

**CLIMATE CHANGE:
PERCEPTIONS, KNOWLEDGE, AND NEEDS
OF LOCAL DECISION-MAKERS IN COASTAL NORTH CAROLINA**

**KELLY BLANDFORD
REBECCA GRUBY
ROBERTO POTT
MICHELLE TALAL
CRISTINA VILLANUEVA**

Prepared for The Nicholas Institute for Environmental Policy Solutions



**ENV 280: Social Science Surveys for Environmental Management
Duke University**



APRIL 2009

**Climate Change:
Perceptions, Knowledge, and Needs of Local Decision-Makers in Coastal North Carolina**

TABLE OF CONTENTS

Executive Summary	2
Problem Statement	3
Methods and Procedures	4
Error Structure	8
Findings	8
Implications	21
References	25
Appendix A: Survey Instrument	26
Appendix B: Focus Group Script	32
Appendix C: Data Coding Sheet	35
Appendix D: Frequency of Responses	38
Appendix E: Additional Data	40

EXECUTIVE SUMMARY

The Nicholas Institute for Environmental Policy Solutions at Duke University (Nicholas Institute) is facilitating a collaborative Climate Ready Estuaries pilot program for the Albemarle-Pamlico National Estuary Program. One goal of the pilot program is to educate local decision-makers in communities surrounding the Albemarle and Pamlico estuaries about the opportunities and challenges inherent in preparing their communities for the potential impacts of climate change. In the study reported here, graduate students at the Nicholas School of the Environment at Duke University administered a 17 question web-based pilot survey to address the Nicholas Institute's need for baseline information about local public officials' knowledge, beliefs, perceptions, and motivations regarding a) the impacts of climate change on their community, and b) activities they are currently undertaking or may undertake to increase resilience and mitigate the effects of climate change in their community. The results of this study provide a starting point for the Nicholas Institute to develop an education program for local officials that is appropriately matched to their needs.

The survey was e-mailed to 160 local decision-makers in coastal cities and counties in North Carolina. Participants were chosen for the survey from coastal counties and cities in North Carolina using a non-random, non-probability sampling method, though attempts were made to gain representation from all coastal counties in North Carolina. Fifty-nine surveys were completed by respondents in fifteen counties and nine cities.

Seventy-three percent of surveyed local officials believe climate change is occurring. Only 38% claim to know what the potential impacts of climate change are in their communities. The highest percentage of respondents identified sea level rise (70%), shore erosion (50%) and increase in storm surge (48%) as expected effects in their communities due to climate change. The highest percentage of respondents also expressed that climate change will affect their communities' tourism, future generations and economy. Sixty-three percent of respondents mentioned that their local government does not consider climate change when making decisions, even though the majority (approximately 60%) believes that there is something their local government can do to prepare their community against climate change impacts. One third of surveyed local officials perceive that they do not have enough political support from their constituents to prepare their community for climate change; however almost half of the respondents indicated that preparing the community for the potential impacts of climate change is at least somewhat important to their constituents.

Our results have several implications for the work of the Nicholas Institute. Although many decision-makers think they do not know the impacts of climate change, many of them do have at least some knowledge of the most important impacts of climate change in their community. This suggests that educational efforts could be focused on affirming and building upon a base of existing knowledge. In terms of capacity and resources, our study found that the factors that greatly affect local officials in preparing for climate change are a lack of funding and a lack of scientific information. In turn, outreach programs could focus on guiding local decision-makers to financial resources and reliable data sources. Respondents also identified activities that have not yet been undertaken but could be helpful in preparing their communities for the effects of climate change (e.g. educating community members, considering climate change when developing land use plans, and updating water supply models). These could be suitable activities to help local governments begin to address. Finally, the study found that local decision-makers are unsure of the appropriate timeframes within which to address the potential climate change impacts. Consequently, an important component of an education program could be to inform local governments of when various impacts are expected to occur, and when local government should initiate action to prepare for these impacts.

PROBLEM STATEMENT

The Albemarle-Pamlico National Estuary Program (APNEP) is a cooperative effort jointly sponsored by the North Carolina Department of Environment and Natural Resources and the Environmental Protection Agency in cooperation with the Virginia Department on Conservation and Recreation. The mission of APNEP is to encourage local communities to take responsibility for managing the resources in their respective jurisdictions¹. As the Albemarle-Pamlico region is among the three areas of the country most threatened by sea level rise, APNEP is currently working to strengthen the region's resilience and mitigation of the effects of climate change on both aquatic and terrestrial habitats and human communities.

