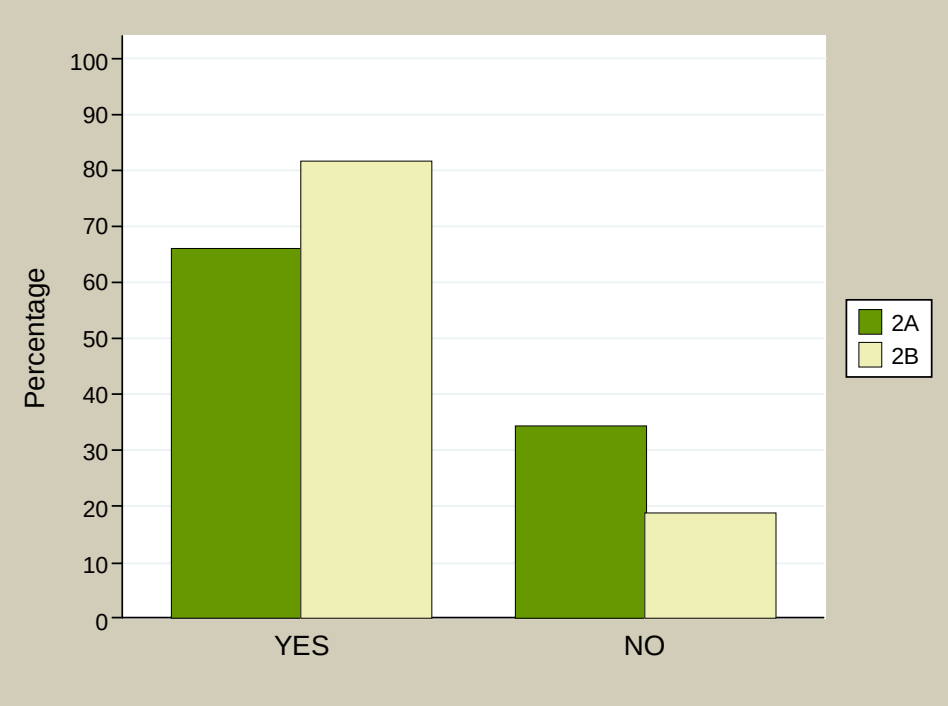
- Specific problems and perceived causes at each location reflect that location's unique natural and social conditions.
  Implications: Introduction of climate science to the local debates over problems will require framing tailored to local concerns and engaging different constituencies at each location. Finding a common meeting ground with regard to goals and values will be an additional challenge.
- National and regional media coverage has exposed stakeholders to the climate change issue but has not assisted in elevating climate change as an aspect of local policy focus.
  Implications: Any efforts to change this situation will require that those interested in bringing the implications of climate change down to the local level engage the regional and local media.

Increasing the Salience of Climate Change for Gulf of Mexico Stakeholders: Evidence from Interviews, Focus Groups, Newspapers and Websites

Stakeholder Perceptions of Local Problems and Potential Impacts of Climate Change

In Wave 2, interviewers introduced climate change to a sample of previously interviewed respondents (Wave 2A) and to a new population (Wave 2B) of area stakeholders. Climate change was rarely a new topic for our interview respondents. As documented in the newspaper analysis, regional and national coverage of climate change have exposed Gulf of Mexico stakeholders to this phenomenon and its global implications. Most of our interview respondents confirmed previous exposure (Figure 4.13) although there was a small number who denied knowing much about it. Because people selectively attend to media coverage of different topics, it is possible to remain largely ignorant of climate change regardless of documented media coverage of the topic. Nevertheless, some sensitization to climate change pre-existed among the majority of our respondents. In addition, respondents knew in advance of Wave 2 interviews that climate change would be among the topics addressed, and this may have increased recall of climate change exposure. More Referrals than Panelists indicated previous exposure to climate change information.

Figure 4.13
Previous Exposure to Climate Change Information: Interviews

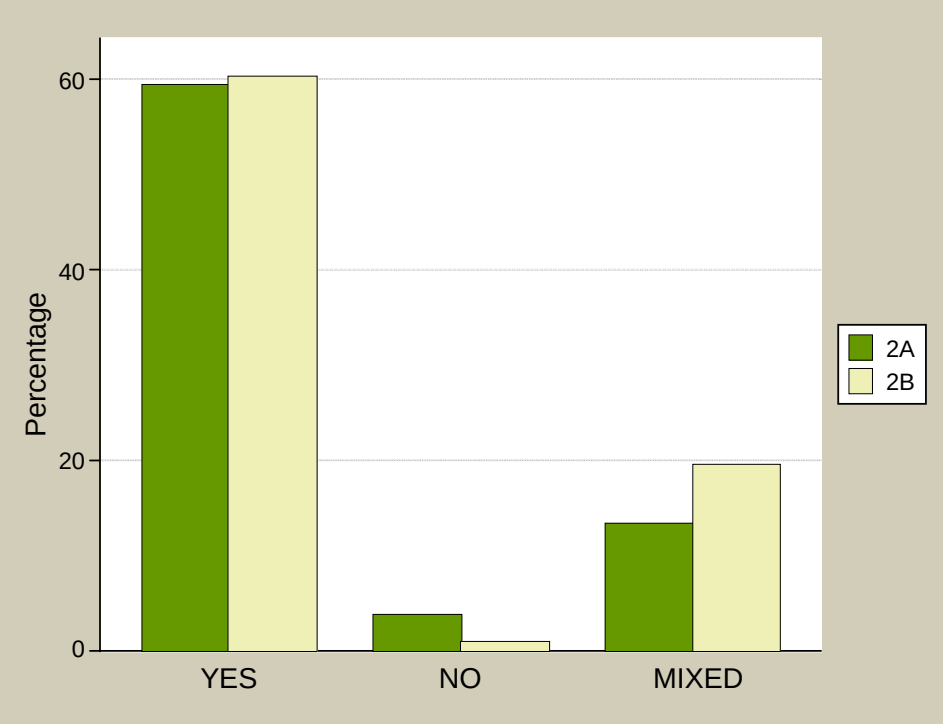


N = Wave 2 respondents by group = 135 (2A); 108 (2B)
(Fisher Exact test suggests significant difference between 2A and 2B at the .01 level)

Response to Climate Change and Scenarios

After the climate change scenarios were introduced, respondents were asked about their general reactions, both to climate change and the scenarios. One of the ways these responses were coded was in terms of *General Acceptance* and *Non-Acceptance*. As can be seen in Figure 4.14, the general response of the majority of respondents was acceptance of the reality of climate change and the possibility of significant stressor changes (i.e. changes in average temperature, precipitation, sea level rise, and storm frequency and intensity). Although more than half of all Wave 2 respondents expressed a general acceptance of climate change, there were reservations on the part of some stakeholders, which are shown in Figure 4.14 as *Mixed Response* and *Unconvinced*. (In future figures and tables, where Panel-Referral differences are not statistically significant or of interest conceptually, the A and B components of Wave 2 will be combined.)

Figure 4.14
General Response to Climate Change and Scenarios: Interviews, All Locations

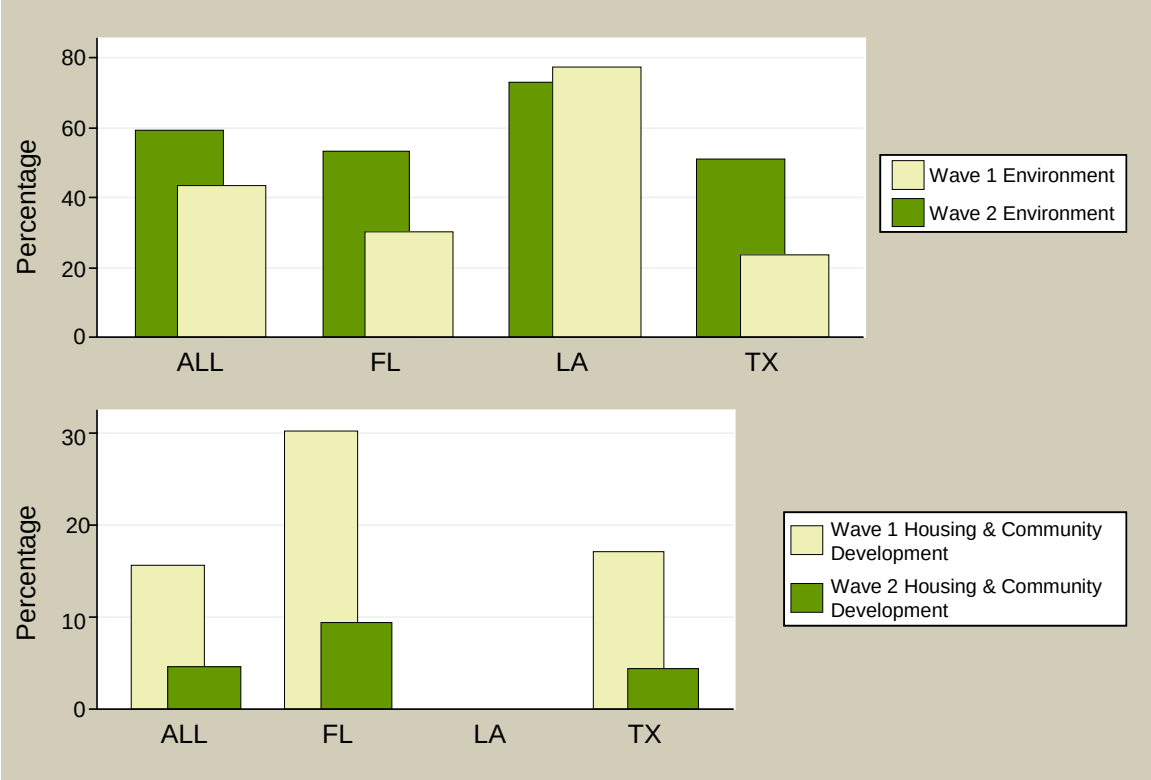


N = Wave 2 respondents by group = 135 (2A); 108 (2B)

At the start of Wave 2A interviews, members of the panel were reminded that they had already discussed dominant problems in their areas, and the scenarios were introduced immediately. Afterward, the Panelists were asked what they would now say about local problems in light of this new information. In spite of some mixed and negative responses to climate change and the local scenarios indicated in Figure 4.14, Figure 4.15 indicates that there were some changes in problem identification after discussion of the scenarios. These changes are displayed for problems identified as either *Environmental* or *Community Development* types of problems (Figure 4.15). Overall, there was a post-scenario increase of just over 15 percentage points in the respondents identifying the most important area problem as an environmental one and a decrease in 11 percentage points in the respondents identifying development as the dominant problem. (Table 2 in Appendix G shows more specific responses to pre-scenario and post-scenario problem identification among Panelists.)

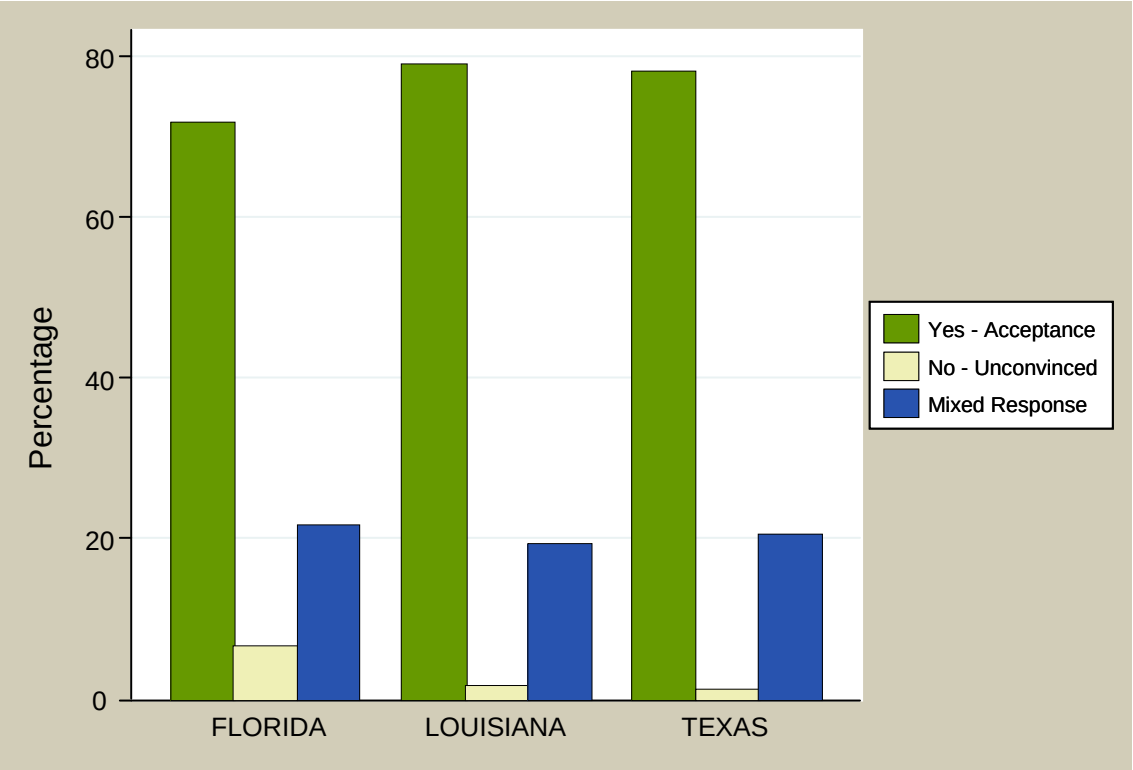
Figure 4.15 also indicates the shift in problem identification among the individual research locations. Louisiana respondents changed relatively little from pre- to post-scenario problem identification. During Wave 1, Panel respondents in the Louisiana research location indicated an overwhelming concern with *Environmental* problems, leaving little room for any shift during Wave 2 toward viewing an *Environmental* problem as even more pressing. Respondents in Florida and Texas locations, however, showed considerably more change. In Florida, there was a shift of just over 23 percentage points toward *Environmental* problems as the most important and a 20 percentage point shift away from *Community Development* as most important. In Florida and Texas, *Community Development* issues tended to be issues that focused on residential and commercial development on the coast and on barrier islands. Projected increases in *Sea Level Rise* and *Storm* frequency introduced by the scenarios evidently put *Development* in a different light and shifted respondent's attention from this problem to other categories, such as the environment. As respondents considered the implications of stressor changes for coastal plant and animal species, for water availability, and (in Florida) for fire potential, a post-scenario shift toward perceiving the primary problem to be an *Environmental* problem took place in both Florida and Texas. Louisiana respondents were already so focused on *Environmental* issues related to rising water, there was little room for post-scenario changes.

Figure 4.15
Character of Most Important Problem Identified
After Introduction of Scenarios: Interviews with Panel by Region and State



N = Panelists = 135

Figure 4.16
Post-Scenario Acceptance of Climate Change: Interviews by State



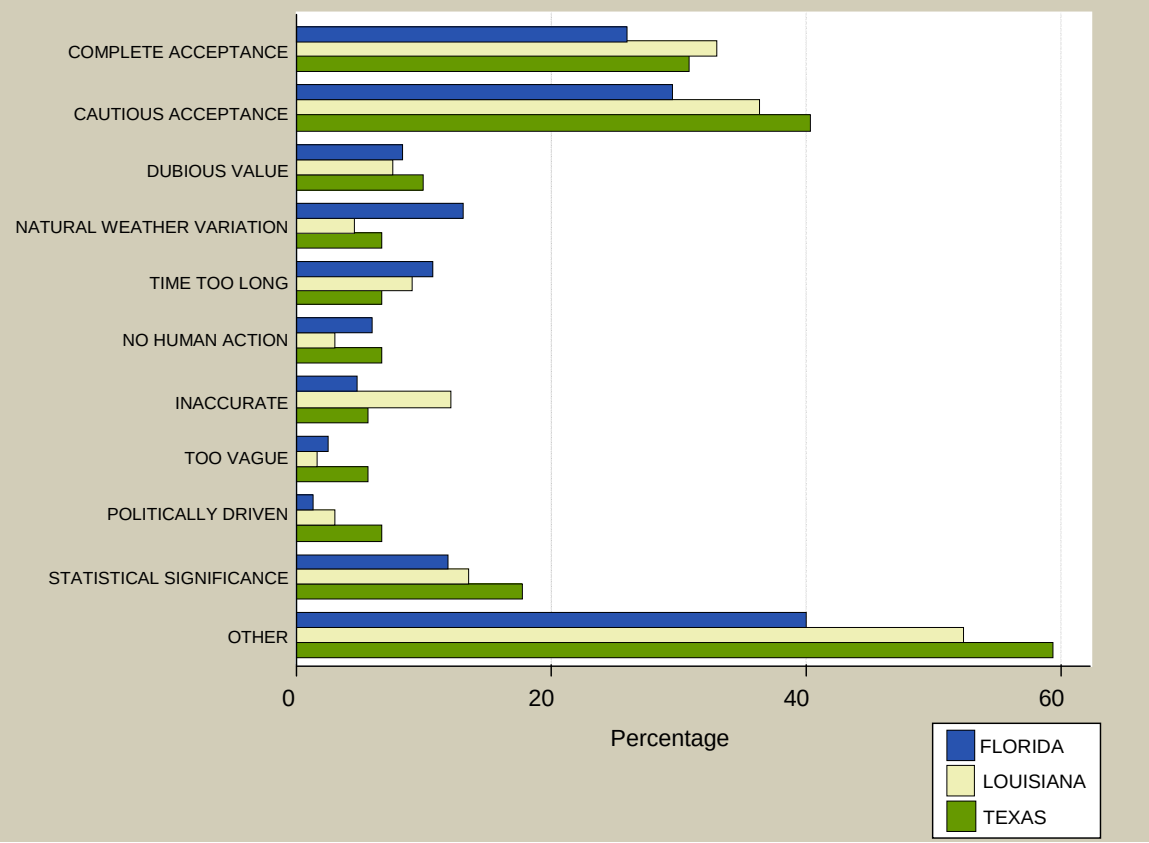
N = Wave 2 respondents who stated their acceptance of climate change= 60 (FL); 57 (LA); 73 (TX)

According to Kasperson and Kasperson (1996) and Turner, et al. (2003), the more aspects of a risk situation that are explored, including a consideration of the particular groups that might be affected, the greater the amplification of the risk and the sense of vulnerability. If this interpretation is correct, it has implications for the way climate change information is introduced into a local population. For the greatest impact, climate change information will need to be framed in the context of issues that are already salient for residents and should be brought even closer to home by including a consideration of vulnerable groups in the framing. In addition, a single "inoculation" with information will probably not suffice to significantly raise the salience of climate change for most people. Linkages between local problems and climate change effects will need to be made repeatedly, with specific examples whenever possible. Anecdotally, a number of un-coded comments on the scenarios that ran through the interviews were of the *why haven't we seen anything like this before?* nature.

Figure 4.16 also shows that complete acceptance of climate change was somewhat lower in Florida than in Texas or Louisiana and highest in Louisiana, although the Louisiana-Texas differences are minimal. Figures 4.17 and 4.18 offer additional insights into the issue of acceptance. It can be seen in the aggregation of comments in Figure 4.17 that relatively more Florida respondents attributed scenario projections to natural weather variation than to climate change. Stakeholders in Florida and Texas were also more likely than stakeholders in Louisiana to mention the potential effects of precipitation change, even though sea level rise was the stressor of most interest in all locations (Figure 4.18). Precipitation was mentioned by four to five more respondents in Florida and Texas than in Louisiana where sea level rise trumped all stressors. Natural weather variation can include dramatic swings in temperature and precipitation, so that over the timeframe formed by a single person's observations, changes in precipitation and hotter temperatures can be easily attributed to natural weather events. This appeared to be the case for relatively more stakeholders in Florida and Texas and probably affected the somewhat lower levels of climate change scenario acceptance for these

locations (Figure 4.16). The *Other* comments shown in Figure 4.17 represent a miscellany of questions and comments that could not be categorized. However, the lengths of the bars grouped under *Other*, under questions about *Statistical Significance* and under *Cautious Acceptance* are indicative of the extent to which the scenarios generated comments, questions, and requests for clarification.

Figure 4.17
Summary of Comments on Scenarios: Wave 2 Interviews by State

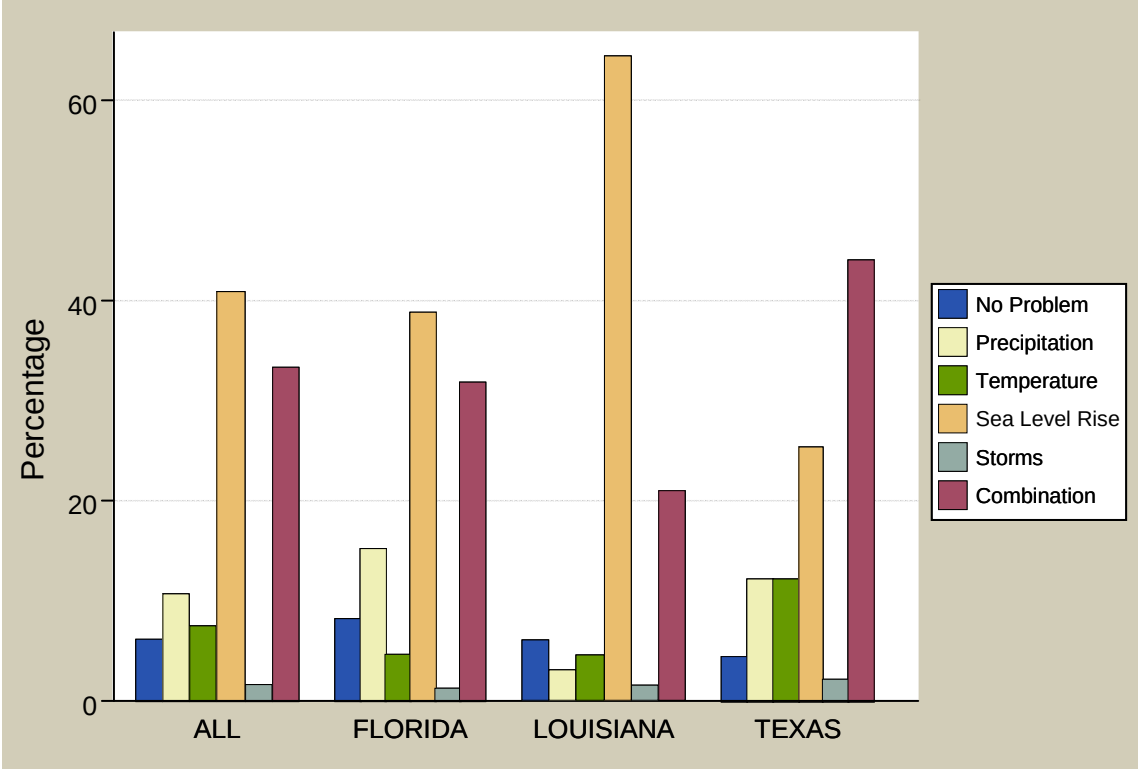


N = Wave 2 respondents by state = 85 (FL); 67 (LA); 91 (TX)

Relative Importance of Stressors

An examination of the part that climate change stressors played in stakeholder conversations is also informative. Figure 4.18 shows that in all three research locations, the stressor receiving the most attention in conversations with stakeholders was sea level rise. It was seen as the single stressor with the most potential to exacerbate old problems or cause new ones. It also dominated all other categories of stressors in Louisiana. Changes in sea level rise are generally more visible to coastal residents than changes in the other stressors. In Louisiana, where over 64% of the stressor mentions involved sea level rise, stakeholders have been able to see many of the changes to the state's coastline in their lifetimes. Scenarios for Louisiana combine the effects of sea level rise and subsidence. As a consequence, the projected changes in coastal water level are significantly greater than they are for the other locations. Nevertheless, the projected changes, while large, are consistent with the fairly dramatic changes that respondents have already seen taking place. While there are cyclical variations in sea level, the loss of land produced by steadily rising water is difficult to dispute. This finding is consistent with the model of social amplification of risk put forth by Kasperson and Kasperson (1996). In that model, personal experience is an important amplifier of information on risk and risk events. In Kasperson's terms, interviewers functioned as "risk communicators" when they introduced the scenarios, and in Louisiana, this communication was amplified more by the common experience of land loss.

Figure 4.18
Frequency of Mention of Climate Change Stressors:
Wave 2 Interviews by Region and State Level Responses



N = Wave 2 respondents by state = 243 (ALL); 85 (FL); 67 (LA); 91 (TX)

Nevertheless, when asked, stakeholders were able to discuss the potential effects of other changes represented in the scenarios (Appendix G Table 3). In both Florida and Texas, they focused more on reduced precipitation than on increased precipitation. In Florida, the implications of reductions in average precipitation included reduction in the quantity of fresh water, particularly for fresh water inflows to the bay; changes in the salinity of ground and surface water; and ecosystem changes – some as a consequence of salinity changes and others as a consequence of reductions in water availability. In Texas, the implications of decreases in average precipitation were more likely to focus on a reduction of fresh water inflows to the bay and reductions in the availability of water for human consumption, reflecting in part the greater population density of the Texas location. When increases in average precipitation were discussed, the differences between Texas and Florida stakeholders also reflected the demographic differences between the two locations. Texas stakeholders were more likely to emphasize urban flooding while Florida stakeholders were more likely to emphasize an increase in harmful run off to the bay.

It is also interesting to note that an increase in the frequency and severity of storms was the least mentioned of all the stressors in spite of the impacts that storms have on the lives of people living around the Gulf. Variation in storm frequency and severity is something that Gulf of Mexico residents expect as part of normal weather cycles, and this view of storms as "naturally" cycling though high and low periods may also have contributed to somewhat lower levels of climate change scenario acceptance in Florida and Texas.

Finally, Figure 4.18 shows that there was a tendency for substantial portions of stakeholders in all locations to talk about combinations of stressors and their impacts on problems. Discussions of combinations of stressors were most marked for Texas and Florida. For example, it was not possible for some stakeholders to discuss possible decreases in average precipitation without discussing possible increases in average temperature and their combined effect on issues such as water availability and ecosystem health. In

fact, stakeholders in Texas were more likely to mention the importance of a combination of stressors than to mention sea level rise – the most frequently mentioned single stressor. A small portion of respondents in each location indicated that stressors would not present problems or add to problems of the area. Examination of raw interview data indicated that these individuals tended to be from the business/commercial sector.

This discovery led to an examination of the relationship between stressor importance and organizational type. Table 4.1 indicates that there is an association between organizational type and the stressor that figured most prominently in conversations with respondents from all three sites.

Table 4.1
Association Between Organizational Type and Type of Stressor Emphasized: Wave 2 Interviews

	NGOS/NPOs	Business	Education	Government
Precipitation	7	2	1	13
	25.93%	15.38%	7.14%	16.88%
Temperature	8	2	2	6
	29.63%	15.38%	14.29%	7.79%
Sea Level Rise	12	9	11	58
	44.44%	69.23%	78.57%	75.32%
Total	27	13	14	77
	100.00%	100.00%	100.00%	100.00%

(Fisher Exact test suggests association between organizational type and type of stressor with a non-significant p-value of .052)

Across all types of organizations, sea level rise was the single most frequently mentioned stressor. NGOs-NPOs were somewhat more likely than other types of organizations to indicate concern with changes in precipitation and temperature. Conversations with representatives of governmental organizations tended to focus on precipitation and sea level rise. While this group comprised both elected officials at various governmental levels and agency personnel, it was somewhat more heavily weighted with agency personnel. Because of the sampling process used, the agencies represented were more likely to be ones responsible for coastal environments, and this may have contributed to their emphasis on sea level rise and precipitation. It can be seen in Table 4.1 that non-governmental groups (NGOs/NPOs) were more likely to focus on temperature and significantly less likely to focus on sea level rise than other groups. This was a varied category of respondents with interests that included among others, environmental interests, drainage and storm water issues, and general issues of quality of life – interests that would increase the relevance of changes in precipitation and temperature.

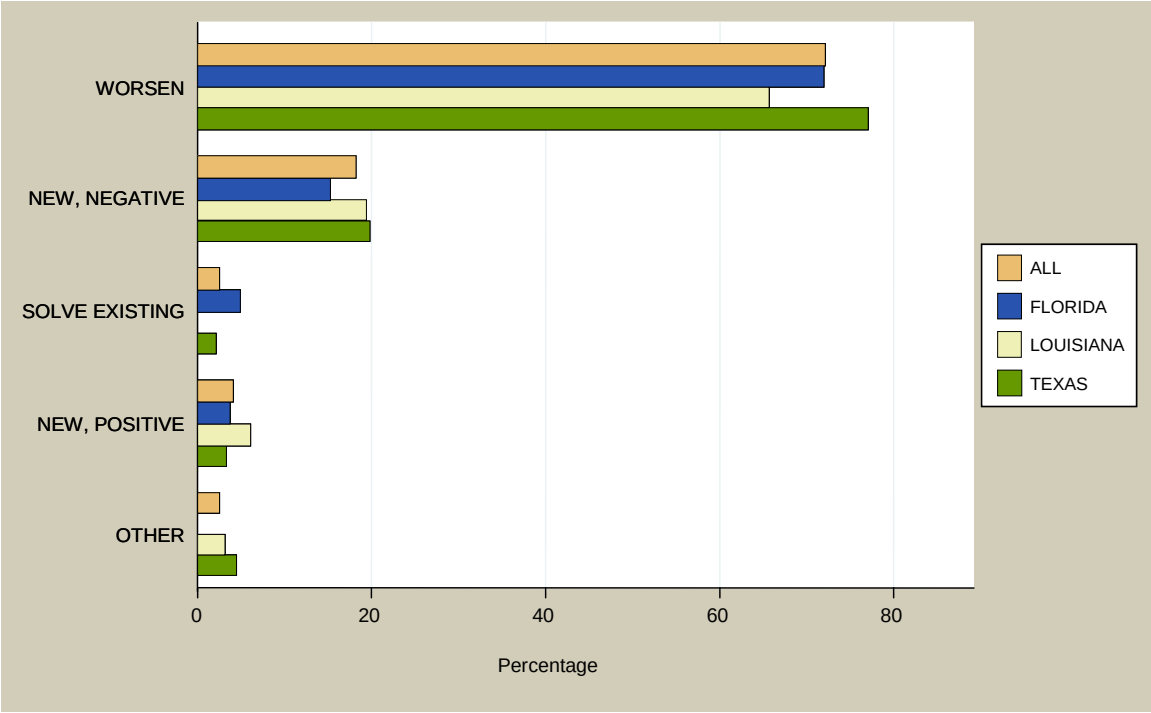
Stakeholder Views of Climate Change Impacts and Need for Decisions

Wave 1 responses indicated that climate changes play little part in the actual decision making activities of any of the three research locations at this time. During Wave 2, respondents were asked to comment on whether decisions *should* be made and, if so, *who should* be involved in making those decisions.

Perceived Need for Decision Making

Stakeholders in the three research locations were given the opportunity to comment on the potential impact of climate change on local area problems, and Figure 4.19 shows data on perception of stressor impacts for the three locations as a group and for each state separately. The majority of Wave 2 respondents (72% of all Wave 2 respondents) said that changes like those described in the scenarios would *Worsen Existing Conditions*. This perception that existing problems would be exacerbated by climate changes dominated in all research locations. However, close to one-fifth of respondents (18.1%) also talked about the potential for new, negative conditions resulting from the changes in stressors. Less than 5% of responses alluded to new, positive conditions resulting from these climate changes.

Figure 4.19
Perceived Impact of Stressor Changes:
Wave 2 Interviews by Region and State-Level Responses



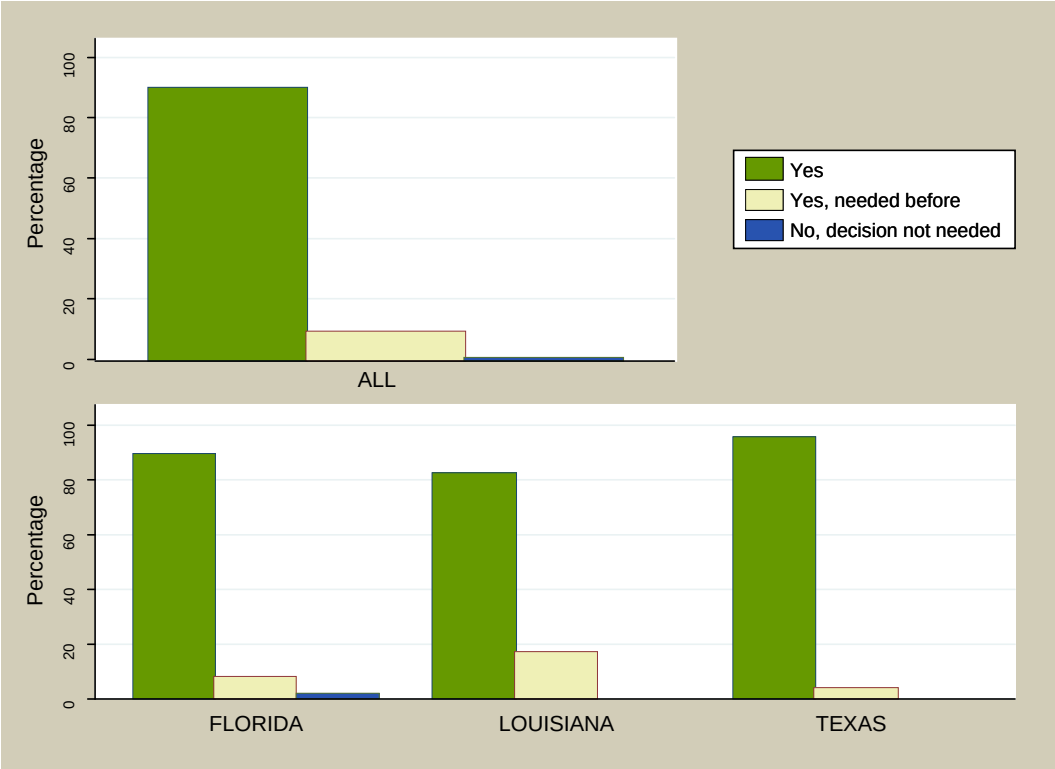
N = Wave 2 respondents by state = 243 (ALL); 85 (FL); 67 (LA); 91 (TX)

Examination of the interview data revealed that in both Florida and Texas, projected increases in average precipitation suggested to these respondents that if the water currently needed for ecosystem health and wetland restoration increased, some of the current problems with decreasing water availability would improve without any need for action. Discussion of the potential for positive consequences was always coupled with discussion of its opposite - in this case with the negative consequences of decreased precipitation. In Louisiana, mentions of new positive impacts were scattered, and there were no respondents who believed that stressors, such as decreased precipitation, could help solve existing problems. The most important message of Figure 4.19 is that respondents were far less likely to mention either *New Positive Opportunities* or *Solutions to Existing Problems* as potential impacts of stressor changes. *Worsening of Existing Conditions* was the dominant response, with close to three-quarters of the full sample giving this response. This kind of response is also consistent with regional newspaper coverage of climate change that was more likely to communicate a negative image of climate change by focusing primarily on harmful consequences of this process.

In addition to believing that the projected changes in stressors would result in the worsening of current problems/conditions, the majority of respondents also stated that if these projections are even reasonably

accurate, decisions with regard to them need to be made. Figure 4.20 shows a summary of respondents' perceived need for decisions, both for the region as a whole and for each research location. This figure, in combination with findings shown in Figures 4.14 and 4.15, clearly indicates the potential for galvanizing stakeholders' concern over climate change and its potential consequences. Virtually the entire respondent sample indicated that decisions were needed under the conditions described in these climate change projections. It can be seen that a somewhat lower percentage of Louisiana respondents indicated that decisions are needed. However, substantially more of them indicated that necessary decisions are late in coming. This may be due to the overwhelming concern for sea level rise that has already resulted from subsidence. Eustatic (ocean wide) rise is not seen as shocking relative to the significant rise already experienced by subsidence.

Figure 4.20
Perceived Need for Decision Making Regarding Climate Change Projections: Wave 2 Interviews by Region and State-Level Responses



N = Wave 2 respondents by state = 243 (ALL); 85 (FL); 67 (LA); 91 (TX)

Acceptance of climate change as a reality is high (Figure 4.14), and in all locations the presentation of scenarios to members of the panel was followed by a shift in the perception of the most important area problem to the environmental category (Figure 4.15). In spite of these positive responses vis-à-vis climate change, comments on the scenarios (Figure 4.17) also indicate substantial caution among stakeholders and questions about specifics of scenario projections. These findings are lent weight by remarks that prefaced many respondents' statements about needed decisions. For example, it was not uncommon for respondents to couch their responses about needed decisions in statements such as, "If these numbers are accurate….," and "This is a *lot* of change, but…."

Barriers to Decision Making

In spite of the fact that the majority of Wave 2 respondents reported a need for decision making based on projected climate change impacts, they also perceived a number of barriers to making the necessary decisions. Table 4.2 summarizes the kinds of barriers that respondents mentioned. While they talked about a variety of barriers, three types stood out for the Gulf as a whole. These are (1) potential *Economic Consequences* of dealing with the local impacts of climate changes, (2) a climate change *Time Frame* (50-100 years) that makes planning for and implementation of decisions difficult for current decision makers, and (3) *Political* considerations. The last category (political considerations) is a more varied category than the other two. It is a composite of responses that includes mention of barriers such as public inertia, a political process bogged down by multiple interest groups, lack of political "will to act," and the federal administration's position on climate change, among others.

Economic Consequences will inevitably follow almost any change in lifestyle patterns or industry protocols. For example, a mitigation strategy such as switching to alternative energy sources, will almost certainly have negative *Economic Consequences* for some segments of the energy industry and their employees. One respondent's comment illustrates opinions regarding this barrier: "No matter what you do, someone is going to be hurt by it." Any change will have economic impacts, and impacts of policy changes on the economic well-being of an area are important to both the general population and to the decision makers whose positions depend, at least in part, on public approval. Furthermore, two of the three areas are struggling to increase their economic viability. The relative importance of decision making barriers among the research locations is also indicated in Table 4.2. The relative importance given to economic barriers is greater in Texas than in Florida and especially marked in Louisiana. Contributors to these differences may include (1) differences in the sizes and complexities of the economies of the locations, (2) the perception among some Florida respondents that development is an important cause of problems even though it can contribute to an improving local economy, and (3) a dependence on the oil and gas industry in Louisiana that exceeds even the dependence of the Texas economy. One approach to the general dilemma of economic impacts is to engage in cost-benefit analyses that project the short and long-term economic consequences of both climate changes and strategies to address them. This kind of information need will surface again in a later discussion.

Table 4.2
Perceived Barriers to Climate Change Decision Making: Wave 2 Interviews

	Percentage of Respondents Who Mentioned Specific Barriers to Decision Making			
	ALL	Florida	Louisiana	Texas
Time Frame	20.99	24.71	13.43	23.08
Inadequate Science	4.84	5.88	2.99	5.49
Too Many Other Problems	9.88	9.41	8.96	10.99
No Interest	9.88	3.24	10.45	10.99
Political	18.52	12.94	26.87	17.58
Economic	27.98	17.65	40.30	28.57
Too Much Study	3.29	0.00	11.94	0.00
Not Organization's Job	4.53	5.88	0.00	6.59
Not Respondent's Job	2.88	2.35	1.49	4.40
Negative Result Decision	0.82	1.18	1.49	0.00
Other	3.70	2.35	4.48	4.40

N = Wave 2 respondents by state = 243 (ALL); 85 (FL); 67 (LA); 91 (TX)

The climate change *Time Frame* is also seen as a stumbling block to decision making. The scenarios are framed in 50-year intervals. The shorter-term changes are projected for 2050, and the next projection is for 2100. In contrast, 5 and 10-year planning periods, while common in government and business, are generally considered long-term plans. A 50-year plan would extend far beyond the life spans of the people who will be making decisions and developing those plans. For example, in Florida, while some respondents recognized that long-term planning was needed to address issues like *Sea Level Rise*, others expressed the view that creation of policy to address such future-oriented issues would be better left to future generations. The *Time Frame* barrier interacts with the importance of economic impacts discussed above. Given the fact that there are almost always winners and losers when large-scale changes are made, government officials who need to please their constituencies and business leaders who need to please their customers and shareholders will find it difficult to advocate for new policies and plans that have no immediate benefit for the groups they serve. Moreover, some respondents explained that policy decisions must be based on scientific information that is more certain than predictive climate models presently are. In other words, changes in the status quo cannot be justified if data do not accurately predict climate/ecological outcomes *on the local level*, with relatively high degrees of certainty. By the same token, to be successfully implemented, changes that citizens are asked to undertake need to be viewed or framed in terms of the benefits that will accrue to their grandchildren rather than to themselves.

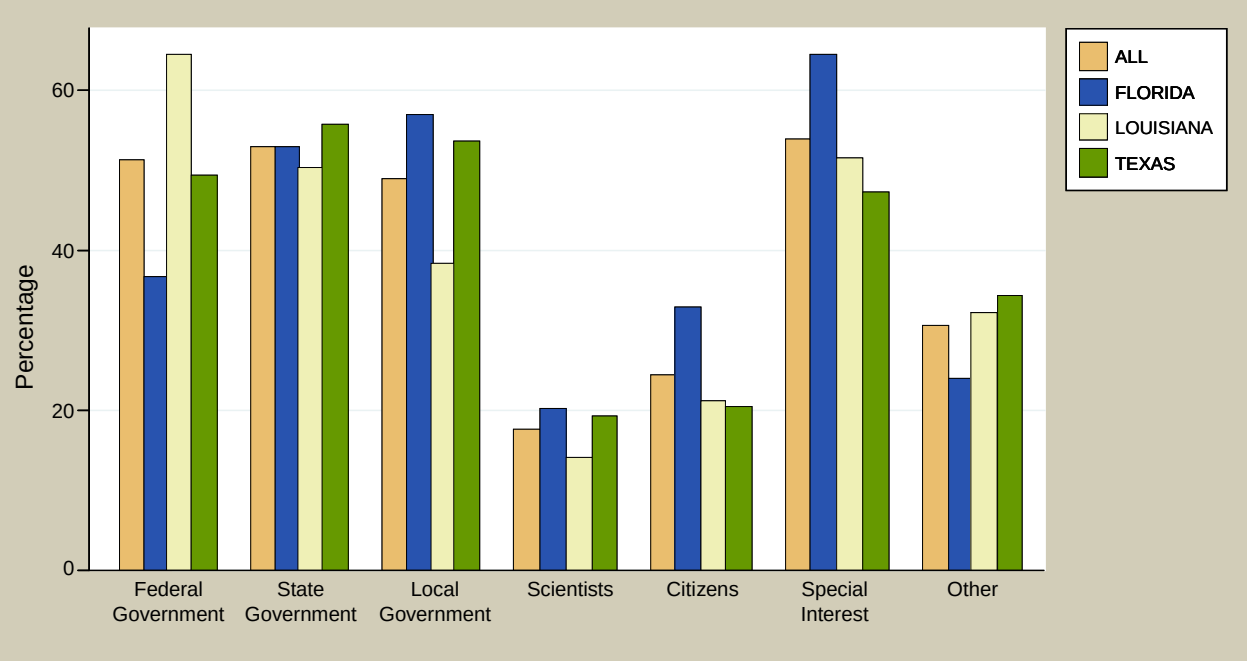
The *Political Considerations* category of barriers to decision making involves issues of leadership (such as lack of interest in or skepticism about the reality of climate change at state and federal levels) and issues involving the process itself (such as lack of coordination among governmental entities and a perception that special interests have undue influence on decisions made). Similar kinds of comments make up the bulk of this category in all locations, but the relative importance of *Political Considerations* is not the same for all locations. Louisiana respondents were more likely to cite *politics*—particularly state politics—as an important barrier to necessary decision making. Unlike respondents in Florida and Texas, respondents in Louisiana cited *Political* and *Economic barriers* more frequently than they cited the barrier of time frame.

Although *Political* and *Economic Barriers* trumped all others in Louisiana, an additional barrier that is unique to that state is a fairly common observation that researchers are covering and recovering old ground (*Too much study*). A sentiment expressed by many Louisiana respondents was, "Enough study has been done, and it is now time for action."

Assignment of Responsibility

During Wave 1 interviews, stakeholders were asked to describe the processes and organizations involved in addressing the most pressing problems facing their areas. When asked who the important participants are in their areas, stakeholders in all locations focused on the same four types of actors, although the relative weight given to each varied somewhat from location to location. It can be seen in Figure 4.21 that in all locations, *Federal Government*, *State Government, Local Government* and *Specialized Interest Groups* were seen as the most important actors in the decision making and policy process. *Other Groups*, such as the general public and academic researchers were also mentioned but figured much less prominently in conversations with stakeholders. In spite of the similarity across locations in the importance of these four groups, Figure 4.21 also shows interesting variation among the locations. We believe these variations reflect differences in the power relationships described under the heading of *Governance* for each of the research locations.

Figure 4.21
Important Participants in the Decision and Policy Process for Problems Identified in Wave 1 Interviews

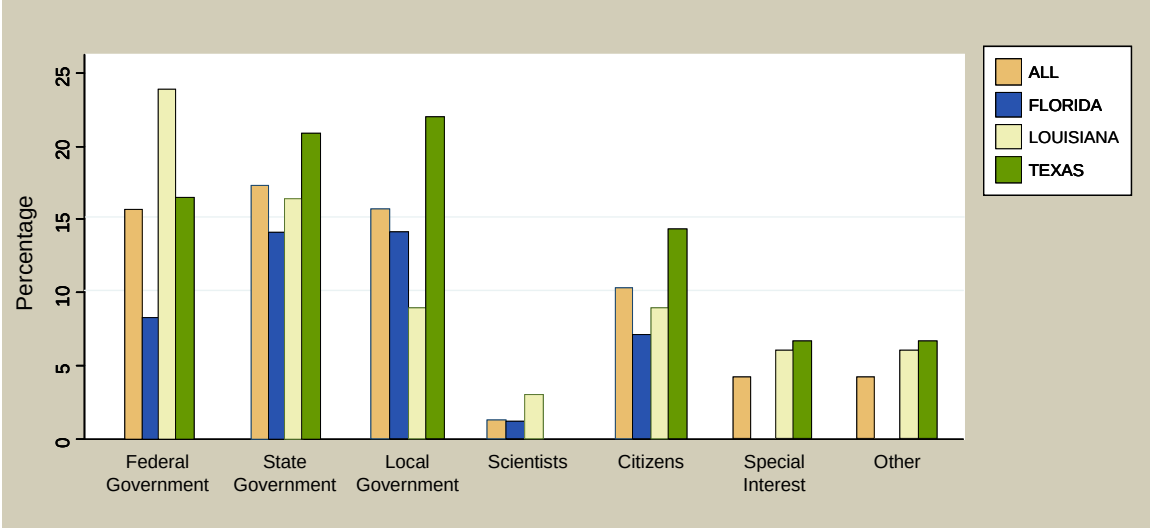


N = Wave 1 respondents by state = 271 (ALL); 79 (FL); 99 (LA); 93 (TX)

After they were presented with the scenarios, stakeholders were asked *who should make* decisions to address climate change. For the Wave 2 respondents who talked about who should be making climate change decisions, perceptions of the dominant actors (Figure 4.22) are quite consistent with the actors identified in Wave 1 and generally reflect established lines of authority among the three levels. Inter-state differences also persist. Florida respondents would give relatively more responsibility to state and local government actors than to federal government actors. Louisiana respondents would continue to cede the most responsibility to federal actors and very little to local actors, with the state falling between. Wave 2 respondents in Texas would like to see more of a balance between state and local actors with relatively less responsibility for federal entities.