As part of this effort, the Nicholas Institute for Environmental Policy Solutions at Duke University (Nicholas Institute) is facilitating a collaborative Climate Ready Estuaries pilot program to foster better understanding and cooperation between university research assets in the physical, life, and social sciences and communities that depend on and are affected by changes to estuarine systems. The Nicholas Institute is a nonpartisan organization that works to provide effective solutions to environmental problems by providing decision-makers in the public and private sectors with unbiased evaluations of policy risks and rewards, and innovative, practical ideas for meeting complex challenges. Two key objectives of the pilot program are to establish a clear sense of public awareness of climate change in key regions of the APNEP system, and to educate the public and local lawmakers and resource managers about the opportunities and challenges inherent in preparing the community for the potential impacts of climate change.

The first step in designing an effective education program is to determine the baseline knowledge, beliefs, perceptions, and motivations of the target groups regarding a) the impacts of climate change on their community, and b) activities they are currently undertaking or may undertake to increase resilience and mitigate the effects of climate change in their community. Several student research groups from North Carolina universities have conducted research on public perceptions about climate change and its effects on the natural and built environment around North Carolina estuaries. Students at the University of North Carolina, Chapel Hill Albemarle Field Station focused on public perceptions of sea level rise in coastal North Carolina counties. Duke University graduate students conducted survey work in estuarine counties on the understanding of the effects of shoreline armoring on estuarine erosion.

In the study reported here, graduate students at the Nicholas School of the Environment at Duke University address the Nicholas Institute's need for information about local public officials' (elected and appointed city and county officials) awareness and concern about climate change and actions to address its impacts in coastal North Carolina communities, including those bordering the Albemarle-Pamlico National Estuary. The results of this pilot survey provide a starting point for the Nicholas Institute to develop an education program for local officials that is appropriately matched to their needs. The main objective of the survey is to answer the following research question:

- **What do local decision-makers know and believe about the potential impacts of climate change on the natural and human environment in coastal North Carolina communities?**

¹ Albemarle-Pamlico National Estuary Program, *available at* <http://www.apnep.org/pages/who.html>

Two secondary research questions the survey seeks to address are:

- **Do local decision-makers have the motivation to adapt to the potential impacts of climate change?**
- **Do decision-makers have the capacity and resources to adapt to these potential changes?**

The researchers established several hypotheses based on the results of the student research mentioned above, a focus group conducted at Duke University, and a literature search:

1. Local officials lack information on the impacts of climate change in their communities.
2. Local officials perceive that their constituents have little interest in preparing the community for climate change.
3. There is a lack of funding for climate change adaptation at the local level.
4. Local officials lack information on state, federal, and non-governmental support that is available to help them prepare their community for climate change.

METHODS AND PROCEDURES

Study Region

Samples for the survey were drawn from all twenty coastal counties in North Carolina (see Figures 1 and 2). The coastal population is 826,019.² There are 320 miles of ocean beaches in North Carolina and more than 8,000 miles of estuarine shoreline (DENR, 2009). The majority of coastal counties in North Carolina directly border the Albemarle Sound or the Pamlico Sound.

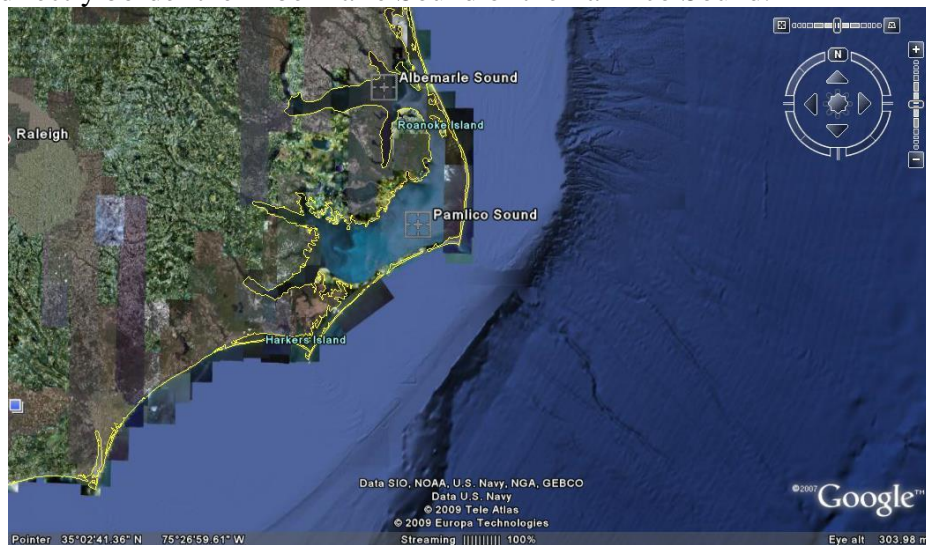


Figure 1. The North Carolina coastline.

² Population estimate from 2000. National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management. Available at <http://coastalmanagement.noaa.gov/mystate/nc.html>

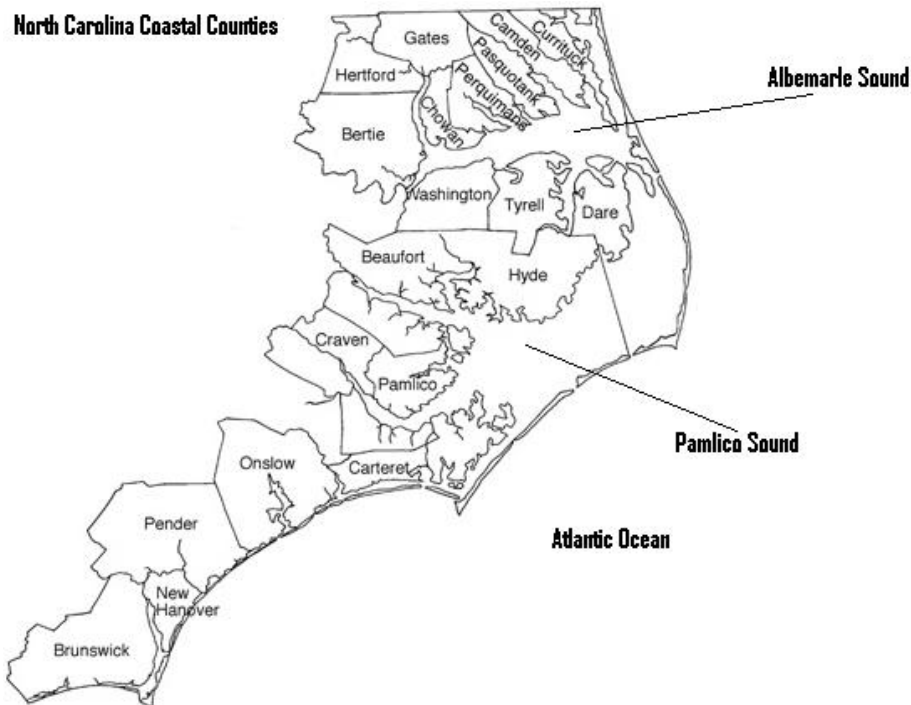


Figure 2. Coastal counties in North Carolina (DENR, 2009).³

Coastal communities in North Carolina are located in the relatively low-income eastern region of the state. Real estate and tourism are important economic sectors in this region. In 2001, the tourism industry in coastal counties had an economic impact of \$1.76 billion (DENR, 2009). Climate change is expected to have major implications for both of these sectors. The development and economic activities along the North Carolina coastline are “vulnerable to risk of coastal flooding, shoreline erosion and storm damages” (Bin et al., 2007). Sea-level rise may have significant effects on beach width, impacting areas that currently host beach cottages and beach recreation. There may also be substantial economic losses from reduced opportunities for beach trips and fishing trips (Bin et al., 2007).

Period of study

The researchers conducted a focus group meeting at the Duke University campus in Durham, North Carolina on February, 19, 2009. The survey instrument was pretested on March 24, 2009 and implemented over the period March 25, 2009- April 3, 2009. The first survey was sent on March 25, with reminders sent on March 30, April 1, and April 3.

³ Image modified from North Carolina Department of Environment and Natural Resources, Division of Coastal Management, available at <http://dcm2.enr.state.nc.us/handbook/section1.htm>.