In Figure 4.22, *Citizens* form the fourth group viewed as legitimately bearing some responsibility for climate change decisions. In contrast, Wave 1 respondents saw *Citizens* as having a substantially smaller role in actual decision making than *Special Interests* - seen in Figure 4.21 as collectively being the fourth important actor. In Figure 4.22, *Other* contains a variety of actors not clearly falling into one of the other groupings, including environmental interests. The Wave 1-Wave 2 difference between who does influence decisions and who should influence decisions is consistent with many of the comments that were coded as *Political Considerations* and shown in Table 4.2. During Wave 1 descriptions of the on-going decision making process, interest groups were portrayed as important players in the decision making process but not necessarily as players that contribute to good outcomes. It seems reasonable that in discussing who *should* have decision making responsibility, Wave 2 respondents might downplay the role of interest groups.

Figure 4.22
Perceptions of Who Should Make Climate Change Decisions:
Wave 2 Interviews



N = Wave 2 respondents by state = 243 (ALL); 85 (FL); 67 (LA); 91 (TX)

In contrast to findings from the analysis of regional newspaper coverage (described above) indicating that newspapers have almost exclusively portrayed climate change as a global issue with national implications, and as such the responsibility of the federal government (Figure 4.12), these stakeholders see roles for state and local government actors as well as for other non-government groupings. Whether one is talking about mitigation or adaptation, any effective action is going to require coordinated effort at many levels, and Gulf stakeholders seem to realize this.

Interview respondents and focus group participants also talked about leadership. There was general agreement that if decisions were to be made and action taken, leadership at all levels would be crucial. In part this is because the general public is not thinking seriously about climate change and its consequences for their lives and in part because any actions taken will change the way they live their lives. However involved in climate change-related decisions state and local government should be, most interviewees who talked about it said that with an issue as broad in scope as climate change, federal leadership would be necessary to get the ball rolling on any scale.

Types of Action Needed

Proposed Solutions

The kinds of solutions interview respondents believe are needed to address climate changes and their potential effects are highly varied, generally adaptive in nature, and tend to be influenced by the type of organization to which the respondent belongs and his/her role in it. The solutions or actions proposed during the Wave 2 interviews generally fell under one of four headings: technical, economic, ecological, and social. Actions or solutions that would take a mechanical or engineering approach to the problems were coded as technical. These included actions such as the building of levees or dams, beach nourishment, and removal of obstacles, such as sea walls and channels. Approaches to problems were coded as *Social* if they involved persuasion, information or policy. The *Social* category included actions such as public education on climate change, writing legislation or developing policy about climate change, political leadership, and persuading people to become involved in being part of the solutions. Comments such as, "If people would just be more aware of the consequences of their behavior, this would go away," fell into this last category. Approaches were coded as *Ecological* if they emphasized the lessening or avoidance of human damage to ecological services and processes. These included actions such as relocation of highways to avoid wetland pollution and diverting

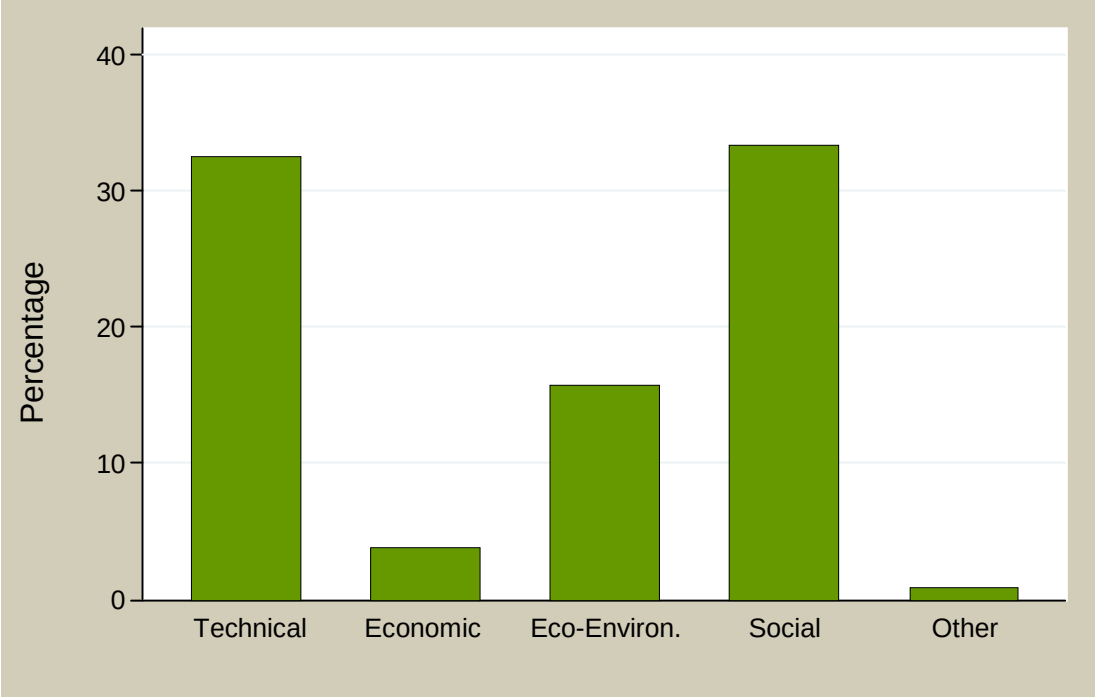
fresh water to alleviate salt water intrusion. *Economic* approaches were those involving markets, price signals, and market weaknesses. For example, trading pollution credits could be an economic solution to a water quality problem.

Obviously, these are not mutually exclusive categories. Siting and planning a highway involves technical expertise even if the intent is to protect the wetland. By the same token, developing policy to provide tax incentives to builders to reduce beach-front development is an approach that is both social and economic in nature. Nevertheless, this coding system helped impose a degree of order on an extremely varied set of responses. Figure 4.23 shows the distribution of the types of solutions recommended for the dominant problem in a respondent's area. Wave 2 stakeholders were more likely to see solutions in technical or social terms than in economic or ecological terms. For example, in Florida during the period of this study residents in several counties were voting on participation in the erection of a new power plant in the region, one powered by fossil fuels. Local environmental organizations mounted education campaigns to inform politicians and voters about the potential risks associated with such a plant, including air pollution, public health effects, and increasing contributions to statewide carbon emissions. Political activism has been advocated and employed by a number of Florida organizations on particular issues (e.g. the ACF issue, sea turtle lighting ordinances, etc…). Letter writing campaigns, lawsuits, lobbying, and public awareness/education activities are commonly employed by a variety of Florida stakeholder groups and could play a role in encouraging decision makers to seek legislative or technical solutions to problems caused by climate change. Taken together with respondents' perceptions of who shares in the responsibility for action (Figure 4.22), this should be welcome information for state and national policy makers. Gulf coast stakeholders evidently believe that action should be taken and that, for the most part, that action should be adaptive in nature. There is awareness among them of greenhouses gases and their effects on climate change as well as some mitigation strategies that have been proposed, but the primary focus for these stakeholders is alleviation or avoidance of stressor effects.

It can also be taken as an encouraging sign that stakeholders see many different kinds of options for addressing climate change induced problems and a significant number of these fall under local or regional, rather than federal, control. Texas respondents suggested a range of ways to address climate change issues they saw as having impacts in their areas. For example, perception of coastal impacts of sea level rise brought up suggestions ranging from continuation of beach nourishment (technical solution) activities to more stringent screening of permits to build close to or on the beach (social-policy). The insurance industry figured frequently in discussions of coastal development, and most of these comments indicated that insuring against storm loss for beach residences should cease with similar curbs on building in flood plains (social-policy). Solutions to the growing problems of water availability also tended to focus on technical solutions (e.g., more creative uses of recycled water), more water conservation among citizens (social-individual responsibility), and more thoughtful water policy - "It would take probably both the state legislature and the Texas Water Development Board to say we want you to plan for these."

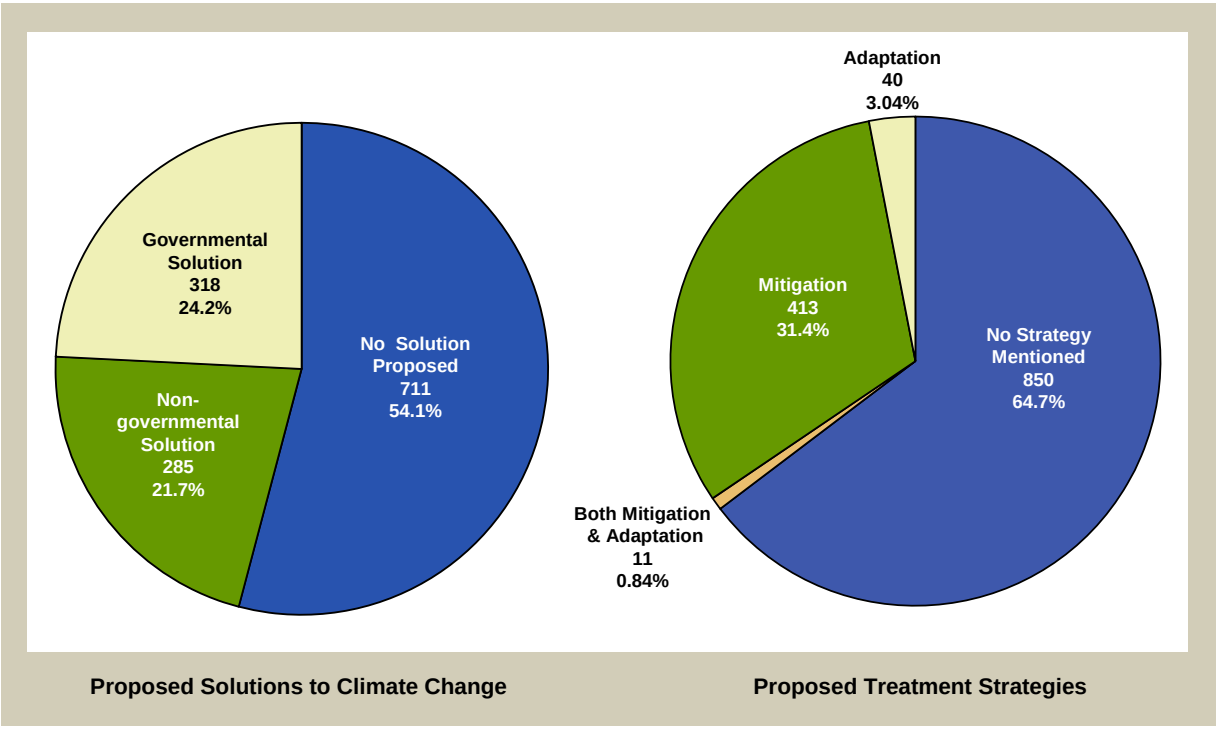
In contrast, regional newspaper articles on climate change mentioned solutions in a little less than half the cases. Figure 4.24 contains two pie charts. On the left, articles that did not discuss solutions to climate change (54.1%) are contrasted with the numbers of articles that did (45.9%). Responsibility for the solution was only a little more often seen as being with the government (24.2%) than with non-government entities (21.7%) such as individual citizens, business, and industry. The actual types of solution strategies mentioned in news coverage of climate change are shown on the right. Most articles (64.7%) did not mention a specific strategy. Among those that did, mitigation dominated the strategies discussed or mentioned.

Figure 4.23
Types of Action Needed to Address Effects of Climate Change on the Dominant Problem: Wave 2 Interviews



N = Wave 2 respondents = 243

Figure 4.24
Proposed Climate Change Solutions and Strategies: Regional Newspaper Analysis



Putting Issues on the Public Agenda[13]

If Gulf stakeholders believe that state and local governments, citizens, and interest groups have roles to play in decision making relevant to climate change, the question becomes how to put climate change on the public agenda so that the necessary discussions and decisions can go forward. In other words, what are the factors that can improve the chances that an issue like climate change will become an agenda item, especially since other problems will continue to vie for public and official attention? To gain further insight into the agenda setting process in the research areas, a finer-grained analysis of decision making data from Wave 1 interviews was done using Kingdon's three-stream framework (1995; Liu, Vincent, Lindquist, & Vedlitz, 2007). The three streams in the policy process that Kingdon refers to are problems, policies/alternatives, and politics. This framework occupies a prominent role in the understanding of public policy. It is derived from in-depth studies of federal transportation policy and health care policy and focuses on the factors that attract attention to a problem or issue, determine how decision agendas are set, and determine what alternative solutions are considered.

Participants in the Agenda Setting Process

Kingdon's study (1995) of national agenda setting indicated that the federal government is a first-tier participant and that state and local levels have little influence in shaping this agenda (1995). In contrast, our data (Figure 4.21) show that first-tier participants in state and local agenda setting decisions are perceived as including state and local decision makers. Furthermore, the relative positions of the different government actors largely mirror the power relationships described in background material on the research locations. Our analysis also indicates that interest groups are the most important non-government participants, a finding that is consistent with Kingdon's analysis of first-tier actors at the national level. One respondent's comments illustrate this type of influence.

"The County commissioners, they take their orders from [Company X]. They do exactly what [Company X] wants them to do, and they will not go up against the Company…. I think they must have a smorgasbord of threats and rewards to be able to get that many people in that first line of work to do their bidding."

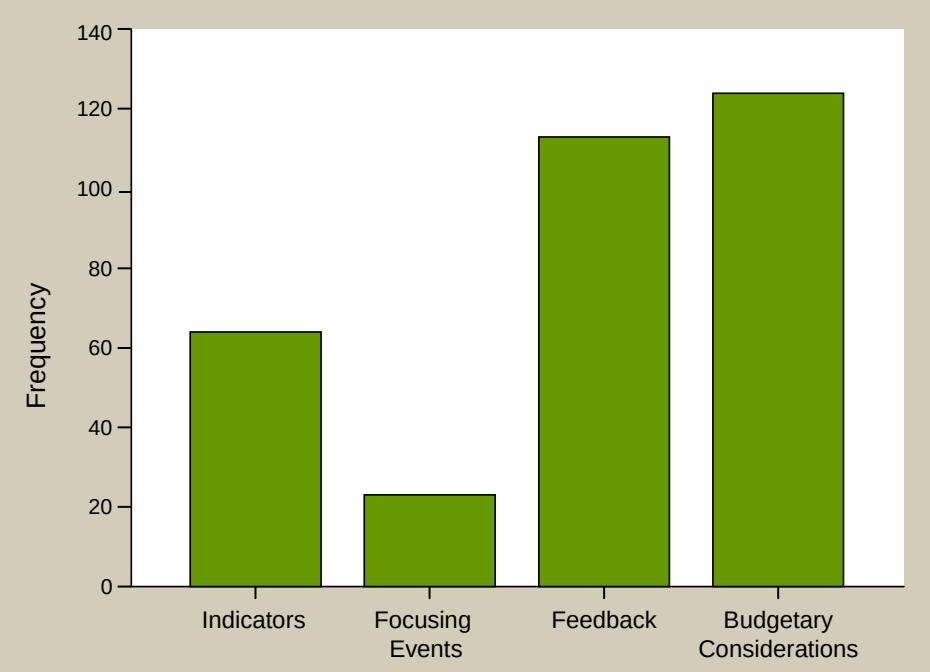
Our data and Kingdon's national data (1995) indicate that, in contrast to interest groups, experts (academics, researchers, and consultants) and the general public share a second-tier status. In Kingdon's study of national agenda setting, however, experts are second in importance to interest groups. Our data indicate that in these research areas, the general public (i.e., the electorate) is perceived as being somewhat more important than the experts in their influence on setting the public agenda. Verification of the importance of the general public also emerged during focus group sessions. In the words of two participants: "…the government responds to what the citizens state are important," and "The public is the one who stimulates the federal government."

Factors that Attract Attention to a Problem

According to Kingdon (1995), factors that attract attention to problems or issues and make them candidates for the public agenda include (1) problem indicators such as quantitative measures of magnitude, scope, impact, and severity of the problem, (2) focusing events (Birkland, 1998) such as crises or disasters, (3) feedback, or information from within the government or from outside (e.g. the public) that a problem is important, and (4) budgetary considerations. Figure 4.25 shows the relative strength of each of these factors as indicated in Wave 1 interviews. Budgetary concerns are the most critical factor in shaping the local policy agenda and setting policy priorities. Among 271 respondents, 124 (46%) mentioned the importance of budgetary considerations. As one respondent succinctly put it, "The budget realities…dictate the priorities."

[13] The material presented in this section was drawn primarily drawn from Liu, Vincent, Lindquist, and Vedlitz (2007).

Figure 4.25
Attention Attractors and Budgetary Considerations in Agenda Setting: Evidence from Wave 1 Interviews



Various forms of *Feedback* are the next most powerful factor in attracting policy attention to public problems. Among these cases, 113 interviewees (42%) discussed the influence of *Feedback* in the local agenda setting process. This makes sense because individual and collective policy makers closely interact at the local level with ongoing programs, their constituencies and interested parties in the community. If a local policy maker ignores *Feedback* from local constituencies, the cost can be even greater than it would be for a policy maker at the national level. Both interviews and focus group responses emphasized the value of inviting local *Feedback*. As one interviewee put it:

> Whenever we have a new project come up, we always have public meetings to get the public involved from the get go…. [They can contribute knowledge on] drainage - you know, how a new levee would affect drainage on the inside, increasing pumping capacity we might need, you know, - how it's just by somebody's house or move somebody's house or relocate somebody or buy a business out…. You name it, they come up with it and a lot of them have good ideas.

Problem *Indicators* and *Indicator* changes are also important in drawing attention to local problems. Approximately one-fifth of the interviewees mentioned that quantitative measures of the severity of local public problems draw policy makers' attention to these problems. For example, empirical measures of the changes in air quality and water quality were cited in the Texas area as important to bringing those issues to the attention of both local and state decision makers. *Focusing Events* (i.e. crisis or disaster events) were less often mentioned in the interviews as an important agenda setting factor. Only 23 respondents (8.5%) discussed how certain events attracted significant levels of attention to specific problems or shifted local governmental priorities.

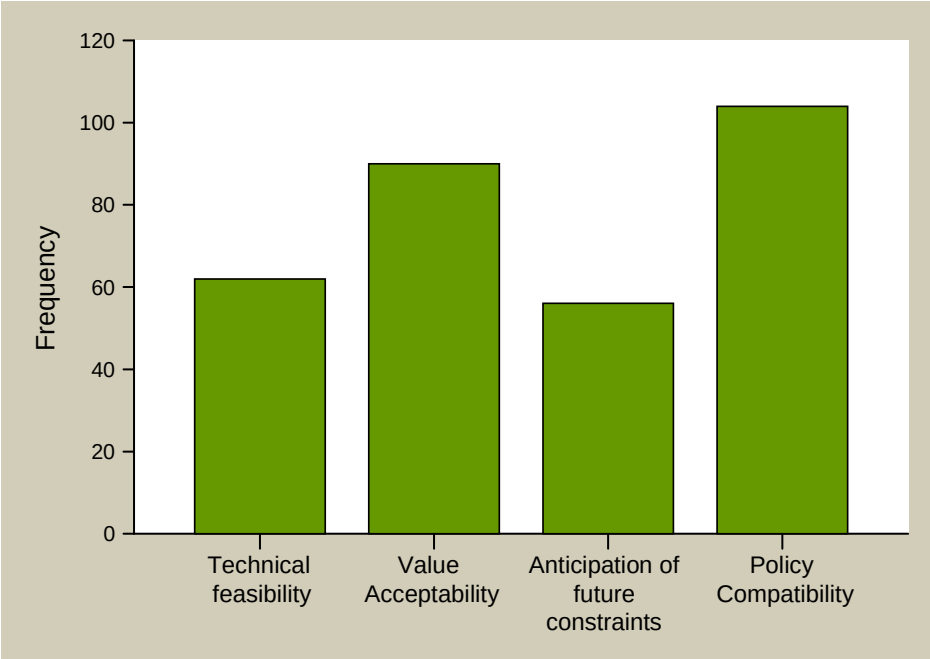
We see Kingdon's problem *Indicators* and Kasperson's model of risk amplification of problems intersecting in important ways (Kasperson, et al., 1988; Kasperson & Kasperson, 1996; Kingdon, 1995). A focusing event, such as a storm, can greatly amplify the public's perception of its vulnerability to similar future events though personal experience and sheer the magnitude of loss. In other words, the problem

Indicators are experienced close at hand by large portions of the population. Such events also generally increase the *Feedback* the public gives to decision makers requesting action. The actual impact of this *Feedback* on agenda priorities is balanced by *Budgetary Considerations* and some assessment of the risks of a repeat event. We know that the power of a *Focusing Event* is greatest at the site of that event. This was corroborated during the focus group sessions when participants were asked if the 2005 storm season had changed the salience of climate change as an issue. In Louisiana and Florida, where storms have had devastating effects in recent years, groups indicated that these events had jolted public awareness of climate change. In Texas, where the research location has been more of a spectator to those events, focus groups indicated almost no effect. The implications for local agenda setting are that factors with the most power to set agendas are local, rather than regional, conditions.

Alternative Selection and Solution Characteristics

When a problem is serious enough to go on the public agenda at a high priority, it is one that, by definition, demands an action or solution. The factors that determine the survival of an alternative or solution according to Kingdon (1995), comprise the third set of variables we examined using Wave 1 interview data.

Figure 4.26
Frequency of Important Solution Characteristics:
Evidence from Wave 1 Interviews



Kingdon's study (1995) indicated the attributes of solutions or alternatives that make them more likely to survive in the policy selection process are *Technical Feasibility*, *Value Acceptability*, and *Anticipation of Future Constraints*. We added the variable of *Policy Compatibility*, a variable referring to the compatibility of local policy and priorities with state or federal policy. Figure 4.26 shows that during the Wave 1 interviews, the most discussed requirement for a solution/alternative to survive was *Policy Compatibility*. Just over a third of respondents (38%) discussed how a new solution needs to be compatible with policies from the upper level of the federal system. A proposal that is, or seems to be, compatible with upper level policies, programs, or initiatives is more likely to gain support and be seriously treated than non-compatible solutions, which are usually ignored or discarded immediately in environmental management practices. As one respondent put it, "So, I think we've made great strides in water quality that kind of come up to a particular peak. But that

change and improvement in the Clean Water Act and results of the Clear Water Act …are the primary driver that caused that turnaround."

Respondents in all locations were very aware of the fact that basic environmental standards and requirements originate at federal levels and that policy/action at state and local levels are expected to conform to them. For both interview and focus group respondents, there were several implications of this federal-level responsibility. One was that, because standards originate at the federal level, leadership for dealing with climate change needs to come from that level even though most respondents recognized that state government, local government, and the general public would need to act in concert on the problem. In addition, dealing effectively with an issue that has the kind of scope that climate change has necessitates a more comprehensive approach than is possible for state and local entities.

Another issue was what many respondents saw a disjunction between the stated goals and regulatory structures of agencies like EPA and NOAA and their effective implementation at state and local levels. A substantial number pointed out that standards already exist, that if applied, could begin to address climate change effects. This view was summed up by one of the focus group participants:

> I would say that they have been very lax in dealing with many issues that affect coastal Louisiana. And that they should look real hard at their rules and regulations…implement the 4041b guidelines that says they need to protect sensitive areas. …I would tell EPA that they have very excellent rules and regulations about protecting wetlands and coastal areas. They need to reread and follow them.

A related issue was, according to respondents, that people, including policymakers, tend to think and plan locally, rather than globally. Although top-level leadership and guidance is called for, the effects of climate change on localities is what has most salience for people. Respondents and focus group participants consistently said that scientific information and policy must both be relevant to the local context. Only then is there a significant chance that people will seriously consider forecasts and projections of risk, and work toward policy to mitigate those risks on the local level or support state or national policies to do so. One focus group participant commented:

> You have to have directives, national direction, but frankly, people are very local in their thinking. And if your county commissioners, or . . . your local government says 'This is really a problem,' 'This is why it's a problem.' And they go out and reach out to the populous and try to explain it and get their buy in, I think you're much more likely to be successful than depending on the U.S. Department of Commerce to come help you.

In Florida, many interviewees indicated that there is no shortage of laws or regulations to protect the environment or manage resources. The problem is that these laws are frequently not enforced. For example, despite federal, state, and local laws protecting endangered sea turtles, many Florida respondents complained that there is widespread apathy in government toward these laws at all levels and, in some cases, willful refusal to enforce them. The implementation and enforcement of environmental laws was consistently described as impossible given the number of regulations combined with the lack of resources to carry out environmental mandates, including lack of personnel to implement and enforce existing laws. This complaint was applicable to many environmental issues discussed with stakeholders, such as the protection of sea grass beds, coastal armoring, wetland protection/preservation, storm water management, endangered species protection, and coastal set-backs.

The second most mentioned attribute for a policy alternative's survival and selection was *Value Acceptability*. About one-third of respondents discussed how various values—such as political ideology, equity and fairness, social justice, efficiency and effectiveness—affect the solution specification and selection process. Alternatives that are compatible with the values of policy makers tend to have a better chance to survive the winnowing process, while proposals that do not conform to the dominant political ideology of a policy community are less likely to be considered for adoption. Perceptions of the relative fairness and efficiency of alternatives were also discussed by interviewees. One respondent explained:

> Sometimes you just have to make the decision on which solution would help the majority of people, one solution might help this group, one solution might help [that] group, but which solution is gonna benefit the majority of the people, and that is who we work for—the majority of the people.

Value compatibility also emerged during focus group sessions. Among the compatibility issues expressed there was potential conflict between individual rights and the common good. Another participant summed it this way:

> I think one of the obstacles to us doing anything in this country to address climate change and, especially sea level rise - if we all agreed it was occurring – is once you've educated people and you've convinced them…that there's an issue, we still, as a country, are so focused on individual rights. We don't like zoning. We don't like any big brother telling us what to do or how to do it. And if you really want to address these sorts of problems, it really requires, I think, a comprehensive approach to addressing them. And that's telling people some things they can and can't do, which is a hard sell.

Problems of continued development in coastal areas and kind of construction allowed on private property are issues that will be complicated by these kinds of value conflicts.

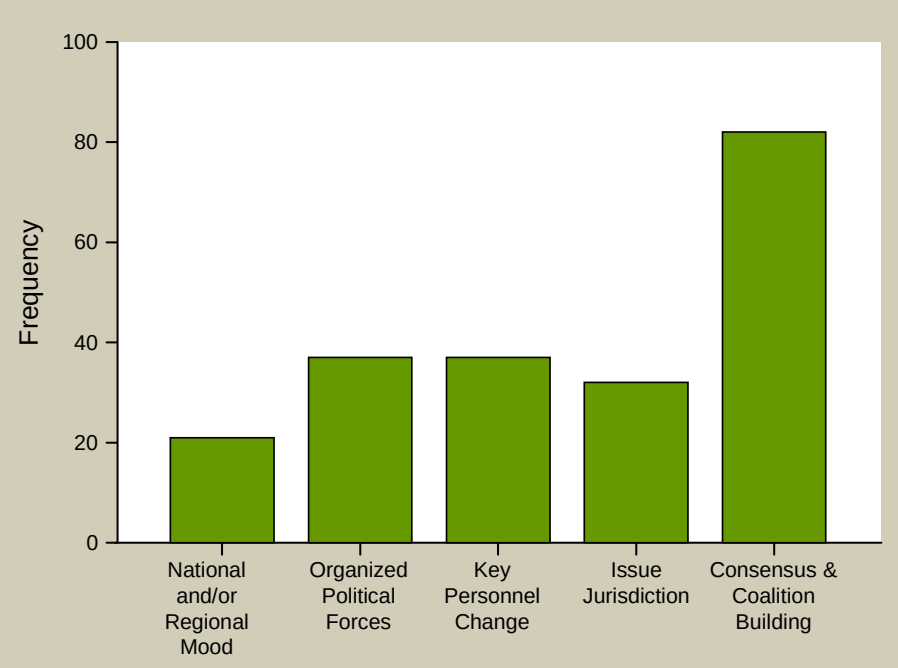
For some respondents, *Technical Feasibility* and anticipation of future constraints were also discussed as important attributes for a proposal's survival and success. Policy proposals to address land loss in coastal Louisiana, for example, often spurred rigorous debate about the *Technical Feasibility* of certain policies that would draw on the expertise of both natural science and engineering. As one interviewee noted:

> When you do something like [reroute the Mississippi River], there's so many other consequences. You have – if you start putting significant amounts of water down that area, then the river will not have the flow it has. You'll have dredging problems, maybe have the Port of New Orleans or a little more salt water in the water.

Factors Defining the Political Environment

Finally, Wave 1 interviews were examined for discussions of a set of variables referring to the political environment in which solutions are evaluated rather than to the attributes of the solution or alternative itself. These Political Factors include *Mood*, *Organized Political Forces*, *Key Personnel Changes*, *Jurisdiction* change, and *Consensus and Coalition Building*.

Figure 4.27
Important Political Factors: Evidence from Wave 1 Interviews



Various important political factors were discussed in the interviews, but overall, there were fewer references to these kinds of variables than to factors that attract attention to problems or that influence the choice of alternative solutions. Figure 4.27 shows the distribution of responses for political factors found in the interviews. Kingdon (1995) found the *National Mood*, or climate, and the *Turnover of Key Personnel*, together, have had the most powerful effect on national policy agendas. While all the variables played some part in interviews, the most frequently discussed political factor and its impact on local agendas was *Consensus and Coalition Building*. *Consensus Building* is a process to mobilize similar interests and settle conflicts that involve multiple parties. In many cases, local decision making involves the full range of stakeholders. One said:

> We brought in probably forty people when we first started this process. All the interest groups, all the agencies, the local government, and anybody else who was involved in coastal issues. 'brought them all in the room. Years back, when we first got started, and we said, 'This is what we want to do, let's make this a living document.' We don't want to say, 'This is what we want to do,' and put it out there. We want this to be an effort that everybody has input in.

While the ideal of building consensus and coalition among as large a number of interested parties as possible was frequently emphasized in the interviews, some respondents noted that *Consensus Building* in the political sphere is actually "governed by bargaining" (Kingdon, 1995, p. 159).

Some discussion of other political factors emerged during interviews and focus group sessions. For example, there were references to the importance that *Mood* can have on the prioritization of problems, such as, "Well now we have an Iraq problem so all the environmental concerns on the Apalachicola Forest are kind of put aside because we are in a war mood." With regard to some issues, one respondent stated that a particular disposition or *Mood* could characterize the policy community in an entire region: "Houston is a unique city…And you might know this from [a review of Houston's] planning, that Houston is a laissez-faire city, and the decision making here is distinct from decision making in, say, Seattle or Dallas, or Atlanta, or Boston, or whatever."

Some respondents also recognized that *Organized Political Forces*, *Personnel Turnovers* in government and competition over *Jurisdiction* are also important in local agenda setting and solution choices. As one observer noted, well-organized political forces whose power and influence may come from money or from positions in political hierarchies can have a great impact on local policy issues. One respondent gave the following example:

> That's a big issue here…. People who sell to make money from the resources – the developers – are employed by the systems that allow them to develop. …people who are interested in conservation by and large…are average citizens who don't have nearly the amount of wealth or the power and political influence as developers do.

In spite of a general recognition that federal power is necessary for the implementation of large-scale programs, at times respondents expressed frustration with federal *Jurisdiction* over issues that have local impact. For example, one interviewee said, "Bayou Lafourche is owned by the state, and everything within it - anything within our levee system…but for the local [area] or the state, it doesn't matter if it's a local concern or a state concern. We don't have any jurisdiction. The Corps does." In addition, some respondents pointed to the importance of *Personnel Turnover*, both at the federal and at the local levels. The following statements illustrate this recognition: "I recognize there's always politics in any governmental process….We have seen huge changes from the Clinton administration to the Bush administration, and now everybody is just sitting around wondering what the next administration is going to do, and that doesn't help anybody," and "We went through some staff turnover. We had a staff during the development of the plan who were not the staff who were appropriate for the …implementation phase…. We have a very good staff right now,…and that's important to a program like that if you really want it to be effective."

Overall, the politics stream can be critical in the local policy process, independently of problem identification and the selection of solutions. *Indicators* of the magnitude and scope of a problem are critical to its attracting attention, and while a focusing event can vividly illustrate vulnerability, sound and trustworthy information on the condition seems to be more important. *Feedback* from citizens will hinge on access to that information. *Budgetary Considerations* are of great importance, but *Personnel Turnover* in government offices, *Jurisdictional* changes, and political *Moods* at federal, state, and local levels will influence how budgets are allocated. Utilizing Kingdon's framework (1995) for this analysis helps to reveal some of the complexity of the local decision making and policy processes in the research locations. For anyone working to bring an issue like climate change to the public agenda, these factors will be critical to insuring a serious consideration of it.

Climate Change Information: Importance, Use and Information Gaps

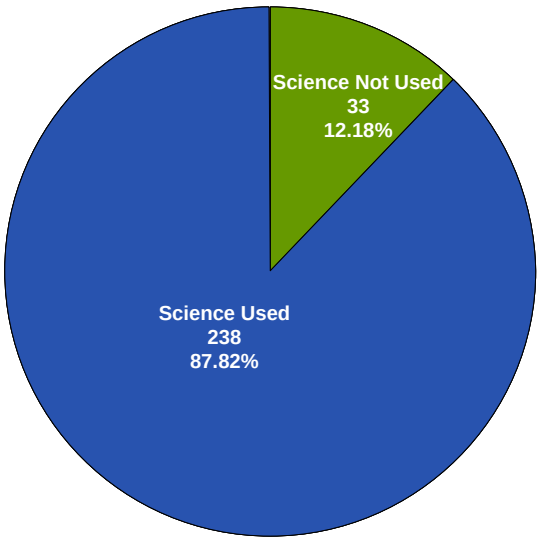
Use of Science-Based Information

When science information is broadly defined as any kind of empirical (as opposed to normative) information, the vast majority of Wave 1 respondents indicated that they use science to define and deal with their current problems (Figure 4.28). Interview analysis is limited to Wave 1 respondents because it was in Wave 1 that the clearest data on actual use of science information was obtained. Also recall that a sample of the Wave 1 respondents participated in Wave 2 interviews as well. The type of information respondents specified ranges widely and includes socio-demographic, economic, ecological-environmental, and structural-engineering information.

Although the majority of respondents in all locations report use of science information, there are some differences among the research locations. Florida indicates the highest level of use and Louisiana the lowest, with Texas in between. We believe this can be accounted for, in large part, by the composition of respondents in each location and does not indicate general resistance in some places to the use of science. Large portions of the Apalachicola Bay area are publicly owned land devoted to recreation and conservation. As such, governmental agencies with an environmental focus represent a significant part of the respondent sample and would be more heavily weighted with personnel who have a science background and routinely use science-based information. In addition, this region is characterized by a close working relationship between resources managers and those who use the resources. While this is not always a comfortable or friendly relationship, it has conditioned users to science-based management and an acceptance of science as a tool for planning and

decision making. In contrast, the Louisiana samples are more heavily weighted toward elected officials and for-profit entities. Texas respondents were also somewhat more heavily weighted toward agency personnel. However, even among for-profit organizations there would have been a bias toward the use of science information as many of these personnel represented environmental specialties within the organization.

Figure 4.28
Respondents Using Science Information in Decision Making: Wave 1 Interviews



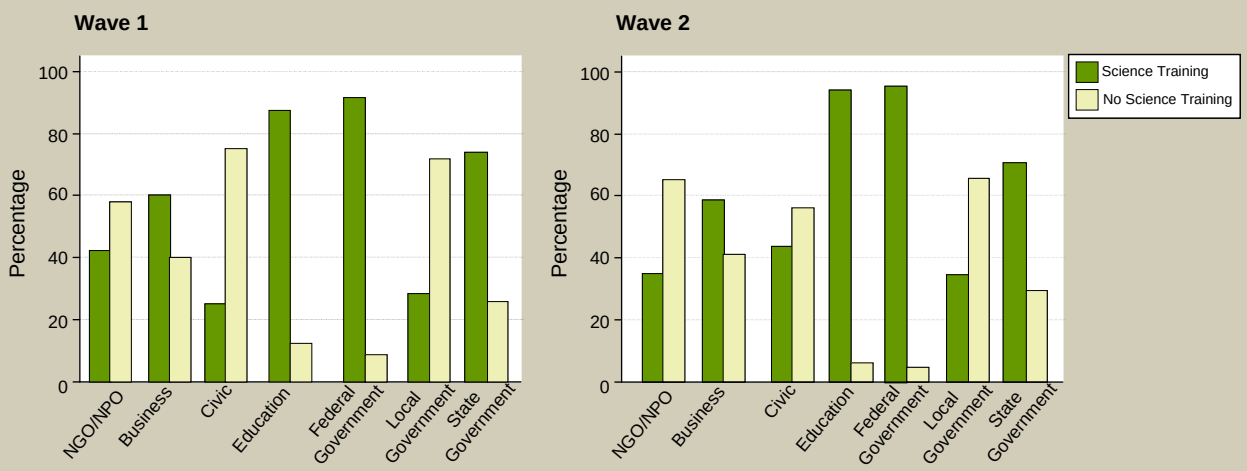
Science Used in Decision Making			
	No	**Yes**	**Total**
Florida	3	76	79
	3.80%	96.20%	100.00%
Louisiana	21	78	99
	21.21%	78.79%	100.00%
Texas	9	84	93
	9.68%	90.32%	100.00%
Total	33	238	271
	12.18%	87.82%	100.00%

Pearson chi2(2) = 13.2873
Pr = 0.001
Fisher's exact = 0.001

N = Wave 1 respondents = 271

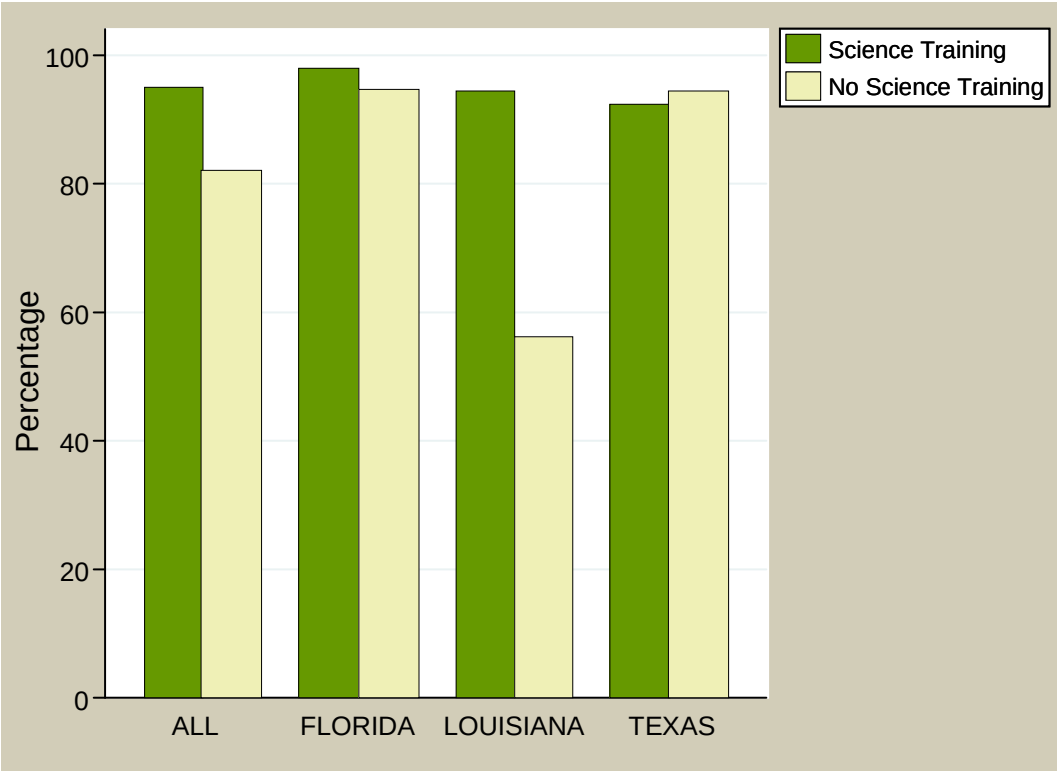
Figure 4.29 documents that there is a definite relationship between the type of organization a respondent represents and the likelihood of the respondent having significant science training. The disparity between those with and those without training is especially marked for local government and civic groups and, to a lesser degree, for the NGO-NPO category.

Figure 4.29
Association Between Organizational Type and Science Training: Waves 1 & 2



(Total organization, bars sum to 100) N: 113 Science Training, 104 No Science Training

Figure 4.30
Percentage Who Use Science-Based Information by Science Training: Wave 1 Interviews



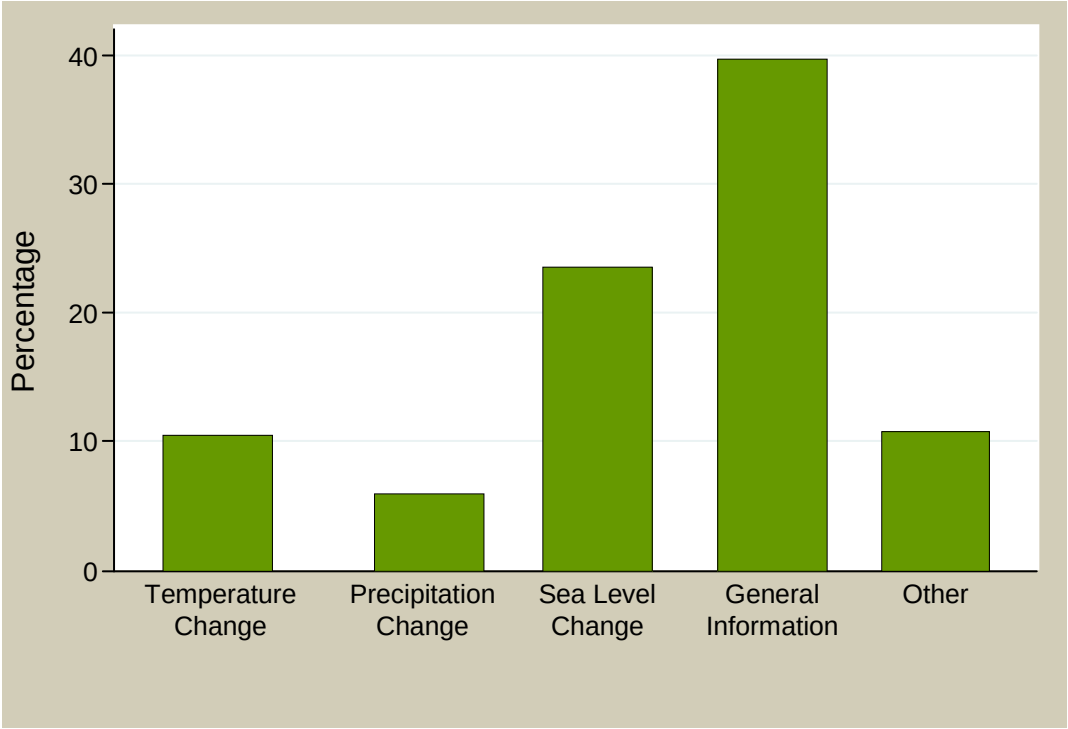
N = Wave 1 respondents by science training = 113 (science training) 104 (no science training)

Furthermore, Figure 4.30 shows how science training affects use of science, in this case use of science to identify and/or deal with local problems. Science training was coded as *Yes* if the individual had a degree in one of the sciences or indicated emersion in science as part of the job. Those who reported having science training were no more likely to say they use science to address their most pressing local problem than those without science training. Furthermore, there is very little difference among the research locations in this relationship, except in Louisiana where those without science training are somewhat less likely to use it in decision making. In summary, the majority of respondents in all the types of organizations tapped in our samples report used science-based information in their decision making. Most of the information accessed by respondents is socio-demographic or economic (Figure 4.33). An examination of interviews indicates that the source or sources of that information can range from peer-reviewed journals, through reports developed by staffs, to popularized science of varying quality. The evidence suggests that stakeholders are accustomed to looking to fact-based information to assist them in decision making, but that experience with information from the natural and physical sciences is not uniform and least likely to be found in government, civic, business, and advocacy organizations. Many focus group participants indicated that effective transmission of information on climate change would require good "translators" to bridge the gap between scientists and the general public. The findings described give more weight to this suggestion.

Exposure and Access to Climate Change Information

The Wave 2 interviews revealed that some respondents already know about available information on climate change. However, Figure 4.31 shows this information is more likely to be general information than information on the specifics of climate change stressors. Among the stressors, knowledge of information on *Sea Level Rise* is the most common. However, even given the fact that *Sea Level Rise* is the most salient of the stressors, it is interesting that less than one-third of those responding knew about the availability of information on it.

Figure 4.31
Types of Climate Change Information Known to be Available:
Wave 2 Interviews

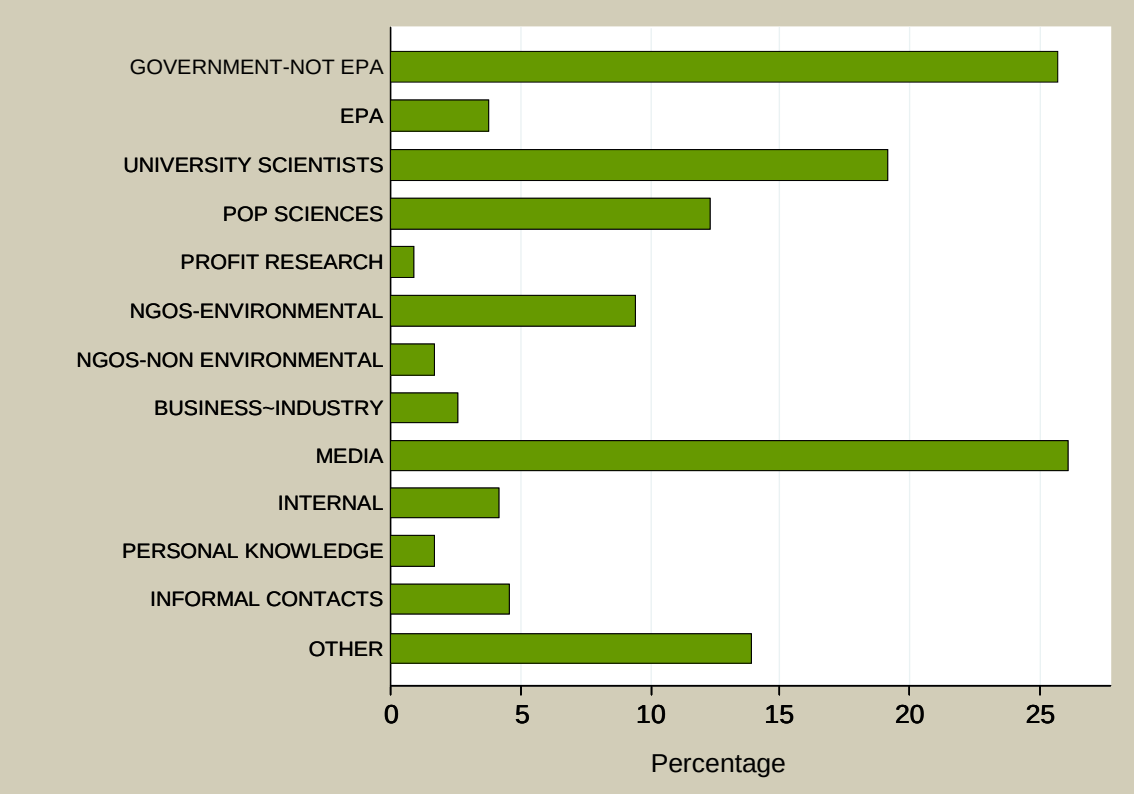


N = Wave 2 respondents = 243

Known sources of climate change information are shown in Figure 4.32. It is not surprising that the most mentioned source of information is the *Media*, given the fact that general information on climate change was the most frequently mentioned type of climate information known to respondents (Figure 4.31). After the *Media*, however, *Government Sources* and *University Sources* of information are the most frequently mentioned sources, or potential sources, of climate change information. *Government* and *University Sources* are also the sources of science-based information most commonly mentioned by Wave 1 respondents who were asked where they actually obtained the science information they used. In Wave 1, *Government Sources* were named by 66% as primary information sources, and university sources were named by 36% of respondents.