Survey Type and Design

We collected data using a web-based survey for several reasons. This implementation method is a convenient, efficient, and cost-effective way to reach respondents distributed over a wide geographical area (Rea and Parker, 2005). In addition, web-based surveys provide a high level of anonymity for respondents, which was particularly important for this survey considering the high-profile nature of the target population and the relatively controversial nature of the survey questions. We used ViewsFlash software to implement the survey primarily due to the program's ability to track and reject duplicate surveys. We sent each potential respondent a personalized e-mail invitation via the ViewsFlash software to participate in the survey. Each e-mail contained a letter explaining the purpose of the survey, a link to the survey, and a unique username and password for accessing the survey. The unique username and passwords tracked survey responses and prevented individuals from taking the survey multiple times.

The survey consisted of 17 questions, many of which had multiple sub-parts. Most questions were closed-ended. Closed-ended questions included response categories with nominal, ordinal, and interval scales. Likert scales were frequently used for ordinal response categories. In addition to the close-ended questions, we included two open-ended questions and a comment box at the end of the questionnaire to allow respondents to share information and opinions that otherwise would not have been captured. Every attempt was made to provide an appropriate response for those respondents who do not believe that climate change is occurring (primarily by providing a "does not apply" answer choice.)

Focus group

The researchers conducted a focus group meeting prior to implementing the survey. A focus group is a "semi-structured discussion among individuals who are deemed to have some knowledge of, or interest in, the issues associated with the research study" (Rea and Parker, 2005). The purpose of the focus group was to improve the quality of the survey instrument by testing specific survey questions, gauging the level of knowledge of the sample population, and learning about ways to increase the response rate.

Researchers administering surveys to a large or generic population often recruit people from the target population to participate in focus groups on survey design. However, because participating in a focus group biases the respondent, he or she cannot participate in the final study. Thus, because the target population for this survey is already small, we chose not to ask local officials from coastal North Carolina counties to participate in the focus group. Seven graduate students (two male, five female) were recruited from the Nicholas School of the Environment at Duke University to participate in the focus group meeting instead. All focus group participants had some knowledge or experience in environmental policy and/or climate change science and policy. The meeting was held on the Duke University campus on February 19, 2009. Before beginning the discussion, the researchers provided a pizza dinner and established voluntary consent for all participants.

The moderator began the discussion by welcoming participants, explaining that everybody's opinions were valuable, and providing background information on the research questions and target population. The first half of the discussion focused on survey implementation issues, including ways in which the researchers could increase the response rate (what day/time to send out the surveys, what to include in the introductory email, etc.) The second half of the meeting was dedicated to testing particular survey questions. The moderator asked participants to read groups of questions on the draft survey.

Then, the moderator asked participants to provide feedback on specific issues such as inconsistencies or ambiguity in the wording of questions, the likelihood of local decision-makers to hold the information necessary to answer the question, and the answer choices (were answer choices realistic, relevant, and comprehensive?)

The feedback from the focus group was invaluable, and several important changes were made to the survey instrument based on its recommendations. First, for those questions that implied that the respondent think that climate change is occurring, we added a sentence that directed those respondents who did not expect their community to experience any effects from climate change to select a “Does not apply” answer choice. Second, we added questions to assess respondents’ belief that climate change is or is not occurring, and to determine the respondents’ perceptions of constituent support for climate change adaptation activities. Third, we removed a question about highly technical environmental management tools because focus group participants did not think that the respondents would have knowledge on this topic at the level of detail necessary to answer the question. We also made minor changes to the wording of several questions to improve clarity.

Pretest

Initially, the research team planned to pretest the survey with local decision-makers in coastal counties in South Carolina. However, because software functionality was a major concern, the researchers opted to pretest the survey with a group of graduate students at Duke University who could provide real-time feedback on the accessibility of the software and questionnaire content. The pretest group consisted of 8 graduate students at Duke University. After troubleshooting software bugs and ensuring that the survey instrument was accessible, the team sent the questionnaire to the target population. This form of pretest was useful to the researcher because of the time constraints of the project. However, with additional time, a pretest with local decision-makers and officials would have been more appropriate.

Sampling Method

Participants were chosen for the survey from coastal counties and cities in North Carolina using a non-random, non-probability sampling method. In a non-probability sample, is it not possible to determine coverage with certainty (the percentage of the population that is included in the sampling frame) or the probability of each person in the population for being selected. However, attempts were made to gain representation from all coastal counties in North Carolina. According to Rea and Parker (2005), the primary advantage of non-probability sampling rests in its usefulness in the early stages of a research project, as it can quickly generate a preliminary understanding of some of the key issues underlying the research study. Local officials in the following positions were targeted for inclusion in the sample: county commissioners, town council members, county and town managers, planners/engineers, risk/emergency managers, and public health officials. The research team used publicly available information on city and county websites to compile a list of e-mail addresses for as many individuals in the foregoing positions as possible within the time available. General county e-mail addresses were avoided to ensure that responses came from selected individuals. We sent 160 surveys to local officials in twenty coastal counties and ten coastal cities in North Carolina.

Data Treatment and Analysis

It is very important to recognize that it is not possible to generalize statistically from a non-probability sample to the general underlying population. In other words, analyses conducted on survey results solely describe the respondents in the sample and cannot be used to make general statements about the underlying population of local-decision makers in coastal North Carolina counties. As such, the survey data were analyzed using descriptive statistics, such as measures of central tendency. When calculating the mean responses to Likert questions, we omitted the responses from the “Does not apply.” When calculating the mode, we included this response category.

ERROR STRUCTURE

It is not possible to quantify the sampling error because the sample was a non-probability sample. However, it is important to identify potential sources of bias in the survey. First, some members of the population were definitely excluded from participating in the survey. These include individuals in cities that do not have websites, and individuals whose e-mail addresses were not available on city or county websites. Second, with web-based surveys, it is not possible to be certain that surveys were completed by individuals who were selected to be a part of the sample. In fact, two respondents told researchers that they forwarded the survey to a colleague. This is problematic because individuals not selected to be a part of the sample may not have the same knowledge and experience as the target population and, thus, their answers will bias the survey results. In addition, complications with the Viewsflash software may have affected the response rate. At least two respondents were unable to access to the survey. This suggests that there might have been other potential respondents who were interested in taking the survey, but were not willing to invest the time to get in touch with the research team to resolve the accessibility issue. It is not possible to determine how many potential respondents had trouble accessing the survey but did not contact the research team. Response bias may also introduce another source of error in the survey. Question wording in some cases could have led respondents to answer questions in such a way that does not reflect their true beliefs. However, the researchers tried to minimize response bias by making every attempt to frame questions in such a way that they did not presuppose a belief in climate change. Along these lines, it was also not possible to determine how many respondents saw the topic in the survey email and refused to take the survey because he or she did not believe in climate change. We tried to minimize other sources of response bias by using a web-based survey to maximize anonymity, and by not mentioning that the research team was associated with the Nicholas School of the Environment.

FINDINGS

Twenty coastal counties and ten coastal cities were included in the survey. Responses were received from fifteen counties and nine cities (Figure 3). Overall, 59 of the 160 surveys were completed, yielding a 37% response rate. See Appendix E for a table with the frequency responses from each jurisdiction.

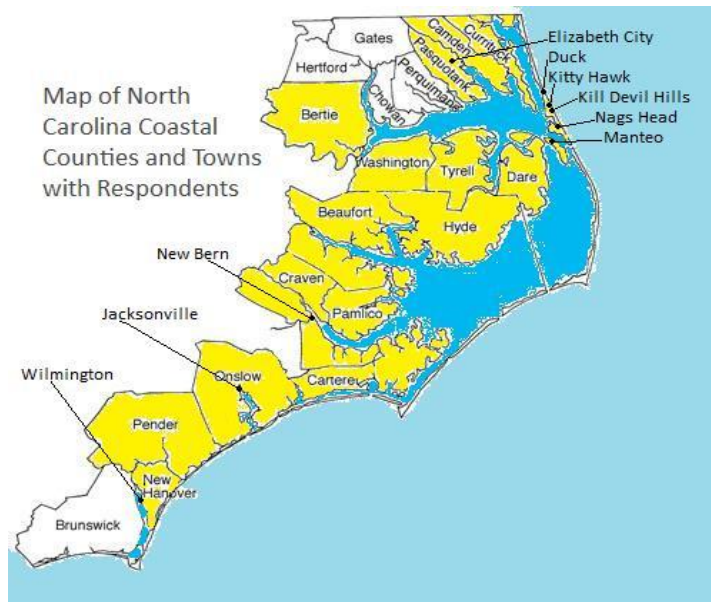


Figure 3. Map of coastal towns and counties surveyed. Responses were received from counties highlighted in yellow.