Given the Wave 1-Wave 2 similarities in sources of information, Wave 1 data were examined for more detailed data on information sources used by respondents. Wave 1 represents data on what respondents actually do vis-à-vis information as opposed to responses to the more hypothetical questions posed during Wave 2. Figure 4.33 shows the types of information Wave 1 respondents said they used these sources for and also shows the relative use of these sources by different types of organizations.

Figure 4.32
Known Sources of Climate Change Information: Wave 2 Interviews

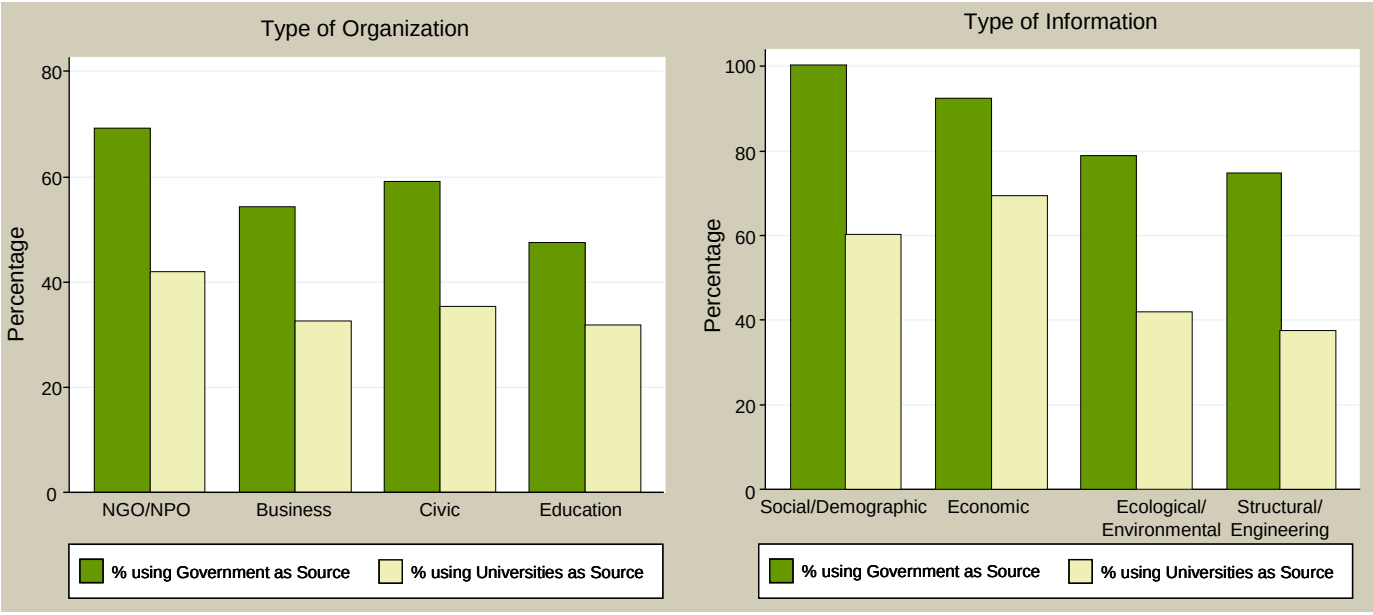


N = Wave 2 respondents = 243

Organizations of every type are more likely to utilize governmental information sources than to utilize academic sources. The difference between use of *Government* and *Academic Sources* is especially marked for environmental and engineering information. *Government* and *Academic Sources* are obviously the information sources most familiar to stakeholders, and these findings should be particularly gratifying to federal and state agencies whose missions almost always include public education and the dissemination of research-based information. It can be argued that the lower profile of *EPA* in this array of information sources stems primarily from the fact that the *Government/Non-EPA* category includes many information sources while the *EPA* category obviously includes just one, giving *Government/Non-EPA* more scope for contact and access by information seekers. The fact that government agencies and academic organizations are so often used by stakeholders as sources of science-based information is very positive. These sources – both at the federal and state levels - provide natural and familiar conduits for dissemination of information on climate change. There is no need to create another structure for information flow. The *Media* and *Popular Science* publications are also a means of information dissemination that could be utilized to a greater degree, particularly for decision makers without formal science training.

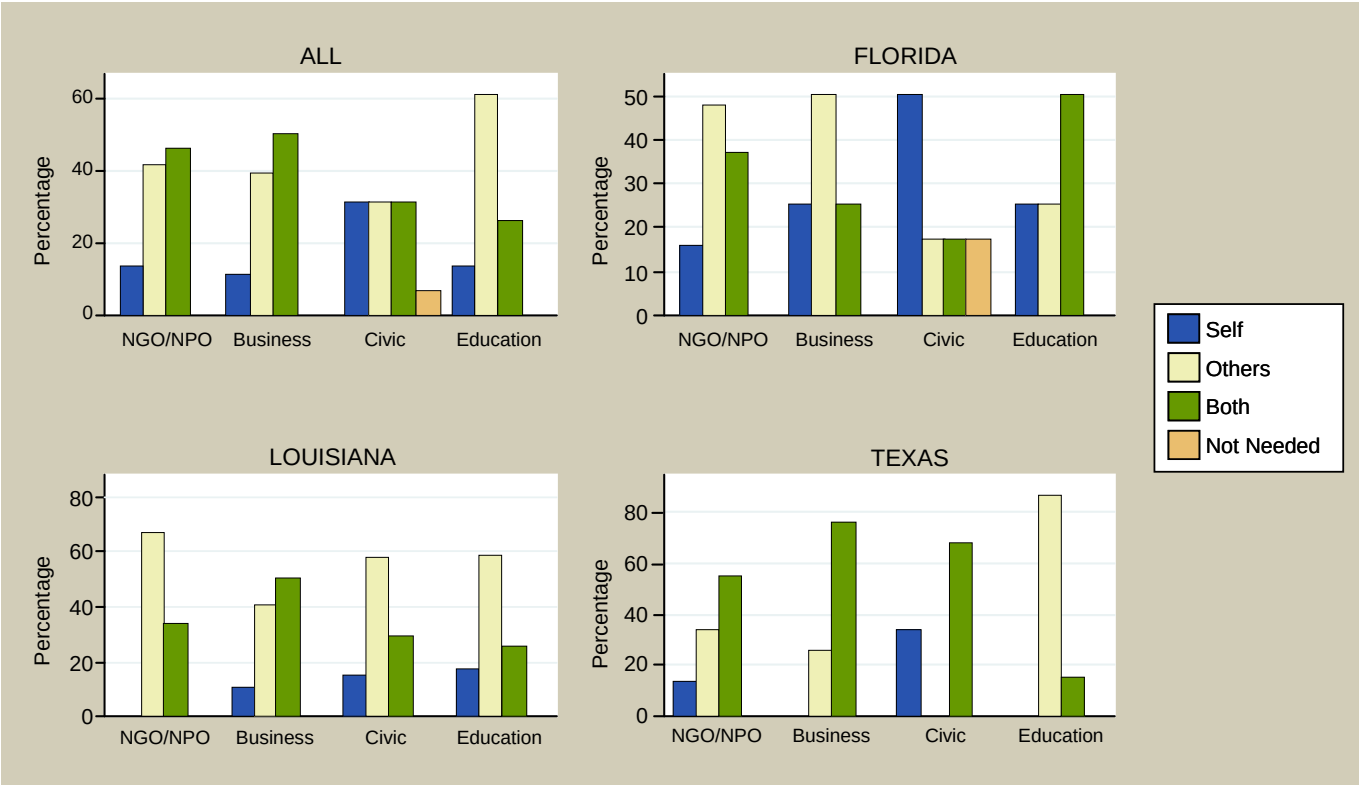
The majority of Wave 2 respondents (72.8%) said they had been exposed to climate change information through personal contacts, popular media, or science information. About half of the stakeholders who responded (52.4%) to questions about climate change networks, said that they were talking about climate change to others, and about 53% could cite other stakeholders or organizations who were talking about climate change. These data do not indicate whether the talk referred to is casual or serious consideration of climate change in the context of the organization's activities. However, the analysis that was done of organizational web sites would suggest that any discussion of climate change is casual in nature. Of the 128 websites with mission statements, only two (1.6%) mentioned global warming in those statements. Of the 67 websites that contained information on endpoints, such as water availability, only two (2.98%) mentioned warming as having a potential effect.

Figure 4.33
Sources of Science Information Used: Wave 1 Interviews



N = Wave 1 respondents by type of information/organization type
N: NGO/NPO 55, Business Org 37, Civic Org 34, Education Org 19
N: Social Demographic 20, Economic 26, Eco-Environmental 187, Structural-Engineering 43

Figure 4.34
Respondents Saying More Climate Change Information is Needed: Wave 2 Interviews



N = Wave 2 respondents by state and organization type.

When asked if more information on climate change is needed, there was a high level of agreement that more information is called for (Figure 4.34). Less than 10% of those responding stated that there is no need for more information. In general, more respondents believe that additional climate change information is needed either for others or generally (i.e., for both themselves and others). There is variation among the types of organizations in the perception of who needs the information, and there is also variation among the three research locations.

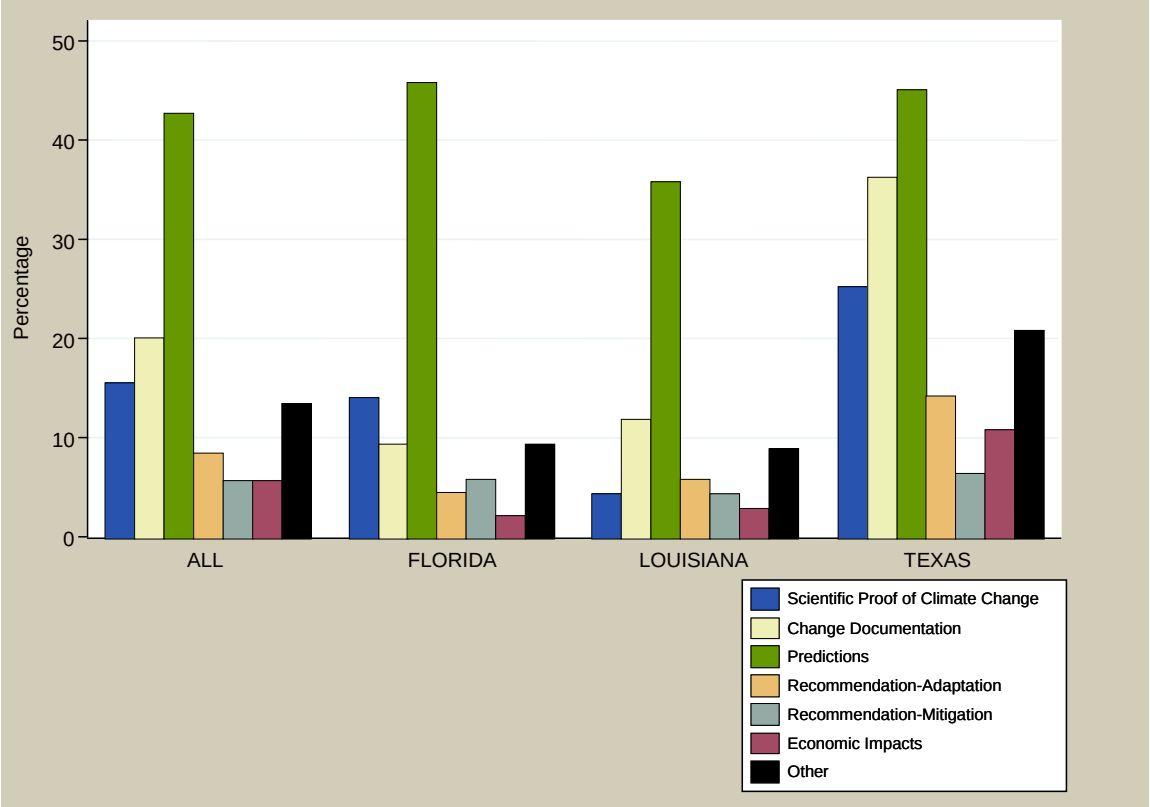
Interview respondents and focus group participants alike saw science as having an important role to play in discussions of climate change. The vast majority of respondents look to fact-based information to assist in decision making and see important roles for scientists and the information they generate. Furthermore, many decision makers with civic or advocacy organizations who do not have science training have science-trained advisors. During discussions with focus group participants, several caveats also emerged with regard to the role of science. First was a high level of agreement that scientists have difficulty conveying information in ways that are understandable and applicable to problems and decisions related to them. Many focus group participants indicated that there is a need for "translators," or "integrators," to bridge the gap between scientists and non-scientist users of their information. One benefit of this kind of translation would be better communication of information on climate change to a public seen as largely unconvinced or uninterested in the issue. Furthermore, these stakeholders were unanimous in their opinion that science-based information is essential to good decision making generally and to climate change decision making in particular. Scientists, as generators of this information, should be able to do their jobs without being "antagonized by the naysayers and outside interests." As one focus group participant put it, scientists should be "responsible but not liable." In other words, they should be held to the high standards that govern scientific inquiry and not punished for findings that are unwelcome.

A second cautionary note to emerge was a perception expressed by many that science reporting is too easily biased by pressures and political considerations, particularly for scientists who are either employed by the government or who receive research funding from the government. This thread of cynicism ran through interviews as well as focus group conversations, and its effects are shown in Figure 4.37 and Figure 4.38. A third theme that emerged – particularly in Louisiana – was an emphasis on how much practical experience and local knowledge has to contribute to scientifically derived descriptions, explanations, and predictions in these complex social and ecological systems.

Information Gaps

Types of climate change information respondents said are needed can be seen in Figure 4.35. Less-than-complete acceptance by some respondents of the scenario projections can be seen in the requests for scientific proof of climate change and in the requests for more documentation of the changes set out in the scenarios. Requests for proof and documentation were especially strong among Texas respondents. Nevertheless, the most frequent response to questions about types of information needed was a request for more information on the local effects of changes in stressors. The need for more certainty regarding local effects of climate change was corroborated by conversations with all of the focus groups. In all focus groups there were comments suggesting that significant numbers of decision makers and members of the public remain unconvinced of the reality of climate change. However, most comments emphasized the importance of having good information on local effects before any long-range planning could be expected to take place. Any future use of these or similar scenarios as educational devices will require careful framing, inclusion of backup documentation, and as much information on local effects as possible.

Figure 4.35
Types of Climate Change Information Needed: Wave 2 Interviews by State



N = Wave 2 respondents by state = 243 (ALL); 85 (FL); 67 (LA); 91 (TX)

The requests for information on the potential economic impacts of the scenario changes can also be interpreted as a request for predictions. The theme of economics runs throughout the interview and focus group data. In all locations there is a concern for keeping the economy humming (or boosting it) and a fear that any changes in established patterns will hamper this. There is also a general perception that there is not enough money to make some of the changes called for and also address other local problems. Figure 4.25 clearly shows how important budgetary considerations are in the setting of agenda priorities. Stakeholders recognize the role that economics plays in agenda setting, and their statements about the need for projected economic impacts of stressor changes were often framed as information that would be needed to convince decision makers that some action should be taken.

Recommendations for information on mitigation or adaptation strategies and requests for information on economic impacts of stressor changes were far less frequently mentioned. However, taken together, they make up almost a quarter of the information requests for the total sample. Many respondents requested copies of the scenarios to share with others. However skeptical a stakeholder might be of the extent of change projected, the scenarios brought potential climate change effects home to these respondents in a way that nothing else seems to have done.

It was a rare respondent who did not express surprise as an initial reaction to the scenarios. The extent of possible changes in stressors was one source of surprise, and responses tended to be one of three types: (1) "I don't believe (temperature, precipitation, sea level rise) will/can change this much; you are going to have to prove it," (2) "If they think this much change will occur, we need to start thinking about it too," or less often, (3) "I have already seen some of these changes but didn't know so much (change) was possible." The last was more likely to be in response to sea level rise projections than to either temperature or precipitation projections.

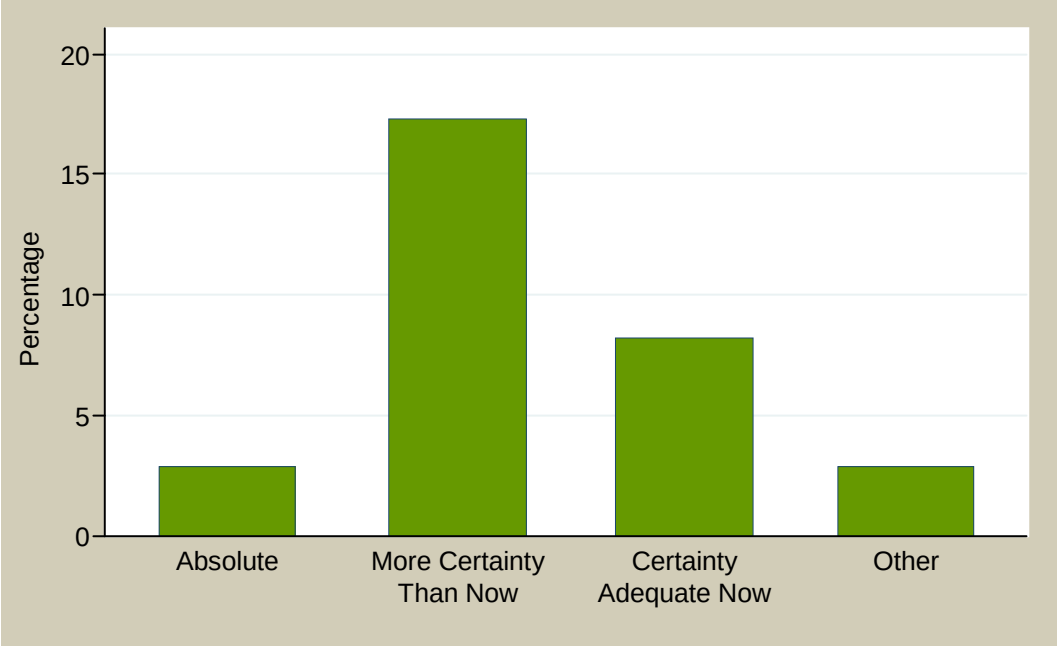
A second source of surprise was the fact that scenarios projected either significant increases *or* significant decreases in average temperature and rainfall. There was a certain amount of frustration expressed over this as well. For example, given the salience of water issues in these locations, a critical information gap for many respondents was the uncertainty of whether they are likely to face decreases or increases in rainfall and temperature conditions. Given a future in which these stressors could either increase or decrease, one might argue for building flexibility into any planning process. However, large scale projects, once set in motion, cannot be easily reversed. For example, a long lead time is required for permitting and building additional reservoir capacity and for negotiating water rights among various users of the source. Committing substantial portions of a state budget to projects like this on the chance there will eventually be significant decreases in precipitation, would mean cutting allocations for other needed projects. Implementing more water conservation measures would be feasible, if harder to sell to the public. For areas already dealing with inadequate water supplies, however, water conservation measures may not be sufficient in the face of greatly decreased rainfall. This kind of dilemma was behind at least some of the requests for information on effective adaptation and/or mitigation actions that can be taken. One focus group member summed up the relationship between certainty and information in the following way: "Because it's very difficult to deal with. I mean, we have a lot of people that—A lot of scientists are providing information that this is, in fact a phenomenon that exists. Um, it's the - the error bars around the rates are large…so it becomes difficult to understand how to use that information. A lot of the models aren't – are not really in existence that we can factor into the day-to-day decisions that we have to make."

Importance of Certainty

Respondents' desire for predictions of stressor impacts shown in Figure 4.34 is, in essence, a wish for greater certainty regarding the local impacts of climate change. When respondents were directly asked how much certainty they would need before acting on climate change information, the most frequent answers were classifiable as "more certainty than I currently have." However, almost as many respondents said there was enough certainty now to justify acting on the information available. In most conversations with respondents, it was not possible to clearly differentiate between statements about climate change as a large scale phenomenon and statements about the local impacts outlined in the scenarios. It is, therefore, difficult to say how many respondents were reacting to the certainty of climate change *per se* and how many to the rather wide error bars set for the local scenario stressors. Given the level of acceptance of climate change

indicated in Figure 4.14, it is likely that the need for more certainty expressed in Figure 4.36 refers primarily to certainty about the local impacts of climate change. This is borne out in part by differences among the research locations in the certainty required for action. Louisiana respondents, with their emphasis on sea level rise, were the most likely to indicate that there is adequate certainty now for action, and in fact action is overdue. Florida respondents were also more likely to believe the current level of certainty to be adequate. Wave 2 respondents in Texas, wanted more certainty than is currently available.

Figure 4.36
Level of Climate Change Certainty Needed: Wave 2 Interviews



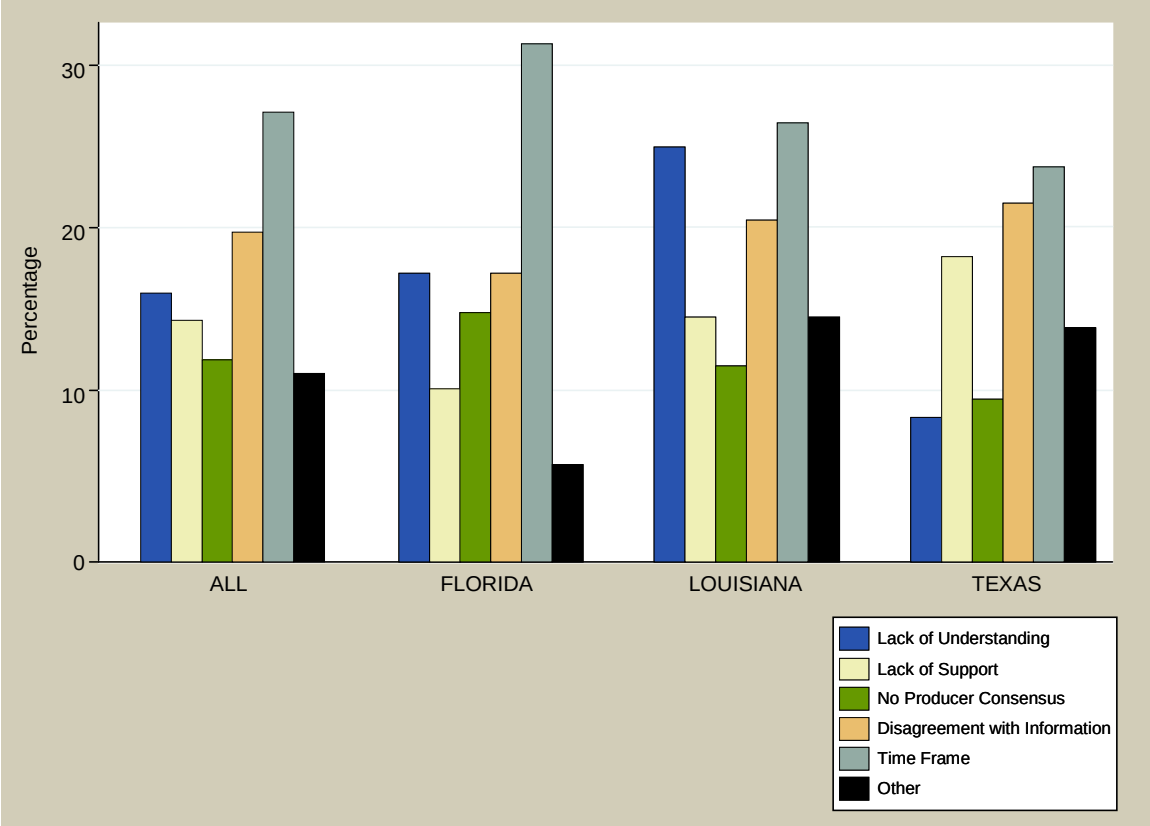
N = Wave 2 respondents = 243

Barriers to Information Use

In addition, useful data on the question of uncertainty and information came from an examination of interviews for material on barriers to information use. Figure 4.37 shows the distribution of coded comments indicating barriers to information use. Comments were varied, and many respondents made more than one kind of comment. The single most frequent comment had to do with the *Time Frame* required for significant climate-driven changes in the research locations. As indicated in the discussion of decision making barriers, the 50 and 100 year periods used in the scenarios yield dramatic changes in *Temperature*, *Precipitation*, and *Sea Level Rise*. However, they also make it easy for decision makers to put off the use of information for planning purposes because the most significant impacts will clearly be realized on someone else's watch.

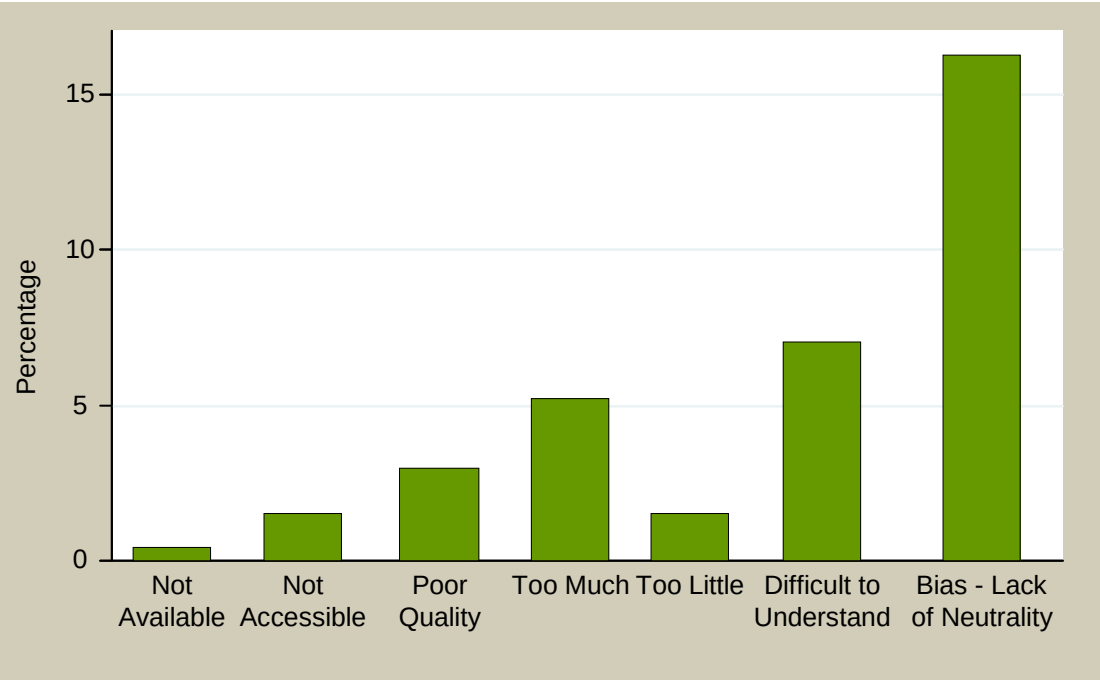
Lack of agreement or consensus among the producers of climate change information played relatively little part in discussions with respondents. Instead, disagreement on the part of the respondent with all or part of the climate change information discussed in the interviews was the second-most frequently mentioned barrier to using climate change information. A common explanation for this lack of agreement was the belief that climate change information is politically driven (i.e., biased) – in this case by environmental interests – and is, therefore, unreliable. Lack of understanding of climate change information was also a frequently mentioned barrier, comprising a low of 8.79% of responses in Texas to a high of 25.37% of responses in Louisiana.

Figure 4.37
Barriers to Using Climate Change Information: Wave 2 Interviews by State



N = Wave 2 respondents by state = 243 (ALL); 85 (FL); 67 (LA); 91 (TX)

Figure 4.38
Barriers to Information Use: Wave 1 Interviews

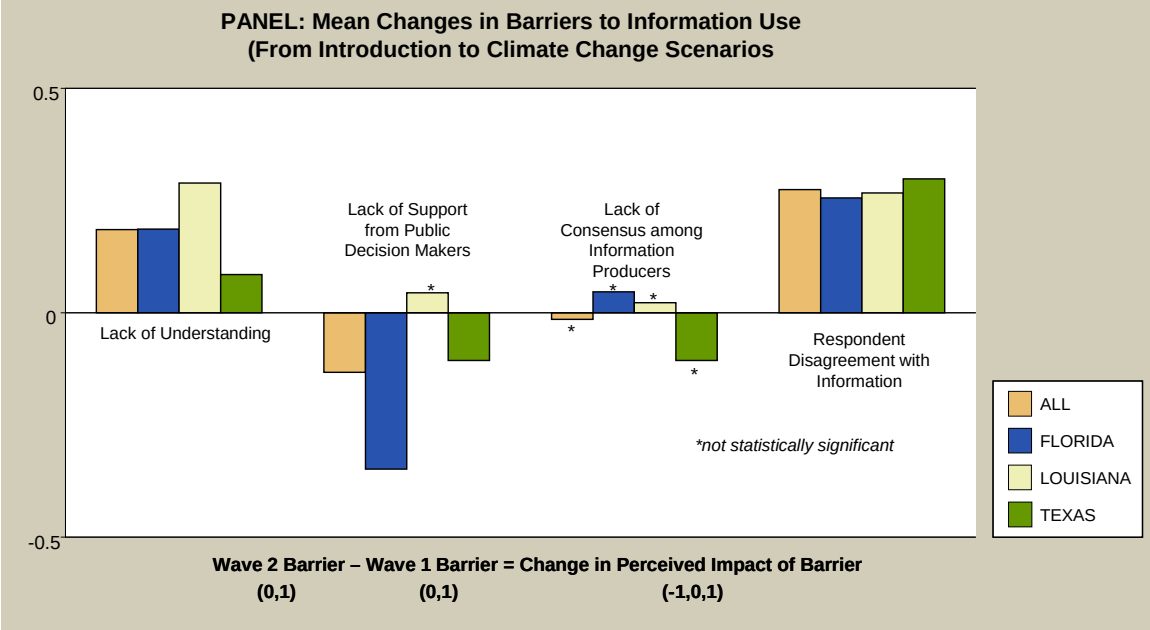


N = Wave 1 respondents = 271

Figure 4.38, allows a comparison with Wave 1 perceptions of barriers to the use of science-based information. Wave 1 respondents appeared to be relatively satisfied with the information they used to address local problems. Less than 10% of responses were complaints about information *Not being Available*, *Not Accessible*, of *Poor Quality*, or *Difficult to Understand*. The most frequent response, but one made by less than a fifth of respondents, is the perception that there is *Bias or a Lack of Objectivity* in the science information available. It has already been pointed out that in focus groups, numbers of participants also referred to perceived bias and evidence of the political manipulation of science that has engendered a perception of scientific information as politicized information. This was a thread that ran through both Wave 1 and Wave 2 interviews. At times, this took the form of comments that environmental agencies have agendas they push through the information they make available. At other times, the comments focused on the agendas of special interests that unduly influence scientific reporting.

Figures 4.37 and 4.38 speak to the perceived trustworthiness of science information. To acquire more direct information on this, focus groups were asked about the sources of climate change information they trusted the most. In spite of reservations about growing bias in science, these groups overwhelmingly trust "scientists with good reputations." Their trusted sources ranged from large agencies like NOAA to research consortia such as the Texas Environmental Research Consortium and foundations like Pew. Agency personnel also read peer-reviewed science publications. Most said that they relied on multiple sources for science information. The *Media* were frequently singled out as an information source that often "gets it wrong."

Figure 4.39
Barriers to Information Use: Wave 1-Wave 2 Interview Comparisons



N = Panelists = 135 *(Matched pairs analysis revealed significant changes at the .05 level for "lack of understanding" and .01 level for "disagreement with information.")*

In Wave 1, respondents were asked about barriers to using science-based information to address local problems. In Wave 2, a sample of the same individuals was asked about barriers to using climate change information to address issues of local climate change impacts. Similar categories of barriers were mentioned by this Panel in both waves, but their relative importance changed with the introduction of climate change. A measure of the change in an individual's opinion was obtained by classifying his/her responses as binary outcomes and then subtracting the Wave 1 response from the Wave 2 response (Figure 4.39). *Difficulty Understanding the Information* increased with the introduction of climate change as did *Respondents' Lack of Agreement* with the information provided. In spite of fairly widespread acceptance of climate change as a global trend, acceptance of some of the local impacts is more problematic.

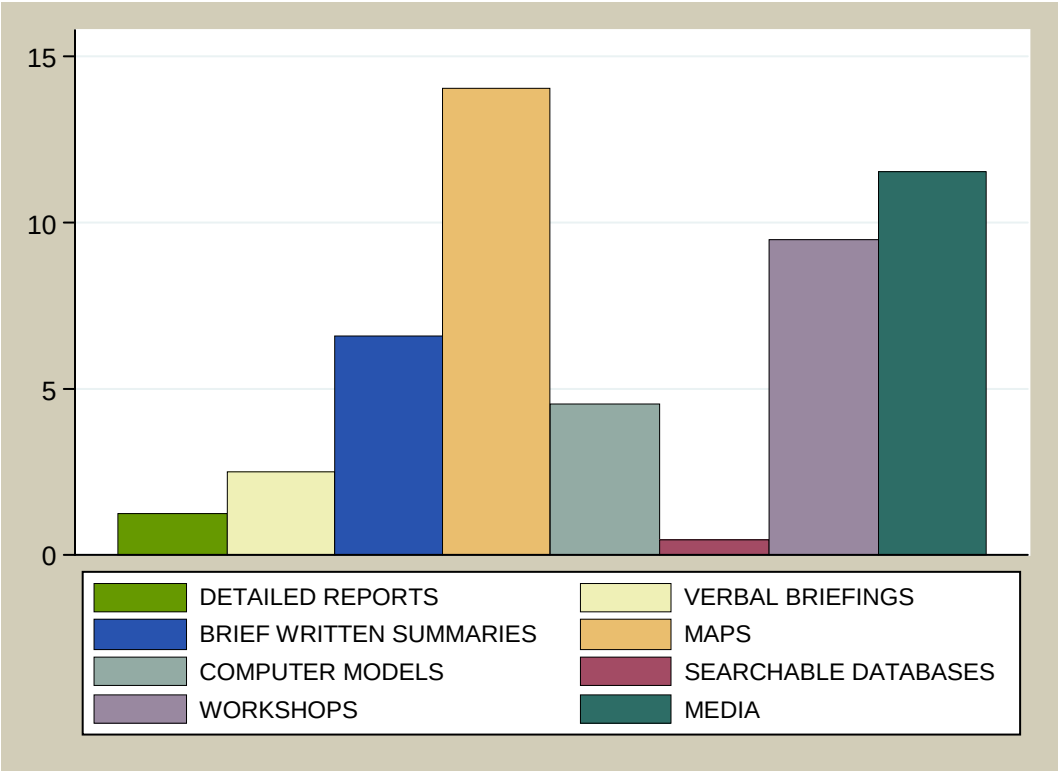
Focus group participants reiterated many of the points made above. They argued that both decision makers and the public find climate change information difficult to understand, particularly as it applies locally. Both groups have other, more immediate, concerns and fail to see the connection between climate change and some of those problems. According to one focus group participant:

> We don't understand enough about what's going on with climate change, and there are so many variables – there are so many things that make that such a difficult science that it kind of takes away credibility from that science, which is probably why there is this underlying current of 'Well, I don't think that's really true.' 'Because there are so many variables and things that are uncertain." In addition, 'We are trying to go as a society from where we are today to controlling CO2, and we skipped a step, which was: 'Climate is changing.' And most people hadn't – it hadn't sunk in that climate is changing and I don't think you can get the CO2 controlled, seriously before you really believe the climate's changing. And we've skipped that step.

Preferred Formats for Climate Change Information

Wave 2 respondents were asked to discuss the formats they thought would be most useful for the transmission of information on climate change. Those responses are shown in Figure 4.40. By far, the most useful format was thought to be *Maps* showing stressor changes, especially if changes over historical time as well as projected changes could be included. This would be a laborious representation to develop, but the impact of a visual format would be greater than for any other. The utility of such GIS mapping is increasingly recognized for its contribution to collaborations and agency decision-making (Farris et al., 2005).

Figure 4.40
Preferred Information Formats: Wave 2 Interviews



N = Wave 2 respondents = 243

The second- and third-most favored formats were *Workshops* and *Media* coverage respectively. *Maps* and *Media* coverage (radio, television, newspaper) are formats that can compress large amounts of information into relatively small frameworks. *Workshops* also represent focused means for the transmission of information that can be scheduled as part of work days. In contrast, *Detailed Reports* and *Searchable Databases*—the least favored formats—require more effort and time commitments from decision makers and/or staff if they are going to be used. While not covered in this summary of findings, organizational barriers to information use were also coded, and time and lack of adequate staff were cited by substantial numbers of respondents as problematic. Generally speaking, as ease of access to adequate information increases, so does its use.

Focus group participants made some very specific recommendations about effective ways to communicate information on climate change. Because these recommendations were presented as lists or recipes for success, they are presented in bullet form below.

- Change the terminology and be consistent with it. "Global warming" is a term that makes the phenomenon something that happens somewhere else, and most people live locally, not globally. In addition, it seems inaccurate to most people, because the bigger picture includes cooling in some place

and warming in others. A much better term would be Climate Change. This term can be used to encompass all the effects that need to be discussed.

> And I don't like the word, global, because it doesn't matter to me what happens on the other side of the planet. We need to be thinking regional climate change. Secondly, we need to be thinking the words, climate change, not global warming. We've got to get out of the mindset, because global warming focuses on the word *temperature*, and in our area a 2 degree temperature change is not nearly going to be as devastating as a 20% change in rainfall or a 15% change in hurricane frequency.

- Effective communication of information on climate change needs to be made an understandable part of locally salient problems, rather than an add-on. One approach will not fit all locations. The focus group participant quoted below communicates the sense of urgency that stakeholders feel about important coastal problems as well as a tendency to see climate changes as somehow separate from them.

> That is what concerns me. It is [a] laudable goal that EPA wants to inform, educate, or identify a particular reason why more people aren't addressing this particular issue. But if you are looking at global climate change as the monster in the closet that you're trying to point to . . . we're somewhat biased, because we're experiencing it. We still have subsidence. We still have coastal erosion. We still have the primary problems that put us in the condition we are in right now. So yes, global climate change is an issue. It is a factor. But separate and apart from everything else that is going on, it is one among many of the concerns that we need to address down here.
>
> If we can personalize the message from EPA—personalize it to the oystermen out there on the boat, to the commissioner up behind the bench, so that we could say this is what the EPA has to offer for ….County and the citizens of …County or wherever it may be.
>
> It has to hit home more so than an Al Gore film. It has to be something that catches their eye, catches their heart . . .

- Focus on things that can be done. Sea level rise is the single most salient stressor in all locations and also the one that is easiest to document.

> My point is that a decision maker will, I think be more receptive to 14 billion dollars for restoration project as a result of the hurricanes than putting the 14 billion into global climate change things. These [are] things they can do something [about], they can see things. Global climate change is on the screen, but our people down here are going to be thinking about building levees and building marsh. Those things are more important to them simply because they are more tangible to them.

- Show real interest and stay on message. EPA's leadership was seen as very important as was leadership at the presidential and Congressional levels.

> Come to the meetings! Sit down, really listen and TALK! Don't just send a staffer who can't say a word. You know, 'cause usually that's what happens. They send staff who are either junior level or just not equipped to respond to any kinds of questions or anything…. And that's really come to be the representation of the EPA….Be an active participant. So you gotta get it on the national dialog. That starts at the top. It has to come from the top."

- Involve the local population as well as the local decision makers. The most trusted information source is the one you know. The Agricultural Extension model was given as an example of a model that is grass roots in nature – small-scale, involving locally known and respected people, bringing in experts when needed, and focusing on the broad base of users.

- Economic considerations (or potential disincentives) need to be part of the solution package.

> You get people's attention when you start saying…the State of Texas is gonna lose a hundred billion dollars of taxable value in property over the next fifty years because of climate change.
>
> I would think that …you'd have to have a change in the insurance structure, which…it drives the pocketbook.

- Work with the media. Even though many of our stakeholders criticized the media for inaccurate reporting, they are obviously an important information source for many people. Media representatives suffer from the same tendencies as the rest of the population to be confused by seemingly conflicting climate change evidence and to view it as something taking place elsewhere.

SUMMARY OF WAVE 2 EVIDENCE

Even though climate change is not a salient issue among the Gulf of Mexico stakeholders interviewed for this project, most stakeholders have been exposed to information on it, and there is a relatively high level of acceptance that some changes are occurring. The media are the primary source of information on climate change for these stakeholders with government and academic sources as the second and third-most frequently mentioned sources.

The response to the scenarios developed for each location is more mixed. Negative reactions seem to stem from 3 primary sources. (1) The changes projected in the scenarios for the 50 and 100 year periods covered by them are dramatic and difficult for some respondents to accept. (2) While the inclusion of both potential increases and potential decreases in precipitation and temperature reflects the state of the science at this point, this is frustrating and difficult for some stakeholders to understand. (3) A substantial number of stakeholders attributed recent historical changes in precipitation, temperature and storm frequency to normal weather variation rather than to climate change. Sea level rise is the most readily accepted stressor change and the one most frequently mentioned as having the potential to exacerbate existing problems. It is also the climate-related change that respondents are more likely to have experienced personally and the least likely to be attributed to weather variation.

In spite of a mixed reception, virtually all respondents were able to discuss links between scenario projections and local environmental and/or development problems. Impacts of stressor changes on endpoints were seen by the majority as having the potential to worsen existing conditions, such as water scarcity and coastal erosion. Furthermore, most believe that if scenarios are even reasonably accurate, decisions related to climate change need to be made, and among Louisiana stakeholders there is a strong sentiment that decisions (and action) are long overdue. The responsibility for climate change decision making is perceived as a shared one. Respondents believe that local, state, and federal governments should all be involved and that citizens should have more involvement than special interests. Nevertheless, respondents recognize that there are barriers to making climate change-related decisions. These barriers to the necessary decision making include: possible serious economic consequences of action, the long time frame required for significant changes to occur, and political issues that range from lack of leadership through the influence of special interests to jurisdictional issues.

The solutions most respondents mentioned involved adaptation rather than mitigation. Even though mitigation is the response strategy that has been most often mentioned in the media coverage of climate change. Technical and social/policy approaches to adaptation dominated the suggestions and were primarily focused on the climate change impacts that could be anticipated locally.

The majority of respondents believe that additional information on climate change is required if necessary decisions are to be made. Few organizations are actively involved in discussions of climate change, and the content of organizational websites indicates virtually no cognizance of a link between organizational missions and projects and climate change. No governmental bodies are seriously discussing climate change as part of their decision or planning process. This may be why more respondents believe that information is needed for others than for themselves.

Specific types of information needed in order of importance are (1) predictions of stressor changes at the local level, (2) proof of climate change and/or documentation of local changes in stressors (3) indicators of the economic impacts of action and inaction, and (4) recommendations for effective adaptation or mitigation strategies. The long time frame in which changes in stressors are couched, is seen as the primary barrier to using climate change information. Lack of agreement either over the reality of climate change or over the details of the changes themselves is a second kind of barrier respondents see to information use. Finally, understanding the climate change information is the third most frequently mentioned information use barrier.

There is great agreement among stakeholders on the preferred format for information. Respondents would like to see maps and figures similar to those used in the scenarios. Ideally, these maps would show historical change as well as projected changes in the various stressors. Good media coverage was the second-most mentioned format, and workshops that would focus on climate change and its relevance for the area were third.

- Most Gulf decision makers have been exposed to climate change information. We know that the most pervasive form of this information available is newspaper coverage. This tends to be general climate change information. Respondents confirm that the media are an important source for climate change information. However, government and university sources are also important for a small portion of respondents.
- Most of our sample of stakeholders appear to accept the reality of climate change although a significant proportion have questions and/or reservations about the specifics of projected changes at local levels (scenarios).
- With the exception of sea level rise, many respondents attribute stressor changes to weather cycles rather than to climate changes.
- Most respondents are able to (1) discuss the links between scenario projections and local problems and (2) foresee potential impacts of stressor changes on these problems. Furthermore, most believe the changes outlined in the scenarios would worsen existing problems.
- Sea level rise is the stressor most frequently mentioned as having the potential to exacerbate existing problems. This is particularly true in Louisiana. In Florida and Texas sea level rise is also important, but changes in precipitation and temperature also figure in discussions.
- The majority of respondents believe that if scenarios are even reasonably accurate, decisions need to be made and action taken.
- Potential solutions mentioned by respondents are varied because the specific problems important to individual respondents are varied. However, technical solutions and social-policy solutions dominate the responses.
- Perceived responsibility for climate change decision making generally reflects current decision making structures in each location. However, respondents also see more of a role for citizens and less of a role for special interests in climate change decisions/action than exists in current decision networks.
- Most respondents believe that major barriers to decision making exist. The most frequently mentioned barriers were economic consequences of action, the long time frame required for significant changes to occur, and political issues of various kinds. The relative importance of these barriers varies among the research locations.
- Most respondents believe that additional information on climate change is needed. Because relatively few organizations are engaged in serious consideration of climate change, more respondents believe that information is needed for others than for themselves.

- Dominant barriers to the use of information on climate change included the long time frame required for significant changes and consensus/agreement, although this was expressed in different ways. Lack of understanding was the third most frequently mentioned barrier.
- Specific types of information needed include, in order of importance: Predictions of stressor changes at the local level, proof of the reality of climate change and/or documentation or proof of scenario projections, economic impacts of changes, recommendations for effective adaptation or mitigation strategies.
- Preferred information formats stress maximum impact with minimal investment of time. Maps of changes and figures similar to those used in the scenarios were the most preferred. Good media coverage was the second-most mentioned format, and workshops were third.

Chapter 5

Conclusions & Recommendations

INTEGRATION OF KEY FINDINGS AND RECOMMENDATIONS

Salience of Climate Change and Relevance to Local Problems

Findings

At the time of the Wave 1 interviews, climate change was not at the forefront of stakeholder concerns. Even though climate change has received increasing amounts of coverage in both regional and national newspapers, it was not seen as contributing to the primary problems of the three research areas studied. By the time focus groups were held, Gulf residents had experienced the dramatic 2005 storm season, and according to focus group participants, this season and hurricanes Katrina and Rita served as events that raised the profile of climate change somewhat. However, even in Louisiana – the area most dramatically affected by Hurricane Katrina - climate change was seen as only one of several factors contributing to local problems. The same was true of Florida respondents. In Texas, the area least affected by severe storms in recent years, the 2005 season was not seen as contributing much to an increased awareness of climate change. Most focus group participants credited the media, rather than local populations, with making the storm-climate change link.

Although there was little reference to climate change in any of the research locations, stakeholders in each of them described local problems largely in terms of endpoints, such as availability of fresh water and ecosystem changes like wetland loss. Their views of problems were generally complex and nuanced. By and large, stakeholders identified human activity of various kinds as the primary causes of endpoint changes. However, they also realized that the impacts of these changes extend beyond the human population and that any given solution to them is likely to result in both positive and negative outcomes for human and non-human groups.

Recommendations

1. *The Environmental Protection Agency and other agencies, such as NOAA, should begin to make linkages between potential climate changes and the future scope and severity of problems that are most salient for particular locations.* Research findings suggest that the salience and complexity of local problems are such that climate change cannot be added to them as a separate set of issues and will be ignored if it is. If climate change is to become an integral part of the planning process around the Gulf of Mexico, it needs to dovetail with locally salient problems and conditions, particularly as it affects endpoints though changes in stressors like sea level rise.

   In Louisiana, for example, land loss—including the loss of barrier islands—and the resulting vulnerability of human populations and economic resources will almost certainly be exacerbated by *Sea Level Rise* and any increase in *Storm* frequency or severity. In Florida and Texas land loss problems are present but not as severe as in Louisiana. However, population growth generally and coastal *Development* particularly are affecting the integrity of coastal systems and also reducing freshwater for both human and *Ecosystem* use. Possible changes in *Temperature* and *Precipitation* will have obvious impacts on the growing problem of *Water Availability* and *Quality*. Educational efforts with regard to climate change have a base on which to build. It is already on the radar screen, and an accumulation of events, such as Hurricane Katrina, the airing of *An Inconvenient Truth*, firmer conclusions on climate change by the IPCC, and initiatives already taken in states like California, have brought it nearer the average person. However, Gulf stakeholders are so focused on dealing with local problems that climate connections with issues like coastal erosion, storm protection, and beach development are not readily made.

2. *Approaches will need to be tailored to each location and based on more than a superficial knowledge of the area.* As stated above, EPA should focus on problems that are already salient, treating climate change as a process with powerful multiplier effects. The problems are not just *Environmental* in nature, they are *Human/Political/Environmental* problems. At all three research locations, stakeholders' concerns include many of the same endpoints (e.g. fresh water). Within these broad categories, however, there are important differences that are associated with environmental characteristics, population characteristics, access to economic resources, and the unique political climate of each place.

   For example, in Louisiana, *Subsidence* and *Human Intervention* have already contributed to significant coastal erosion and increased vulnerability to *Storms*. Populations in danger of displacement or already displaced tend to have fewer economic and social resources, and the sense of urgency is greater. In this location, the traditional dependence on the oil and gas industry makes it a powerful interest group. In contrast, Florida has experienced less dramatic land loss. Although there is a local population traditionally dependent on the fisheries for a living, there is also a growing population of educated and well-to-do coastal residents who value the area for its natural attractions and whose skills can also be tapped to influence policy. Interviews and focus group sessions suggest, however, that all interested parties need to have a better understanding of the long-lasting effects of human action on natural systems and to realize that they have a common stake in protecting the system. The Texas situation is similar to Florida's in many ways: changes to the coast and its *Ecosystems* have been less obvious than in Louisiana; there is a mixture of long-time and new residents and an even greater mixture of interests and socioeconomic groupings. In all three locations, the economic impacts of change will be an important consideration, and a tension between individual rights and the common good will underlie almost any discussion of change.

3. *Establish a long-term EPA presence in the area.* To be successful at the local level, EPA will need to have a long-term presence at that level. This could be accomplished by EPA personnel being located in what are considered critical areas and/or by bringing locals into frequent contact with EPA regional personnel.

Decision Making to Address Local Problems in a Climate Change Context

Findings

Stakeholders believe that if scenarios are correct, decisions relevant to climate change are needed. The question of who should make these decisions is answered in remarkably similar ways at all locations. Wave 1 respondents were asked to list the key actors responsible for addressing the important problems of the area, and Wave 2 respondents were asked who *should* address problems related to climate change. In many respects these lists are the same. Federal, state, and local governments are seen as sharing responsibility. The relative importance of each government actor varies according to the unique distribution of power in each location. In the case of climate related decisions, however, stakeholders see a somewhat smaller role for *Special Interests* and a larger one for *Citizen* input. Stakeholders see citizen input and participation as legitimate, and from a practical point of view citizen engagement can provide the *Feedback* that fuels official action. In other words, elected officials will be much more likely to act on climate change scenarios if the electorate is sending signals (*Feedback*) that this is an important issue for them. Scientists are seen as having a relatively small role in current decision making and a small one in climate change decision making. That role is provider of trustworthy information and advice.

What is lacking, according to stakeholders, is leadership. Federal agencies are seen by many stakeholders as having been lax in the rigorous application of existing environmental standards. State and local levels have followed their lead, influenced by special interests. Some stakeholders went so far as to say that the solutions to some climate-related problems already exist in current regulations and only need to be applied (e.g. destruction of barrier islands and wetlands, and a variety of other water issues). In the case of climate change, leadership at the federal level is seen as even more critical, although the meaningful inclusion of states and localities in agenda setting and solution-development is extremely important. Because climate change is

rooted in causes that are beyond the ability of any single location to address and because there is uncertainty about its local effects, most stakeholders responding to questions about this aspect of the issue believe that information and direction on how to proceed must come from the federal level if any action is to be taken, although state and local leadership must be involved in finding local solutions. Communities want to have some control over and participation in their policy destiny, even when the laws and regulations apply only to federal jurisdictional resources and issues. The emphasis that stakeholders put on collaboration and coalition building is illustrative of this partnership.

What are the decisions that are needed? Decisions about land use, water use, and infrastructure placement all emerged in the interviews as endpoints decisions that are called for. When asked about potential solutions to problems created or exacerbated by climate change effects, stakeholders' responses were varied, reflecting the varied nature of the organizations they represented. Most suggestions were about adaptation to anticipated changes rather than about mitigation of climate causes. Mitigation is seen as beyond the capabilities of local areas acting alone even though some states have taken the initiative to introduce mitigation programs. California is one example, and Florida voters' efforts to stop the building of another coal-burning power plant would be another. Nevertheless, adaptation was the approach emphasized by our stakeholders, using a combination of technical and social means. Their emphasis on adaptation stands in direct contrast to newspaper coverage that has emphasized mitigation.

Respondents were very clear about the barriers that exist to making the necessary decisions. At the top of the list in Texas and Florida are the long *Time Frame*, *Economic Considerations*, and *Political Issues* of various kinds, with Florida respondents mentioning *Time Frame* most often and Texas respondents mentioning *Economic Considerations* only slightly more than *Time Frame*. In Louisiana, *Economics* and *Political Issues* dominated stakeholders' concerns about decision making. It was also in Louisiana that stakeholders expressed the most frustration over delays in acting to address problems while additional studies are done.

Recommendations

1. *Decision making structures that stakeholders are familiar with already exist, and EPA needs to work with and within them.* The same networks and many of the same groups mentioned by respondents as they discussed their *Environmental* and *Development* problems will also take part in climate related decisions. This kind of partnership with local areas will require more knowledge of the area, its decision processes, and its key decision makers than could be provided by this project. The downside to this kind of integration is that existing decision making systems will continue to bear the characteristics that currently act as barriers to effective problem solving, such as lack of coordination, influence by special interests, and budgetary constraints.

2. *Solutions need to be tailored to the needs of the local area and its dominant problems.* Stakeholders identified *Consensus and Coalition Building* as the most important element in evaluating and implementing a solution of any kind. This kind of activity will be especially important to hammering out plans that will inevitably favor some interests over others. It will also be critical given the importance that stakeholders attach to *Value Acceptability* as a factor in the selection of solution alternatives.

3. *Keep the focus on human responsibility.* Currently, Gulf stakeholders tend to see human activity as the root of many of their environmental problems. If the burden of responsibility is shifted to climate change—a process seen by most as beyond our capacity to change – planning and action will seem futile.

4. *Help provide the leadership that is needed at the federal level to address climate change issues.* Because of recent changes, this is a task that should become easier. Unfortunately, part of the task of providing leadership will also involve improving the image of government agencies and of the science enterprise. Many stakeholders expressed skepticism about the "purity" of science, maintaining that science can be bullied and bought.

5. *Understand that each community or locality is unique, socially, ecologically, and politically, and integrate this understanding into outreach approaches and interactions*. This research has highlighted the problem of using a one size fits all approach when dealing with localities. It is necessary for federal agencies to understand more about the context of the localities wherein they seek to influence local policy or implement federal policy. A sensitive and meaningful recognition of the unique aspects of communities would go a long way toward remedying problems of rapport, thereby increasing potential for consensus-building and collaboration.

Information for Decision Making

Findings

Stakeholders saw *Budgetary Considerations* as the factor with the most power to influence whether or not an issue reaches the public agenda. In addition, *Feedback* from both inside (other agencies, other government levels) and outside (e.g. public interest groups, the electorate) the government that a problem is important had almost as much power. Objective information that a problem will have significant and widespread impacts is a direct indicator of an issue's importance and critical link between Indicators and Feedback. Consistent and trusted information on the potential impacts to the local area of climate changes is lacking.

When presented with the climate change scenarios, most interview respondents were readily able to extrapolate from them to their implications for local problems. Furthermore, stakeholders were able to talk about the impacts of combinations of stressors. Although there is a relatively high level of acceptance for climate change generally, there were reservations about the scenarios. The criticisms of the scenarios focused largely on one or more of three concerns:

- The accuracy of the scenarios, including a need for more information on the kinds of data used to develop them and the probabilities or error bars involved. For Florida and Texas particularly there was a tendency among some stakeholders to see projected changes in *Precipitation*, *Temperature*, and *Storm* severity as "weather" rather than climate.
- Even among stakeholders who accepted that there might be climate trends in *Temperature* and *Precipitation*, there was frustration over the fact that for these stressors, scenarios included the potential for both significant increases and significant decreases. This compounds the complexities of planning.
- The *Time Frame* in which scenarios were expressed was not seen as useful. Fifty and 100-year periods both exceed the planning frames of most decision making bodies and make it easy to put off its inclusion in decision making/planning activities.

Sea Level Rise was the single most frequently mentioned stressor having the potential to exacerbate important local problems. It is also the easiest stressor to document historically and to project into the future as well as the one most likely to have been experienced personally. It is also the only one that is unidirectional—it only goes up. Finally, it is the only stressor that stakeholders are unlikely to attribute to weather variation rather than to climate changes.

In weighing action alternatives, stakeholders were convinced that there would be winners and losers, whatever the solution. They were also very concerned about the economic consequences of action or lack of it. Many respondents believed that it was the *Economic Considerations* alone that would tip the balance between action alternatives.

Recommendations

Overall, the response to scenarios point up important information gaps.

1. *Stakeholders want more information, and the information most in demand is information on climate change predictions. Furthermore, to be most useful, climate change information needs to be location specific.* We are aware of *Sea Level Rise* maps generated for EPA and of the many difficulties of projecting *Sea Level Rise* for un-surveyed elevations and for shorelines that are in a continual state of change. Nevertheless, this is information stakeholders believe they are most in need of.
2. *Start with Sea Level Rise.* It is the stressor most frequently mentioned as having the potential to worsen important local problems. It is also the easiest to document historically, the most likely to have been experienced, and it is unambiguous in its direction – up. In the absence of highly accurate inundation maps, would historical trends be useful in communicating a sense of incremental change? If so, dissemination of information on long-term historical trends in all the stressors might also assist in illustrating the difference between weather and climate. This is a source of confusion for many stakeholders and one that is a barrier to the acceptance of potential climate changes.
3. *Information also needs to be presented in a time frame more relevant to decision makers today.* If sea level in Apalachicola is expected to rise by 1 inch over the next 15-20 years, it would be ideal if stakeholders had information on expectations that involve this shorter term rise. Even better would be information on what such a short-term rise would mean for important elements in their lives, such as existing shorelines, changes in grass species and salt water intrusion into fresh water wells. The more dramatic changes predicted in the 50-year intervals represented in the scenarios are also relevant, but without some sense of short term, or incremental change, these long-term trends are too distant in time to evoke action now. If tipping points could be identified, they will lend power to shorter-term predictions.
4. *Stakeholder requests for clarification and documentation of scenarios suggest that information needs to be clear, consistent and well-documented.* This kind of presentation might assist in reducing general skepticism about climate change information. Focusing first on the most easily documented stressor – *Sea Level Rise* – could also heighten the sense that greater certainty exists. We assume that as data are accumulated and models improve, projections of *Precipitation* and *Temperature* changes will also become more certain and easier for the lay person to understand. If science were only to establish that the most likely change with regard to *Temperature* is a general increase, it would greatly facilitate stakeholder planning. Given their importance to issues of future *Water Availability* and *Quality*, a better understanding of *Temperature* and *Precipitation* is critical.
5. *Information is needed on the potential economic impacts of (1) doing nothing, as well as on (2) various plans of action.* One of the most important barriers to agenda setting and decision making is an economic one. There is a general sense that any change to address climate trend issues will inevitably have negative economic consequences for an area. This is the case whether the change is a demand for emissions reduction, limitations on coastal building, or re-establishing marshland. However, there is a lack of actual cost-benefit studies for specific areas.
6. *Visual representation of stressor changes and their impacts is the most powerful kind of information and should be utilized whenever possible.* Information formats should also accommodate the time limitations that most decision makers must deal with. Clarity and ease of access are keys, but there must be ample documentation for those who want it.
7. *Work with the media.* The *Media* are obviously an important source of information for decision makers as well as the general public. However, the regional *Media's* portrayal of climate change and action options has emphasized a global, rather than a local, view. It would appear that regional *Media* have been following the lead of newspapers that have a more national audience. Newspapers and other news *Media* want a story and want it to be pertinent to the target audience. Work with local experts and influentials, give them what they want – a climate change story that does not come from the *New York Times*.

Recommendations for the Future Research

1. Continue to work on the problems of prediction and representation. For example, utilizing local expertise to identify critical but relatively small geographical areas, EPA could work with local individuals/groups to do surveying required for modeling potential human-environment interactions and evaluating different approaches for dealing with sea level rise. Even these small scale studies, if widely disseminated, could elevate climate change salience and generate more careful assessments in other locations.
2. Conduct more research into a local population's attitudes toward different aspects of climate change and their willingness to make lifestyle changes. These could be meta studies of existing surveys or new ones. Given the importance of *Feedback* from the general population and the fact that efforts to either mitigate or adapt to climate changes will affect them, this kind of information is important background to policy making.
3. Evaluate the effectiveness of mitigation and adaptation strategies currently being put into place: their goals, their short-term impacts, and the economic and social consequences.

References

Agency for Workforce Innovation. (2006). *Florida labor market trends*. Tallahassee, FL: Agency for Workforce Innovation. Retrieved 16 June 2006, from http://www.labormarketinfo.com/library/pubs/trends/trends-june162006.pdf

Barry, D. (2006, June 19). In Louisiana, a sinking island wars with water and the government. *New York Times*.

Baumgartner, F.R., & Jones, B.D. (1993). *Agendas and instability in American politics*. Chicago: University of Chicago Press.

Belsie, L., & Axtman, K. (2006, June 12). Post-Katrina, New Orleans coming back more Hispanic. *Christian Science Monitor*. Retrieved 13 November 2007, from http://www.csmonitor.com/2006/0612/p01s03-ussc.html

Berger, E. (2006, February 20). Task force recommends stronger state oversight of evacuations. *Houston Chronicle*.

Best, J. (1989). Images of issues: Typifying contemporary social problems. New York: Aldine de Gruyter.

Birkland, T. (1998). Focusing events, mobilization, and agenda setting. *Journal of Public Policy, 18*, 53-74.

Boykoff, M.T., & Boykoff, J.M. (2004). Balance as bias: global warming and the US prestige press. *Global Environmental Change Part A, 14*, 125-136.

Census Scope Education Statistics. (2007a). *Florida – Educational attainment*. Retrieved 13 November 2007, from www.censusscope.org/us/s12/chart_education.html.

Census Scope Education Statistics. (2007b). *Louisiana – Educational attainment*. Retrieved 13 November 2007, from http://www.censusscope.org/us/s22/chart_education.html.

Census Scope Education Statistics. (2007c). *Texas – Educational attainment*. Retrieved 13 November 2007, from http://www.censusscope.org/us/s48/chart_education.html

Chen, E.C., & Gerber, J.F. (1990). Climate. In R.L. Myers, & J.J. Ewel (Eds.), *Ecosystems of Florida* (pp. 150-193). Orlando: University of Central Florida Press.

Cobb, R.W., & Elder, C.D. (1983). *Participation in American politics: The dynamics of agenda-building*. Baltimore, MD.: Johns Hopkins University Press.

Dearing, J.W., & Rogers, E.M. (1996). *Agenda-setting*. Thousand Oaks, CA.: Sage.

Enfield, D.B., & Mayer, D.A. (1997). Tropical Atlantic SST variability and its relation to El Niño-Southern Oscillation. *Journal of Geophysical Research*, *102*, 929–945.

Envision Houston Region. (2006). *Envision Houston + Region*. Retrieved 22 October 2007, from http://www.envisionhoustonregion.org/faqs.htm

Farris, M.T., Laska, S., Wesley, M., & Sternhell, R. (2005). Successful application of GIS technology for post-9/11 disaster management: Overcoming challenges, capitalizing on advantages. Special issue on GIS and risk assessment management. *International Journal of Risk Assessment and Management, 6*, 423-439.

Fiedler, J., Mays, F., & Siry, J. (Eds.) (2001). *Feeling the heat in Florida: Global warming on the local level*. New York: Natural Resources Defense Council.

Florida Department of Community Affairs-Division of Community Planning. (2003). *Division of Community Planning: Program summary*. Tallahassee: Department of Community Affairs.

Freudenburg, W.R., Gramling, R., & Davidson, D. (2007). Scientific Certainty Argumentation Methods (SCAMs): Science and the politics of doubt**.** *Sociological Inquiry, 78*, 2-38.

Galloway, D.L., Jones, D.R., & Ingebritsen, S. E. (1999). *Land subsidence in the United States*. U.S. Geological Survey circular, 1182. Reston, VA: U.S. Geological Survey.

Galveston Bay Estuary Program. (2002). *The state of the bay: A characterization of the Galveston Bay Ecosystem*. 2nd edition. Austin: Texas Commission on Environmental Quality.

Galveston Chamber of Commerce. *Economy*. Retrieved 19 October 2007, from http://www.galvestoncc.com/custom2.asp?pageid=204.

Glazer, B., & Strauss, A. (1967). *The discovery of grounded theory*. New York: Aldine.

Governor's Task Force on Conservation. (2000). *Taking care of Texas*. Retrieved 19 October 2007, from http://www.tpwd.state.tx.us/publications/nonpwdpubs/media/taking_care_of_texas_report.pdf

Greater Houston Partnership. *Houston Facts 2007*. Retrieved 18 October 2007, from http://www.houston.org/houston-facts/Houston-Facts.pdf.

Halfbinger, David M. (2002, June 3). Small catches, low prices and imports bedevil Louisiana shrimpers. *New York Times*.

Hendry, M. 1993. Sea-level movements and shoreline changes. In: G.A. Maul (Ed.), *Climatic change in the Intra-Americas Sea: Implications of future climate on the ecosystems and socio-economic structure in the marine and coastal regions of the Caribbean Sea, Gulf of Mexico, Bahamas, and the northeast coast of South America* (pp. 115-161). London: Edward Arnold.

Hilgartner, S. & Bosk, C.L. (1988). The rise and fall of social problems: A public arenas model. *American Journal of Sociology 94*, 53-78.

Hilgartner, S. (1992). The social construction of risk objects: Or how to pry open networks of risk. In J.F. Short & L.B. Clarke (Eds.), *Organizations, uncertainties, and risk* (pp. 39-53). Boulder: Westview Press.

Houghton, J. T. (2001). *Climate change 2001. The scientific basis: Contribution of Working Group I to the third assessment report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press.

House Research Organization. Texas House of Representatives. (2002). *Do counties need new powers to cope with urban sprawl?* Focus Report, no. 77-26. Austin: Texas House of Representatives. Retrieved 19 October 2007, from http://www.hro.house.state.tx.us/focus/sprawl.pdf.

Iyengar, S., & Kinder, D.R. (1987). *News that matters: Television and American opinion*. Chicago: University of Chicago Press.

Jones, B. D., & Baumgartner, F. R. (2005). *The politics of attention how government prioritizes problems*. Chicago: University of Chicago Press.

Jones, B.D. (1994). *Reconceiving decision-making in democratic politics: Attention, choice, and public policy*. Chicago: University of Chicago Press.

Jordan, L.A., Marcus, A.C., & Reeder, L.G. (1980). Response styles in telephone and household interviewing: A field experiment. *Public Opinion Quarterly, 44*, 210-222.

Kasperson, R.E., & Kasperson. J.X. (1996). The social amplification and attenuation of risk. *Annals of the American Academy of Political and Social Sciences, 545*, 95-105.

Kasperson, R.E., Renn, O., Slovic, P., Brown, H.S., Emel, J., Goble, R., et al. (1988). The social amplification of risk: A conceptual framework. *Risk Analysis, 8*, 177–187.

Kingdon, J.W. (1995). *Agendas, alternatives, and public policies*. New York: Harper Collins College.

Lafourche Parish. *Lafourche Parish code of ordinances, chapter 19. Planning and zoning*. Retrieved 10 October 2007, from http://www.lafourchegov.org/lafourchegov/CouncilCode/Chapter%2019.pdf

Lester, J., & Gonzalez, L. (2005). *Briefing paper on Galveston Bay Plan action items. Species protection*. Galveston Bay Status and Trends Project. TCEQ, Galveston Bay Estuary Program. Retrieved 22 October 2007, from http://www.galvbaydata.org/projects/reports/docs/BriefingPaper%20Sp_Protection.pdf

Liu, X., Lindquist, E., & Vedlitz, A. (2006). *Explaining U.S. media and congressional attention to climate change, 1969-2005: The effect of problem indicator, focusing event and scientific feedback*. Working paper. College Station, TX: Institute for Science, Technology and Public Policy, Texas A&M University.

Liu, X., Vedlitz, A., & Alston, L. (in press). Regional news portrayals of global warming and climate change. *Environmental Science and Policy*.

Liu, X., Vincent, K., Lindquist, E., & Vedlitz, A. (2007, November). *Agenda setting and alternative selection in local policy processes*. Paper presented at the 27th Annual Research Conference of the Association for Public Policy Analysis and Management, Washington, D.C.

Longman, J., & Brick, M. (2005, September 26). Waters recede, leaving a trail of frustration. *New York Times*.

Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority. (1998). *Coast 2050: Toward a sustainable coastal Louisiana*. Baton Rouge: Louisiana Department of Natural Resources.

Louisiana Department of Natural Resources. (2007). *Louisiana coastal facts*. Retrieved 12 October 2007, from http://dnr.louisiana.gov/crm/coastalfacts.asp

Louisiana Recovery Authority. *Louisiana Recovery Authority*. Retrieved 12 October 2007, from http://www.louisianaspeaks.org/

Mazur, A., & Lee, J. (1993). Sounding the global alarm: Environmental issues in the US national news. *Social Studies of Science, 23*, 681-720.

McComas, K., & Shanahan, J. (1999). Telling stories about global climate change: Measuring the impact of narratives on issue cycles. *Communication Research, 26*, 30-57.

McCombs, M.E., & Shaw, D.L. (1972). The agenda-setting function of mass media. *The Public Opinion Quarterly, 36*, 176-187.

McDaniels, T.L., Gregory, R.S., & Fields, D. (1999). Democratizing risk management: Successful public involvement in local water management decisions. *Risk Analysis, 19,* 497-510.

Morton, R.A., Miller, T.L., & Moore, L.J. (2004). *National assessment of shoreline change, Part 1. Historical shoreline changes and associated coastal land loss along the U.S. Gulf of Mexico.* St. Petersburg, FL: U.S. Geological Survey, Center for Coastal and Watershed Studies.

Nelson, B.J. (1984). *Making an issue of child abuse: Political agenda setting for social problems*. Chicago: University of Chicago Press.

Neuendorf, K.A. (2002). *The content analysis guidebook*. Thousand Oaks, CA: Sage Publications.

O'Brien, K. (2003, March 16). Prayers of the shrimpers. *New Orleans Times-Picayune*.

Peabody, R.L., Hammond, S.W., Torcom, J., Brown, L.P., Thompson, C., & Kolodny, R. (1990). Interviewing political elites. *PS: Political Science & Politics, 23,* 451-455.

Reder, S. M. (1998). *The State of literacy in America: Estimates at the local, state, and national levels*. Washington, DC: National Institute for Literacy. Available from Florida Geographic Data Library. Florida counties, Level 1 literacy rates. Retrieved 08 January 2007, from http://www.fgdl.org

Reinard, J.C. (2001). *Introduction to communication research*. Boston: McGraw-Hill.

Rochefort, D.A., & Cobb, R.W. (1994). *The politics of problem definition: Shaping the policy agenda*. Lawrence: University Press of Kansas.

Scavia, D., Field, J.C., Boesch, D.F., Buddemeier, R.W., Burkett, V., Cayan, D.R., et al. (2002). Climate change impacts on U.S. coastal and marine ecosystems. *Estuaries, 25*, 149-164.

Schattschneider, E.E. (1960). *The semisovereign people: A realist's view of democracy in America*. New York: Holt, Rinehart, and Winston.

Schleifstein, M. (2002, June 27). Coastal resuscitation: An ambitious 30-year plan would pump new life into south Louisiana's beleaguered coast and wetlands. *New Orleans Times-Picayune*.

Shanahan, J., & Good, J. (2000). Heat and hot air: Influence of local temperature on journalists' coverage of global warming. *Public Understanding of Science, 9*, 285-295.

Shanahan, J., & McComas, K. (1999). *Nature stories: Depictions of the environment and their effects*. Cresskill, N.J.: Hampton Press.

Shelton, S. (2006, December 19). 'Water wars' talks deadline extended. *The Atlanta Journal-Constitution*. Retrieved 10 January 2007, from www.ajc.com/services/content/metro/stories/2006/12/19/1220meshwater.html

Smith, J. (2005). Dangerous news: Media decision making about climate change risk. *Risk Analysis, 25*, 1471-1482.

Soroka, S.N. (2002). *Agenda-setting dynamics in Canada*. Vancouver: University of British Columbia Press.

Soroka, S.N. (2003). Media, public opinion, and foreign policy. *The Harvard International Journal of Press/Politics, 8*, 27-48.

Stephenson, D.S. (2000). The Tri-State Compact: Falling waters and fading opportunities. *Journal of Land Use & Environmental Law, 16*, 83-110.

Stone, D.A. (1989). Causal stories and the formation of policy agendas. *Political Science Quarterly, 104*, 281-300.

Strauss, A.L., & Corbin, J.J (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage Publications

Texas Commission on Environmental Quality. *Houston-Galveston-Brazoria eight-hour ozone nonattainment area*. Retrieved 17 October 2007, from http://www.tceq.state.tx.us/implementation/air/sip/hgb.html.

Texas Environmental Profiles. *Land in Texas*. Retrieved 18 October 2007, from http://www.texasep.org/html/lnd/lnd_5pub.html.

Texas Legislature Online. Retrieved 18 October 2007, from http://www.capitol.state.tx.us/Home.aspx.

Texas Workforce Commission. *Labor market & career information*. Retrieved 24 October 2007, from http://www.tracer2.com/cgi/dataanalysis/labForceReport.asp?menuchoice=LABFORCE

Trumbo, C. (1996). Constructing climate change: claims and frames in US news coverage of an environmental issue. *Public Understanding of Science, 5*, 269-283.

Turner, B.L., II, Kasperson, R.E., Matson, P.A., McCarthy, J.J., Corell, R.W., Christiansen, L., et al. (2003). A framework for vulnerability analysis in sustainability science. *Proceedings of the National Academy of Sciences, 100*, 8074-8079.

Twilley, R.R., & Reed, D. (2001). *Louisiana: State findings from confronting climate change in the Gulf coast region*. Washington, D.C.: Ecological Society of America - Union of Concerned Scientists.

Twilley, R.R., Barron, E.J., Gholz, H.L., Harwell, M.A., Miller, R.L., Reed, D.J., et al. (2001). *Confronting climate change in the Gulf coast region: Prospects for sustaining our ecological heritage*. ,Cambridge, MA: Union of Concerned Scientists & Ecological Society of America.

Tzoumis, K. (2001). *Environmental policymaking in Congress: The role of issue definitions in wetlands, Great Lakes, and wildlife policies*. New York: Garland Pub.

Ungar, S. (1992). The rise and (relative) decline of global warming as a social problem. *Sociological Quarterly, 33*, 483-501.

United States Bureau of the Census, & Inter-university Consortium for Political and Social Research. (1986). *Survey of income and program participation (SIPP). Wave IV rectangular file.* Ann Arbor, MI: Inter-university Consortium for Political and Social Research.

Wanless, H.R., Parkinson, R.W., & Tedesco, L.P. (1994). Sea level control on stability of Everglades wetlands. In S. Davis, & J. Ogden (Eds.), *Everglades: The ecosystem and its restoration* (pp. 199-223). Delray Beach, FL: St. Lucie Press.

Watson, R. T., & Albritton, D. L. (2001). *Climate change 2001. IPCC Synthesis report.* Cambridge: Cambridge University Press.

Williams, J.L. (2001). The rise and decline of public interest in global warming: Toward a pragmatic conception of environmental problems. Huntington, N.Y.: Nova Science Publishers.

Wood, B.D., & Vedlitz, A. (2007). Understanding issue definition: Information processing, social forces, and the politics of global warming. *American Journal of Political Science, 51*, 552-568.

Zehr, S.C. (2000). Public representations of scientific uncertainty about global climate change. *Public Understanding of Science, 9*, 85-103.

Zimmerman, R., & Siemann, E. (2001). *Texas: State findings from confronting climate change in the Gulf coast region.* Washington, D.C.: Ecological Society of America - Union of Concerned Scientists.

Appendix A

Research Location Summaries

FLORIDA BACKGROUND SUMMARY

The region of interest included several counties in the eastern Panhandle of northwest Florida (Figure A.1). This area, including the counties of Leon, Wakulla, Franklin, Gulf, Liberty, Calhoun, Jackson, and Gadsden, are linked by climate, hydrology, and other natural features, as well as government and political landscapes, all of which were of interest in this study. The latter three counties are located within the watershed of the Apalachicola River, which extends into Georgia and Alabama. Franklin, Gulf, and Wakulla Counties are all coastal counties having some portion of their county fronting the Gulf of Mexico. The most significant urban centers are Tallahassee to the east (in Leon County), which is the seat for state government of Florida, and Pensacola to the west. Franklin County was of central focus in this study because it contains the mouth of the Apalachicola River and, in addition, its coastal boundary spans the Apalachicola Bay.

Figure A.1
Apalachicola Bay Region in Northwest Florida

Social & Demographic Overview

This region of Florida is one of the least densely populated in the State. Excluding Leon County, approximately 78% of all residents in the region live in rural areas (Table A.1), compared with 11% for the State of Florida as a whole. Looking specifically at the coastal counties, 73% of Franklin County's population lives in rural areas, whereas in Gulf County 67% are rural dwellers. Census figures for Wakulla County are somewhat difficult to interpret because Crawfordville, the largest settled area in the County and a rapidly growing bedroom community for the City of Tallahassee, remains unincorporated. By far the most urbanized county in the central-eastern Panhandle is Leon County, wherein Tallahassee is located.

Table A.1
Total and Percentage Population Residing in Urban and Rural Areas, 2000

	Total	Urban	Rural	Urban %	Rural %
Franklin County	11,057	2,974	8,083	27	73
Gulf County	13,332	4,415	8,917	33	67
Wakulla County	22,863	0	22,863	00	100
Calhoun County	13,017	4,485	8,532	34	66
Gadsden County	45,087	15,252	29,835	34	66
Jackson County	46,755	7,950	38,805	17	83
Leon County	239,452	204,857	34,595	86	14
Liberty County	7,021	0	7,021	00	100
Florida	15,982,378	14,274,392	1,707,986	89	11

Source: Adapted from U.S. Census Bureau. Data Set: Census 2000 Summary File 3 (SF 3)-Sample Data. Table P5. Urban and Rural [7]-Universe: Total population.

Although much of this region is considered rural, according to U.S. Census Bureau statistics (Table A.2), most of these counties have experienced varying degrees of growth in human population from 1990 to 2000. The most significant increases were in Franklin (23.3%), Wakulla (61.0%), Liberty (26.1%), and Leon Counties (24.4%). This growth trend continued into the early 2000s, with only Gulf County experiencing a slight decline in population from 2000 to 2004.

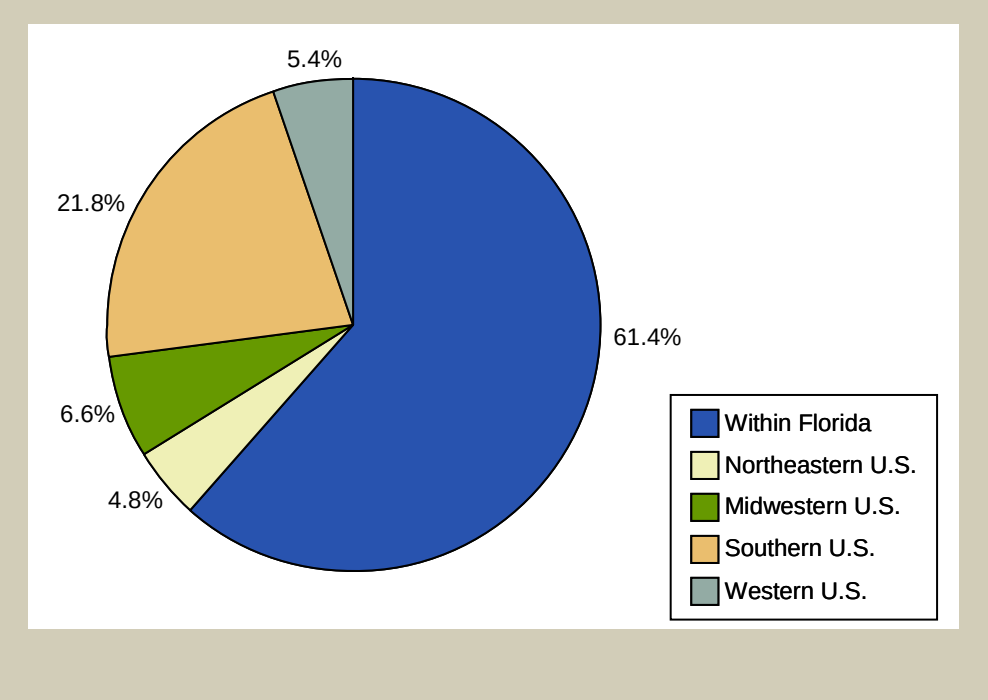
Table A.2
Population 2000, 2004
and Population Percent Change 1990 to 2000, 2000 to 2004

	Franklin County	Gulf County	Wakulla County	Calhoun County	Gadsden County	Jackson County	Leon County	Liberty County	Florida
Population, 2000	11,057	13,332	22,863	13,017	45,087	46,755	239,452	7,021	15,982,378
Population, % change, 1990 to 2000	23.3%	15.9%	61.0%	18.2%	9.7%	13.0%	24.4%	26.1%	23.5%
Population, 2004 estimate	10,123	13,816	27,179	13,185	46,107	47,692	243,867	7,406	17,397,161

Source: Adapted from U.S. Census Bureau. State and County QuickFacts. Retrieved 6 December 2005 from, http://quickfacts.census.gov/qfd/states/12000.html.

The vast majority of persons who relocated to the region between 1995 and 2000 came from other counties within the State of Florida. This trend was particularly true for Wakulla County, where 85% of those residing in the county in 2000 that had lived at a different residence in 1995 relocated to Wakulla County from another county in Florida. Similarly, as shown in Figure A.2, 61.4% of the population of Franklin County had formerly resided in Florida during 1995. For Franklin County, of those persons relocating from out of state, most came from the southern United States.

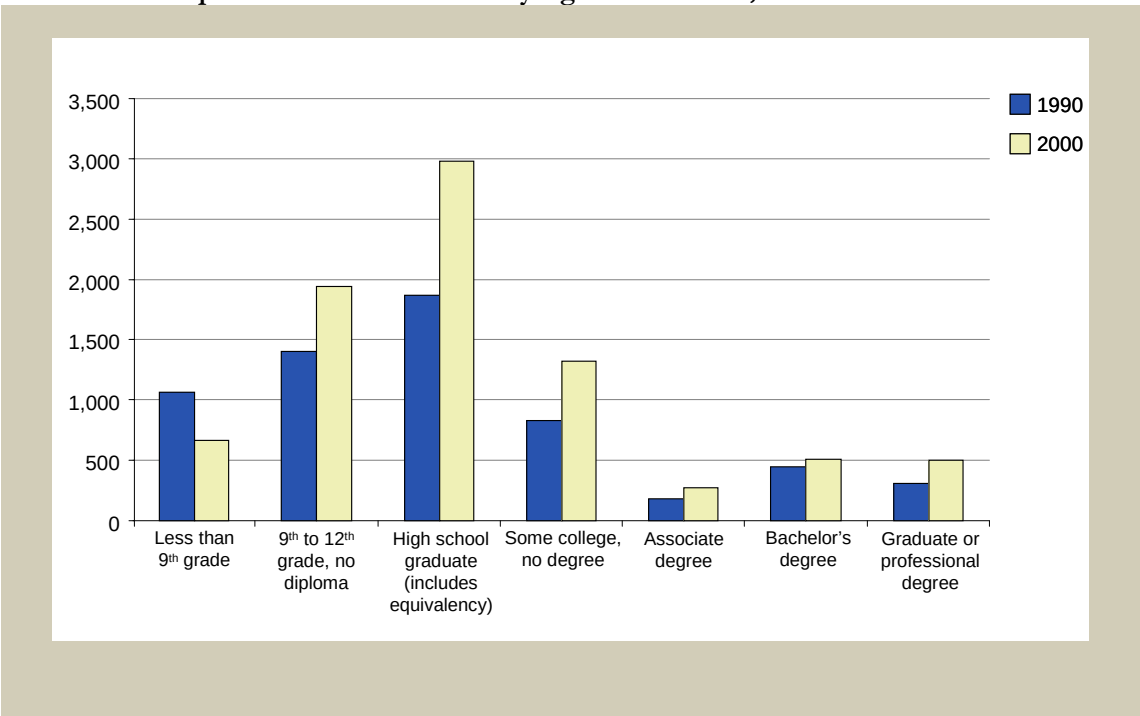
Figure A.2
Location of Former Residence in 1995 for Recently Relocated Franklin County Residents Aged 5 Years and Older, 2000 Census



Source: U.S. Census Bureau. Data Set: Census 2000 Summary File 3 (SF 3)-Sample Data, Table P24 Residence in 1995 for the Population 5 Years and Over--State and County Level [18]-Universe: Population 5 years and over AND Data Set: 1990 Summary Tape File 3 (STF 3)-Sample data, Table P043. Residence in 1985--State and County Level-Universe: Persons 5 years and over.

The influx of new residents to the region has shifted local population demographics. For instance, comparing the age distribution of Franklin County's population between the 1990 and 2000 censuses (Figure A.3), it can be seen that immigration increased the number of young adults and middle-aged persons, with the bulk of the added population being between 25 and 54 years of age. The number of children in Franklin County has declined overall, with only a slight increase in retirement-aged persons.

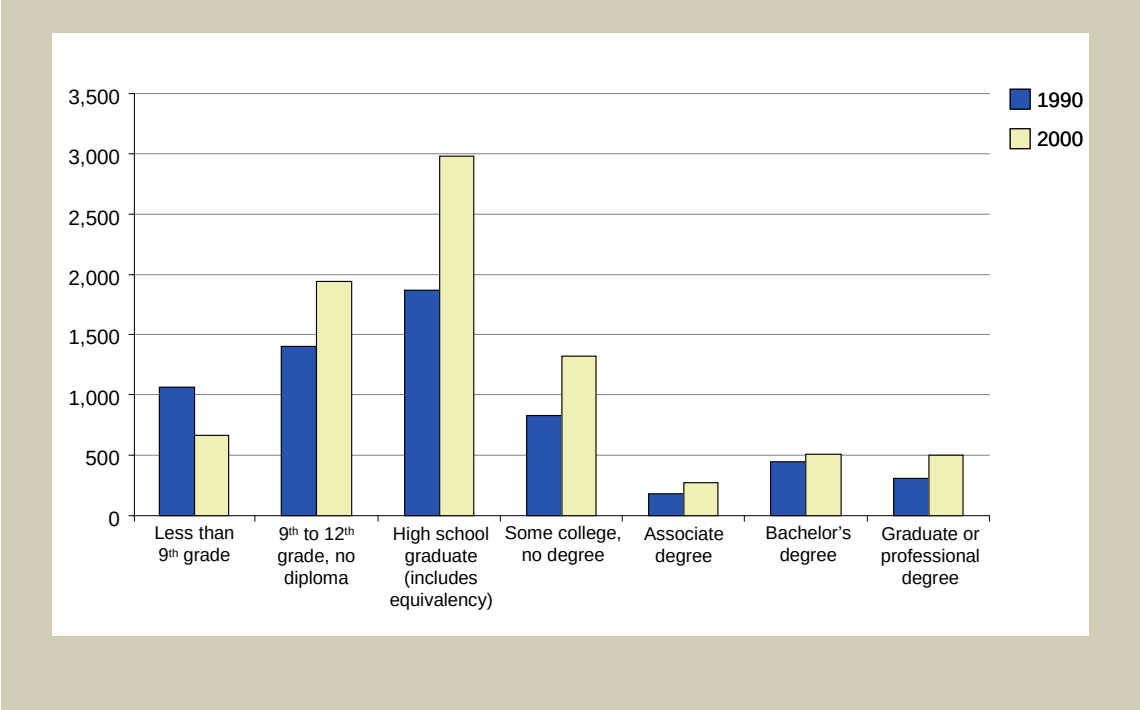
Figure A.3
Comparison of Franklin County Age Distribution, 1990 and 2000



Source: Data Set: Census 2000 Summary File 3 (SF 3)-Sample Data. Table P8. Sex by Age [79] - Universe: Total population AND 1990 US Census Data Database: C90STF3A, Summary Level: State—County.

In terms of education, counties in this region have followed a general trend in Florida toward a more educated population. There was a decline in persons having less than a 9th grade education for Franklin, Gulf, and Wakulla Counties between the 1990 and 2000 census. This decline was particularly notable for Franklin County. At the same time, there was an increase in the number of persons earning a high school diploma or equivalency, especially for Franklin County, which showed a 59.6% increase in the percentage of the population earning a high school diploma from 1990 to 2000 (Figure A.4). Overall, there has been a remarkable increase in the number of people who have attained education beyond the high school level, meaning that a growing number of persons in the population have had some college education or possess a college or post-graduate degree. In Franklin County, the number of people possessing a graduate or professional degree increased 64.5% from 1990 to 2000. Undoubtedly, the population in this region is significantly more educated than just ten years ago.

Figure A.4
Franklin County: Educational Attainment for Persons 25 Years and Older
1990 and 2000



Source: U.S. Census Bureau, Data Set: Census 2000 Summary File 3 (SF 3)-Sample Data. Table P37. Sex by Educational Attainment for the Population 25 Years AND Data Set: Census 1990 Summary Tape File 3 (STF 3)-Sample data. Table P057. Educational Attainment - Universe: Persons 25 Years and Over.

In terms of the economic prosperity of local residents, this region of Florida has historically been more economically challenged when compared to the state as a whole. Census figures from 2000 indicate this is the still the case for all counties in the region, with the exception of Wakulla and Leon counties (Table A.4). The percentage of persons in poverty by county (Table A.5) in the region in 1999 ranged from a low of 11.28% in Wakulla County to a high of 20.0% in Calhoun County. According to the Agency for Workforce Innovation in Florida, unemployment rates (not seasonally adjusted) in May 2006 for Franklin, Gulf, and Wakulla Counties were 3.1, 3.0, and 2.3, respectively, with a statewide rate of 2.9 for Florida (Agency for Workforce Innovation, 2006).

Table A.4 Median Household Income, Per Capita Income (Total Population): 1999 (Dollars)		
	Median household income in 1999 (Household)	**Per capita income in 1999 (Total Population)**
Franklin County	26,756	16,140
Gulf County	30,276	14,449
Wakulla County	37,149	17,678
Calhoun County	26,575	12,379
Gadsden County	31,248	14,499
Jackson County	29,744	13,905
Leon County	37,517	21,024
Liberty County	28,840	17,225
Florida	38,819	21,557

Source: Adapted from U.S. Census Bureau, Data Set: Census 2000 Summary File 3 (SF 3)-Sample Data. Table P53. Median Household Income in 1999 (Dollars) [1]-Universe Households AND Table P82. Per Capita Income in 1999 (Dollars) [1]-Universe-Total population.

Table A.5 Poverty Status Based on Income in 1999								
	Franklin County	**Gulf County**	**Wakulla County**	**Calhoun County**	**Gadsden County**	**Jackson County**	**Leon County**	**Liberty County**
Total	9,330	11,915	21,610	11,261	42,705	40,730	225,863	5,611
Below poverty level	1,654 (17.7%)	1,988 (16.7%)	2,437 (11.3%)	2,252 (20.0%)	8,509 (19.9%)	6,998 (17.2%)	41,078 (18.2%)	1,114 (19.9%)
At or above poverty level	7,676 (83.3%)	9,927 (83.3%)	19,173 (88.7%)	9,009 (80.0%)	34,196 (80.1%)	33,732 (82.8%)	184,785 (81.8%)	4,497 (80.2%)

Source: Adapted from U.S. Census Bureau, Data Set: Census 2000 Summary File 3 (SF 3)-Sample Data. Table P87. Poverty Status in 1999 by Age [17]-Universe-Population for whom poverty status is determined.

Politics, Governance & Decision-making

The state representatives from Florida Congressional Districts 6, 7, and 10 in northwest Florida are each Republican. However, the state senator from Florida Senate District 6 (including the counties of Gulf, Franklin, Liberty Wakulla, Calhoun, Gadsden, Jackson and parts of Bay, Leon, Jefferson, and Madison Counties), is presently a Democrat who has been in office since 2000. On the federal level, the region is represented by Rep. Allen Boyd (D) of the 2nd Congressional District, and U.S. Senators Bill Nelson (D) and Mel Martinez (R).

In Florida, as in other states, political governance is multi-level, combining the authority and jurisdiction of federal, state, county, and municipal entities. Local governments in Florida retain a great deal of autonomy in decision-making related to land use planning, development, and zoning. However, as per state regulations, each county and municipality in Florida must complete a Local Government Comprehensive Plan. Additionally, coastal counties and municipalities must also include a Coastal Management Element.

According to the Florida Department of Community Affairs (n.d.), local comprehensive plans must address future management and planning for particular elements, such as land use, housing, transportation, local infrastructure, coastal management, resource conservation, green/open spaces, recreation space/facilities, and capital improvements. For example, it is the local comprehensive plan that defines the standards for development, such as development density and coastal/wetland set-back requirements, although local policies must be consistent or more stringent than any existing state statutory or regulatory requirements. Each local comprehensive plan is subject to the guidance and approval of state authorities. All development planning and activity within a county or municipality must be consistent with state statutes and the local comprehensive plan, although plans may be amended biannually.

Historically, Franklin County, including the cities of Carrabelle and Apalachicola, were identified as "Areas of Critical State Concern." This designation, established by state statute, seeks to protect "key resources and public facilities of major statewide significance" (Florida Department of Community Affairs, 2003). Additional scrutiny and economic resources were or are directed to these areas to improve or preserve key resources, such as the Apalachicola Bay, as well as to facilitate economic growth and development.

In terms of decision-making, most counties have a great deal of autonomy in drafting local codes and ordinances. County governance is conducted by a Board of County Commissioners, members of which are elected. Municipalities, as well, enjoy much latitude in governance of people and property within their political boundaries. Municipalities typically have a mayor, as well as a Board of City Commissioners. Counties and municipalities may also have additional political structures, such as a Planning and Zoning Committee or a Board of Adjustments or Variances. However, some townships, such as Eastpoint in Franklin County, have no political structures at all and so are governed only by county officials.

While counties and municipalities enjoy much independence, they are still required to meet state and federal standards or guidelines related to particular activities governed by law. Frequently, in such cases, as with local comprehensive plans, local decision-makers must submit materials to the appropriate state or federal agency, such as to the Florida Department of Environmental Protection (FDEP), and negotiate approval for planned projects, activities, or actions.