On average, respondents have worked in local government for 11.8 years (range: 0.5 - 36 years). Respondents have worked in their current positions for an average of 6.39 years (range: 0.3 - 30 years). Forty percent of respondents have held their positions for 0 – 3 years, 29% for 4-7 years, 12% for 8-11, and 18% for more than 12 years (Figure 4).

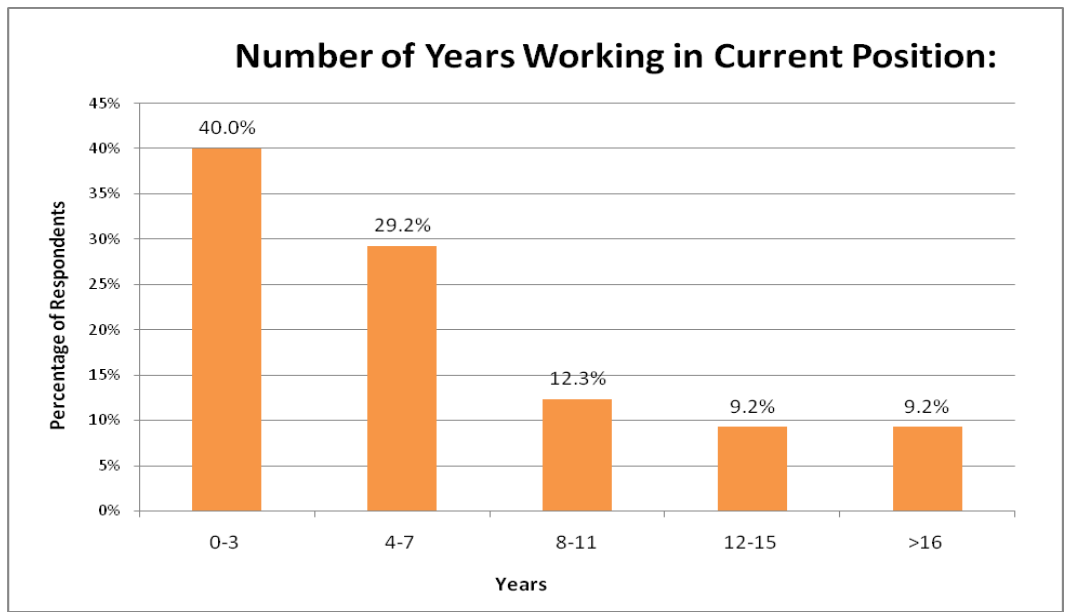


Figure 4. Years in current position.

Approximately 27% of respondents had expertise in business, followed by 26% in public policy (Figure 5). The other areas of expertise include land use planning (19%), environment (14%), economics (11%), law (8%), and social services (6%). Twenty-one percent of respondents provided fill-in responses that were grouped into the “other” category. Respondents write-ins for the “other” category included: engineering, finance, emergency management, public safety, public works, accounting, stormwater management, elected commissioner and chairman, and science.