Governance of Regional Natural Resources

While the provision of infrastructure and the regulation of economic development are largely the responsibility of local governing bodies, natural resources in the region are, for the most part, under the jurisdiction of state and/or federal government agencies. For the most, counties and municipalities must meet only those minimum standards that have been set forth by state or federal entities, such as with setback rules related to development near wetlands. That is not to say, however, that local governments cannot create standards to govern development or protect natural resources within their jurisdiction that are more stringent than those set at the state or federal level. For example, the City of Apalachicola has more stringent building codes than does Franklin County, wherein the city is located.

In terms of real property, a significant amount of the land in the region is currently held in public trust. For example, in 2003, public sector landholdings in Franklin County amounted to 62% of the total land area, with another one-fourth of the county's total land area owned by St. Joe Timber and Development Company (Chapin, 2003). While counties and municipalities do own and manage real property in the form of recreational parks and public infrastructure, most publicly owned land is under the jurisdiction of state or federal agencies.

Among those state agencies managing public property in the region are the Florida Department of Environmental Protection (FDEP)-Florida Division of Recreation and Parks, Florida Department of Agriculture and Consumer Services (FDACS)-Division of Forestry, and the Northwest Florida Water Management District (FWMD). On the federal level, the region is home to the Apalachicola National Forest (U.S. Department of Agriculture-Forest Service), St. Vincent National Wildlife Refuge (U.S. Fish and Wildlife Service), and St. Marks Wildlife Refuge (U.S. Fish and Wildlife Service). In Gulf County and further to the west of the focal study region, significant landholdings are associated with two federal military installations, Tyndall Air Force Base and Eglin Air Force Base.

Other sizeable tracts of land or coastal properties in the region are owned by private, non-governmental interests such as St. Joe Timber and Development Company, which is the most significant landholder in the

region behind government, as mentioned previously. However, other notable landowners in the region are The Nature Conservancy, the St. George Island Plantation Owner's Association, and Florida State University.

In terms of aquatic resources, the Florida Department of Agriculture and Consumer Services (FDACS)-Division of Aquaculture is a major player in the governance and regulation of local natural resources. This Division of FDACS is responsible for monitoring water quality in Apalachicola Bay and for regulating activities in shellfish-harvesting waters. The U.S. Army Corps of Engineers also plays a significant role in the management of coasts and watersheds, although management of water resources in this region is the responsibility of a state-level agency, the FWMD. Likewise, near-shore, submerged aquatic lands are under the ownership of the State of Florida. Finally, the Apalachicola region is host to three "Florida Coastal and Aquatic Managed Areas," which are designated by the State of Florida and administered by the FDEP: Alligator Harbor, Apalachicola Bay, and St. Joseph Bay. Apalachicola Bay, along with the lower portion of the Apalachicola River watershed, is also a federally designated "National Estuarine Research Reserve."

Industrial and Economic Characteristics

The Apalachicola Bay region has historically been a center for natural resource-based industry. Agriculture is still practiced in much of the region, including crop farming (e.g., peanuts) and, to a lesser extent, livestock production. Bee-keeping and the production of Tupelo honey are also an important niche industry, which is directly tied to Apalachicola River and wetlands where Black tupelo trees are native.

Seafood harvesting is another traditional industry, which remains of great economic and social importance in some cities and counties in the region. Apalachicola Bay is renowned for the production of oysters, while scallops (no longer commercially harvested) are typically associated with St. Joseph Bay. Other species harvested for commercial purposes include shrimp, blue crabs, and a number of finfish species. More recently, aquaculture has begun in Alligator Harbor, where private individuals lease submerged lands from the State of Florida for the cultivation of clams.

Until the closure of local paper mills in the last twenty years or so, timber harvest and production were of central economic importance. However, the significance of timber production has waned since the conversion of St. Joe Timber Company into a land-development company. Because of the activities of St. Joe Company, and following a more general trend in Northwest Florida, construction is now a central and rapidly growing industry (Table A.6).

Many coastal cities and counties in the region are making concentrated efforts to build and develop tourism as a focal industry. Much of the recreational opportunities in the region are nature or resource-related, such as charter fishing trips and beach vacations. As cities like Apalachicola and Port St. Joe become tourist destinations, there is a corresponding increase in the number of service and entertainment businesses being established to meet visitor needs, such as restaurants, boutiques, and other vacation services.

Table A.6
Employed Civilian Population 16 Years and Over by Industry, 2000

	Franklin County	Gulf County	Wakulla County	Calhoun County	Gadsden County	Jackson County	Leon County	Liberty County	Florida
Total	3,936	4,667	10,602	4,608	18,051	17,315	122,840	2,375	6,995,047
Agriculture, forestry, fishing and hunting	357	131	203	293	670	533	404	114	8,4719
Mining	5	0	14	14	129	35	68	7	7,744
Construction	474	512	1257	522	1526	1187	6036	410	562,111
Manufacturing	190	359	536	278	1,026	1,266	2,981	210	507,870
Wholesale trade	262	94	333	164	470	350	1,887	73	278,360
Retail trade	538	495	1,055	560	1,974	2,147	14,215	180	943,449
Transportation, warehousing and utilities	79	263	489	328	693	874	2,995	134	374,179
Information	31	141	302	94	277	286	3,768	33	215,787
Finance and insurance	141	159	361	89	548	457	4,425	30	363,980
Real estate and rental and leasing	232	141	157	34	273	202	2,167	3	199,572
Professional, scientific, and technical services	86	96	660	111	641	418	9,440	7	400,633
Management of companies and enterprises	0	0	0	0	0	0	33	0	2,477
Administrative, support and waste management	77	140	390	114	541	368	3,686	37	336,406
Educational, health and social services	531	902	1,729	890	4,426	4,530	29,172	416	1,264,965
Arts, entertainment, and recreation	71	55	100	38	83	169	2,037	3	192,801
Accommodation and food services	305	238	526	262	1,064	881	8,900	94	539,659
Public administration	416	631	2,051	570	2,780	2,679	24,201	493	360,910
Other services (except public administration)	141	310	439	247	930	933	6,425	131	359,425

Source: Adapted from U.S. Census Bureau, Data Set: Census 2000 Summary File 3 (SF 3)-Sample Data. Table P49: Gender by Industry for the Employed Civilian Population 16 Years and Over.

Events and Issues of Regional Significance

There are several important issues and events that are of consequence to the local culture, economy, and/or natural resources. Foremost, the political backdrop dominating most discussion about local natural resources in the Apalachicola watershed is the "Tri-state Water Wars." In the late 1980s a dispute erupted between Georgia on the one hand and Alabama and Florida on the other, each of which continue to claim a significant interest in management of the water flow within the Apalachicola-Flint-Chattahoochee system. When the U.S. Army Corps of Engineers sought to change the flow regime of the river system by withholding water for the benefit of Atlanta, the agency was promptly sued by Alabama and, later, Florida (Stephenson, 2000). In essence, Florida's argument is that vast withdrawals of water in Georgia would deprive the Apalachicola River and its related ecological systems of much needed freshwater flow, particularly during

times of drought. Moreover, it is feared that a reduction in the flow of the system will negatively impact water quality (Stephenson, 2000). Such alterations in both the water quantity and quality of the Apalachicola River would, in turn, harm many plant and animal species that depend on the river and bay, including commercially harvested species like oysters. In other words, the State of Florida is concerned with the diversity and productivity of dependent ecological communities (Northwest Florida Water Management District, 2002). The three states have been in negotiations over water allocation in this system since 1992 (with a brief breakdown in talks occurring in 2003) to no avail (Northwest Florida Water Management District, 2004). The most recent deadline set by the United States District Court-Northern District of Alabama for completion of a water allocation agreement expired on January 31, 2007 (Shelton, 2006), although the states petitioned the court to again extend the deadline to the end of March 2007 (Associated Press, 2007).

Coastal communities in this region have undergone additional challenges, unrelated to the Tri-state Water Wars. Red tide (*Karenia brevis*), for example, has recently posed a problem for coastal counties in the Panhandle. An outbreak of red tide occurred in the Apalachicola Bay in September of 2003, prompting the closure of shellfish harvesting waters for a short period of time (Florida Department of Agriculture, 2003). In 2004, there was a substantial dolphin mortality event in St. Joseph Bay in March and April, which was later linked to brevetoxins associated with red tide (National Oceanic and Atmospheric Administration, 2004). Finally, in 2005, a number of shellfish harvesting areas in the Apalachicola Bay were again closed due to the presence of red tide. The 2005 closure lasted from early September to late November, which was a serious hardship on those who made their living from the bay (Ritchie, 2005a; 2005b).

Finally, the Florida Panhandle was impacted by hurricanes and tropical storms in 2004 and 2005. According to Ralph Clark and James LaGrone (2006), although making landfall well to the west, Hurricane Dennis (2005) was a significant hurricane event for the Gulf-Franklin-Wakulla County area. A powerful storm surge, exacerbated by high tide and geomorphologic features, caused extensive beach erosion and damaged 98 structures, 52 of which were located in Franklin County. Although not as devastating as Hurricane Kate in 1985, Dennis destroyed many shellfish processing businesses located on the coast in Eastpoint, FL. Many of these sites, often located on the water's edge, are now being sought after and purchased by developers for residential developments (Kirkland, 2006). While the seafood industry remains viable in the region, pressures related to periodic closures of the Bay to shell fishing and coastal damage from storm events, combined with coastal prospecting and development, have taken their toll on the industry over the past several years.

LOUISIANA BACKGROUND SUMMARY

Lafourche and Terrebonne Parishes, which both border the Gulf of Mexico (Figure A.5), are linked by climate and hydrology, as well as government and political landscapes. The most significant urban centers are Thibodaux (population 14,431) in Lafourche Parish, and Houma (population 32,393) in Terrebonne Parish. Both cities also serve as their respective parish seats.

Figure A.5
Map of southeastern Louisiana showing Lafourche and Terrebonne Parishes

Social and Demographic Review

Like most of Louisiana, Terrebonne and Lafourche Parishes have significant urban populations (75% Terrebonne; 72% Lafourche; 72.6% Louisiana). The urban population for Terrebonne is slightly understated because Houma, Terrebonne's largest city, is designated as a separate census place and thereby does not contribute to Terrebonne's urban population percentage. Since we are using census data collected before Hurricane Katrina, the urban population of Louisiana may have decreased. Lafourche and Terrebonne Parishes may have even greater relative urban densities compared to that of Louisiana, especially if people moved from New Orleans to the two parishes.[1]

[1] If you want these measurements, help me open Louisiana's summary file (an FTP file) at http://www.census.gov/census2000/states/la.html. These measures seem to be accurate based on 1990 measurements in Terrebonne Parish:
http://factfinder.census.gov/servlet/QTTable?_bm=n&_lang=en&qr_name=DEC_1990_STF3_DP2&ds_name=DEC_1990_STF3_&geo_id=05000US22109
There was no such data in the 2000 chart.

Table A.7
Total and Percentage Population Residing in Urban and Rural Areas, 2000

	Total	Urban	Rural	Urban %	Rural %
Lafourche Parish	89,974	64,950	25,024	0.72188	0.27812
Terrebonne Parish	104,503	78,397	26,106	0.75019	0.24981
Louisiana	4,468,976	3,246,994	1,221,982	0.72656	0.27344

Source: U.S. Census Bureau, Data Set: Census 2000 Summary File 3 (SF3) - Sample Data

The population densities of Lafourche Parish and Terrebonne Parish in 2000 were 82.9 people per square mile and 83.3 people per square mile, respectively. This was less than the population density for the State of Louisiana, which was 102.6 people per square mile. Lafourche Parish and Terrebonne Parish also had fewer housing units per square mile than the rest of Louisiana (U.S. Census Bureau, 2000). Since these data are from the 2000 Census, and since Hurricanes Katrina and Rita impacted much of Louisiana's coast in 2005, the population densities in both parishes and in Louisiana may be overstated in these measurements.

Terrebonne and Lafourche Parishes' growth rates are very different from Louisiana's growth rate. The population change in Lafourche Parish between 1999 and 2000 was 4.79%, slightly lower than the population percentage change for Louisiana. At 7.76%, Terrebonne's growth rate was notably high. Most recent statistics (2000-2004) show higher growth in Lafourche Parish (2.20%) than in Terrebonne Parish (1.87%) or Louisiana (0.60%).

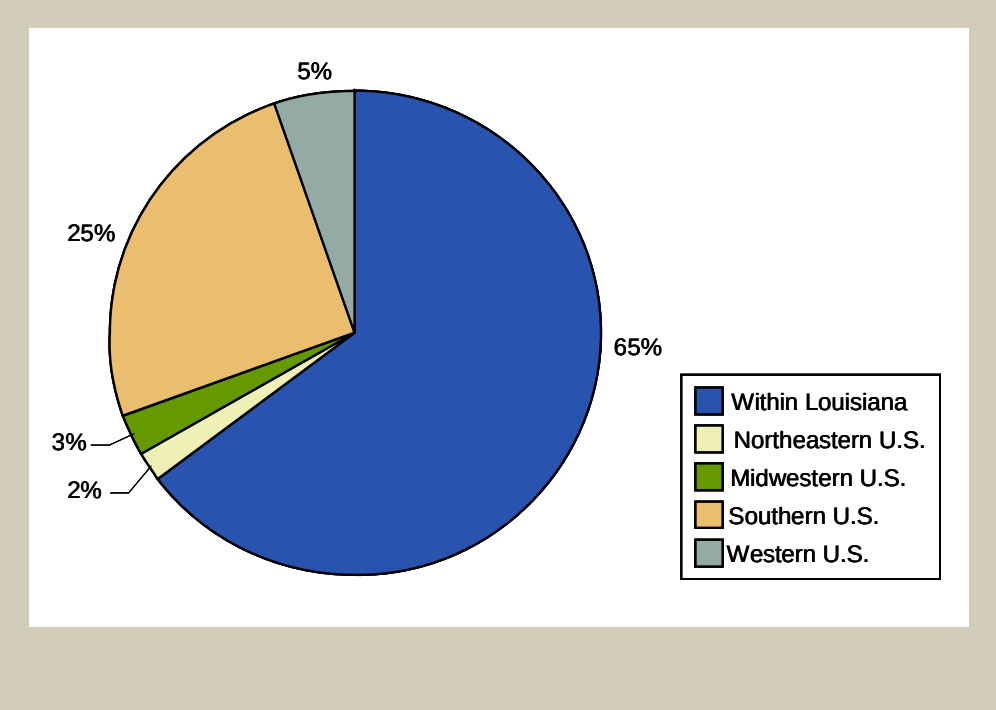
Table A.8
Population 2000, 2004, and Population Percent Change
1990 to 2000, 2000 to 2004

	Lafourche Parish	Terrebonne Parish	Louisiana
Population, 2000	89,974	104,503	4,468,976
Population, percent change, 1990 to 2000	4.79%	7.76%	5.90%
Population, 2004 estimate	91,955	106,454	4,495,706
Population, percent change, April 1, 2000 to July 1, 2004	2.20%	1.87%	0.60%

Source: U.S. Census Bureau: State and County QuickFacts. Data derived from Population Estimates, 2000 Census of Population Housing, 1990 Census of Population and Housing, Small Area Income and Poverty Estimates, County Business Patterns, 1997 Economic Census, Minority- and Women-Owned Business, Building Permits, Consolidated Federal Funds Report, 1997 Census of Governments

Most people moving to Lafourche or Terrebonne Parish come from other parishes within Louisiana. However, 25% come from Southern United States, 5% from Western United States, 3% from Midwestern United States, and 2% from Northeastern United States. In census data that tracked the location of the residents of each county in 1995 and 2000, we find that people in Lafourche and Terrebonne Parishes were less mobile than people in the rest of Louisiana. From 1995 to 2000, a large proportion of people in Lafourche and Terrebonne Parishes stayed in the same house (66.5% and 62.4%), whereas only 59.0% of Louisiana residents stayed in the same house.

Figure A.6
Location of Former Residence in 1995 for Recently Relocated Lafourche and Terrebonne Parish Residents Aged 5 Years and Older, 2000 Census



Source: U.S. Census Bureau. Data Set: Census 2000 Summary File 3 (SF 3)-Sample Data, Table P24 Residence in 1995 for the Population 5 Years and Over--State and County Level [18]-Universe: Population 5 years and over AND Data Set: 1990 Summary Tape File 3 (STF 3)-Sample data, Table P043. Residence in 1985--State and County Level-Universe: Persons 5 years and over.

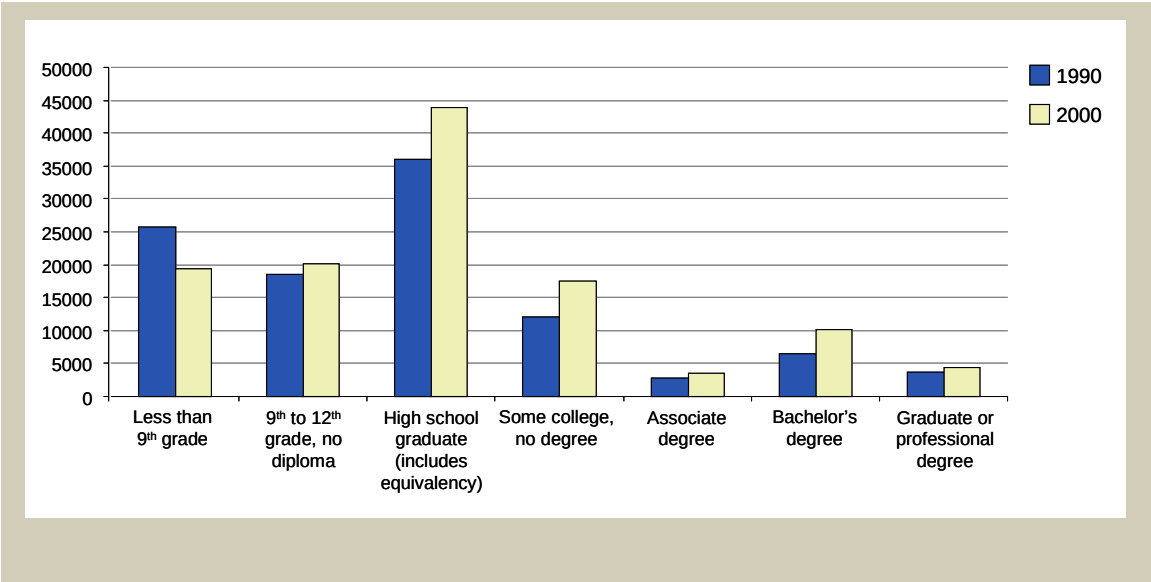
In terms of regional emigration, most people in Lafourche and Terrebonne Parishes moved to the Southern states. The next highest destinations were the Western states, followed by the Midwestern states. The areas to which most Louisianans emigrate are the same areas from which they receive most of their incoming population.

Following Hurricane Katrina, in-state migrants to Lafourche and Terrebonne Parishes increased. At the same time, however, the net population of Terrebonne and Lafourche Parishes may have declined, since most Katrina evacuees moved to Atlanta and Houston following the hurricane (Dewan, 2006). Latino immigrants, who migrated to the state to help in reconstruction, smoothed Louisiana's population shock. Officials have recorded high birth rates among these immigrant communities, leading to a "baby boom" in Louisiana (Porter, 2006).

According to U.S. Census data, Lafourche and Terrebonne Parishes have aged. Between 1990 and 2000, the number of children under age 14 decreased along with the number of young adults between ages 25 and 34. The aggregate number of people over the age of 35 increased sharply in both counties, especially in the subcategory of ages 45-54. Many people moving to these two parishes may be middle-aged citizens preparing for retirement. Immigration does not explain the trend completely. Since a significant portion of Lafourche and Terrebone Parishes residents remained in the same house between 1995 and 2000, much of the population may simply have aged while the birth rate declined among couples. In both parishes, there was an increase in retirement-aged persons, though the increase was not as substantial as that among middle-aged persons who would have remained in the workforce.

Literacy rates in Lafourche and Terrebone Parishes have followed the trend in Louisiana between 1990 and 2000. Both parishes are experiencing increasing educational levels. What distinguishes Lafourche and Terrebonne Parishes from Louisiana as a whole is the sharp increase in the number of people with Bachelor's/Associate degrees. In Lafourche and Terrebonne Parishes, the percent changes in completed Bachelor's/Associate degrees were 55.3% and 59.4% respectively, compared to 27.2% in the State of Louisiana. The increase in undergraduate education will probably continue, since Terrebonne and Lafourche Parishes have a high population still working on their degrees. The percentage increase in the population of people with some college and no degree was 40% in our selected parishes, versus 30% in Louisiana. Terrebonne and Lafourche Parishes also saw a sharp aggregate increase in the number of people with a high school equivalency. There were also increases in educational attainments above this level, along with a clear decrease in the number of persons with less than a 9th grade educational attainment.

Figure A.7
Aggregate Figures for Lafourche and Terrebonne Parishes:
Educational Attainment for Persons 25 Years and Older, 1990 & 2000



Source: Adapted from U.S. Census Bureau, Data Set: Census 2000 Summary File 3 (SF 3)-Sample Data. DP-2. Profile of Selected Social Characteristics: 2000. LaFourche Parish, Louisiana and Terrebonne Parish, Louisiana, AND 1990 Summary Tape File 3 (STF 3)-Sample data. Table P057. Educational Attainment-Universe: Persons 25 Years and Over.

Table A.9
Educational Attainment for Persons 25 Years and Older, 1990 to 2005

	Lafourche Parish			Terrebonne Parish			Louisiana		
	1990	2000	Percent Change	1990	2000	Percent Change	1990	2000	Percent Change
Total	49724	55891	12.4%	55636	63271	13.7%	2536994	2775468	9.4%
Less than 9th Grade	13393	9861	-26.4%	12260	9615	-21.6%	372913	257710	-30.9%
9th to 12th grade, no diploma	8394	8957	6.7%	10191	11231	10.2%	430959	441342	2.4%
High school graduate (includes equivalency)	16588	21236	28.0%	19412	22649	16.7%	803328	899354	12.0%
Some college, no degree	5009	7427	48.3%	7138	10096	41.4%	437622	561486	28.3%
Associate degree	1363	1502	10.2%	1392	1928	38.5%	83049	95798	15.4%
Bachelor's degree	3071	4769	55.3%	3419	5451	59.4%	267055	339711	27.2%
Graduate or professional degree	1906	2139	12.2%	1824	2301	26.2%	142068	180067	26.7%

Source: Adapted from U.S. Census Bureau, Data Set: Census 2000 Summary File 3 (SF 3)-Sample Data. Table P37. Sex By Educational Attainment for the Population 25 Years AND 1990 Summary Tape File 3 (STF 3)-Sample data. Table P057. Educational Attainment-Universe: Persons 25 Years and Over.

The median and per capita incomes in this area are similar to the income level in Louisiana as a whole. The 1999 median household income in Terrebonne and Lafourche Parishes ($35,235 and $34,910) did not differ much from that of Louisiana ($32,566). Per capita incomes in Terrebonne Parish and Lafourche Parish were only slightly below the per capita incomes in Louisiana ($16,051; $15,809; and $16,912). These figures probably fell after Hurricane Katrina, due to damage in New Orleans and due to the flow of impoverished refugees from New Orleans to neighboring parishes. The percentage of people with an income below the poverty line was about 19% in Terrebonne Parish and Louisiana, and 16.5% in Lafourche Parish. The unemployment rate in both parishes was similar—5.9% in Lafourche Parish and 5.90% in Terrebonne Parish.[2] Louisiana's unemployment rate in 2000 was 5.0%, lower than both Lafourche and Terrebonne counties' rate. While Louisiana's unemployment rate spiked to 6.7% following Hurricane Katrina in 2005, it dropped back down to 4.0% in 2006 (U.S. Department of Labor, Bureau of Labor Statistics).[3] This might be due to an initial loss of businesses, followed by labor opportunities in reconstruction.

[2] The most recently published census data comes from the 2000 census. Unemployment figures may have increased due to the effects of Hurricanes Rita and Katrina. http://quickfacts.census.gov/qfd/states/22/22109.html
[3] http://stats.bls.gov/lau/home.htm, also note that there are no unemployment statistics for individual parishes after 2000

Table A.10 Median Household Income, Per Capita Income (Total Population) 1999 (Dollars)		
	Median household income in 1999 (Household)	Per capita income in 1999 (Total Population)
Lafourche Parish	34,910	15,809
Terrebonne Parish	35,235	16,051
Louisiana	32,566	16,912

Source: Census 2000 Summary File 3 (SF 3) - Sample Data (Tables P53 and P82)

Table A.11 Poverty Status in 1999*			
	Lafourche Parish	**Terrebonne Parish**	**Louisiana**
Total	88,077	102,709	4,334,094
Income in 1999 below poverty level	14,560	19,607	851,113
	(16.53%)	(19.09%)	(19.64%)
Income in 1999 at or above poverty level	73,517	83,102	3,482,981
	(83.47%)	(80.91%)	(80.36%)

Source: Census 2000 Summary File 3 (SF 3) - Sample Data (Based on Table P87-Poverty Status in 1999 by Age).
*Population for whom poverty status is determined.

Politics, Governance & Decision-Making

Lafourche and Terrebonne Parishes are represented in the Louisiana state senate by Democrats D.A. "Butch" Gantreaux, Reggie P. Dupre, and Joel T. Chaisson II. Of the five state representatives in Terrebonne and Lafourche Parishes, three are Democrats and two are Republicans. Louisiana's governor is Democrat Kathleen Blanco, however she opted not to run for re-election in 2007, and U.S. Representative Bobby Jindal, a Republican, was elected in October 2007 as Louisiana's next governor. At the federal level, Democrat Charlie Melancon represents Louisiana's Third Congressional District. Louisiana's U.S. senators are Mary L. Landrieu (D) and the more recently elected David Vitter (R).

Parishes enforce state and federal legislation of public utilities, parks and recreation, regional zoning, agricultural and economic development, and infrastructure. Parish governments include an elected parish president and a parish council. Like a senate, the parish council is comprised of representatives from each parish district. There are also various parish committees and subcommittees that mirror state committees. Often, the parishes will work alongside the state to implement projects. For example, Terrebonne Parish's Department of Coastal Restoration and Preservation works closely with Louisiana's Department of Environmental Quality. Similarly, parish finance departments distribute funds that the state treasury allocates to chosen parishes. While parishes must abide by state legislation (to receive funds and also to stay within the legal constitution of the State of Louisiana), they can still create independent systems of governance.

Most parishes are governed by police-juries, but, depending on their home-rule charter, some parishes elect other forms of government. Each parish has an elected sheriff who is in charge of general law enforcement in the parish. The sheriff also oversees tax-collection. Zoning in parishes is governed by the

parish Board of Commissioners, who are appointed by the Parish Council. The commission creates governing plans which are then submitted to the parish governing authority for approval (Lafourche Parish, 1996).

Due to the small size of many parishes (compared to counties in other states), municipalities do not play a great role in governance. Parishes are small enough to essentially usurp the powers that municipalities hold in other states. Parish codes include regulations on many systems that are generally controlled by cities, such as the regulation of health and sanitation, libraries, motor vehicles and traffic, drainage, and street lighting systems. When cities enlarge, though, parishes must cede some control to municipalities. According to the Terrebonne Parish Code, to enlarge city limits, parishes must seek the consent of taxpayers living in that area (Terrebonne Parish Consolidated Government, 1991).

Governance of Regional-Natural Resources

Natural resources in the region are subject to state and federal agencies. Parishes do not possess much control over mineral resources. In fact, unlike the parish committees that mirror state committees on utilities and public works, there are no parish committees for natural resources in Terrebonne and Lafourche Parishes.

The Louisiana Department of Natural Resources (DNR) monitors coastal restoration and management, conservation, and mineral resources. The Office of Coastal Restoration and Management (OCRM), a branch of the Louisiana DNR, maintains the state wetlands and regulates Louisiana's coastal zone. Within the OCRM, Coastal Management Division (CMD) manages the construction of artificial crevices and shoreline protection projects. It also manages the construction of levees and canals. Generally coastal restoration projects must be approved by the Louisiana state legislature, which pays attention to federal guidelines and enforcements. The Louisiana Office of Conservation, which is also a branch of the Department of Natural Resources, issues drilling permits and reservoir construction permits. It also heads Louisiana's surface mining program and pipeline operations.

Louisiana's Department of Environmental Quality enforces federal environmental guidelines and works to combat such things as illegal dumping and other environmental hazards at the local and parish level. The Louisiana DEQ also connects federal programs to parishes.

Industrial and Economic Characteristics

"Feeding and Fueling America" is the motto of Lafourche Parish. Nicholls State University and the parish government are located in the northern portion of the parish, an area well-suited to sugarcane production. The southern end of the parish is home to Port Fourchon. Located on the Gulf of Mexico, the port is the gateway for over 30% of the oil and gas entering the United States. The port employs over 6,000 people and, when combined with support industries such as intermodal transportation, this employment hub in Lafourche provides even more jobs (Louisiana Recovery Authority, 2007). Half the drilling activity in the Gulf and 75% of all deepwater production is supported out of Port Fourchon. More than 250 vessels a day travel the port's channels (Greater Lafourche Port Commission, 2007).

With 2,066 square miles, Terrebonne Parish is Louisiana's second largest parish, and more than 90% of the parish is covered by wetlands (Louisiana Recovery Authority). Residents of Terrebonne Parish have always depended on the area's natural resources for their livelihood. Oysters, shrimp, crabs, and fish contribute their share of wealth to the parish. The oysters from Terrebonne Parish have become internationally known as the finest in the world. In the great stretches of marshland surrounding Terrebonne Parish, trapping of Louisiana muskrat, mink, otter, raccoon, and nutria pelts are another form of local commerce. Starting in 1929, the oil and gas industries brought a period of economic development and prosperity to the parish. With the discovery of offshore oil, Terrebonne became the gateway to the heaviest concentration of offshore oil service companies in the state. By 1960, Houma had become one of the fastest growing cities in America, this growth driven by the combination of rich oil production backed by Houma's productive waters, fertile soil, and natural mineral resources. In 1961, the Houma Navigational Canal was completed to provide a 30 mile link to Terrebonne Bay and the Gulf of Mexico. By the late 1970s, Houma's main focus was the oil industry. Those companies not related to oil and gas depended on this industry for their survival. The early 1980s saw the U.S. domestic oil industry suffer huge economic losses, due to cheaper foreign oil and dwindling local resources. At this time, the Houma-Terrebonne area experienced an unemployment rate near 25% (Terrebonne Parish Consolidated Government).

While the oil industry is still the primary source of revenue for the Houma-Terrebonne area, alternative industries are also represented. The parish still accounts for over 20% of Louisiana's seafood production. In addition to a growing medical industry, tourism is also a source of commerce for the area. Planners hope that Houma's new Civic Center will bring entertainment and convention revenue to Houma. (Terrebonne Parish Consolidated Government).

Events and Issues of Regional Significance

The dominant issue facing the Barataria-Terrebonne region is land loss due to subsidence, sea level rise and storm events. There has been much discussion over whether this loss has accelerated due to human activities but, regardless of the causes, which remain varied and complex, the issue is of critical importance to the state and nation and has brought together actors with a broad array of interests: state officials, business leaders, scientists, and environmentalists (Schleifstein, 2002).

Louisiana has 30% of the total coastal marsh in the 48 contiguous states but accounts for 90% of the coastal marsh lost. Since the 1930s, Louisiana has lost 1,900 square miles of land. Between 1990 and 2000, wetland loss was approximately 24 square miles per year (Louisiana Department of Natural Resources, 2007). Known as "America's Wetland," coastal Louisiana is an area of great ecological and economic significance (America's Wetland; Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority, 1998; Union of Concerned Scientists). The losses are not uniformly distributed, but rather are concentrated in a few areas, with the lower Terrebonne and Barataria Basins experiencing some of the greatest loss (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority, 1998). The impact of land loss in the Barataria-Terrebonne area has significant economic ramifications. More than 25% of all the oil and gas used by the U.S. comes through this area by tanker, barge, or pipeline, and the distribution of energy for the entire eastern U.S. begins at the Louisiana coast. The loss of protective wetlands and barrier islands exposes energy infrastructure—wells, pipelines, ports, roads, and levees—to the forces of the Gulf and leaves these facilities vulnerable to damage. In addition, the coastal wetlands of Louisiana provide a vast nursery for the country's seafood. Estimates are that as much as 95% of all marine life in the Gulf of Mexico spends all or part of its life cycle in these coastal wetlands and the key fisheries along Louisiana coast are of national significance (America's Wetlands; Union of Concerned Scientists; *New Orleans Times-Picayune*, June 27, 2002). The impacts of this threat to the energy and seafood industries will have a ripple effect throughout the local, state, and national economy (America's Wetlands; Union of Concerned Scientists; *New Orleans Times-Picayune*, June 27, 2002). In addition to smaller catches and other ecological damage to marine life resulting from land loss, the aquaculture industry along the Louisiana coast has also suffered from low prices for seafood, competition from imports, and rising fuel costs (Halfbinger, 2002; O'Brien, 2003).

At the local and state level, this land loss was well-known and a cause of great concern. Actors within the state believed that this was an issue that should be addressed at the national level, given the importance of the Louisiana coast to the nation as a whole. In 1990, passage of the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA), also known as the Breaux Act, signaled the first concerted restoration effort at the national level (Schleifstein, 2002).

Just when efforts to restore the Louisiana coastline were gaining steam, 2005 brought two devastating hurricanes to the area. Because of the catastrophic flooding in New Orleans, Hurricane Katrina will forever be remembered as the more destructive storm, however, compared to their neighboring parishes Lafourche and Terrebonne suffered less destruction from that storm. Hurricane Rita was responsible for extensive flooding and damage in Terrebonne Parish (Longman and Brick, 2005) and the parish was declared a federal disaster area following both storms. However, the disruption Katrina caused to all aspects of life in the state has created problems for the study area. As a result of these storms, many of the residents of Lafourche and Terrebonne Parishes, who were already struggling, have decided to leave the area and migrate to other parts of the state and nation that offer greater economic opportunity (Barry, 2006).

TEXAS BACKGROUND SUMMARY

The project focused on the Galveston Bay region, located in Southeast Texas in the Houston-Galveston area (Figure A.8). Galveston Bay is the largest and most biologically productive estuary in Texas and is adjacent to one of most heavily urbanized, industrialized areas in the nation. Approximately 4.5 million people reside in the five counties surrounding Galveston Bay: Brazoria, Chambers, Galveston, Harris, and Liberty counties (Galveston Bay Estuary Program). The most significant urban center in the region is Houston, located in Harris County. Many small municipalities also exist in the region. Although they are independent from Houston in terms of governance, we include most of these places in the greater Houston area.

Figure A.8
Galveston Bay Region in Southeast Texas

Social and Demographic Overview

Galveston Bay constitutes a major population center in Texas. Houston is the largest city in Texas and the fourth largest city in the United States. The urban area is concentrated on the western side of Galveston Bay, while the eastern side remains largely rural. Fewer than 10% of the residents of Harris and Galveston counties live in rural areas, compared to 17% of Texans. In Harris County, only 2% of the 3.4 million residents are rural dwellers. Chambers County and Liberty County are the most rural locations in the study, with 64% and 68% of citizens in rural areas.

The population of nearly all the counties grew significantly between the 1990 and 2000 census (Table A.12). Brazoria, Chambers, and Liberty Counties grew at greater rates than the State of Texas (22.75%). Harris County grew by more than 20% and Galveston by 15%. Between 2000 and 2004, Brazoria County experienced the region's greatest percentage increase in population.

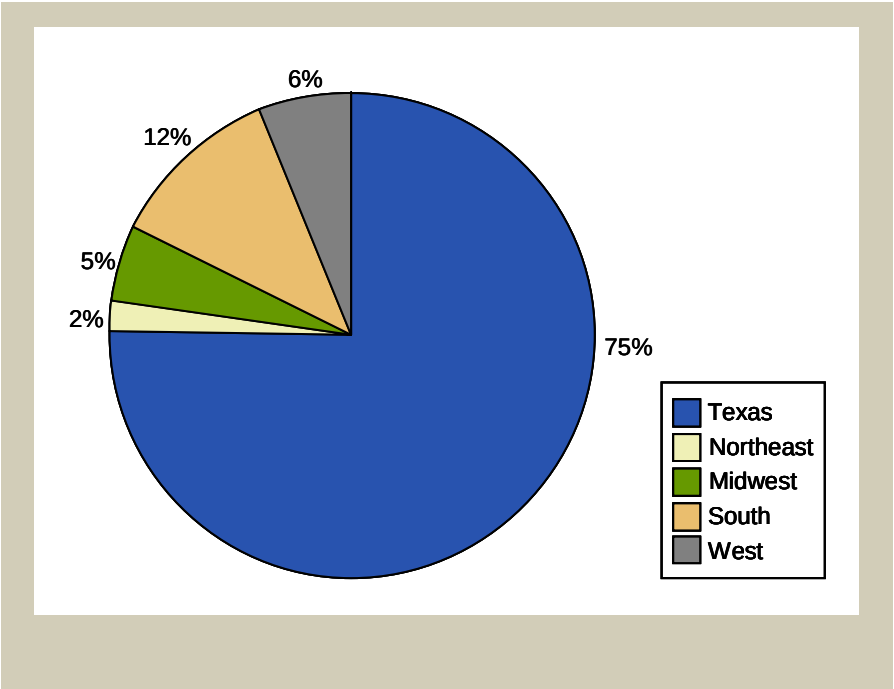
Table A.12
Population 2000, 2004, and Population Percent Change 1990 to 2000, 2000 to 2004

	Brazoria County	Chambers County	Galveston County	Harris County	Liberty County	Texas
Population, 2000	241,767	26,031	250,158	3,400,578	70,154	20,851,820
Population, percent change, 1990 to 2000	26.11%	29.58%	15.07%	20.66%	33.05%	22.76%
Population, 2004 estimate	270,870	28,129	272,024	3,641,114	74,962	22,517,901
Population, percent change, April 1, 2000 to July 1, 2004	12.04%	8.06%	8.74%	7.07%	6.85%	7.99%

Source: U.S. Census Bureau: State and County QuickFacts. Data derived from Population Estimates, 2000 Census of Population Housing, 1990 Census of Population and Housing, Small Area Income and Poverty Estimates, County Business Patterns, 1997 Economic Census, Minority- and Women-Owned Business, Building Permits, Consolidated Federal Funds Report, 1997 Census of Governments

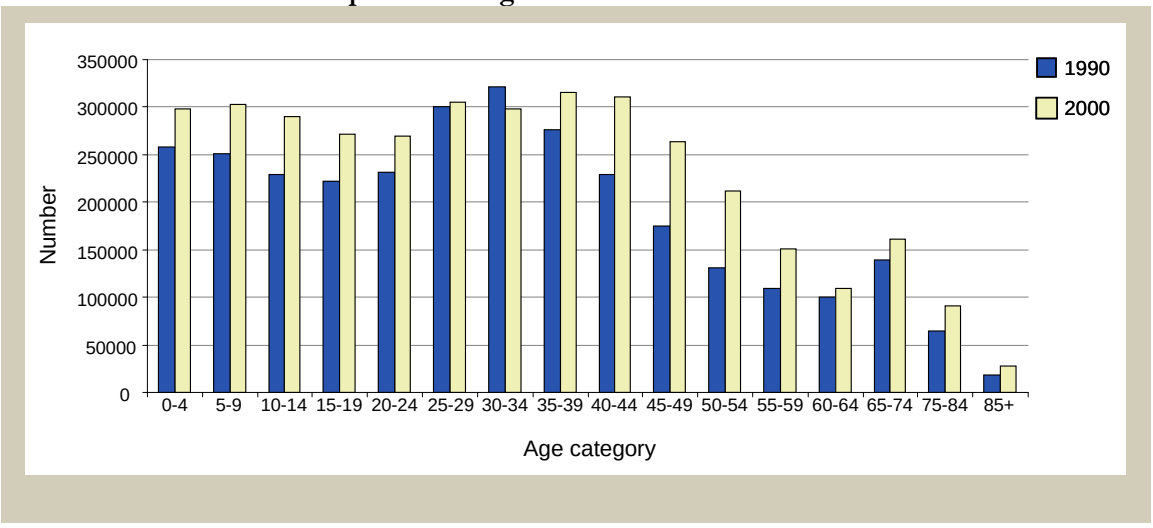
Most people who migrated to the Galveston Bay area are from elsewhere in Texas. Seventy-five percent of the people who relocated to Galveston, Harris, and Chambers counties from 1995 to 2000 came from other counties in Texas. None of the counties in the research area stray from this trend. The second largest source of people moving to the area is the southern states. In 2005 and 2006, the Houston-Galveston area experienced a significant influx of evacuees from Louisiana following hurricanes Katrina and Rita (Cobb, Carroll, & Rodriguez, 2006; Gray, 2006). Demographics in the research area also shifted during the 1990s. In Chambers, Galveston, and Harris counties, the population below age 24 grew considerably. The counties experienced minimal growth in persons aged 25-29, and the population between 30 and 34 declined. The largest increases came in the middle-aged subsets of the population (45 to 54). The population above age 54 also increased, but on a smaller scale.

Figure A.9
Location of Former Residence in 1995 for Recently Relocated Chambers, Galveston and Harris Country Residents Aged 5 Years and Older 2000 Census



Source: U.S. Census Bureau. Data Set: Census 2000 Summary File 3 (SF 3)-Sample Data, Table P24 Residence in 1995 for the Population 5 Years and Over--State and County Level [18]-Universe: Population 5 years and over AND Data Set: 1990 Summary Tape File 3 (STF 3)-Sample data, Table P043. Residence in 1985--State and County

Figure A.10
Aggregate of Chambers, Galveston and Harris Counties: Comparison of Age Distribution 1990 and 2000



Level-Universe: Persons 5 years and over.
Source: Data Set: Census 2000 Summary File 3 (SF 3)-Sample Data. Table P8. Sex by Age [79] - Universe: Total population AND 1990 US Census Data Database: C90STF3A, Summary Level: State—County.

In terms of education, counties in this region have followed a general trend in Texas toward a more educated population. A notable exception to this was Brazoria, where the number of persons having less than a 9th grade education increased by 7.1%. At the same time, the number of people earning a high school diploma or equivalency increased; this was evidenced in Liberty County, which showed a 46% increase in the percentage of the population earning a high school diploma from 1990 to 2000. The increase in educational attainment has also shown up in the percentage of people earning an Associate, Bachelor's, and professional degree. In Brazoria, despite the increase in the population with less than a 9th grade education, the number of people with a graduate/professional degree increased by 71.8%. The region as a whole clearly shows an increase in educational attainment.

There is little economic uniformity among the project counties. In economic measurements, they fall both above and below the average for the State of Texas. The median and per capita incomes of Brazoria, Chambers, Galveston and Harris counties are greater than that of Texas (Table A.13). The opposite is true for Liberty County (Table A.13). Other poverty rates in the area ranged from 10.18% (Brazoria) to 14.97% (Harris). According to the Texas Workforce Commission, the statewide unemployment rate for Texas residents 15 years and older was 4.4% in September 2007. The five subject counties had unemployment rates ranging from a low of 4.3% in Harris County to a high of 5.3% in Liberty County.

Table A.13
Median Household Income, Per Capita Income (Total Population): 1999 (Dollars)

	Median household income in 1999 (Household)	Per capita income in 1999 (Total Population)
Brazoria County	48,632	20,021
Chambers County	47,964	19,863
Galveston County	42,419	21,568
Harris County	42,598	21,435
Liberty County	38,361	15,539
Texas	39,927	19,617

Source: Census 2000 Summary File 3 (SF 3) - Sample Data (Tables P53 and P82)

Table A.14
Poverty Status in 1999

	Brazoria County	Chambers County	Galveston County	Harris County	Liberty County	Texas
Total	230,436	25,719	245,887	3,360,536	64,878	20,287,300
Income in 1999 below poverty level	23,465 (10.18%)	2,833 (11.02%)	32,510 (13.22%)	503,234 (14.97%)	9,296 (14.33%)	3,117,609 (15.37%)
Income in 1999 at or above poverty level	206,971 (89.82%)	22,886 (88.98%)	213,377 (86.78%)	2,857,302 (85.03%)	55,582 (85.67%)	17,169,691 (84.63%)

Source: Census 2000 Summary File 3 (SF 3) - Sample Data (Based on Table P87-Poverty Status in 1999 by Age).
*Population for whom poverty status is determined.

Politics, Governance, and Decision-Making

Texas government and the state constitution are shaped by the Anglo-American tradition, as well as Spanish and Mexican influences reflecting Texas' storied history. Although law and equity play a prominent role in the government, provisions for community property and personal property rights are highly valued by Texans. The extension of private property rights into the protection of homesteads from debt collection is largely a Texas innovation (Handbook of Texas Online).

The executive branch consists of the Governor, Lieutenant Governor, Comptroller of Public Accounts, Land Commissioner, Attorney General, Agriculture Commissioner, and the Secretary of State. All of these positions are elected by the populace, with the exception of the Secretary of State, who is appointed by the Governor. Texas has a bicameral legislature which meets in regular session once every two years. The Legislature of Texas is bicameral. The House of Representatives has 150 members and is presided over by the Speaker of the House. The Lieutenant Governor presides over the Senate, which has 31 members. (Texas Online; Texas House of Representatives).

All of the elected offices in the state's executive branch are currently held by Republicans. Additionally, Texas' two U.S. senators, Kay Bailey Hutchison and John Cornyn, are Republicans. Texas has 32 representatives in the U.S. House of Representatives, with nine representing the counties of the Galveston Bay area. Of these, five are Republicans and four are Democrats. In the state legislature, the Galveston Bay counties are represented almost equally by members of the two major parties. The area has seven state senators: three Democrats and four Republicans; and 30 state representatives: 16 Republicans and 14 Democrats (Texas Legislature Online).

All Texas counties have the same form of government, although in some urban counties the state has allowed additional offices or courts. As a legal subdivision of the state, a county serves as an administrative arm of the state in helping to carry out the state's business. Counties in Texas do not have as much autonomy as cities. The primary administrative and policy making body is the commissioners court, which is comprised of four elected commissioners and the county judge, who serves as the presiding officer. The court approves the county budget, sets the tax rate, approves subdivision platting, and may oversee county activities such as bridge and road repair, local courts, or county hospital administration. It also manages all county functions not run directly by other county officials. In most counties, voters also elect a sheriff, tax assessor-collector, clerk, and treasurer, all with duties specified by the Constitution or state statute.

In Texas, areas within each county are either incorporated – part of a city— or unincorporated. A city may contract with the county for needed services within its incorporated areas. All counties have regulatory authority within unincorporated areas over residential subdivision plats, junkyards, keeping wild or exotic animals, and mass gatherings of 5,000 or more people. Many counties have unique powers to regulate specific activities or to enact ordinances. No county in Texas has general ordinance-making authority, although in many cases, the state legislature can authorize a county to enact rules or ordinances in regard to a specific issue. For example, although counties generally do not have zoning authority, certain Texas counties have been given the authority to adopt zoning ordinances in limited areas around special features (House Research Organization).

Cities in the state are classified as either "general law" or "home rule." A city may elect home rule status and draft an independent city charter once it exceeds a population of 5,000 and the voters agree to home rule. Otherwise, it is classified as general law and has very limited powers. One example of the difference in the two structures regards annexation. General law cities cannot annex adjacent unincorporated areas without the property owner's consent; home rule cities may annex without consent but must provide essential services within a specified period of time (usually three years) or the property owner may file suit to be de-annexed. Once a city adopts home rule it may continue to keep this status even if the population later falls below 5,000. Incorporated cities in Texas have limited authority for various purposes in areas beyond their city limits. This "extraterritorial jurisdiction," (ETJ) is defined by the Local Government Code to extend for different distances, ranging from one-half mile to five miles, depending upon the number of inhabitants in a city (Texas Statutes. Local Government Code.)

The five counties in the study are also part of a larger regional organization, the Houston-Galveston Area Council (H-GAC). H-GAC is a voluntary association of local governments and elected officials, organized in 1966 after authorization by state enabling legislation. H-GAC has 133 local government members, including all major general-purpose local governments in its 13-county Gulf Coast Planning region. H-GAC's chief mission is to promote efficient and accountable use of local, State, and Federal tax dollars; serve as a

problem-solving and information forum for local governments; and help local governments, business, and civic organizations analyze trends and conditions affecting the area and respond constructively, either individually or collectively. H-GAC promotes voluntary approaches in region-wide purchasing, solid waste management, air and water quality, workforce development, criminal justice system improvements and law enforcement officer training, transportation system improvements planning, 9-1-1 emergency telephone communications, homeland security and emergency preparedness, trauma/emergency care policy, and other significant areas of concern to local government (H-GAC).

Governance of Regional Natural Resources

Over 90% of Texas' 176 million acres of land is privately owned (Texas Environmental Profiles; Governor's Task Force on Conservation, 2000). This vast amount of land in private hands, coupled with the region's historically strong inclination to allow owners of private property free rein, means that protection of natural resources in Texas has not been a high priority and attempts to place any restrictions on use of private property generally meet with strong opposition (Scheibal, 2005; Tolson, 1003). Only recently have the area's natural resources come to be viewed as economically important (HARC).

Just 3% of the land in Texas is owned by the state and the Texas Parks and Wildlife Department (TPWD) manages just 0.6% of this 3 percent. There are approximately 1,400,000 acres of state parks and wildlife management areas in the Texas Parks and Wildlife Department's system. Of this amount, 650,000 acres are state parks (state parks, historical sites, and natural areas). One-half of the state park system is leased from the federal government. Just over 2.5% of the state's total outdoor recreation and conservation land is provided by the federal government. This includes land managed by the U.S. Fish and Wildlife Service, the U.S. Forest Service, the National Park Service, and the U.S. Army Corps of Engineers. The remainder of recreational land in the state is provided by local governments and private sources (Texas Environmental Profiles).

In the Galveston Bay region, the federal government manages the Anahuac National Wildlife Refuge, the Texas Mid-Coast National Wildlife Refuge complex, the Trinity River National Wildlife Refuge (U.S. Fish and Wildlife Service) and the Big Thicket National Preserve (National Park Service). The U.S. Army Corps of Engineers manages the Addicks and Barker Reservoirs (over 26,000 acres) and the Wallisville Lake project; both of which provide recreational and nature observation opportunities, in addition to their flood control functions.

Among those state agencies managing public property in the region are the Texas Parks and Wildlife Department, with two state parks (Galveston Island State Park and the Varner Hogg Plantation), three wildlife management areas (one each in Brazoria, Chambers, and Harris counties), and ten Texas Gulf Ecological Management Sites. Gulf Ecological Management Sites (GEMS) are geographic areas that have special ecological significance to the continued production of fish, wildlife, and other natural resources, or that represent unique habitats (TPWD).

The five individual counties in the region also own and manage a number of parks and recreation facilities, the largest landholders being Harris and Galveston counties. In addition, the municipalities also own parkland. The City of Houston has 350 developed parks and more than 200 green spaces totaling over 38,945 acres, while the City of Galveston manages 12 parks, including 32 miles of beach.

Other state agencies with interest in the natural resources of the region are the Texas Commission on Environmental Quality (TCEQ), which is charged with protecting the state's "human and natural resources consistent with sustainable economic development," and the Texas General Land Office (GLO), which manages 20.4 million acres of state property. Included the portfolio managed by the GLO are the beaches, bays, estuaries, and other "submerged" lands out to 10.3 miles in the Gulf of Mexico, institutional acreage, grazing lands in West Texas, timberlands in East Texas, and commercial sites in urban areas throughout the state. The GLO leases drilling rights for oil and gas production on state lands, producing revenue and royalties. The GLO also administers the Texas Coastal Management Program to improve the management of the state's coastal natural resource areas (CNRAs) and to ensure the long-term ecological and economic productivity of the coast. As part of the Texas Coastal Management Program, the Coastal Coordination Council is a forum for coordinating state, federal, and local programs and activities of the Texas coast (Texas GLO).

Other sizeable undeveloped properties in the region are owned by private, non-governmental interests such as the Houston Audubon Society's bird sanctuaries, the Trust for Public Land's Houston-Galveston Coastal Heritage Program, and Nature Conservancy preserves.

Industrial and Economic Characteristics

The economy of the Houston-Galveston region is primarily based on the energy industry (particularly oil); however, biomedical research and aerospace are also large parts of the region's economic base. The Houston metropolitan area comprises the largest petrochemical manufacturing area in the world and, in addition to oil and gas, includes, synthetic rubber, insecticides, and fertilizers. The area is also the world's leading center for building oilfield equipment. The city is home to 5,000 energy-related establishments, including many of the top oil and gas exploration and production firms and petroleum pipeline operators. Houston is second to New York City in the number of Fortune 500 companies headquartered in the city (Greater Houston Partnership).

The Houston Ship Channel, a 52-mile inland waterway, connects the Houston area with markets throughout the world. The Port of Houston is a 25-mile (40-kilometer) complex of diversified public and private facilities just a few hours' sailing time from the Gulf of Mexico. The Port of Houston is the world's sixth largest port and routinely ranks first in the nation in volume of foreign tonnage and second in the nation in total tonnage. Two major railroads and 150 trucking lines connect the port to the continental United States, Canada, and Mexico (Greater Houston Partnership).

Like the region as a whole, Galveston Island has experienced a great deal of growth in the past decade, and more than $2.3 billion in new investment is currently underway or planned. This growth includes industries such as health care, life sciences/biotechnology, tourism/hospitality, off-shore oil, maritime, services, retail, education, and government. The tourism industry is growing with the addition of new hotels and expansion and renovation of existing ones. The Port of Galveston now ranks as the eleventh-largest cruise port in the world and the number-one cruise port in the Gulf of Mexico and Texas. The port's industrial growth continues at facilities and terminals along the Galveston Harbor (Galveston Chamber of Commerce). The jobs added to the economy also mean that the housing stock will need to increase.

The Houston-Galveston region has over 315,000 students enrolled in more than 100 universities and other colleges or trade school. Baylor College of Medicine, University of Houston, Rice University, University of Texas Health Science Center, Texas A&M University at Galveston, and the University of Texas Medical Branch (UTMB) at Galveston are just a few of the region's major institutions of higher learning (Greater Houston Partnership). UTMB is in the process of investing over $300 million in campus facilities on Galveston Island. With more than 12,000 employees, the university is the largest employer in Galveston County and among the largest employers in the Houston-Galveston area.

Other major employers in the region are the Texas Medical Center (TMC) and the Johnson Space Center. With 46 institutions, the Texas Medical Center is the largest in the world and accounts for nearly $6 billion in regional spending, $3.9 billion in regional personal income and over 140,000 jobs (TMC; Federal Reserve Bank of Dallas). The Johnson Space Center civil service workforce includes about 3,000 employees, while more than 12,000 contractors work onsite or in the area (NASA).

Galveston Bay's environmental resources provide a major source of income for the region, through commercial fishing and shrimping, recreational fishing, hunting, and ecotourism, particularly bird watching. Galveston Bay contributes one-third of the state's commercial fishing income and one-half of the state's recreational fishing income (Lester & Gonzalez, 2005).

Events and Issues of Regional Significance

The Houston-Galveston region is expected to grow by 2 to 3 million people over the next 25 to 30 years (Greater Houston Partnership; Envision Houston + Region). The pattern of growth in the region has been increasingly decentralized, with much of the growth taking place in unincorporated areas outside of city limits. Many county governments are thus struggling to cope with the challenges arising from urban sprawl (Greater Houston Partnership; House Research Organization). Transportation infrastructure has been unable to keep up with this growth (Greater Houston Partnership), and, even if trip demand could be accommodated with more roadways, the region's air quality is already compromised. Since 1990, the eight-county Houston-Galveston metropolitan area has been classified as a nonattainment area by the U.S.

Environmental Protection Agency, meaning that the region exceeds the federal standard for certain pollutants under the Clean Air Act Amendments. Since that time, the state and the region's various governing and planning entities have sought options to bring the region's air quality within federal standards. In addition to the pollution resulting from vehicle exhaust, the region's air quality is also impacted by its industries and weather patterns (TCEQ).

The Houston-Galveston Area Council has led an initiative designed to create a regional vision to address and manage region's growth. "Envision Houston Region" aims to facilitate citizen involvement in the process of how future growth will affect land use and transportation planning. In addition to H-GAC, several local partners are participating in the initiative, including Bay Area Houston Economic Partnership, Blueprint Houston, the City of Baytown, the Economic Development Alliance for Brazoria County, Galveston Economic Development Partnership, Greater Fort Bend Economic Development Council, Greater Greenspoint District, North Houston Association, and West Houston Association. (Envision Houston + Region).

Other issues and events of regional significance have been the tropical storms and hurricanes that affect the region. Over a period of five days in June 2001, Tropical Storm Allison dumped over 36 inches of rain on the Houston area, causing 22 deaths and over $5 billion in damage, primarily due to flooding. Two-thirds of the area flooded lay outside the 100-year flood plain. Tropical Storm Allison is the costliest natural disaster in Houston's history (National Weather Service). In the aftermath of Tropical Storm Allison, the Federal Emergency Management Agency (FEMA) and the Harris County Flood Control District began a multi-year initiative called the Tropical Storm Allison Recovery Project (TSARP) to comprehensively assess the flood risks associated with the major flooding sources within Harris County, including complete remapping of the county's flood plains (Harris County Flood Control District).

In August 2005, Hurricanes Katrina and Rita struck the U.S. Gulf coast. These two storms affected the Houston-Galveston region in very different ways. Katrina's impact has been felt in the Houston area with the resulting influx of evacuees from Louisiana. Estimates are that the region absorbed 160,000 refugees from Katrina, many choosing to stay on in Texas rather than return to the devastated New Orleans area. These newcomers have impacted schools and public services throughout the region (Cobb, Carroll & Rodriguez, 2006).

Following Katrina, Hurricane Rita headed for landfall at Galveston in September 2005. In the wake of Katrina's devastation, residents in the path of Hurricane Rita were encouraged to evacuate, resulting in massive traffic jams stretching from Galveston and Houston to points much farther north. Official estimates are that 2.5 million residents attempting to leave the area filled the roadways. Contributing to the congestion was the fact that nearly half of those evacuating traveled in caravans of more than one vehicle, with about 30% saying they traveled with 3 or fewer companions in multiple vehicles. Follow-up research suggests that people were bringing along their second cars, in an attempt to safeguard a perceived valuable possession (Mack, 2005). This research also found that nearly one out of every 10 ended up returning home, frustrated by the slow-moving traffic or fearful that they would run out of gas. Just over half of the evacuees completed their trips, either to their intended shelter destination or back home, in less than 10 hours, but just over 20% spent 20 hours or more on the road. So great was the congestion that trips which normally take 3 hours took up to 21 hours (Mack, 2005).

The storm ultimately veered eastward, missing a direct hit with Galveston Island and making landfall at Sabine Pass on the Texas-Louisiana border. Seven deaths were attributed directly to the storm, with an additional 55 fatalities in Texas resulting from the evacuation, including deaths from heat stroke and traffic accidents (Knabb, Brown & Rhome, 2006). The problems resulting from the mass evacuation in advance of Hurricane Rita highlighted major flaws in emergency preparedness and response in the region. Texas Governor Rick Perry convened a task force to investigate what went wrong and to address the lessons learned from Hurricane Rita. The task force concluded that a single, well-informed official could best coordinate an efficient evacuation of multiple cities, counties, and regions (Berger, 2006).

REFERENCES

Agency for Workforce Innovation. (2006). *Florida Labor Market Trends*. Tallahassee, FL: Agency for Workforce Innovation. Retrieved on June 16, 2006, from http://www.labormarketinfo.com/library/pubs/trends/trends-june162006.pdf

Associated Press. (2007). States ask for extension on water-sharing agreement. Retrieved on February 12, 2007, from http://www.accessnorthga.com/detail.php?n=96095&c=10

Barry, D. (2006, June 19). In Louisiana, a sinking island wars with water and the government. *New York Times*. Retrieved from http://www.nytimes.com/2006/06/19/us/19road.html

Berger, E. (2006, February 20). Task force recommends stronger state oversight of evacuations. *Houston Chronicle*. Retrieved from http://www.chron.com/disp/story.mpl/special/05/rita/3672282.html

Chapin, T. (2003). *A Population and Employment Forecast for Franklin County*. Tallahassee, FL: Florida State University. Retrieved from http://garnet.acns.fsu.edu/~tchapin/urp5261/FC%20Final%20Report.pdf

Clark, R.R., & LaGrone, J. (2006 February). *A Comparative Analysis of Hurricane Dennis and Other Recent Hurricanes on the Coastal Communities of Northwest Florida*. Proceedings of the National Conference on Beach Preservation Technology, Sarasota, FL. Retrieved on January 10, 2007, from http://www.fsbpa.com/2006%20Proceedings.htm

Cobb, K., Carroll, S., & Rodriguez, L. (2006, December 22). Louisiana's population loss is a gain for Texas; Immensity of the Katrina migration is shown in staggering census figures. *Houston Chronicle,* p. B1.

Dewan, S. (2006, August 24). Storm's escape routes: one forced, one chosen. *New York Times*, p. A1.

Envision Houston Region. (2006). *Envision Houston + Region*. Retrieved on October 22, 2007, from http://www.envisionhoustonregion.org/faqs.htm

Federal Reserve Bank of Dallas, Houston Branch. (2001). *Houston Business: A Perspective on the Houston Economy*. Houston, TX: Federal Reserve Bank of Dallas, Houston Branch. Retrieved on October 19, 2007, from http://www.texasmedicalcenter.org/Images/fedresrpt.pdf

Florida Department of Agriculture and Consumer Services, Division of Aquaculture. (2003, October). *Florida Aquaculture*. Issue 27. Tallahassee, FL: Florida Department of Agriculture and Consumer Services.

Florida Department of Community Affairs, Division of Community Planning. (n.d.) *Comprehensive Planning*. Tallahassee, FL: Florida Department of Community Affairs. Retrieved on November 12, 2007, from http://www.dca.state.fl.us/FDCP/DCP/compplanning/index.cfm

Florida Department of Community Affairs, Division of Community Planning. (2003). *Division of Community Planning: Program Summary 2003*. (p. 13) Tallahassee, FL: Florida Department of Community Affairs.

Galveston Bay Estuary Program. (2002). *The State of the Bay: A Characterization of the Galveston Bay Ecosystem*. (2nd ed.). Austin, TX: Texas Commission on Environmental Quality.

Galveston Chamber of Commerce. (2007). *Economy: Historic City…New Opportunities*. Retrieved on October 19, 2007, from http://www.galvestoncc.com/custom2.asp?pageid=204.

Governor's Task Force on Conservation. (2000). *Taking Care of Texas*. Austin, TX: Office of the Governor. Retrieved on October 19, 2007, from http://www.tpwd.state.tx.us/publications/nonpwdpubs/media/taking_care_of_texas_report.pdf

Grey, Lisa. (2006, January 1). 2005 Year in Review; A year of storms that proved Houston's heart, and tested our readiness. *Houston Chronicle*, p. A1.

Greater Houston Partnership. (2000). *Trip 2000: Travel Rate Improvement Program for the Houston Area – Preserving Mobility in the 21st Century*. Houston, TX: Greater Houston Partnership. Retrieved on October 22, 2007, from http://www.houston.org/pdfs/trip2000.pdf

Greater Houston Partnership. (2007). *Houston Facts: Discover the Houston Region*. Houston, TX: Greater Houston Partnership. Retrieved on October 18, 2007, from http://www.houston.org/houston-facts/Houston-Facts.pdf

Greater LaFourche Port Commission. (2007). *Port Fourchon – The Gulf's Energy Connection*. Retrieved on October 12, 2007, from http://www.portfourchon.com/

Halfbinger, D. (2002, June 3). Small Catches, Low Prices and Imports Bedevil Louisiana Shrimpers. *New York Times*, p. A13.

Handbook of Texas Online, s.v. "Government." Retrieved on October 18, 2007, from http://www.tsha.utexas.edu/handbook/online/articles/GG/mzgfq.html

Harris County Flood Control District. (n.d.) *Tropical Storm Allison Recovery Project*. Retrieved on October 22, 2007, from http://www.hcfcd.org/tsarp.asp?flash=yes

House Research Organization. (2002, November 6). *Focus Report: Do Counties Need New Powers to Cope with Urban Sprawl?* Austin, TX: Texas House of Representatives.

Houston Advanced Research Center (HARC). (2007). *Valuing Nature in Texas*. Retrieved on October 19, 2007, from http://www.harc.edu/Projects/Nature/

Houston Endowment. (2007). *Grant Topics: Preserving Land*. Retrieved on October 18, 2007, from http://www.houstonendowment.org/grants/Topics/community/land.htm

Houston-Galveston Area Council. (2007). *H-FAC Facts*. Retrieved October 18, 2007, from http://www.h-gac.com/HGAC/About+H-GAC/H-GAC_Facts.htm

Kirkland, S. (2006, March/April). Florida's Vanishing Oystermen. *Florida Wildlife Magazine*, 40-42.

Knabb, R.D., Brown, D.P., & Rhome, J.R. (2006). *Tropical Cyclone Report: Hurricane Rita*. National Hurricane Center. Retrieved on October 22, 2007, from http://www.nhc.noaa.gov/pdf/TCR-AL182005_Rita.pdf

Lafourche Parish, Louisiana. (1996). Chapter 19: Planning and Zoning. *Lafourche Parish Code of Ordinances*. Thibodaux, LA: South Central Planning and Development Commission. Retrieved on October 10, 2007, from http://www.lafourchegov.org/lafourchegov/CouncilCode/Chapter%2019.pdf

Lafourche Parish, Louisiana. (2007). *Lafourche Parish Government Website*. Retrieved on October 20, 2007, from http://www.lafourchegov.org/lafourchegov/

Lester, J., & Gonzalez, L. (2005). *Briefing Paper on Galveston Bay Plan Action Items: Shoreline Management*. Houston, TX: Houston Advanced Research Center (HARC). Retrieved on October 22, 2007, from http://galvbaydata.org/projects/reports/docs/BriefingPaper%20Shoreline.pdf

Longman, J. & Brick, M. (2005, September 26). Waters Recede, Leaving a Trail of Frustration. *New York Times*. Retrieved on November 12, 2007, from http://www.nytimes.com/2005/09/26/national/nationalspecial/26houma.html#

Louisiana Coastal Wetlands Conservation and Restoration Task Force & the Wetlands Conservation and Restoration Authority. (1998). *Coast 2050: Toward a Sustainable Coastal Louisiana*. Baton Rouge, LA: Louisiana Department of Natural Resources.

Louisiana Department of Natural Resources. (2007). *Louisiana Coastal Facts*. Retrieved on October 12, 2007, from http://dnr.louisiana.gov/crm/coastalfacts.asp

Louisiana Recovery Authority. (2007). *Louisiana Speaks: A Long-Term Planning Initiative of the Louisiana Recovery Authority*. Retrieved on October 12, 2007, from http://www.louisianaspeaks.org/

Mack, K. (2005, October 6). Rita Re-examined: How We Reacted: Most say they will leave again if a similar storm heads to Houston. *Houston Chronicle*, p. A,1.

National Aeronautics and Space Administration (NASA). (2006). *NASA Facts: Johnson Space Center – Exploring the Science of Space for the Future of Earth*. Retrieved on October 19, 2007, from www.nasa.gov/centers/johnson/pdf/167745main_FS_JSC508c.pdf

National Oceanic and Atmospheric Administration (NOAA). (2004). *Interim Report on the Bottlenose Dolphin (Tursiops truncatus) Unusual Mortality Event Along the Panhandle of Florida*. Washington, D.C.: NOAA.

National Weather Service, Houston/Galveston Office. (2007-last update). *Tropical Storm Allison Floods*. Retrieved on October 22, 2007, from http://www.srh.noaa.gov/hgx/projects/allison01.htm

Northwest Florida Water Management District. (2002). *Annual Report 2001*. Havana, FL: Northwest Florida Water Management District.

Northwest Florida Water Management District (2004). *Annual Report 2003*. Havana, FL: Northwest Florida Water Management District.

O'Brien, K. (2003, March 16). Prayers of the Shrimpers. *New Orleans Times-Picayune*, Sect. LIVING, p. 1.

Porter, E. (2006, December 11). Katrina Begets a Baby Boom by Immigrants. *New York Times,* p. A1.

Ritchie, B. (2005a, September 7). Oyster Harvesting at a Halt. *Tallahassee Democrat*, p. B1.

Ritchie, B. (2005b, November 24). Oyster Harvest Reopens at Last. *Tallahassee Democrat*, p. A1.

Scheibal, S. (2005, April 8). Land Bill has Austin's SOS Rules in its Sights. *Austin American-Statesman,* p. A1.

Schleifstein, M. (2002, June 27). Coastal Resuscitation: An Ambitious 30-year Plan would Pump New Life into South Louisiana's Beleaguered Coast and Wetlands. *New Orleans Times-Picayune*. Retrieved on November 12, 2007, from http://www.nola.com/hurricane/content.ssf?/washingaway/futureofcoast_1.html

Shelton, Stacy. (2006, December 20). Talks on Chattahoochee Extended Through Jan. 31. *The Atlanta Journal-Constitution*, Sect. D, 9.

Stephenson, D. (2000). The Tri-State Compact. *Journal of Land Use & Environmental Law* 16(1), 83-110.

Terrebonne Parish Consolidated Government. (n.d.). *History of Houma/Terrebonne*. Retrieved on October 10, 2007, from http://www.tpcg.org/main/about.asp

Terrebonne Parish Consolidated Government. 1991. *Parish Code*. Tallahassee, FL: Municipal Code Corporation. Retrieved on October 10, 2007, from http://www.municode.com/resources/gateway.asp?pid=10737&sid=18

Texas Commission on Environmental Quality. *Houston-Galveston-Brazoria Eight-Hour Ozone Nonattainment Area*. Retrieved on October 17, 2007, from http://www.tceq.state.tx.us/implementation/air/sip/hgb.html

Texas Environmental Profiles. (n.d.). *Land: Public Lands and Public Recreation*. Retrieved on October 18, 2007, from http://www.texasep.org/html/lnd/lnd_5pub.html

Texas General Land Office. (n.d.). *About the Land Office*. Retrieved on October 19, 2007, from http://www.glo.state.tx.us/about/landoffice.html

Texas House of Representatives (n.d.). *Texas House of Representatives – About Us*. Retrieved on October 18, 2007, from http://www.house.state.tx.us/help/about.htm

Texas Legislature Online. Retrieved on October 18, 2007, from http://www.capitol.state.tx.us/Home.aspx

Texas Online. Retrieved on October 18, 2007, from http://www.texasonline.com

Texas Legislature. (n.d.). *Texas Statutes – Local Government Code*. Retrieved on October 23, 2007, from http://tlo2.tlc.state.tx.us/statutes/lg.toc.htm

Texas Workforce Commission. (2007). *Texas Labor Market Information Tracer*. Retrieved on October 24, 2007, from http://www.tracer2.com/

Tolson, M. (1993, November 3). Zoning Opponents Relieved at Prospect of 'Free City.' *Houston Chronicle*, Sect. A, 21.

U.S. Census Bureau. 2000.

U.S. Department of Labor, Bureau of Labor Statistics. (2007). *Bureau of Labor Statistics Data*. Louisiana 1997 – 2007, not seasonally adjusted. Series ID: LAUST22000003. Retrieved on October 9, 2007, from http://data.bls.gov/cgi-bin/surveymost

Union of Concerned Scientists. (2005). *Gulf Coast's Louisiana Coastal Development and Infrastructure*. Retrieved on October 9, 2007, from http://www.ucsusa.org/gulf/gcstatelou_dev.html

Appendix B

Interview
Recruitment Materials & Guides

Telephone Contact – Wave 1

My name is_____

I am part of a research team at TAMU. We have a grant from the Environmental Protection Agency, and as part of the project we are talking to stakeholders and decision makers about different kinds of problems facing Gulf coast communities. As part of the community, _____ (the organization name) faces some unique problems, and as _____ (person's position), we believe you could provide us with valuable information about them and the ways you deal with them. By talking to important decision makers and groups in the community, we believe we will learn more than if we just did a public survey. We are especially interested in learning about

- Key problems facing the community, particularly from your organization's perspective
- Solutions or potential solutions to those problems
- How decisions are made regarding solutions and approaches to problems
- What kinds of information are used in reaching decisions

I would like to set up a time for an interview that is convenient for you. The interviews are running anywhere from 30 minutes to an hour, depending on how much our interviewee wants to talk. I would like to schedule an hour with you if I can, just to make sure we have enough time.

I can be reached at _____ (phone number) if you have questions between now and the interview time and my email address is _____.

Pat Answers:

1. My organization doesn't have anything to do with environmental problems, so why talk to me?

   ANS: The EPA's primary focus is the environment, but the agency has come to realize that communities face many problems that compete for attention with environmental issues. EPA wants to learn more about these, and the Galveston Bay area is one place we have chosen to focus on.

2. How did you choose my organization?

   ANS: We first did a search of the web for organizations whose decisions had important impacts on the Galveston Bay area. Your organization is one of these. [There will be variations depending on the particular organization in question.]

3. Why me?

   ANS: Your position as _____ means that you know a great deal about both your organization and the community and can give us the most accurate information and important insights.

4. What kinds of questions will you be asking?

   ANS: We will be asking about
   - Key problems facing the community, particularly from your organization's perspective
   - Solutions or potential solutions to those problems
   - How decisions are made regarding solutions and approaches to problems
   - What kinds of information are used in reaching decisions

5. Can you send me more information on the project?

   ANS: Yes. I will be glad to send you our project summary. Faxing it to you will be the quickest. What is your fax number?

6. Can you send me the list of questions in advance of the interview?

   ANS: No. There is no interview instrument. We are holding open-ended interviews with decision-makers in the community on the general topics I mentioned. The idea is to allow the person being interviewed as much freedom as possible to tell us what he/she thinks is important to the organization and the community.

7. Does this have to be a face-to-face interview? Can I do it by phone, email/fax/etc.?

   ANS: Out interviewees have been very generous with their time and have, until now, all agreed to be interviewed face-to-face. In order to insure uniformity in the method we are using, I am hoping that you will also agree to an interview. It will be scheduled entirely at your convenience.

Project Information Sheet for Interviewees

The Gulf of Mexico is one of North America's richest resources and touches some of the most economically vibrant states in the union. These states depend a great deal on their coastal regions and tend to concentrate significant portions of their recreation and economic development in coastal areas.

This project is designed to capture the problems of Gulf coast communities as defined by community decision makers. The project is also focusing on the potential impact of global warming and how possible climate changes might influence the ways decision makers define and address the various problems that they confront. This project is being supported by a grant from the Environmental Protection Agency. This agency understands that many problems compete for the attention of decision makers and that not all of these problems are environmental in nature. However, EPA believes that global warming and climate change are issues it needs to provide effective and relevant information on. The agency is interested in learning more about the problems facing coastal communities, the kinds of solutions that are being discussed to address them, and the kinds of information that are being used to make decisions about them. This includes information on global warming and climate change. Information from decision makers on the types of information and the most useful information formats will enable EPA to improve the kinds of information it makes available to decision makers and other stakeholders.

Four university partners are engaged in this project: Texas A&M University, University of New Orleans, University of Louisiana at Lafayette, and Florida A&M University. Research teams at these locations involve both social and natural scientists. These teams are interviewing decision makers in three research locations: the Galveston Bay area, the La Fourche-Terrebonne area of Louisiana, and Apalachicola Bay in Florida. As many as 200 interviews will be done in each location for a total of approximately 600 interviews for the project as a whole. Information provided by decision makers will be confidential. All information will be aggregated and reported in summary form so that no link can be made between respondents and their statements. The research protocols have been approved by the Institutional Review Boards at the partner universities for the protection of human subjects.

If you have any additional questions about the project, you may contact:

Dr. Arnold Vedlitz, Ph.D.
Principal Investigator
Director, Institute for Science, Technology and Public Policy
979.845.2929

Dr. Letitia Alston, Ph.D.
Co-Principal Investigator
Associate Director, Institute for Science, Technology and Public Policy
979.845.4114

Interview Guide – Wave 1

INTRODUCTION

My name is _____

I am a _____ (professor, research scientist, research associate) with _____ at Texas A&M University.

I am part of a team that is working on a research project funded by the Environmental Protection Agency. The EPA realizes that the Gulf coast is an important area and that communities along the coast face a variety of problems, only some of which are environmental in nature. Although the EPA primary interest is the environment, the agency realizes that it needs to know more about the different kinds of problems communities are facing and how they are dealing with these problems.

WHO ARE YOU TALKING TO?

- ✓ Make sure that your contact information is correct. This is also a place you can demonstrate that you are knowledgeable about the individual and the organization.
- ✓ Are you are talking to the correct person?
- ✓ Length of time in the area
- ✓ Length of time with the organization

CONSENT AND TAPING FORMALITIES

- ✓ Give the respondent the information sheet
- ✓ Ask if there are any questions
- ✓ Ask if you can tape the interview—
  The reason for taping is not to miss any important information. Tapes will be destroyed after the information is in the database. Stress that the taping can stop at any point in the interview
- ✓ Issue of using quotes—
  Tell that respondent that sometimes the best way to tell the story of the data is with quotes from the people on the ground. If statements from this interview turn out to be the best way to express something, could we quote the statement without using the respondent's name or the name of the organization? Make a note of the response and make sure you have it on tape as well.

INTERVIEW

Problems

- What are the ***problems***?
- ***Prioritize*** them if there are multiple problems
- ***Describe*** each of them, starting with the most serious:
  Probe for seriousness, risks, timing, causes, who is affected, who recognizes the problem
- How did this become ***recognized*** as a problem
- Do other organizations have these problems as well – ***shared?***
- ***How*** were they ***defined*** as problems:
  Probe for role of information in defining or understanding the problem: probe for source and type of information
- ***Who does R talk to*** about the problem:
  Probe for network for information on the problem
- ***Who knows most*** about the problem?

Solutions & Decision Process

- What is/are the ***ideal solution***(s)
- What is/are the ***possible solution***(s)
- Who is ***suggesting*** it/them: Probe for relative influence of groups or individuals
- Who is actually ***making decisions*** about what to do:
  Probe for why the solution was put forward
- How are decision-makers ***communicating***
- Is there ***disagreement or conflict*** over solution(s)
- What ***information*** is being used to make these decisions:
  Probe for type, source and trust if different from 6th bullet above and how the different types of information affect decisions
- How can ***information be improved*** to aid decision making:
  Probe for sources, types, formats
- What are the ***resources*** available to address the problem
- What are other ***barriers*** to implementation of solutions:
  Probe for the level at which barriers exist (local, regional, state, national), windows of opportunity, communication barriers, information barriers

Telephone Re-Contact Panel – Wave 2A

My name is_____

I am calling from TAMU. We contacted you in _____ to participate in a series of interviews we were doing with stakeholders and decision makers in the Galveston Bay area. You were very generous with your time and gave us some valuable information about the kinds of problems you and your organization are currently facing. At that time, you also indicated that you would be willing to give us a second interview if we had additional questions.

We have entered the second phase of this study. In this phase, we are focusing more on environmental issues and the kinds of environmental information that could be valuable to decision makers. If you remember, this study is being funded by EPA, and EPA is particularly interested in how possible changes stemming from global warming might affect decision making and increase the need for new kinds of information. Even organizations that are not directly involved with things like wetlands or bird sanctuaries can be affected by climate changes, such as increases in temperatures, increases in sea level, and bigger storm surges.

Building on information you have already provided, I would like to talk to you about some specific projections of climate changes, how you think these could affect your organization and the kinds of information you would need to take warming and climate change into consideration when you are making decisions.

I would like to set up a time for an interview that is convenient for you. The interviews are running under an hour although some have lasted longer, depending on how much our interviewee wants to talk. I would like to schedule an hour minutes with you if I can – to make sure we have enough time.

I can be reached at _____ (phone number) if you have questions between now and the interview time and my email address is _____.

Responses to Questions for Wave 2A:

1. Why did you decide to come back to me?

   ANS: We looked at all our interviews from the first phase of the research and sampled from that group with a method that would give us the best representation of organizations in the area. We wanted to make sure that we included _____ (respondent's organization type), and your name came to the surface. [If the respondent understands sampling, you could just talk about stratified random sampling instead of the statement above – but ONLY if.]

2. I don't believe that climate change exists and so won't have anything to say to you.

   ANS: It is especially important for us to talk to people who have reservations about the reality of global warming and climate change. EPA is one of several governmental agencies convinced that global warming and climate change are already under way, but if important segments of the population don't agree (remain unconvinced), the agency needs to know that and to know why.

3. I can't imagine how climate change would affect me/my organization and so don't have anything to say to you.

   ANS: It is especially important for EPA to distinguish between organizations that are taking climate change into consideration and those that aren't. We have developed some very specific climate change scenarios for the Galveston Bay area and need to have feedback about their relevance from decision makers like you. EPA is interested in increasing the relevance of the information it provides, and only the decision makers themselves can determine what is relevant and what is not.

4. Why didn't you ask me about climate change during the first interview?

   ANS: There are two reasons. First, we wanted to get an accurate reading on the kinds of problems facing people in the Galveston Bay area without biasing them toward a consideration of environmental problems. EPA realizes that environmental issues are only one kind of issue competing for our attention.

   Second, it was during the first phase of the research that we worked with climate scientists to develop a set of climate change possibilities for the Galveston Bay that are based on the best science we have. In this phase of the research, we want to use these to brainstorm with decision makers on how their decision making may be affected by aspects of warming and climate change.

5. What are you going to ask me this time?

   ANS: I would like to show you a graphic that displays plausible consequences of warming and climate change for the Galveston Bay area and then ask you about the following:

   - Your opinion of these possible changes, including how real you think they are
   - How such changes might affect your organization and the decisions you would need to make
   - What kinds of information you would need before you started taking climate change into consideration and
   - What kinds of information on change you would need in order to make these decisions

6. Can you just fax me the graphic so we can do this over the phone, or so I can be more prepared, or etc.?

   ANS: I would prefer not to do this. Our interviews have been face-to-face. In order to insure uniformity in the method we are using, I am hoping that you will also agree to an interview. It will be scheduled entirely at your convenience. An additional consideration is the fact that the graphic represents *Possibilities*, not *Predictions*. If the graphic were viewed out of context, this distinction could be lost.

Follow-up Letter – Wave 2A

Thank you so much for your time during your first interview. We are currently doing a second round of interviews with people that have already been interviewed during the first round. According to the design of this project, it is important that we speak with the same person that we spoke with in the first round.

In this second interview, I will be showing you a graphic that displays plausible consequences of warming and climate change for the Galveston Bay area and then ask you about the following:

- Your opinion of these possible changes, including how real you think they are,
- How such changes might affect your organization and the decisions you would need to make,
- What kinds of information you would need before you started taking climate change into consideration and,
- What kinds of information on change you would need in order to make these decisions.

The graphic depicts two possible scenarios in 50 years and in 100 years in regards to changes in sea level, temperature and precipitation. We do not want to send the graphic out in advance because the graphic only represents possibilities, not predictions. We are guarding against the graphic being viewed out of context of the interview.

Interview Guide – Wave 2A

PANEL

[Note: interviewers should review the transcript from each Panelist's first interview before doing the second. Note problems and vulnerabilities previously described by the respondent to use during probes.

Introduction

Example: Thank you for agreeing to a second interview. We talked to you in (month) _____, and you were very helpful in describing problems facing the area and ways decision makers are dealing with them. Now we would like to introduce some new material for you to consider.

Scenarios

Introduce the two Scenarios, explaining the plausible ranges of change in precipitation, temperature, and sea level and using graphs and bulleted information as visual tools.

Post-Scenario Questions

General: Without mentioning the specific problems he/she mentioned in the first interview, ask R for general reactions to the scenarios. Example: Last time we talked, you told us about important problems facing (area or community name) _____. What would you say now in the light of these two scenarios?

Specific: Probe for how/if climate changes will affect the problems described in the first interview, how those might be dealt with, what information would be needed, where it would come from, etc.

Sample Intro: Last time we talked, you pointed out _____, _____, and _____ as particular problems/vulnerabilities for (area or community name) _____. How do you think these might be affected by the possible changes in precipitation, temperature and sea level rise I just described?

Probes

Probe for more information on context, competing issues, resources available, how decision making might change, and information the respondent thinks is available &/or needed. Specific areas for probing could be:

- What is R's perception of the risk of having the storyline become a reality
- What, if any, specific "climate-related problem" has R dealt with in his/her SH role; what specific decisions does R make that relate to specific endpoints (infrastructure/ecosystem/water)?
- What kinds of decision(s), if any, would R and/or R's organization need to make in the face of the climate change consequences described in the storyline
- If decisions are needed, what kinds of information would be needed to make these decisions, potentially including:
  - Type of information
  - Degree of certainty required before acting on the information
  - The most useful format for the information
- Does R currently utilize information on climate and/or climate change? If yes, probe for source, including such information as:
  - What kinds of information are used
  - Whom does R go to for information or whom does R talk to regularly
  - What are the sources of the information/where is information sent

  - What are the types and sources of documents
  - What sources are most trusted and why
  - What is the basic information network on climate/climate change
  - How can information (sources, types, amounts, formats) be improved
  - What role does timing play in decision making.
  - Can the group identify windows of opportunity where it would be more likely to use/promote climate change information in decision making
  - What is the role of a natural hazard in decision-making?
- What other groups or institutions are working/thinking about these climate driven problems; what groups does R belong to?
- If specific groups/institutions are mentioned, probe for the nature of these groups/institutions, seeking such information as:
  - Who are they
  - What are they doing with regard to climate change
  - How do they define the problem of climate change, and other issues
  - How are they organized
  - Who leads them; is there one policy entrepreneur (i.e., who is the "mover and shaker"/the person who makes things happen) they can identify in the organization/institution
  - Do the groups develop/research scientific information on climate change
  - Do the groups use scientific information on climate in decision making
  - What are the networks of relationships and interactions
  - How are agendas determined
  - What is the source of resources/$
  - How are plans and strategies developed
  - What are goals, benchmarks, objectives
  - How does the group try to affect the policy process – who is targeted
  - Is the group more focused on adaptation or mitigation, or both?

Referrals

Recommendation for other interviews. Sample: Who else might have some insights into these problems/issues?

Telephone Contact Referrals – Wave 2B

My name is_____

I am part of a research team at TAMU. We have a grant from the Environmental Protection Agency, and as part of the project we are talking to stakeholders and decision makers about different kinds of problems facing Gulf coast communities, including problems that have some environmental component. As part of the community, _____ (the organization name) faces some unique problems, and as _____ (person's position), we believe you could provide us with valuable information about them and the ways you deal with them. By talking to important decision makers and groups in the community, we believe we will learn more than if we just did a public survey. We are especially interested in learning about

- Key problems facing the community, particularly from your organization's perspective
- Solutions or potential solutions to those problems
- How decisions are made regarding solutions and approaches to problems
- What kinds of information are used in reaching decisions
- The role, if any, that global warming and climate change play in your decision processes
- The kinds of information on climate change you would need to make climate change a consideration in the decisions you make.

I would like to set up a time for an interview that is convenient for you. The interviews are running anywhere from 30 minutes to an hour, depending on how much our interviewee wants to talk. I would like to schedule an hour with you if I can, just to make sure we have enough time.

I can be reached at _____ (phone number) if you have questions between now and the interview time and my email address is _____.

Pat Answers for Wave 2B:

1. Why me?

   ANS: Your position as _____ means that you know a great deal about both your organization and the community and can give us the most accurate information and important insights.

2. How did you choose my organization?

   ANS: We first did a search of the web for organizations whose decisions had important impacts on the Galveston Bay area. Your organization is one of these. [There will be variations depending on the particular organization in question.]

3. My organization doesn't have anything to do with environmental problems (or climate change isn't relevant), so why talk to me?

   ANS: The EPA's primary focus is the environment, but the agency has come to realize that communities face many problems that compete for attention with environmental issues. EPA wants to learn more about these, and the Galveston Bay area is one place we have chosen to focus on.

   Ditto climate change…It is especially important for EPA to distinguish between organizations that are taking climate change into consideration and those that aren't. We have developed some very specific climate change scenarios for the Galveston Bay area and need to have feedback about the from decision makers like you. EPA is interested in increasing the relevance of the information it provides, and only the decision makers themselves can determine what is relevant and what is not.

4. What kinds of questions will you are asking?

   ANS: We will be asking about

   a. Key problems facing the community, particularly from your organization's perspective
   b. Solutions or potential solutions to those problems
   c. How decisions are made regarding solutions and approaches to problems
   d. What kinds of information are used in reaching decisions
   e. The role, if any, that global warming and climate change play in your decision processes
   f. The kinds of information on climate change you would need to make climate change a consideration in the decisions you make.

5. Climate change? I don't believe that climate change exists and so won't have anything to say to you.

   ANS: It is especially important for us to talk to people who have reservations about the reality of global warming and climate change. EPA is one of several governmental agencies convinced that global warming and climate change are already under way, but if important segments of the population don't agree (remain unconvinced), the agency needs know that and to know why.

6. Can you send me more information on the project?

   ANS: Yes. I will be glad to send you our project summary. Faxing it to you will be the quickest. What is your fax number?

7. Can you send me the list of questions in advance of the interview?

   ANS: No. There is no interview instrument. We are holding open-ended interviews with decision-makers in the community on the general topics I mentioned. The idea is to allow the person being interviewed as much freedom as possible to tell us what he/she thinks is important to the organization and the community.

8. Does this have to be a face-to-face interview? Can I do it by phone, email/fax/etc.?

   ANS: For this project we are conducting our interviews in person, and in order to insure uniformity in the method we are using, I am hoping that you will also agree to a face-to-face interview. It will be scheduled entirely at your convenience.

Project Description – For Faxing Upon Request

Research is being conducted in selected locations around the Gulf of Mexico to gather information on the way stakeholders in these areas assess and use science and other information to make decisions about infrastructure, ecosystems and water resources and to identify the kinds of information stakeholders need to make these decisions. Possibilities for changes in the Galveston Bay area that are linked to global warming could affect stakeholder decision making. The possible impacts of climate changes on decision making are also of interest. The research is being supported by a grant from the Environmental Protection Agency (EPA). The research results will be used to improve the kinds of information available to decision-making stakeholders. Research is being conducted by four universities: Texas A&M University, University of New Orleans, University of Louisiana at Lafayette, and Florida A&M University.

As many as 200 respondents from each research location will be interviewed for a total of 600 interviews for the project as a whole. Participation in interviews is voluntary, and any information provided will be kept confidential. Participants are free to refuse to answer any question that makes them uncomfortable. There will be no negative consequences of refusal to answer any question. There will be no monetary compensation and neither risk nor direct benefit for participating.

Because of the open-ended nature of the questions, interviews may last for varying lengths of time. However, most interviews do not last for more than 1 hour.

Confidentiality

All responses will be held in confidence. All interviews will be transcribed, stripped of individual identifiers, and entered into a central database. Field notes taken by the researcher will be kept in a secure and locked location and will be available only to the research team.

Permission is being requested to audiotape this interview. These tapes will be used only to insure that the interviews are accurately transcribed. After interviews have been transcribed and checked for errors, the interview will be stripped of individual identifiers and entered into the database. The audiotape will then be destroyed. If an individual does not wish to have his/her interview audio taped, this will not affect eligibility to participate in the interview process.

Researchers would also like to be able to use statements made by respondents as a way of illustrating their points in scholarly publications. These quotes will not be attributed to an individual, and all information that could lead to the identification of the individual who is author of the quote will be removed. An individual may refuse to be quoted or to have any part of the interview quoted, and this will not affect his/her eligibility to participate in the interview process.

If you wish to contact the principal investigator with any questions, you may contact Dr. Arnold Vedlitz, Texas A&M University at (979) 845-2929 or Dr. Letitia Alston at the Institute for Science, Technology and Public Policy, Texas A&M University at (979) 845-4114.

This research study has been reviewed and approved by the Institutional Review Board-Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, the Institutional Review Board at Texas A&M University may be contacted through Dr. Michael Buckley, IRB Coordinator, Office of the Vice President for Research and Associate Provost for Graduate Studies at (979) 845-8585.

Interview Guide – Wave 2B Referrals

My name is _____. I am a (professor, research scientist, research associate) with _____ at Texas A&M University.

I am part of a team that is working on a research project funded by the Environmental Protection Agency. The EPA realizes that the Gulf coast is an important area and that communities along the coast face a variety of problems, some of which are environmental in nature. The agency believes it need to know more about the problems that communities are facing, how they are dealing with these problems, and the kinds of information they use and need to make decisions.

We are especially interested in learning about:

- Key problems facing the community
- Solutions or potential solutions and approaches to these problems. Most of these "solutions" will be hypothetical, i.e. will not have been tried.
- The kinds of information that are used in reaching decisions about solutions

(Consent Formalities as appropriate to the institution)

Pre-Scenario Questions

Take Wave 1 guide. In an open-ended format and without prompting, solicit R's perception(s) of problems facing his/her community, these might include the broad range of short and long-term problems facing his/her immediate, localized community; the broader community/sub-region; and the whole [Bay/watershed] system. Ask R to prioritize these issues if it seems possible. Probe for solutions, decision processes and information used.

Scenarios

Introduce the two Scenarios, explaining the plausible ranges of change in precipitation, temperature, and sea level and using graphs and bulleted information as visual tools.

Post-Scenario Questions

Probe for how/if climate changes will affect the problems described earlier in the interview, how those might be dealt with, what information would be needed and where it would come from, etc.

Sample Intro: Earlier, you pointed out _____, _____, and _____ as particular problems/vulnerabilities for (area or community name) _____. How do you think these might be affected by the possible changes in precipitation, temperature and sea level rise I just described?

Probes

Probe for more information on context, competing issues, resources available, how decision making might change, and information the respondent thinks is available &/or needed. Specific areas for probing could be:

- What is R's perception of the risk of having the storyline become a reality
- What, if any, specific "climate-related problem" has R dealt with in his/her SH role; what specific decisions does R make that relate to specific endpoints (infrastructure/ecosystem/water)?
- What kinds of decision(s), if any, would R and/or R's organization need to make in the face of the climate change consequences described in the storyline

- If decisions are needed, what kinds of information would be needed to make these decisions, potentially including:
  - Type of information
  - Degree of certainty required before acting on the information
  - The most useful format for the information
- Does R currently utilize information on climate and/or climate change? If yes, probe for source, including such information as:
  - What kinds of information are used
  - Whom does R go to for information or whom does R talk to regularly
  - What are the sources of the information/where is information sent
  - What are the types and sources of documents
  - What sources are most trusted and why
  - What is the basic information network on climate/climate change
  - How can information (sources, types, amounts, formats) be improved
  - What role does timing play in decision making.
  - Can the group identify windows of opportunity where it would be more likely to use/promote climate change information in decision making
  - What is the role of a natural hazard in decision-making?
- What other groups or institutions are working/thinking about these climate driven problems; what groups does R belong to?
- If specific groups/institutions are mentioned, probe for the nature of these groups/institutions, seeking such information as:
  - Who are they
  - What are they doing with regard to climate change
  - How do they define the problem of climate change, and other issues
  - How are they organized
  - Who leads them; is there one policy entrepreneur (i.e., who is the "mover and shaker"/the person who makes things happen) they can identify in the organization/institution
  - Do the groups develop/research scientific information on climate change
  - Do the groups use scientific information on climate in decision making
  - What are the networks of relationships and interactions
  - How are agendas determined
  - What is the source of resources/$
  - How are plans and strategies developed
  - What are goals, benchmarks, objectives
  - How does the group try to affect the policy process – who is targeted
  - Is the group more focused on adaptation or mitigation, or both?

Referrals

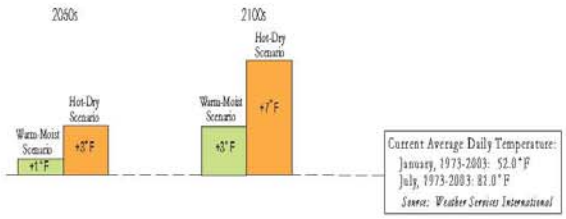
Recommendation for other interviews (e.g. "Who else might have some insights into these problems/issues?")

Appendix C

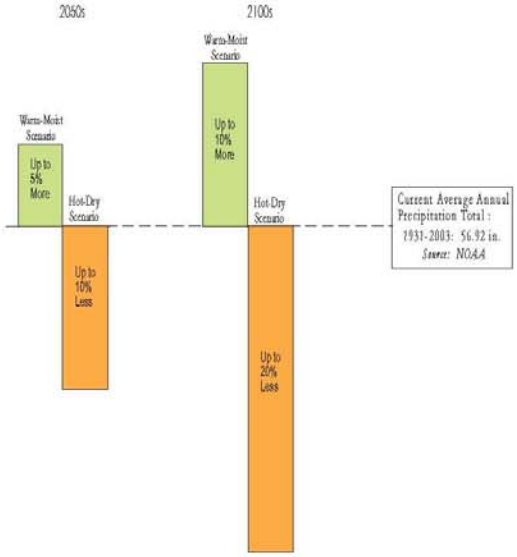
Scenarios for Each State for Wave 2 Interviews

Climate Change Effects Anticipated in the Apalachicola Bay Region

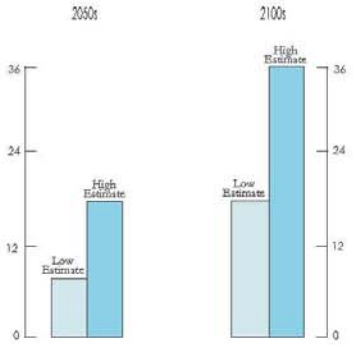
Average Temperature Changes Anticipated (in degrees Fahrenheit)



Average Precipitation Changes Anticipated (in percent change)



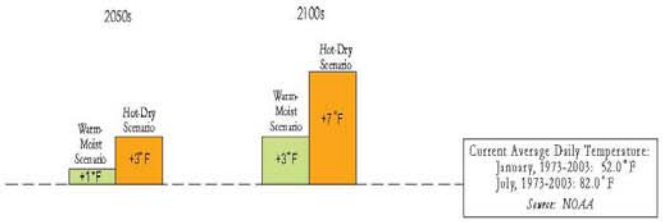
Anticipated sea level rise (in inches)



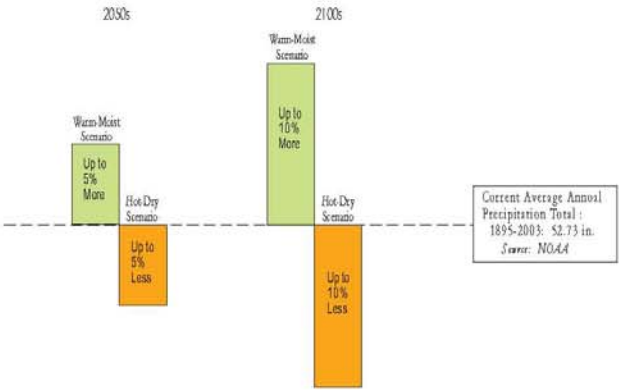
EPA Project No. R-85023601-0

Climate Change Effects Anticipated in the Barataria/Terrebonne Watershed Region

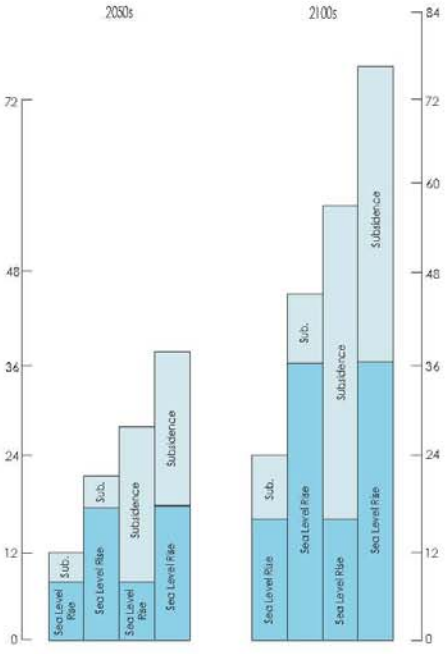
Average Temperature Changes Anticipated (in degrees Fahrenheit)



Average Precipitation Changes Anticipated (in percent change)



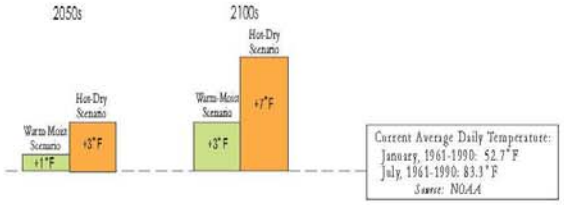
Anticipated Sea Level Rise and subsidence (in inches)



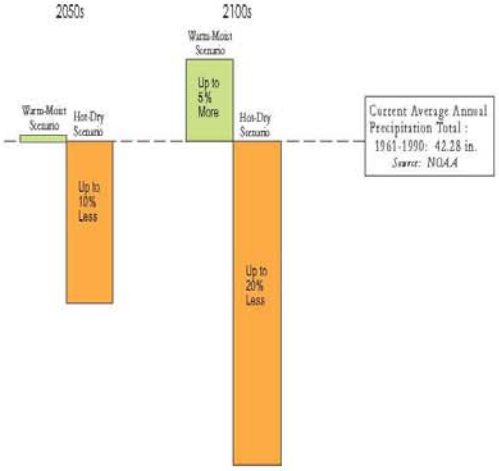
EPA Project No. R-83023601-0

Climate Change Effects Anticipated in the Galveston Bay Region

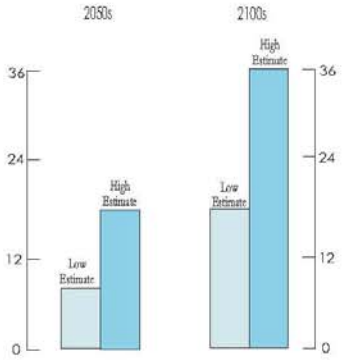
Average Temperature Changes Anticipated (in degrees Fahrenheit)



Average Precipitation Changes Anticipated (in percent change)



Anticipated Sea level Rise (in inches)



EPA Project No. R-83023601-0

Appendix D

Focus Group
Recruitment Materials & Questions

Script for Follow-Up Phone Call

Hello. My name is _____, and I am part of an EPA supported research project that is being conducted in [Area Name].

You should have received a letter from us inviting you to participate in a focus group session to test conclusions we have drawn from interviews done in the area. The letter also included a brief description of the project.

I am calling you today to ask whether you will be able to participate in the focus group being held from [Time 1 to Time 2] on [Date] at [Location]. Will you be able to assist us?

IF YES

I am very glad to hear that. Thank you.

Do you have any questions about the project? {If "yes," answer those questions.]

Let me tell you a little about the focus groups.

- There will be 8 participants all together. They will all be [Other Agency Personnel or Community Residents like you – whichever is appropriate].
- There will be a professional facilitator there to help us explore questions such as what the major problems in the area are, how decisions are generally made, what impact, if any, climate change might have on these problems, what information is used to assist in decision making, and what specific kinds of information, if any, decision makers would need on climate change or other environmental problems in the area.
- All comments or statements made during the focus group will be held in confidence. The results of the focus groups will be reported in summary form only, and no individual responses will be reported.
- We *would* like to audiotape the session in order to insure the accuracy of our summary. The sessions will be transcribed, and numbers will be assigned to each speaker at that time. All tapes will be destroyed once they are used to transcribe the session discussion. Do you agree to our taping the session?

  If yes, go on to paragraph below.

  There will be monetary compensation for participating. Each participant will receive $60 to cover travel expenses and to compensate you to some extent for your time.

  [Note: if this is a government employee, he/she will not be able to accept compensation.]

  Closer to the date for the focus group session, we will send you a reminder with the time and location. Thank you very much. We look forward to working with you.

  If no, say: I am sorry. Because this is a group discussion, we can't tape some individuals and not others. Thank you very much for your willingness to be a focus group participant.

If all focus group slots have been filled and there are still calls to make

Ask the individual if he/she would be willing to serve an alternate participant. There could be last minute changes in plans that prevent some people from attending.

Focus Group Recruitment Letter

Dear Name

Within the last year, you participated in an interview conducted by researchers at Texas A&M University that focused on [Area Name: Galveston Bay/Barataria-Terrebonne/Apalachicola Bay] decision making and climate change. We have completed interviews with key decision makers in the area and done a preliminary analysis of the data. Because our interviews were open-ended and wide ranging, clarifying and condensing our findings has been challenging. We, therefore, believe it is important to get additional feedback from stakeholder participants before summarizing our findings for EPA. To do this, we will be convening focus groups in your area. We have selected you from among those who were interviewed to participate in one of these focus groups. We appreciate the fact that you have already generously devoted time to helping us with our research and hope that you will also be able to assist us in this final test and clarification of our analysis.

There will be eight (8) participants in each of the two focus groups that will be held in your area. This relatively small number will insure that everyone will have a chance to contribute. The group you have been selected for will be held on [Date] from [Time 1 to Time 2] at [Location]. In order to insure the accuracy of our transcriptions, we would like to audiotape the session. These tapes will be destroyed after transcriptions are done. We will be following this letter with a call to verify your participation and to ascertain your willingness to be taped. Your participation is voluntary and anything said in the focus groups will be held in confidence. Enclosed is an informed consent that describes the focus group in more detail. These forms will be available for signature at the session.

Because our conversations with decision makers were open-ended and wide ranging, it has been a challenge to condense and clarify the findings into a smaller set of conclusions. We, therefore, believe it is important to get additional feedback from [Area Name] stakeholders before summarizing our findings for EPA. We hope you will help us.

Sincerely,

Dr. Arnold Vedlitz
Principle Investigator
Director, Institute for Science, Technology and Public Policy
Texas A&M University, 4350 TAMU
College Station, TX 77845.4350

Focus Group Discussion Questions

The purpose of the focus groups is to generate a conversation among the environmental leaders/stakeholders instead of simply the stove-piped interviews to really tease out the methods of information dissemination that the focus group participants suggest that the EPA can support.

We are trying to determine how these key environmental stakeholders see the challenge of communicating about global climate change and the solutions they recommend.

With the above theme in mind, the topics of discussion will specifically focus on:

(1) whether recent storms have affected thinking about climate change
(2) the perceived relevance of climate changes to local decision making,
(3) the primary decision actors and the decision processes normally followed,
(4) the types of information deemed to be the most important,
(5) the role of scientists in the decision process,
(6) the preferred modes of information transmission,
(7) unmet information needs.

Appendix E

Regional News Article Codebook

Regional News Article Codebook

1. Article Identification

Article ID Number:
Assigned prior to coding (automatically)

Document Source:
Choose from a drop-down list of document source:
HC (Houston Chronicle)
TP (Times Picayune)
TT (Tampa Tribune)

Year:
Year that article appears (in the format of YYYY)

Month:
Month that article appears (in the format of MM)

Date:
Date that article appears (in the format of DD)

Text Begins with:
Type in the first five words of the article

Valid Article:
Check *Valid Article* box if it discusses climate change issues; leave it blank if climate issue was mentioned but not the main concern of the article. If an article is identified as invalid article, there is no need to input any further information in the record. NOTE: Due to the search methods we used in Lexis-Nexis, some articles just occasionally mentioned *climate change*, *global warming* or *greenhouse gas*, but the whole story was mainly about something else. Specific criteria and procedures are as follows:
(a) if article mentions all three key terms, code it as *Valid Article*.
(b) if article only occasionally mentions one of the three key terms, AND the article is mainly about something else, leave it blank (i.e., not a valid article)

Length:
Number of lines of the article

2. Story Nature, Stimulators, and Scope

U.S. Government Action
Choose one from the drop-down list
0 – Non US Government Action
1 – US Government Action

Definition:
(a) U.S. Government is defined as all US governmental institutions and actors in all three branches (Executive, Legislature, Court) at all levels (Federal, state, local).
(b) Government Action is defined as all US governmental outputs and actions (or in-actions on issues). These include new laws, regulations, executive orders, congressional hearings, bills, presidential initiative, court cases, treaties, etc.
(c) Code as "US Government Action" only when a new government action is reported in the article. Articles discussing previous government policies/actions/programs/regulations are considered as non-government action.

Story Stimulator

Was the story stimulated by a domestic event or an international event, or both?

Choose one from the drop-down list:

1 – US Domestic
2 – US and Foreign
3 – International
4 – Unknown/undetermined

Scientific Stimulator

Was the story stimulated by some kind of outputs from scientific community? Outputs from scientific community include scientific finding and discovery, research project and effort, academic conference, petition signed by scientists, formation of new scientific research group, etc. You typically can get the answer from the lead sentences of the article.

Choose from a drop-down list:

0 – Non-Scientific Stimulator
1 – Scientific Stimulator

Scope of Story

Climate issues in an article may be discussed at different levels and referred to various scopes. While one story may strictly discuss climate change risks and issues at local/regional community level, another story may discuss the issues at multiple levels.

Check all that apply:

- Local-Regional
- State
- Multiple States
- US National
- Foreign National
- International and Global

3. Issue Linkages and Endpoints

Issue Linkage

(1) Check *Issue Linkage* box if climate issue is linked to other public issues in the article; leave it blank if climate issue is NOT linked to other issue.
(2) Check appropriate issue box if climate issue is linked to that issue (check all that apply).

- Agriculture
- Banking Finance and Commerce
- Civil Rights and Civil Liberties
- Culture and Entertainment
- Defense
- Education
- Energy
- Environment
- Foreign Trade
- Government Operation
- Health
- Housing and Community Development
- International Affairs and Cooperation
- Labor, Employment and Immigration
- Law, Crime, and Family Issues

- Macroeconomic Issues
- Public Lands and Water Management Issues
- Social Welfare Issues
- Science and Technology Issues (Science R and D)
- State and Local Government Administration
- Transportation Issues

Refer to the detailed list of issue topics and subtopics in *Policy Dynamics*, eds. Frank Baumgartner and Bryan Jones, University of Chicago Press, 2000.

Endpoints

(1) Check "Endpoint" box if any endpoint was mentioned/discussed in the article; leave it blank if no endpoint was mentioned
(2) Check all endpoints that apply:
- Ecosystem
- Infrastructure
- Water Supply

4. Proposal or Solution

Proposal/Solution Mentioned?

Choose from the drop-down list:

0 – No solution mentioned – No solution to the climate change issues is mentioned or discussed in the article
1 – Non-Government Solution – proposal/solution is mentioned or discussed but does not clearly indicate US government's responsibility for the solution or does not call US government action to deal with climate change
3 – Government Solution – article clearly calling US government action on climate change

Focus of Proposal (Resource)

Articles that mentioned solutions or proposals can be categorized into three different views on how to use limited resources (technological, economic, and ecological) to alleviate climate-related problems. These views differ primarily in what aspects of the issue come into focus, resulting in some being magnified, others obscured, distorted, or totally ignored.

(1) Check *Focus of Proposal (Resource)* box if any of the following three views on resources allocation can be identified
(2) Check all that apply:
- Technological
- Economic
- Ecological

Focus of Proposal (Approach)

Solutions or proposals may differ in the approaches/mechanisms/arenas about where and how solutions can be advanced or achieved. Solutions focusing on political approach typically count on government regulations/interventions, political elections, international government agreements/protocols/treaties, etc.; social/cultural/educational approach typically emphasizes awareness, education, and other social/cultural/educational venues and mechanisms; individual and other approaches include all other solutions (e.g., urging individuals to use public transportation systems or buy environmentally friendly vehicles)

(1) Check *Focus of Proposal (Approach)* box if any of the following three approaches can be identified
(2) Check all that apply:
- Political
- Social/Cultural/Educational
- Individual and other

Focus of Proposal (Treatment)

There are two basic strategies to treat climate change problems: *mitigation* and *adaptation*. The primary goal of mitigation strategy is to alleviate climate change problems actively and directly by reducing the pace and magnitude of climate stressors that induce climate change. Here we attempt to identify whether the proposal/solution aims directly at reducing greenhouse gas emissions. The main objective of mitigation strategy is to act before the effect. Adaptation is the reaction and adjustment in response to actual or expected climatic impacts. The primary goal of adaptation is to lessen the harm or possible harm of climate change and exploit beneficial opportunities that changing climate may bring in.

(1) Check *Focus of Proposal (Treatment)* box if any of the following two treatment strategies can be identified
(2) Check all that apply:
- Mitigation
- Adaptation

5. Scientific Information Utilization and Source

"Scientific information" Used

Check the box if any scientific information or evidence is presented in the article. Leave it blank if no scientific information was used.

Scientific information is defined as empirical evidence rather than normative argument or belief. Key words that are often associated with scientific information in the article include (but are not limited to) the following terms: analysis, report, assessment, study, evaluation, finding, model, professor, scientist, researcher, university, lab, etc.

Sources of Scientific Information

"Scientific Information" may come from different sources. Check all appropriate boxes that apply:
- *Academic/Independent Source*—check this box if scientific information come from university professors and researchers, science societies and associations, the United Nations and other international organizations (e.g., the Intergovernmental Panel on Climate Change), and other independent research organizations
- *Government Source*—check this box if scientific information come from scientific research establishments of U.S. or foreign governments (e.g., national research laboratories)
- *Environmental Source*—check this box if scientific information come from scientists of environmental advocacy groups, coalitions, and organizations
- *Industry Source*—check this box if scientific information come from researchers from corporations, companies, and business groups

- *Other Source*—check this box if scientific information come from all other scientific sources rather the four categories mentioned above, or if the information source is unknown or can not be determined.

Different "Scientific" Views

Check this box if the scientific information used in the article presents different views on climate change causes, processes, or consequences, etc.

6. Overall Image, Tone, and Frame

This section focuses on the overall message of the entire article despite possible disputes or controversies presented in the article.

Does this article have a favorable tone toward natural-resources-based industry?

Is the story, framed as a whole, predominantly thematic or episodic?

Harmful Issue

This variable identifies whether global climate change is generally viewed harmful or not in the article. Choose from the drop-down list:

1 – HARMFUL
0 – Mixed/Uncertain/Neutral/Unknown: if the overall view is mixed (i.e., the article considers global warming/climate change both harmful and beneficial), uncertain, neutral, or unknown
-1 – NOT harmful

Overall Tone toward Natural Resources Based Industry

1 – Pro-Industry
2 – Con-Industry
3 – Mixed or Neutral–
88 – Mixed or Neutral

Issue Frame

Read the entire news story and make a decision about whether the story, framed as a whole, is predominantly 'thematic' or 'episodic'. *Thematic framing* attempts to place events in a broad event of related events, show effects of events, and discuss possible implications. In other worlds, *thematic framing* category includes stories that depict issues more generally either in terms of collective outcomes, public policy debates, or historical trends. It gives the viewer helpful social, political and historical background knowledge regarding the cause and effect of problems. *Episodic framing* presents issues as single, concrete events, as specific case histories, and instances occurring more or less isolation. It only provides snapshots of an issue, with any explanations based on sensational and emotional appeal.

While these thematic and episodic categories are reasonably distinct and exhaustive, a clear distinction between the two categories is almost impossible. It is rare to encounter a story that is either exclusively thematic or episodic. Nonetheless, one frame or the other clearly predominates. This predominant frame or focus is the most important factor.

Rule for coding: A two-thirds rule will be used to determine the predominant focus of the story. If a story is judged to be two-thirds or more thematic (in terms of lines), it will be coded as thematic. If a story is judged to be two-thirds or more episodic, it will be coded as episodic. If a story is judged to be split between thematic and episodic frames (less than two-thirds predominant focus), it will be coded as mixed.

1 – Episodic
2 – Thematic
3 – Mixed
88 – Undetermined or unknown

7. Actors and Campaigns

Government Actor

(1) Check this box if any of the following U.S. government actors is involved in the news story

(2) Check specific U.S. government actors involved in the news story. Check all that apply:

- President—including Presidential staff (such as economic advisor, national security advisor, etc)
- Congress—including congresspersons, staff, committees, subcommittees, special congressional task force, etc
- Courts—court cases, court decisions, litigations, etc
- Federal Agency—Federal departments and agencies
- State/Local—State and local governments

Candidates and Campaigns

Check this box if elections, campaigns, or candidates were mentioned in the story

Interest Groups

(1) Check the first box if any interest groups were involved. Interest group must be identified with specific organization title in the article. Interest group includes US and foreign and international interest groups.

(2) Check the following specific interest group category. Check all that apply:

- Environmental interest group
- Industrial and commercial interest group
- Professional/scientific interest group
- Other interest groups (including all other interest groups that can not categorized into the three groups mentioned above)

Appendix F

Coding Instructions for Website Information

Coding Instructions for Website Information

INTRODUCTION

The purpose of this web site analysis is to corroborate information obtained from stakeholder interviews during Waves 1 and 2 of those interviews. The website for each of the organizations that formed the interview dataset should be visited. (In the text below, these organizations will sometimes be referred to as "interviewed organizations.") Two types of data should be sought and coded: (1) the web links (no more than 2 layers deep) that appear on the organization's website and (2) information on the organization's own mission, goals, and current programs/projects. The variables to be coded are described below.

Web links found at each site will be considered indications of types of information that are considered important on the assumption that an organization will only link to others it deems useful for its users. Links will also be viewed as indicators of social alignment on the assumption that an organization will only post links to others it identifies with.

I. CODING OF WEB LINKS

The website for each of the organizations that formed the interview dataset should be visited. Three levels of coding are required. Each link should be coded as to its location in relation to the interviewed organization (1 below), the type of information potentially provided at the linked site (2 below), and the type of organization represented by the linked organization (3 below). The interviewed organization should also be coded as to its major interest (see 4 below).

A. Location

1. ***Research Location***. These are web sites for organizations that are in general proximity to the research location and thus share an overall social, political and geographical context. This would include the sharing of potential climate change impacts. "General proximity" is defined as within the area in which interviews were conducted. The only exception to this is Texas where some interviews were conducted in Austin. Links to Austin-based organizations would be coded as *Research State/Region*.
2. ***Research State/Region***. These are websites for organizations that are within the research location's state or that represent the research location's state and contiguous states. An example would be the EPA Region 6, which includes Texas and surrounding states.
3. ***Locations Other than Research Area or Research State/Region.*** This category is for all other websites. These may be a Washington-based federal organization, organizations in other states, or even international organizations.

B. Type of Linked Information

1. ***Environmental/Ecological***. This kind of information is information on animal or plant species or on ecosystems. It also includes information on geographical formations or changes, such as coastal erosion and information on weather and/or climate. In most cases the website will self-identify as an environmental website.
2. ***Economic***. Economic information is information that involves, for example, information on commerce, markets, price signals, and market weaknesses. In some cases, there may be overlap with other information categories. For example, websites on economic markets to encourage environmental stewardship combine environmental and economic issues. In this case creating a water trading market for agricultural producers would be an economic solution to a water quantity problem. Trading pollution credits could be an economic approach to water pollution. Giving tax credits to real estate developers who create wetlands or leave wooded corridors would be an Economic approach to ecosystem loss. In all cases, the website would be coded in the *Economic* category.

3. ***Social***. The category is generally defined as information on the characteristics or activities of individuals and communities. It would include demographics, community grow rates, and information on the cultural characteristics of individuals or communities as well as changes in traditional culture. It includes websites devoted to general public education as well.

   [Note: Information on policy and politics should be coded as environmental, economic or technical depending on the thrust of the policy or campaign.]

4. ***Technical***. Technical information refers to information that is mechanical or engineering in nature. For example, a reorientation of the energy system from fossil fuels to easily renewable energy sources is technological. Building a levee or a dam would be a technological solution to a water quantity problem. Replenishing sand on a beach would be a technical solution to the problem of beach erosion.

5. ***Other***. Anything that doesn't fit into the above categories.

C. Type of Linked Organization

1. ***EPA***. This should be straightforward. EPA is included here as a separate organizational type because it is the funding organization and may be interested in knowing how often it is linked to the stakeholder organizations.

2. ***Governmental-non-EPA***. Any website that is NOT EPA but includes .gov, .state or .us should be coded under this category.

3. ***Education***. This category comprises any website that includes .edu as part of the designation.

4. ***Non-profit***. This will be a varied category. Websites that are links to non-profit or citizen groups that have an educational focus, including environmental education, should be included.

5. ***Business/Industry***. This category is for any group that has a commercial or for-profit interest.

6. ***Other***.

II. CODING OF MISSION/GOAL/PROGRAM CONTENT

The purpose of this section is two fold. First, we want to assess the organization's concern with *climate change*, with the *stressors* associated with climate change (temperature, precipitation, sea level rise, storms), and/or with the perceived effects of these stressors on selected *endpoints*. To achieve this, the mission and goals of the organization will be coded for any mention of the variables listed below. Second, we want to examine the organization's website for activity focusing on endpoints. (In other words, what is the organization doing about the effects of climate change - if anything?) Each organization's current programs or projects will be coded for activity focused on endpoints.

A. Overall Mission/Role of Interviewed Organization

This variable refers to the dominant orientation of interviewed organizations toward environmental protection and economic growth. Two items need to be examined and considered to identify an organization's orientation: (1) organization's official name, and (2) organization's mission statement.

1. ***Environment***: organizations with a focus on ecosystem, environmental protection and/or conservation of natural resources.

2. ***Development***: organizations with a focus on development and growth (commerce, finance, business, trade, labor, employment, agricultural development, land development, energy production, etc.).

3. ***Mixed or Comprehensive***: organizations with a mixed orientation toward growth and the environment or organizations with a comprehensive role that performs multiple functions (such as city government or state senator's office).

4. ***Other/Unknown/Not code-able***: other organizations that cannot be coded as one of the above (such as public safety agency, public schools, office of emergency management), organizations whose orientations are unknown, or organizations that are otherwise not code-able.

B. Climate Change in Organization's Missions and Goals

1. ***Mention of Climate Change***. Examine the organization's mission and goals for mention of any of the following key words: climate change, global warming, greenhouse gases. Record the total frequency of mention for any or all of these terms.

2. Mention of 1 or more Stressors

   a. ***Warming (stressor)***. This refers to an increase in average temperature over time.

   b. ***Sea Level Rise (stressor)***. This refers to an increase in the volume of sea water resulting in more land being covered by Gulf or ocean waters. Note: Some websites may refer to subsidence. Check this category only if subsidence and sea level rise are mentioned together.

   c. ***Changes in Precipitation (stressor)***. This refers to change in precipitation levels over time. The change could be either perceived or projected increases in precipitation or decreases in precipitation. The reference should be to climate changes over time that result in a higher or lower average precipitation, NOT to the fact that some years are wetter or drier than other years.

   d. ***Increasing frequency or severity of hurricanes or other types of storms (stressor)***. Again, this refers to changes over time in the numbers or severity of storms experienced.

3. Mention of 1 or more Endpoints

   a. ***Ecosystems (endpoint)***. This term applies to land change or to any combination of plant or animal community. Code for one of the following:

      i) *Wetlands/Beaches*. Key words include land loss, beach erosion, wetlands or marshes, swamp, bayous, disappearing grasses, root destruction, washing away, sinking, erosion, boat wakes, prop wash, storm surge, impact of navigation, disappearing grasses, beach habitat, inundation, scouring, storm surge, changes in marsh or beach habitat or species. Also relevant would be mention of natural resources, ecosystem health or environmental services as they apply to marshes, wetlands or beaches.

      ii) *Uplands*. Key words include storm surge, salt water intrusion, species changes, habitat. Key words also include animal names, birds and bird names. Key words denoting impacts on ecosystems for any of the categories above could also include natural resources, ecosystem health, environmental health, environmental services.

      iii) *Fish or Shellfish*. Key words include fishing, commercial fishing, fisheries, shrimp, oysters, crabbing, nurseries.

      iv) Other.

   b. ***Infrastructure/Built Environment***. This term refers to structures built by humans. Look for Mission or Goal references and code as one of the following:

      i) *Land Transportation*. Key words include highways, bridges, roads, railroads

      ii) *Water Transportation*. Key words include ports, docks, canals, channels

      iii) *Flood/Storm Protection*. Key words include levees, dams, sea walls, rip-rap.

      iv) *Drainage*. Key words include drainage, storm water, run-off, flooding, pumps/pumping

v) *Utilities*. Key terms include water treatment, pipelines, sewer lines, gas.

vi) *Other*.

c. ***Water***. As used here, this term refers to either the quantity or the quality of water for use by human or non-human groups. Code as one or more of the following:

i) *Quality for human use*. Key words include pollution (chemical or bacterial), contamination, effluent, runoff, water quality standards, salinity, salt water intrusion, fresh water, potable water

ii) *Quality for nonhuman use*. Key words include fresh water inflows, pollution, contamination, effluent, runoff, salinity, salt water intrusion, fresh water. (Many of the same key words apply to human and nonhuman populations.)

iii) *Quantity for human use*. Key words include water availability, water shortage, water supply, agricultural use.

iv) Quantity for non-human use. Key words include fresh water inflows, water withdrawals.

v) Other.

d. **Other**

C. Current Projects/Programs

The emphasis for coding current projects and programs is on any action the organization is taking to address the effects of climate change stressors on endpoints. Read the summary or abstract describing the project/program. If there is no summary, only read the first page of the project description. For the most part, coding categories for projects/programs are the same as the ones used for endpoints, above. That is, coding is in terms of whether action is consistent with concerns as expressed in mission and goals. Note, however, that there are some new key words.

1. ***Ecosystems***. In the context of programs or projects, what you will primarily be looking for are projects or programs that are focused on restoration or replacement of ecosystem elements or on protection or conservation of existing ecosystem elements.

a. Emphasis on Replacement. Key words to watch for would include, but not be limited to, beach nourishment, wetland restoration, marsh restoration, planting grasses, fresh water diversion.

b. Emphasis on Protection or Conservation. Key words to watch for would include, but not be limited to, armoring, seawalls, rip-rap, lobbying, legislation or policy that would limit development or other human use of the land.

c. Other.

2. ***Infrastructure/Built Environment.*** In this context projects/programs that have infrastructure as the focus are also more likely to talk about either replacement (as in relocating a highway away from rising water), construction of new infrastructure (as in building additional highways for evacuation or water treatment facilities for new residential construction), or on protection of existing structures.

a. Emphasis on Relocation or New Structures. Key words would include highway relocation, levee building, new docks, higher bridges, new evacuation routes, replacing outdated drainage systems or pumps, lobbying, legislation, or policy that would limit insurance, or forbid building in areas such as beaches and flood plains.

b. Emphasis on Protection of Existing Structures. Key words would include armoring, sea walls or rip-rap for the purpose of protecting houses and businesses, dredging canals and channels to maintain them for navigation, any involvement with restitution for losses during flooding.

c. Other.

3. ***Water.*** The coding of water-related projects/programs will be in terms of either water quality or water quantity, regardless of whether the quality or quantity issue is an issue for human or ecosystem use. Quality refers to how good the water is for its intended purpose. Quantity refers to having enough water.
   a. Water Quality. Key words include chemical pollution, bacterial pollution, contamination, effluent, runoff, salinity, salt water intrusion, fresh water, fresh water inflows, potable water, drinking water.
   b. Water Quantity. Key words include water availability, water shortage, fresh water inflows (as this applies to having enough fresh water for ecosystem use), water withdrawals, agricultural use.
   c. Other.
4. ***Education.*** Some organizations will have programs or projects that have some kind of public education as the goal. This type of program could provide a potential conduit for information on climate change. Code these programs under one or more of the following stressor and endpoint categories.
   a. Climate change
   b. Sea Level Rise/Subsidence
   c. Precipitation
   d. Temperature
   e. Storms
   f. Ecosystems
   g. Infrastructure
   h. Water – for either human or ecosystem use
5. ***Other***

Appendix G

Tables & Figures Referenced in Research Findings

Table G.1
Wave 1 Problems and Category Reclassifications
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Category
1	FL	Development on the coastal fringe	Housing and Community Development
	FL	Water supply issues	Public Lands and Water Management
	FL	Wetland loss. draining	Environmental
2	FL	River pollution	Environmental
	FL	St. Joe development	Housing and Community Development
	FL	Water pollution	Environmental
3	FL	Development	Housing and Community Development
4	FL	Pressure on fishing industry	Economic
	FL	Amount of freshwater flow into the bay	Public Lands and Water Management
	FL	Population growth/development	Housing and Community Development
	FL	Storm water management	Environmental
5	FL	Development/natural resource interface	Housing and Community Development
	FL	Water supply issues	Public Lands and Water Management
6	FL	Upstream water issues	Public Lands and Water Management
	FL	St. Joe development	Housing and Community Development
	FL	Preservation of fisheries	Environmental
7	FL	Hurricanes	Environmental
	FL	Drinking water	Environmental
	FL	Pressure on traditional industry	Economic
	FL	Road maintenance	Transportation
8	FL	Public education on the environment	Other
	FL	Storm water pollution/water quality	Environmental
	FL	Invasive plant species	Environmental
	FL	Alteration of shorelines	Environmental
	FL	Habitat loss	Environmental
	FL	Global air quality	Environmental
9	FL	Water pollution	Environmental
	FL	Development	Housing and Community Development
10	FL	Population growth	Housing and Community Development
	FL	Crowding at the park	Public Lands and Water Management
	FL	Water quality	Environmental
	FL	Pressure on traditional industry	Economic
11	FL	Population growth/development	Housing and Community Development
	FL	Water quality	Environmental
	FL	Air quality	Environmental
12	FL	Healthcare	Health
	FL	Development/Population Growth	Housing and Community Development
	FL	Coastal Erosion	Environmental
	FL	Salt Water Intrusion	Environmental
	FL	Wetland management	Environmental
	FL	Beach Access	Public Lands and Water Management
13	FL	Intersection of Environment and Development	Housing and Community Development
14	FL	Development	Housing and Community Development
	FL	Wastewater treatment	Environmental
15	FL	Water quality issues	Environmental

Table G.1
Wave 1 Problems and Category Reclassifications
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Category
	FL	Growth/development	Housing and Community Development
	FL	Invasive exotics	Environmental
16	FL	Habitat destruction/growth impinging	Environmental
	FL	Water resource issues	Environmental
17	FL	Water Quality	Environmental
	FL	Development	Housing and Community Development
18	FL	Water quality issues	Environmental
	FL	Tri-state river issue	Public Lands and Water Management
	FL	Permitting disparities	State and Local Government
	FL	Fisheries depletion/user conflict	Environmental
19	FL	Management of fisheries	Agricultural
	FL	Illegal fishing	Environmental
20	FL	Water quality	Environmental
	FL	Development	Housing and Community Development
21	FL	Water Quantity	Public Lands and Water Management
	FL	Losing agricultural lands	Agriculture
	FL	Farm chemical problems	Environmental
22	FL	Water supply issues	Public Lands and Water Management
	FL	Development	Housing and Community Development
23	FL	Dredging of the Apalachicola	Public Lands and Water Management
	FL	Pressure on fishing	Agriculture
	FL	Development/permitting issues	Housing and Community Development
	FL	Tri-state river issue	Public Lands and Water Management
24	FL	Water quality issues	Environmental
	FL	Tri-state river issue	Public Lands and Water Management
	FL	Development	Housing and Community Development
25	FL	Ignorance about the environment	Other
	FL	Point source and non-point source pollution	Environmental
	FL	Wetland issues	Environmental
	FL	Planning problems/lack of green space	State and Local Government
	FL	Turtle persecution	Environmental
26	FL	Development will eventually hurt seafood industry	Housing and Community Development
27	FL	Development/pressure on resources	Housing and Community Development
	FL	River management - dredging & tri-state	Public Lands and Water Management
28	FL	Population growth & the environment	Housing and Community Development
	FL	Coastal erosion	Environmental
29	FL	Development	Housing and Community Development
	FL	Prescribe fire conflict	Public Lands and Water Management
30	FL	Tri-state river issue	Public Lands and Water Management
	FL	Dredging of the Apalachicola	Public Lands and Water Management
	FL	Development/land use	Housing and Community Development
	FL	Log removal from the river	Environmental
31	FL	Local decision process & Zoning	State and Local Government
	FL	Property value issues, Development	Housing and Community Development
	FL	Waste water treatment	Environmental

Table G.1
Wave 1 Problems and Category Reclassifications
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Category
	FL	Sunken boats	Environmental
	FL	Tri-state river issues (freshwater inflows)	Public Lands and Water Management
32	FL	"Progressive connectivity of habitat"	Environmental
	FL	Groundwater issues	Environmental
	FL	Hurricanes	Environmental
	FL	Development in the future	Housing and Community Development
33	FL	Water Quality	Environmental
	FL	Wetland issues	Environmental
34	FL	Tri-state river issue	Public Lands and Water Management
	FL	Development	Housing and Community Development
35	FL	Protection of the river	Environmental
	FL	Water supply issues	Public Lands and Water Management
	FL	Need for economic growth	Economic
36	FL	Development	Housing and Community Development
	FL	Education	Education
37	FL	Water Quality	Environmental
	FL	Tri-state river issue	Public Lands and Water Management
	FL	Development	Housing and Community Development
	FL	Pressure on the fishing industry	Agriculture
38	FL	Tri-state river issue	Public Lands and Water Management
	FL	Dredging of the Apalachicola	Public Lands and Water Management
	FL	Development	Housing and Community Development
39	FL	Freshwater Quantity	Public Lands and Water Management
	FL	Development	Housing and Community Development
	FL	Invasive exotics	Environmental
40	FL	Tri-state river issue	Public Lands and Water Management
	FL	Dredging/Dams	Public Lands and Water Management
41	FL	Tri-state river issue	Public Lands and Water Management
	FL	Development	Housing and Community Development
42	FL	Water quantity and quality	Public Lands and Water Management
	FL	Human population growth	Housing and Community Development
43	FL	Development	Housing and Community Development
	FL	Pressure on the fishing industry	Agriculture
44	FL	Invasive exotics	Environmental
	FL	Development	Housing and Community Development
	FL	Enforcement of ordinances	State and Local Government
	FL	Water/beach/boat ramp access	Public Lands and Water Management
	FL	Pressure on fishing industry	Agriculture
45	FL	Tri-state river issue, water Quantity	Public Lands and Water Management
	FL	Storm water pollution, water quality degradation	Environmental
46	FL	Reduction of freshwater flows	Public Lands and Water Management
	FL	Water pollution	Environmental
	FL	Wetland loss	Environmental
	FL	Growth management	Housing and Community Development
47	FL	Development/Population Growth	Housing and Community Development

Table G.1
Wave 1 Problems and Category Reclassifications
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Category
48	FL	Encroachment on turtle habitat	Environmental
49	FL	Water Quality	Environmental
	FL	Water Quantity	Public Lands and Water Management
	FL	Oil supplies	Energy
50	Fl	Urban sprawl	Housing and Community Development
	FL	Hydrological disturbance	Environmental
	FL	Fragmentation of habitat	Environmental
	FL	Future decisions on carrying capacity	Public Lands and Water Management
51	FL	Fishing regulations/fishery depletion	Agriculture
52	FL	Development/insurance risk	Environmental
53	FL	Development	Housing and Community Development
	FL	Loss of habitat/inability to burn	Public Lands and Water Management
	FL	Coastal erosion	Environmental
	FL	Water Quantity	Public Lands and Water Management
54	FL	Development	Housing and Community Development
	FL	Tri-state river issue	Public Lands and Water Management
55	FL	Development	Housing and Community Development
	FL	Human impact on the water supply	Environmental
	FL	Tri-state river issue	Public Lands and Water Management
56	FL	Unmanaged recreation/ATV's	Public Lands and Water Management
	FL	Invasive exotics	Environmental
	FL	Prescribed fire	Public Lands and Water Management
	FL	Balancing biodiversity and conservation (timber)	Public Lands and Water Management
	FL	Springs conservation	Public Lands and Water Management
57	FL	Need for dredging of the Apalachicola	Public Lands and Water Management
	FL	Development	Housing and Community Development
	FL	Coastal erosion	Environmental
58	FL	Wetlands/habitat destruction	Environmental
	FL	Water quality	Environmental
59	FL	Development	Housing and Community Development
	FL	Salinity in Apalachicola Bay	Environmental
	FL	Pressure on the fishing industry	Agriculture
60	FL	Beach Maintenance	Public Lands and Water Management
	FL	Park usage	Public Lands and Water Management
	FL	Water supply issues	Public Lands and Water Management
	FL	Development	Housing and Community Development
61	FL	Dredging/Tri-River Issue	Public Lands and Water Management
62	FL	Water quantity/quality	Environmental
	FL	Development	Housing and Community Development
63	FL	Need for a middle class employment base	Economic
	FL	Regulatory barriers to increased development	Housing and Community Development
	FL	Preservation of the bay (an economic asset)	Environmental
64	FL	Development	Housing and Community Development
	FL	Oyster/shrimping industry peril	Agriculture
65	FL	Water quality and quantity	Environmental

Table G.1
Wave 1 Problems and Category Reclassifications
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Category
	FL	Transportation/automobiles	Transportation
	FL	Development	Housing and Community Development
	FL	Air quality	Environmental
	FL	Education	Education
66	FL	Fishing industry pressure	Agriculture
67	FL	Development	Housing and Community Development
68	FL	Growth	Housing and Community Development
	FL	Sewage runoff	Environmental
	FL	Decline in traditional industries	Economic
69	FL	Water Quality	Environmental
	FL	Development	Housing and Community Development
70	FL	Pressure on fishing	Agriculture
	FL	Development	Housing and Community Development
	FL	Lawsuit burden on the county	State and Local Government
71	FL	Tidal marsh/sea grass/wetlands	Environmental
	FL	Water quality/quantity	Public Lands and Water Management
	FL	Military base expansions	Defense
72	FL	Development	Housing and Community Development
	FL	Pressure on the fishing industry	Agriculture
73	FL	Corps-induced beach erosion	Public Lands and Water Management
	FL	County commission sleaze/representation	State and Local Government
	FL	Bacteria in the water	Environmental
74	FL	Poor local government	State and Local Government
	FL	Stewardship/environmental balance issues	Other
	FL	Dredging	Public Lands and Water Management
	FL	Water quantity	Environmental
	FL	Wetland issues	Environmental
75	FL	Water for the oysters	Public Lands and Water Management
	FL	Development	Housing and Community Development
76	FL	Sewer issues	State and Local Government
	FL	Water quality	Environmental
	FL	Wetlands management	Environmental
	FL	Development	Housing and Community Development
	FL	Pressure on the fishing industry	Agriculture
77	FL	Hydrological disturbance/herbicides	Environmental
	FL	Prescribed fire conflict	Public Lands and Water Management
	FL	Public land holdings vs. development	Public Lands and Water Management
	FL	Tri-state river issue	Public Lands and Water Management
	FL	Dredging of the Apalachicola	Public Lands and Water Management
	FL	Invasive exotics	Environmental
	FL	Deadhead logging	Public Lands and Water Management
78	FL	Development	Housing and Community Development
	FL	Water quality/quantity	Environmental
79	FL	Development	Housing and Community Development
	FL	Coastal erosion	Environmental

Table G.1
Wave 1 Problems and Category Reclassifications
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Category
	FL	Economic development/balance in the area	Economic
80	LA	Land loss	Environmental
	LA	Fishery stress from conservation	Agriculture
	LA	Water quality	Environmental
81	LA	Land loss	Environmental
	LA	Saltwater intrusion	Environmental
82	LA	Flooding/drainage	Environmental
	LA	Wetland loss	Environmental
	LA	Water quality vs. drainage needs	Environmental
83	LA	Coastal erosion	Environmental
	LA	Invasive exotics	Environmental
	LA	Upkeep of levee and drainage systems	Public Lands and Water Management
	LA	LA1 issues/evacuation	Transportation
84	LA	Taxation/services desired gap	Economic
	LA	Coastal erosion/wetland loss	Environmental
85	LA	Maintaining adequate drinking water supply	Environmental
	LA	Erosion of marshes	Environmental
	LA	Federal exploitation of Louisiana	Energy
	LA	Loss of fisheries	Environmental
86	LA	Economic development in the area	Economic
	LA	Housing	Housing and Community Development
	LA	Land loss	Environmental
87	LA	Coastal erosion/wetland loss	Environmental
	LA	Inadequate transportation infrastructure	Transportation
88	LA	Illegal dumping of reinjection water	Environmental
	LA	Land loss	Environmental
	LA	Offshore oil spills	Environmental
	LA	Tough times in the offshore oil industry	Economic
	LA	Storm surges	Environmental
89	LA	Growth in the area	Housing and Community Development
90	LA	Land loss	Environmental
	LA	Highway 1 and transportation	Transportation
	LA	Storm surges and salinity	Environmental
91	LA	Land loss	Environmental
92	LA	Land loss	Environmental
93	LA	Coastal erosion	Environmental
	LA	Road in disrepair	Transportation
94	LA	Coastal land loss	Environmental
	LA	Highway/funding issues	Transportation
95	LA	Hurricane emergency issues	Other
96	LA	Coastal erosion	Environmental
97	LA	Land loss	Environmental
	LA	Saltwater intrusion	Environmental
98	LA	Import competition	Agriculture
	LA	Coastal erosion	Environmental

Table G.1
Wave 1 Problems and Category Reclassifications
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Category
	LA	Regulation of the shrimping industry	Agriculture
99	LA	Coastal erosion	Environmental
	LA	Economic downturn in the area	Economic
	LA	Evacuation/emergency management	Other
	LA	Insufficient government responsiveness	State and Local Government
	LA	Road/levee/wetland conflict	Public Lands and Water Management
100	LA	Land loss	Environmental
	LA	Sugar farming problems	Agriculture
	LA	Pollution/permitting issues	Environmental
	LA	Litter	Environmental
101	LA	Coastal erosion	Environmental
	LA	Hurricanes	Environmental
102	LA	Economic strife in the area (oil & shrimping)	Economic
103	LA	Coastal erosion	Environmental
104	LA	Coastal erosion	Environmental
105	LA	Land loss	Environmental
	LA	Oil company permitting	Environmental
106	LA	Coastal erosion	Environmental
	LA	Road quality/LA1	Transportation
107	LA	Coastal Erosion	Environmental
	LA	Land issues (commercial and tribal)	Public Lands and Water Management
	LA	Houma tribal identity	Public Lands and Water Management
108	LA	Coastal erosion	Environmental
109	LA	Storms/flooding	Environmental
	LA	Coastal erosion	Environmental
	LA	Struggling shrimping industry	Agriculture
110	LA	Storm surges	Environmental
	LA	Wetland loss	Environmental
	LA	Habitat loss	Environmental
111	LA	Coastal erosion	Environmental
	LA	Flood protection	Environmental
	LA	Highway infrastructure	Transportation issues
	LA	Coastal development	Housing and Community Development
112	LA	Apparent cancer clusters	Health
	LA	Humans and the environment	Environmental
	LA	Need for growth in the area	Economic
113	LA	Wetland loss	Environmental
114	LA	Land loss	Environmental
	LA	Bridge/highway 1	Transportation
115	LA	Coastal erosion	Environmental
	LA	Tribal recognition	Public Lands and Water Management
116	LA	Land loss	Environmental
	LA	Transportation infrastructure	Transportation
117	LA	Relative sea level rise	Environmental
118	LA	Coastal erosion	Environmental

Table G.1
Wave 1 Problems and Category Reclassifications
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Category
119	LA	Population growth	Housing and Community Development
	LA	Use of natural resources	Environmental
	LA	Socialization of land/use of public goods	Public Lands and Water Management
	LA	Land loss	Environmental
120	LA	Entrenched interests	Other
	LA	Coastal erosion	Environmental
	LA	Non-point source pollution	Environmental
	LA	Global climate change	Environmental
	LA	Air quality	Environmental
121	LA	Coastal erosion	Environmental
122	LA	Water seepage into lakes and rivers	Environmental
123	LA	Natural gas prices	Energy
	LA	Environmental regulations	Environmental
	LA	Louisiana being treated unfairly	Public Lands and Water Management
124	LA	Federal funding issues	Federal government operations
	LA	Land loss	Environmental
125	LA	Coastal erosion	Environmental
	LA	Fisheries loss	Environmental
126	LA	Land loss	Environmental
	LA	Water pollution from landfill	Environmental
	LA	Hurricanes	Environmental
127	LA	Land loss	Environmental
128	LA	Land loss	Environmental
129	LA	Shrimping business problems	Economic
	LA	Coastal Erosion	Environmental
	LA	Levee breaking	Public Lands and Water Management
130	LA	Eminent domain issues	Public Lands and Water Management
	LA	Land sinking	Environmental
131	LA	Coastal erosion	Environmental
	LA	Water quality - salinity	Environmental
132	LA	Land loss	Environmental
133	LA	Land loss	Environmental
134	LA	Land loss	Environmental
135	LA	Coastal erosion	Environmental
	LA	LA1 issues	Transportation
136	LA	Coastal Erosion	Environmental
	LA	Jurisdiction over areas	Public Lands and Water Management
	LA	Mitigation inefficiency	Public Lands and Water Management
137	LA	Saltwater intrusion	Environmental
138	LA	Regulations/permitting	Public Lands and Water Management
	LA	Litigation over clean-ups	Other
	LA	Fees for seismic exploration	Public Lands and Water Management
	LA	Coastal land loss	Environmental
139	LA	Coastal erosion	Environmental
140	LA	Coastal erosion issues	Environmental

Table G.1
Wave 1 Problems and Category Reclassifications
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Category
141	LA	Coastal erosion	Environmental
142	LA	Water quantity	Environmental
	LA	Land sinking	Environmental
143	LA	Coastal erosion	Environmental
144	LA	Water quantity	Environmental
145	LA	Coastal wetland loss	Environmental
146	LA	Local and social change; regulations	Other
	LA	Coastal erosion	Environmental
	LA	Aging infrastructure	Housing and Community Development
147	LA	Subsidence	Environmental
	LA	Pressure on the fishing industry	Agriculture
148	LA	Coastal land loss	Environmental
149	LA	Coastal erosion	Environmental
	LA	Transportation infrastructure	Transportation
150	LA	Coastal erosion	Environmental
	LA	Highway access	Transportation
151	LA	Coast washing away	Environmental
152	LA	Coastal erosion	Environmental
	LA	LA1 issues	Transportation
153	LA	Coastal erosion	Environmental
154	LA	Fishery habitat loss	Environmental
155	LA	Regulation of land development/permitting	Public Lands and Water Management
	LA	Wetland loss	Environmental
156	LA	Coastal erosion	Environmental
	LA	Transportation infrastructure	Transportation
157	LA	Coastal erosion	Environmental
158	LA	Coastal erosion/restoration	Public Lands and Water Management
	LA	Problems with Corps processes	Environmental
159	LA	Focus on narrow interests	Other
	LA	Marsh loss	Environmental
160	LA	Coastal land loss	Environmental
	LA	Water management/waterway closures	Public Lands and Water Management
	LA	Water quality decline	Environmental
	LA	Disruption of the Atchafalaya basin/navigation	Public Lands and Water Management
	LA	Decline of fisheries/fishing industry	Economic
	LA	Road prioritization	Transportation issues
	LA	Upkeep of roads	Transportation issues
161	LA	Coastal erosion	Environmental
	LA	FEMA and vacation homes	Economic
162	LA	Saltwater intrusion	Environmental
	LA	Government ineptitude/weak mentality	State and Local Government
163	LA	Lack of formal education	Education
	LA	Coastal issues	Public Lands and Water Management
	LA	Hurricanes	Environmental
164	LA	Storm surge	Environmental

Table G.1
Wave 1 Problems and Category Reclassifications
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Category
165	LA	Wetland loss	Environmental
	LA	Inadequate treatment at pump out stations	Public Lands and Water Management
166	LA	Preservation of Cajun Culture	Other
	LA	Water intrusion/land sinking	Environmental
	LA	VA problems	Defense
	LA	Mistreatment of Native Americans	Public Lands and Water Management
167	LA	Land loss	Environmental
	LA	Transportation infrastructure	Transportation
	LA	Hurricanes	Environmental
	LA	Saltwater intrusion	Environmental
168	LA	Loss of fishery habitats	Environmental
169	LA	Marsh loss	Environmental
170	LA	Coastal restoration issues	Environmental
	LA	Hurricanes	Environmental
	LA	Air quality	Environmental
171	LA	Coastal Erosion	Environmental
	LA	Hurricanes	Environmental
172	LA	Wetland loss	Environmental
173	LA	Environmental injustice vs. Native Americans	Public Lands and Water Management
	LA	Pressure on commercial fishing	Agriculture
	LA	Coastal erosion	Environmental
	LA	Poor consultation process	Federal government operations
174	LA	Coastal erosion	Environmental
	LA	Pressure on traditional industries	Environmental
175	LA	Coastal restoration issues	Public Lands and Water Management
176	LA	Coastal erosion	Environmental
177	LA	Land loss	Environmental
178	LA	Land loss	Environmental
	LA	Levee issues	Public Lands and Water Management
179	TX	Wetlands issues	Environmental
	TX	Depletion of fisheries	Environmental
180	TX	No Identifiable downtown area	Housing and Community Development
	TX	Communication issues	Housing and Community Development
	TX	Identity as a city	Housing and Community Development
	TX	Drainage, water issues	Environmental
	TX	Mobility and traffic	Transportation issues
181	TX	Disenfranchisement of parts of the population	Other
	TX	Delivery of healthcare	Health
182	TX	Health care	Health
	TX	Garbage pickup	State and Local Government
	TX	Taxation/expectation gap	State and Local Government
	TX	Beach erosion	Environmental
	TX	Petrochemical industry pollution	Environmental
	TX	Flooding issues	Public Lands and Water Management
183	TX	Air pollution	Environmental

Table G.1
Wave 1 Problems and Category Reclassifications
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Category
	TX	Water pollution	Environmental
184	TX	Water quantity	Environmental
	TX	Coastal flooding	Environmental
185	TX	NOAA funding for private land projects	Federal government operations
	TX	Coastal erosion	Environmental
	TX	Water quality	Environmental
186	TX	EPA not using its power	Federal government operations
	TX	Bayport dredging issue	Public Lands and Water Management
	TX	Poor coastal zone management	Environmental
187	TX	Traffic	Transportation
	TX	Growth in the area	Housing and Community Development
188	TX	Unemployment/Economic Development	Economic
189	TX	Water runoff from agricultural lands	Environmental
	TX	Prescribed burning	Public Lands and Water Management
190	TX	Human capital - public education	Education
	TX	Human capital - public healthcare	Health
	TX	Quality of place - environment	Environmental
	TX	Sustainability of Houston's Economy	Economic
	TX	Development/expansion of Houston	Housing and Community Development
191	TX	Non-point source pollution	Environmental
	TX	Lack of knowledge about the water/air relationship	Environmental
	TX	Freshwater inflows	Environmental
192	TX	Traffic	Transportation
	TX	Air quality	Environmental
	TX	Urban Sprawl	Housing and Community Development
	TX	Water quantity	Environmental
	TX	Invasive exotics	Environmental
	TX	Coastal erosion	Environmental
193	TX	Taxation/expectation gap	State and Local Government
	TX	New generation of public servants	State and Local Government
	TX	State lack of understanding of local issues	State and Local Government
	TX	Air Quality in Longview	Environmental
194	TX	Accessible and affordable healthcare	Health
	TX	Transportation	Transportation
	TX	Affordable housing	Housing and Community Development
195	TX	Flooding	Public Lands and Water Management
	TX	Attainment regulations	State and Local Government
196	TX	Growth management	Housing and Community Development
197	TX	Freshwater inflows	Environmental
	TX	Wetlands & habitat protection	Environmental
198	TX	Air quality	Environmental
	TX	Disaster management	Other
199	TX	Bayport & other planning problems	State and Local Government
	TX	Coastal erosion	Environmental
	TX	Disaster management	Other

Table G.1
Wave 1 Problems and Category Reclassifications
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Category
200	TX	Water supply issues	Public Lands and Water Management
201	TX	Increase in people	Housing and Community Development
	TX	Bycatch of pelagic fish species	Environmental
202	TX	In-stream flow	Public Lands and Water Management
203	TX	Pressure on coastal resources	Environmental
	TX	Air pollutions as it affect water quality	Environmental
	TX	Dredging	Public Lands and Water Management
204	TX	Quality of life in Houston	Housing and Community Development
205	TX	Ozone non-attainment	Environmental
	TX	Freshwater inflows	Public Lands and Water Management
	TX	Invasive exotics	Environmental
	TX	Persistent contaminants	Environmental
	TX	Non-point source pollution	Environmental
206	TX	Air pollution	Environmental
	TX	Mercury polluting fisheries	Environmental
	TX	Climate change/emissions	Environmental
207	TX	Hurricanes	Environmental
	TX	Hazardous Material Management	Environmental
208	TX	Subsidence/marsh loss	Environmental
	TX	Aging infrastructure	Housing and Community Development
	TX	Clear Creek/Bayport issues	Public Lands and Water Management
209	TX	Public health/fish diseases	Health
	TX	Public health/arboviral diseases	Health
	TX	Storm vulnerability	Environmental
210	TX	Commercial development	Housing and Community Development
	TX	Wind farm problems	Energy
211	TX	Development impacting forests	Housing and Community Development
	TX	Expansion of the grand parkway	Transportation
212	TX	Rainwater and sewer systems	Housing and Community Development
	TX	Alvin roads/highway access	Transportation
	TX	Management of growth and Mustang Bayou	Public Lands and Water Management
	TX	Road ditches as wetlands	Other
213	TX	Reopening of highway 87	Transportation
	TX	Storms	Environmental
	TX	Farmers/water/oysters	Environmental
	TX	Coastal erosion	Environmental
214	TX	Urban Sprawl	Housing and Community Development
215	TX	Parks and trails	Housing and Community Development
	TX	Trees and landscape	Housing and Community Development
	TX	Signage	Housing and Community Development
	TX	Littering and graffiti	Housing and Community Development
216	TX	Public health problems	Health
	TX	Habitat loss	Environmental
	TX	Too many nutrients in the water	Environmental
	TX	Invasive exotics	Environmental

Table G.1
Wave 1 Problems and Category Reclassifications
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Category
	TX	Freshwater inflows	Public Lands and Water Management
217	TX	Restoration of highway 87	Transportation
	TX	Port and waterway expansion	Public Lands and Water Management
218	TX	Water rights/usage	Public Lands and Water Management
	TX	Flood control	Public Lands and Water Management
219	TX	Water quantity - ecosystem use	Public Lands and Water Management
220	TX	Utilities management	Housing and Community Development
	TX	Economic development	Economic
	TX	Flood management	Public Lands and Water Management
	TX	Community diversity/housing conditions	Housing and Community Development
	TX	Need for dredging	Public Lands and Water Management
221	TX	Pollution	Environmental
	TX	Population outgrowing fire department	State and Local Government
	TX	Traffic	Transportation
	TX	Flood control	Public Lands and Water Management
222	TX	Continuing the prosperity of Houston	Economic
	TX	Traffic	Transportation
	TX	Crime	Law, crime, and family issues
	TX	Air pollution	Environmental
223	TX	Water quantity - ecosystem use	Public Lands and Water Management
	TX	Urban Sprawl	Housing and Community Development
	TX	Global climate change	Environmental
224	TX	Hurricane preparedness	Environmental
	TX	Flooding	Environmental
	TX	Evacuations routes	Transportation issues
	TX	Water rights, droughts, and wildfire	Environmental
	TX	Hazardous material spills	Environmental
225	TX	Bayport dredging issue	State and Local Government
	TX	Emergency management: terrorism & storms	Other
	TX	Air pollution	Environmental
	TX	Litter	Environmental
226	TX	Inadequate resources for the refuge	Public Lands and Water Management
	TX	Invasive exotics	Environmental
	TX	Flooding	Public Lands and Water Management
	TX	Habitat fragmentation	Environmental
227	TX	Air pollution	Environmental
	TX	Water pollution	Environmental
	TX	Global climate change	Environmental
228	TX	Bayport	Public Lands and Water Management
	TX	Urban Sprawl	Housing and Community Development
	TX	Air pollution	Environmental
	TX	Wetland loss	Environmental
	TX	Hurricanes	Environmental
229	TX	Air quality	Environmental
	TX	Houston's image	Housing and Community Development

Table G.1
Wave 1 Problems and Category Reclassifications
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Category
	TX	Housing concerns	Housing and Community Development
	TX	Basic infrastructure	Housing and Community Development
	TX	Traffic	Transportation issues
	TX	Clean water	Environmental
	TX	Flooding	Environmental
230	TX	Water quantity	Environmental
	TX	Water quality	Environmental
	TX	Habitat loss	Environmental
	TX	Coastal erosion	Environmental
231	TX	Population changes/educating the workforce	Housing and Community Development
	TX	Air pollution	Environmental
	TX	Poor environmental regulatory structure	Environmental
	TX	Economic viability of the United States	Economic
	TX	Need for alternative energy in the future	Energy
232	TX	Pressure on the shrimping industry	Agriculture
	TX	Freshwater inflows	Public Lands and Water Management
233	TX	Freshwater inflows	Public Lands and Water Management
	TX	Wetland loss	Environmental
	TX	Coastal erosion	Environmental
	TX	Relative sea level rise	Environmental
234	TX	Public school funding	Education
	TX	Safety/disaster management	Other
	TX	Sitting of new schools	Education
	TX	Bus restrictions	Environmental
	TX	Flooding	Public Lands and Water Management
235	TX	Transportation	Transportation
	TX	Flooding/Clear Creek	Public Lands and Water Management
	TX	Air quality	Environmental
	TX	City water supply	Public Lands and Water Management
236	TX	Human encroachment on habitat	Environmental
	TX	Increased park usage	Public Lands and Water Management
	TX	Economic development	Economic
	TX	Grand parkway	Transportation
237	TX	Commercial over fishing	Environmental
	TX	Habitat degradation	Environmental
	TX	Freshwater inflows	Public Lands and Water Management
238	TX	Global climate change	Environmental
239	TX	Sustainable growth/quality of life	Housing and Community Development
	TX	Community safety (Bayport)	Other
	TX	Service needs outgrowing tax base	State and Local Government
	TX	Clear Creek channeling issues	Public Lands and Water Management
	TX	Air quality	Environmental
240	TX	Limit domestic energy resources	Energy
	TX	Urbanizations as it affects resources	Housing and Community Development
	TX	Environmental regs outgrowing infrastructure	Housing and Community Development

Table G.1
Wave 1 Problems and Category Reclassifications
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Category
	TX	Air quality	Environmental
	TX	Wetland loss	Environmental
	TX	Freshwater inflows	Public Lands and Water Management
241	TX	Air & water pollution	Environmental
	TX	Exotic and native grass infestation	Environmental
	TX	Water quantity	Public Lands and Water Management
242	TX	Lack of awareness of coastal issues	Other
	TX	Balancing environmental and usage concerns	Public Lands and Water Management
	TX	Coastal erosion	Environmental
	TX	Beach access	Environmental
243	TX	Job loss at Dow and BASF	Economic
	TX	Beach erosion	Environmental
	TX	Road maintenance	Transportation issues
244	TX	Communication issues	Other
	TX	Hurricanes	Environmental
	TX	Evacuation routes & signage	Transportation
	TX	Difficulty in receiving grants	Federal government operations
245	TX	Hospital finance/doctor availability	Health
	TX	Lack of a geriatric psych unit	Health
	TX	Hurricanes/evacuations	Environmental
	TX	Nursing shortage	Health
246	TX	Hurricanes	Environmental
247	TX	Habitat loss	Environmental
	TX	Invasive exotics	Environmental
	TX	Freshwater inflows	Public Lands and Water Management
	TX	Funding for conservation projects	Environmental
248	TX	Development of middle class housing	Housing and Community Development
	TX	Parking on the sea wall	State and Local Government
	TX	Beach access	Public Lands and Water Management
249	TX	Competing demands on natural resources	Environmental
	TX	Loss of ecological services	Environmental
	TX	Lack of environmental awareness	Other
250	TX	Healthcare pressure	Health
	TX	NASA money	Federal government operations
251	TX	Moving away from the chemical economy	Economic
	TX	Demographic pressures	Housing and Community Development
	TX	Navigable water	Public Lands and Water Management
252	TX	Lack of middle income population/housing	Housing and Community Development
	TX	Aging infrastructure	Housing and Community Development
	TX	Natural resource management	Environmental
	TX	Beach erosion	Environmental
253	TX	Underground pipelines	Transportation issues
	TX	Car and rail transport of hazmats	Transportation issues
	TX	Indoor and outdoor air quality	Environmental
	TX	Road quality issues	Transportation issues

Table G.1
Wave 1 Problems and Category Reclassifications
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Category
254	TX	Conflict of use	Environmental
	TX	Freshwater inflows	Public Lands and Water Management
	TX	Ozone non-attainment	Environmental
255	TX	Ecosystem health	Environmental
	TX	Effects of economic development	Housing and Community Development
256	TX	Public expectations > public resources	Public Lands and Water Management
257	TX	Strains of growth	Housing and Community Development
	TX	Need for economic development	Economic
258	TX	Flooding issues	Public Lands and Water Management
259	TX	Drainage system maintenance	Housing and Community Development
	TX	Water quality/rainwater	Environmental
260	TX	Drainage	Housing and Community Development
	TX	Healthcare	Health
	TX	Historical resources	Housing and Community Development
	TX	Affordable housing	Housing and Community Development
	TX	Coastal erosion	Environmental
	TX	Water issues	Public Lands and Water Management
261	TX	Freshwater inflows	Public Lands and Water Management
	TX	Habitat loss	Environmental
	TX	Population growth	Housing and Community Development
262	TX	Aging transportation infrastructure	Transportation
	TX	Emergency management	Other
	TX	Beach erosion	Environmental
263	TX	Water quality	Environmental
	TX	Erosion	Environmental
	TX	Lack of diverse habitat	Environmental
	TX	Invasive exotics	Environmental
	TX	Flooding	Public Lands and Water Management
264	TX	Development	Housing and Community Development
	TX	Erosion	Environmental
265	TX	Freshwater inflows	Public Lands and Water Management
	TX	Water quality	Environmental
266	TX	Infrastructure management	Housing and Community Development
	TX	Population growth/development	Housing and Community Development
	TX	Reaching consensus between local stakeholders	State and Local Government
267	TX	Drainage	Housing and Community Development
	TX	Transportation	Transportation
	TX	Retaining and retraining the labor force	Economic
268	TX	Marsh loss/conservation	Environmental
	TX	Development	Housing and Community Development
	TX	Beach erosion	Environmental
269	TX	Grass carp	Environmental
	TX	Agricultural water pollution	Environmental
	TX	Coastal erosion	Environmental
270	TX	Beach erosion	Environmental

Table G.1
Wave 1 Problems and Category Reclassifications
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Category
	TX	Marshes and estuaries	Environmental
271	TX	Transportation/traffic	Transportation
	TX	Education of the workforce	Education
	TX	Air pollution	Environmental
	TX	Water supply issues	Public Lands and Water Management
	TX	Flooding	Public Lands and Water Management
	TX	Crime	Law, crime, and family issues

Table G.2
Pre- and Post-scenario Problem Identification by Panelists
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Pre-Scenario (Wave 1)	Post-Scenario (Wave 2a)
1	FL	Housing & Community Development	Economic
		Environment	Public Land & Water Management
		Agriculture, Aquaculture	
2	FL	Public Land & Water Management	Agriculture, Aquaculture
		Agriculture, Aquaculture	Environment
		Environment	Agriculture, Aquaculture
3	FL	Public Land & Water Management	Economic
			Environment
			Public Land & Water Management
4	FL	Environment	Housing & Community Development
		Environment	Environment
			Environment
5	FL	Public Land & Water Management	Environment
		Housing & Community Development	
6	FL	Public Land & Water Management	Public Land & Water Management
		Housing & Community Development	Public Land & Water Management
		Environment	Environment
			Environment
7	FL	Environment	Economic
		Environment	Economic
		Environment	Environment
		Housing & Community Development	
8	FL	Environment	Housing & Community Development
		Housing & Community Development	
9	FL	Housing & Community Development	Environment
		Environment	Environment
		Economic	
10	FL	Public Land & Water Management	Environment
		Environment	Housing & Community Development
		Environment	Environment
		Housing & Community Development	
11	FL	Public Land & Water Management	Public Land & Water Management
		Public Land & Water Management	
		Housing & Community Development	
12	FL	Housing & Community Development	Public Land & Water Management
			Environment
13	FL	Environment	Environment
		Environment	Environment
14	FL	Housing & Community Development	Environment
		Environment	Environment
		Public Land & Water Management	Environment
			Economic
15	FL	Environment	Environment
		Public Land & Water Management	
		State & Local Government	

Table G.2
Pre- and Post-scenario Problem Identification by Panelists
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Pre-Scenario (Wave 1)	Post-Scenario (Wave 2a)
		Environment	
16	FL	State & Local Government	
		Housing & Community Development	
		Environment	
		Environment	
		Public Land & Water Management	
17	FL	Housing & Community Development	
		Agriculture, Aquaculture	
18	FL	Other	Environment
		Environment	Environment
		Environment	Environment
		Environment	Health
		Environment	
		Environment	
19	FL	Public Land & Water Management	Environment
		Environment	Environment
20	FL	Environment	Environment
		Housing & Community Development	Environment
		Environment	Economic
21	FL	Other	Environment
		Environment	Economic
		Environment	
		State & Local Government	
		Environment	
22	FL	Public Land & Water Management	Environment
		State & Local Government	
		Environment	
23	FL	Housing & Community Development	Housing & Community Development
		Public Land & Water Management	Environment
			Housing & Community Development
24	FL	Public Land & Water Management	Public Land & Water Management
		Housing & Community Development	Public Land & Water Management
		Environment	Environment
			Environment
25	FL	Public Land & Water Management	Public Land & Water Management
		Environment	Environment
		Public Land & Water Management	Economic
		Public Land & Water Management	Public Land & Water Management
		Public Land & Water Management	
26	FL	Environment	Environment
		Public Land & Water Management	
		Housing & Community Development	
		Agriculture, Aquaculture	
27	FL	Environment	Environment
		Environment	

Table G.2
Pre- and Post-scenario Problem Identification by Panelists
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Pre-Scenario (Wave 1)	Post-Scenario (Wave 2a)
28	FL	Housing & Community Development	Housing & Community Development
		Environment	Environment
29	FL	Agriculture, Aquaculture	
		Environment	
30	FL	Environment	Environment
		Public Land & Water Management	
		Energy	
31	FL	Housing & Community Development	Environment
		Public Land & Water Management	Economic
32	FL	Public Land & Water Management	Public Land & Water Management
		Housing & Community Development	Economic
33	FL	Economic	Environment
		Public Land & Water Management	Environment
		Housing & Community Development	Environment
		Environment	
34	FL	Environment	Environment
		Housing & Community Development	Environment
		State & Local Government	
		Public Land & Water Management	
		Agriculture, Aquaculture	
35	FL	Environment	Agriculture, Aquaculture
		Housing & Community Development	Environment
			Environment
36	FL	Environment	Environment
		Public Land & Water Management	Public Land & Water Management
		Defense	Environment
37	FL	Housing & Community Development	Environment
			Environment
			Environment
			Environment
38	FL	Housing & Community Development	Environment
		Public Land & Water Management	Public Land & Water Management
		Environment	
		Public Land & Water Management	
39	FL	Housing & Community Development	Agriculture, Aquaculture
		Agriculture, Aquaculture	
40	FL	Environment	Environment
41	FL	Agriculture, Aquaculture	Environment
42	FL	Housing & Community Development	Environment
		Environment	Public Land & Water Management
		Environment	Environment
		Public Land & Water Management	
43	FL	Housing & Community Development	Public Land & Water Management
		Education	Economic
44	LA	Public Land & Water Management	Environment

Table G.2
Pre- and Post-scenario Problem Identification by Panelists
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Pre-Scenario (Wave 1)	Post-Scenario (Wave 2a)
		Agriculture, Aquaculture	Environment
		Environment	
		Fed. Gov. Operation	
45	LA	Environment	Public Land & Water Management
			Environment
46	LA	Environment	Public Land & Water Management
		Public Land & Water Management	Environment
47	LA	Public Land & Water Management	Environment
		Environment	
48	LA	Environment	Environment
		Environment	
49	LA	Environment	Environment
		Public Land & Water Management	Environment
		Environment	
		Public Land & Water Management	
		Economic	
		Transportation	
50	LA	Environment	Environment
		Transportation	
51	LA	Environment	Environment
			Public Land & Water Management
52	LA	Environment	Environment
			Environment
53	LA	Environment	
		Transportation	
54	LA	Environment	Environment
55	LA	Environment	Environment
			Environment
56	LA	Environment	
		Transportation	
57	LA	Fed. Gov. Operation	Public Land & Water Management
		Environment	Environment
58	LA	Environment	Environment
		Environment	
		Environment	
59	LA	Environment	Environment
		Environment	
		Environment	
60	LA	Environment	Environment
		Transportation	Public Land & Water Management
61	LA	Public Land & Water Management	
62	LA	Public Land & Water Management	Energy
		Other	
		Public Land & Water Management	
		Environment	

Table G.2
Pre- and Post-scenario Problem Identification by Panelists
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Pre-Scenario (Wave 1)	Post-Scenario (Wave 2a)
63	LA	Environment	Environment
		Transportation	
		Environment	
64	LA	Environment	Environment
		Environment	Public Land & Water Management
		Environment	
65	LA	Environment	Environment
		Public Land & Water Management	
66	LA	Energy	Environment
		Environment	Energy
		Public Land & Water Management	Economic
			Environment
67	LA	Environment	Environment
		Environment	
68	LA	Agriculture, Aquaculture	Other
		Environment	Public Land & Water Management
		Public Land & Water Management	Environment
			Environment
69	LA	Environment	Environment
		Environment	
		Transportation	
		Housing & Community Development	
70	LA	Environment	Transportation
		Economic	Environment
		Other	
		State & Local Government	
		Public Land & Water Management	
71	LA	Education	Environment
		Public Land & Water Management	Public Land & Water Management
		Environment	Environment
72	LA	Environment	Environment
			Environment
			Health
			Housing & Community Development
73	LA	Environment	Environment
74	LA	Environment	Environment
75	LA	Environment	Agriculture, Aquaculture
		Economic	Environment
76	LA	Environment	Environment
77	LA	Environment	Public Land & Water Management
78	LA	Environment	Environment
		Transportation	
79	LA	Environment	Environment
80	LA	Environment	Environment
		Public Land & Water Management	Agriculture, Aquaculture

Table G.2
Pre- and Post-scenario Problem Identification by Panelists
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Pre-Scenario (Wave 1)	Post-Scenario (Wave 2a)
		Public Land & Water Management	
81	LA	Environment	Environment
		Environment	Environment
		Energy	
		Environment	
82	LA	Other	Environment
		Environment	
83	LA	Environment	Environment
			Environment
84	LA	State & Local Government	Environment
		Environment	Environment
85	LA	Environment	
		Transportation	
86	LA	Environment	Environment
			Environment
87	LA	Environment	Environment
		Transportation	
88	LA	Environment	Environment
		Transportation	Energy
			Public Land & Water Management
89	TX	Environment	Environment
		Environment	
		Environment	
90	TX	Public Land & Water Management	Transportation
		Environment	Environment
		Public Land & Water Management	
		Environment	
91	TX	Environment	Environment
		Housing & Community Development	Public Land & Water Management
		Environment	
92	TX	Housing & Community Development	Health
		Environment	Housing & Community Development
93	TX	Environment	Economic
		Housing & Community Development	Public Land & Water Management
94	TX	Housing & Community Development	Environment
		Housing & Community Development	Environment
		Housing & Community Development	
		Housing & Community Development	
95	TX	Health	Economic
		Health	
		Environment	
		Health	
96	TX	Housing & Community Development	Environment
		Energy	Environment
			Public Land & Water Management

Table G.2
Pre- and Post-scenario Problem Identification by Panelists
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Pre-Scenario (Wave 1)	Post-Scenario (Wave 2a)
			Environment
97	TX	Environment	Economic
		Public Land & Water Management	Environment
		Environment	Environment
			Transportation
98	TX	Transportation	Public Land & Water Management
		Environment	Environment
		Environment	Environment
		Environment	
99	TX	Environment	Environment
		Environment	Environment
		Transportation	Environment
		Environment	
		Environment	
100	TX	Education	Public Land & Water Management
		Health	Other
		Environment	Environment
		Economic	
		Housing & Community Development	
101	TX	Public Land & Water Management	Environment
		Environment	Public Land & Water Management
		Environment	Environment
		Environment	
102	TX	Public Land & Water Management	Public Land & Water Management
		State & Local Government	Energy
			Environment
103	TX	Other	Health
		Health	Public Land & Water Management
104	TX	Transportation	Transportation
		Other	
		Environment	
105	TX	Housing & Community Development	Environment
			Housing & Community Development
			Environment
106	TX	Fed. Gov. Operation	Environment
		Public Land & Water Management	Environment
		Environment	Environment
107	TX	Transportation	Environment
		Environment	Other
		Housing & Community Development	
		Environment	
		Environment	
		Environment	
108	TX	Environment	Public Land & Water Management
		Public Land & Water Management	Environment

Table G.2
Pre- and Post-scenario Problem Identification by Panelists
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Pre-Scenario (Wave 1)	Post-Scenario (Wave 2a)
		Economic	
		Transportation	
109	TX	Economic	Environment
		Housing & Community Development	Environment
		Public Land & Water Management	Environment
			Environment
110	TX	Environment	Economic
		Other	
111	TX	Housing & Community Development	Public Land & Water Management
		Environment	Public Land & Water Management
112	TX	Economic	Environment
		Environment	
		Transportation	
113	TX	Economic	Environment
			Environment
			Energy
			Environment
114	TX	Energy	
		Housing & Community Development	
		Housing & Community Development	
		Environment	
		Environment	
		Environment	
115	TX	Other	Environment
		Environment	Environment
		Transportation	
		Fed. Gov. Operation	
116	TX	Environment	Environment
		Environment	Public Land & Water Management
			Environment
117	TX	Housing & Community Development	Housing & Community Development
		Environment	Environment
		Environment	
		Economic	
		Energy	
118	TX	Environment	Environment
			Public Land & Water Management
119	TX	Public Land & Water Management	Environment
			Environment
120	TX	Economic	Environment
		Transportation	
		Law, Crime, family	
		Environment	
121	TX	Public Land & Water Management	Public Land & Water Management
		Housing & Community Development	Environment

Table G.2
Pre- and Post-scenario Problem Identification by Panelists
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Pre-Scenario (Wave 1)	Post-Scenario (Wave 2a)
		Environment	Environment
		Environment	Energy
		Environment	
122	TX	Public Land & Water Management	Transportation
		Environment	
		Environment	
		Environment	
123	TX	Health	Environment
		Environment	Public Land & Water Management
		Environment	Environment
		Environment	
		Public Land & Water Management	
124	TX	Environment	Public Land & Water Management
		Environment	Environment
125	TX	Public Land & Water Management	Environment
		Environment	Environment
126	TX	Public Land & Water Management	Environment
			Environment
			Health
			Public Land & Water Management
127	TX	Transportation	Education
		Transportation	
		Environment	
		Transportation	
128	TX	Health	Health
		Transportation	
		Housing & Community Development	
129	TX	Transportation	Environment
		Public Land & Water Management	Environment
130	TX	Public Land & Water Management	Public Land & Water Management
		Housing & Community Development	Environment
		Environment	Environment
			Environment
131	TX	Environment	Environment
		Environment	Environment
		Other	
132	TX	Housing & Community Development	Housing & Community Development
		Economic	Environment
133	TX	Housing & Community Development	Environment
		Economic	
		Public Land & Water Management	
		Housing & Community Development	
		Public Land & Water Management	
134	TX	Agriculture, Aquaculture	Public Land & Water Management
		Public Land & Water Management	

Table G.2
Pre- and Post-scenario Problem Identification by Panelists
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Pre-Scenario (Wave 1)	Post-Scenario (Wave 2a)
135	TX	State & Local Government	Environment
		Environment	Environment
		Other	Environment
			Public Land & Water Management

Table G.3
Post-scenario Problems and Links to Stressors
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Stressor
1	FL	Runoff	Precipitation
	FL	Land loss	Sea Level Rise (SLR)
	FL	Salinity increase	Sea Level Rise
	FL	Loss of Freshwater	Sea Level Rise
2	FL	Land loss	Sea Level Rise
	FL	Salinity increase	Sea Level Rise
	FL	Storm water Runoff	Precipitation
3	FL	Land loss	Sea Level Rise
	FL	Saltwater Intrusion	Sea Level Rise
	FL	Hurricane Preparedness	Sea Level Rise
	FL	Public Health problems	Temperature
	FL	Declines in Biodiversity	Temperature
4	FL	No problems	N/A
5	FL	Coastal Development	Storms/Sea Level Rise
	FL	Ecosystem Change	Temperature
6	FL	Saltwater Intrusion	Sea Level Rise/Precipitation/Combo
	FL	Ecosystem Change	Temperature
	FL	Hurricane Preparedness	Storms
7	FL	Coastal Development	Storms
	FL	Ecosystem changes	Precipitation
	FL	Vegetation changes	Precipitation
8	FL	Land loss	Sea Level Rise
9	FL	No problems	N/A
10	FL	Coastal Development	Combo
11	FL	Ag Water Availability	Precipitation
	FL	Storm water Runoff	Storms
	FL	Ag Mold	Temperature
12	FL	Freshwater Supply	Precipitation
13	FL	Loss of Wetlands	Sea Level Rise
	FL	Loss of property	Combo
14	FL	Freshwater Inflows	Combo
	FL	Water quality/Runoff	Precipitation
15	FL	No problems	N/A
16	FL	Tourism	Heat
	FL	Property Loss	Sea Level Rise
	FL	Storm water Runoff	Precipitation
17	FL	Saltwater Intrusion	Sea Level Rise
	FL	Storm frequency/intensity	Heat
18	FL	Freshwater Inflows	Precipitation
	FL	Loss of property	Sea Level Rise
19	FL	Saltwater Intrusion	Precipitation
20	FL	Freshwater Inflows	Precipitation
21	FL	Hardening of Coastline	Sea Level Rise
	FL	Freshwater Inflows	Precipitation
	FL	Contaminated runoff	Precipitation

Table G.3
Post-scenario Problems and Links to Stressors
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Stressor
	FL	Saltwater Intrusion	Sea Level Rise
22	FL	Hardening of Coastline	Sea Level Rise
	FL	Property Damage/flooding	Precipitation
23	FL	No problems	N/A
24	FL	Bay Ecosystem changes	Combo
	FL	Coastal Beach erosion	Sea Level Rise
25	FL	Decreased Salinity	Precipitation
	FL	Contaminated runoff	Precipitation
26	FL	Land loss	Sea Level Rise
	FL	Loss of economic development	Precipitation
27	FL	Freshwater Inflows	Combo
	FL	Explosive Development Management	Combo
	FL	Potable water	Precipitation
28	FL	Loss of Habitat	Temperature/Sea Level Rise
	FL	Saltwater Intrusion	Sea Level Rise/Precipitation
29	FL	Coastal Erosion/Property Loss	Combo
	FL	Hurricane Evacuations	Storms
	FL	Loss of Habitat	Combo
30	FL	Loss of Habitat	Sea Level Rise
	FL	Freshwater Inflows	Precipitation
31	FL	Population Declines	Temperature
	FL	Loss of Habitat	Sea Level Rise
	FL	Coastal flooding	Combo (SLR/Storms)
32	FL	Drainage	Precipitation
	FL	Habitat Damage	Combo
	FL	Water quality/Runoff	Precipitation/Sea Level Rise
	FL	Flood Insurance Problems	Combo (SLR/Storms)
33	FL	Prescribed Fire	Precipitation
	FL	Loss of Wetland Ponds	Precipitation
	FL	Coastal Erosion/Property Loss	Sea Level Rise
	FL	All Terrain Vehicle (ATV) Problems/wetlands	Precipitation
	FL	Spring Conservation	Precipitation
34	FL	Public access to beaches	Sea Level Rise
	FL	Drainage Problems	Storms
	FL	Beach Erosion	Sea Level Rise
	FL	Land loss	Sea Level Rise
35	FL	Land loss	Sea Level Rise
36	FL	Coastal Erosion/Property Loss	Sea Level Rise
	FL	Freshwater Inflows	Precipitation
37	FL	Coastal Erosion/Property Loss	Sea Level Rise
	FL	Saltwater Intrusion	Precipitation
	FL	Freshwater Inflows	Precipitation
38	FL	Salinity Balance	Sea Level Rise/Precipitation
39	FL	Land loss	Sea Level Rise
	FL	Ecosystem Bay Changes	Precipitation

Table G.3
Post-scenario Problems and Links to Stressors
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Stressor
40	FL	Clam Industry Problems	Temperature
	FL	Water quality	Sea Level Rise
	FL	Red Tide	Temperature
41	FL	Marsh Loss/Ecosystem Damage	Combo (SLR/Temp)
	FL	Freshwater Inflows	Precipitation
	FL	Fisheries dynamics	Combo
42	FL	Drought problems	Temperature/Precipitation
43	FL	Coastal Beach erosion	Sea Level Rise
44	LA	Coastal Erosion	Sea Level Rise/Subsidence
	LA	Water Quality	Sea Level Rise
45	LA	Water Line problems	Sea Level Rise
	LA	Salt water intrusion	Sea Level Rise
46	LA	Land Loss	Sea Level Rise/Subsidence
	LA	Oil line problems	Sea Level Rise/Subsidence
	LA	Flooding	Precipitation
47	LA	Land Loss	Combo (Temp/SLR)
48	LA	Marsh Loss	Sea Level Rise/Subsidence
49	LA	No problem	N/A
50	LA	Loss of Roads/Docks (Infrastructure)	Sea Level Rise
	LA	Flooding/Storm surge	Storms
51	LA	Marsh Loss	Sea Level Rise
52	LA	Ridge Loss	Sea Level Rise
	LA	Land Loss	Sea Level Rise/Subsidence
53	LA	Coastal Land loss	Sea Level Rise/Subsidence
	LA	Flooding	Sea Level Rise/Subsidence
54	LA	Coastal Erosion/Land loss	Sea Level Rise/Subsidence
55	LA	Land loss	Sea Level Rise/Subsidence
	LA	Ecosystem Changes	Combo (temp/precipitation)
	LA	Diseases	Combo (temp/precipitation)
	LA	Built environment	Precipitation
56	LA	Coastal Land loss	Sea Level Rise
57	LA	Water Inundation	Sea Level Rise
	LA	Land Loss	Sea Level Rise
58	LA	Coastal Land loss	Sea Level Rise
59	LA	Coastal Erosion/Land loss	Sea Level Rise
	LA	Fresh water availability	Sea Level Rise
60	LA	Storm water loading	Precipitation
	LA	Pipe infrastructure	Sea Level Rise
	LA	Shipping	Sea Level Rise/Subsidence
	LA	Salt water intrusion	Sea Level Rise
	LA	Co2 emissions restrictions	Combo
61	LA	Levee Infrastructure	Sea Level Rise/Subsidence
	LA	Coastal Marsh loss	Sea Level Rise/Subsidence
62	LA	Land loss/Marsh loss	Sea Level Rise/Subsidence
63	LA	Higher temperatures	Temperature

Table G.3
Post-scenario Problems and Links to Stressors
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Stressor
	LA	Freshwater inflows	Precipitation
	LA	Land Loss	Sea Level Rise
	LA	Salt water intrusion	Sea Level Rise
	LA	Dead zone	Temperature
64	LA	Land Loss	Sea Level Rise
65	LA	Land Loss	Sea Level Rise
66	LA	Infrastructure Damage	Sea Level Rise
67	LA	Coastal Land loss	Sea Level Rise/Subsidence
68	LA	Coastal land/wetland loss	Sea Level Rise/Subsidence
	LA	Habitat Changes	Sea Level Rise
69	LA	Land Loss	Sea Level Rise/Subsidence
70	LA	Coastal Land/Marsh Loss	Sea Level Rise/Subsidence
	LA	Hurricane damage/storm surge	Combo (temp/storm)
71	LA	Saltwater Intrusion	Sea Level Rise
	LA	Land Loss	Sea Level Rise/Subsidence
72	LA	Flooding	Precipitation
	LA	Habitat Loss	Precipitation/Temperature
	LA	Land Loss	Sea Level Rise/Subsidence
73	LA	No problem	N/A
74	LA	Flooding	Combo (precipitation/SLR)
75	LA	How to use CC info in planning process	Sea Level Rise/Subsidence
76	LA	Climate Change	Combo
	LA	Land Loss	Sea Level Rise
77	LA	Fisheries Loss	Temperature
	LA	Land Loss	Sea Level Rise/Subsidence
78	LA	Coastal Land Loss	Sea Level Rise
79	LA	Coastal Erosion	Sea Level Rise/Subsidence
	LA	Freshwater inflows	Precipitation
80	LA	Hurricane damage/storm surge	Combo (storms/temp)
81	LA	Marsh Loss/Land loss	Sea Level Rise/Subsidence
82	LA	Land Loss	Sea Level Rise
	LA	Hurricane damage/storm surge	Storms
83	LA	No relevance to Land loss	N/A
84	LA	Coastal erosion/loss of marsh	Sea Level Rise/Subsidence
85	LA	Flooding	Combo (precipitation/SLR/subsidence
	LA	Hurricane damage/storm surge	Combo (storms/SLR)
86	LA	Land Loss	Combo (storms/SLR/subsidence)
87	TX	Water Quantity	Precipitation; Temperature
	TX	Salt Water Intrusion	Precipitation; Sea Level Rise
88	TX	Health issues related to temperature	Temperature; Precipitation
	TX	Flooding	Precipitation
89	TX	Averting CC Impacts	Combo
	TX	Freshwater inflows	Precipitation
	TX	Physical Environ. Changes	Sea Level Rise
90	TX	Loss of Marsh Habitat	Sea Level Rise

Table G.3
Post-scenario Problems and Links to Stressors
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Stressor
	TX	Salt Water Intrusion	Precipitation
	TX	Environmental Policy	Combo
91	TX	Air Quality	Temperature
	TX	Land loss	Sea Level Rise
	TX	Heat Waves/Energy Demand	Combo
	TX	Salt Water Intrusion	Sea Level Rise
92	TX	Flooding	Sea Level Rise
	TX	Quality of Life	Temperature
	TX	Water Quantity	Precipitation
93	TX	Air Quality	Combo
	TX	Heat Waves/Quality of Life	Temperature
94	TX	Affordable & Accessible Health Care	Temperature
95	TX	Flooding	Precipitation
	TX	Energy Availability	Temperature
	TX	Water Consumption	Temperature
96	TX	Lack of Leadership	Combo
	TX	Flooding	Precipitation
	TX	Water Quantity	Precipitation
97	TX	Freshwater Inflows	Precipitation
	TX	Flooding	Precipitation
98	TX	Disaster Management	Combo
99	TX	Flooding	Precipitation; Sea Level Rise
	TX	Coastal changes	Sea Level Rise
	TX	Air Quality	Temperature
	TX	Freshwater inflow	Temperature; Precipitation
100	TX	Freshwater inflow/availability	Combo
	TX	Land management	Sea Level Rise
101	TX	Coastal Flooding	Sea Level Rise
	TX	Water Availability	Precipitation
	TX	Coastal Erosion	Sea Level Rise
102	TX	Loss of Marsh Habitat	Sea Level Rise
103	TX	Flooding	Precipitation
	TX	Salinity	Precipitation; Storms
	TX	Freshwater inflow	Precipitation; Storms
	TX	Loss of Wildlife Habitat	Precipitation; Storms
104	TX	Freshwater inflow/availability	Temperature
	TX	Coastal Erosion	Combo
	TX	Salt Water Intrusion	Sea Level Rise
105	TX	Climate Change	Combo
	TX	Air Quality	Temperature
106	TX	Coastal Erosion/Habitat Loss	Sea Level Rise
	TX	Freshwater inflow	Precipitation
	TX	Flooding	Precipitation
107	TX	Freshwater availability	Precipitation
	TX	Coastal landless	Sea Level Rise

Table G.3
Post-scenario Problems and Links to Stressors
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Stressor
108	TX	Freshwater availability	Precipitation
109	TX	Global climate Change	Combo
110	TX	Freshwater inflow	Precipitation
	TX	Air quality	Temperature
	TX	Freshwater for Human Use	Precipitation
	TX	Increases in fires and pests	Temperature
111	TX	Freshwater for Human Use	Precipitation
	TX	Coastal Erosion	Storms
	TX	Heat Waves	Temperature
112	TX	Flooding	Sea Level Rise
113	TX	Flooding	Sea Level Rise
	TX	Exotics	Temperature
114	TX	Flooding	Sea Level Rise
	TX	Salt Water Intrusion	Sea Level Rise
	TX	Heat Waves	Temperature
	TX	Politics	Combo
115	TX	Algal blooms	Temperature
	TX	Freshwater inflow	Precipitation
	TX	Habitat Loss	Sea Level Rise
116	TX	Flooding	Sea Level Rise
	TX	Air Quality	Temperature
117	TX	Freshwater inflows	Precipitation
118	TX	Flooding	Sea Level Rise
119	TX	Flooding	Sea Level Rise
	TX	Loss of Habitat	Sea Level Rise
120	TX	No problem	N/A
121	TX	Loss of shoreline	Sea Level Rise
122	TX	Air quality	Temperature
	TX	Coastal Erosion	SLR/Storms
123	TX	Flooding Evacuation	Storms
124	TX	Loss of Fresh water	Precipitation
	TX	Flooding/Storm Surge	Combo
125	TX	Loss of Wetlands	Sea Level Rise
	TX	Saltwater Intrusion	Sea Level Rise
126	TX	Flooding	Sea Level Rise/Storms
	TX	Loss of Fresh water	Precipitation
	TX	Increased Salinity	Sea Level Rise
	TX	Air Quality	Temperature
127	TX	High Temperatures/School Calendar	Temperature
128	TX	Flooding	Sea Level Rise
	TX	Loss of land	Sea Level Rise
	TX	Air Quality	Combo
	TX	Flood Evacuation	Storms
129	TX	Flood Evacuation	Combo
	TX	Freshwater inflows	Precipitation

Table G.3
Post-scenario Problems and Links to Stressors
(Shading in table separates individual stakeholder responses)

Stakeholder	State	Problem	Stressor
130	TX	Air Quality	Temperature
	TX	Lack of Fresh water	Precipitation
	TX	Health issues related to temperature	Temperature
	TX	Urban flooding	Precipitation
131	TX	Flooding	Sea Level Rise
	TX	Air Quality	Temperature
132	TX	Flooding Roadways/Infrastructure	Combo
133	TX	Land loss	Sea Level Rise
	TX	Freshwater availability	Precipitation
134	TX	Air Quality/Human Health	Temperature
	TX	Unplanned growth/Erosion	Precipitation
135	TX	Land loss/erosion	Sea Level Rise
	TX	Land acquisition/conservation	Combo

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