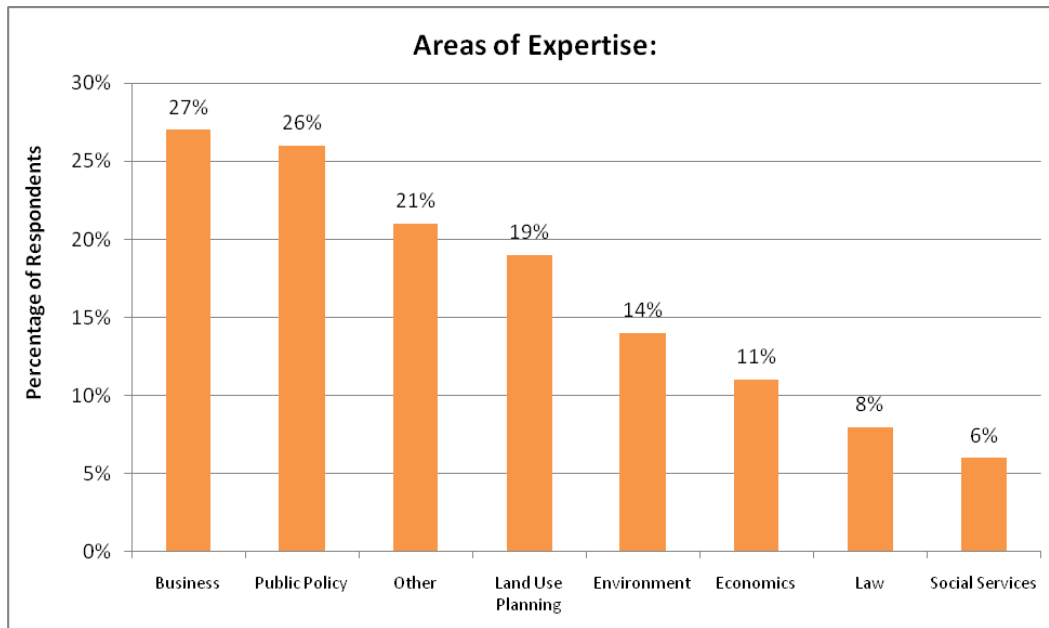


Figure 5. Respondent expertise.

Knowledge and Beliefs

Twenty seven out of 59 respondents (46%) believe that climate change is occurring, and 16 respondents (27%) believe that climate change is probably occurring (Figure 6). Therefore, a total of 73% of respondents believe that climate change is at least probably occurring. Eight respondents (13%) believe that climate change is probably not occurring or not occurring, and eight respondents (13%) do not know whether climate change is occurring. The modal response to this question is that “climate change is occurring” while the mean response is that “climate change is probably occurring.”

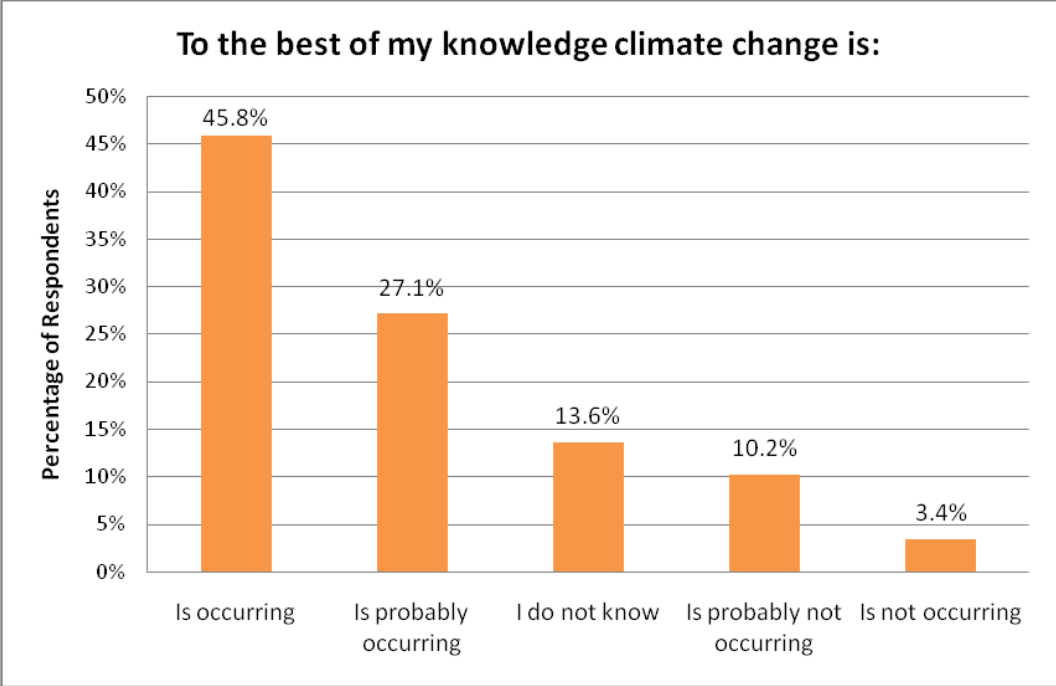


Figure 6. Respondent beliefs about the occurrence of climate change.

Respondents were asked to indicate their level of agreement with the following statement: “I don’t know what the environmental impacts of climate change will be in my community” (Figure 7). Twenty-two respondents (37%) agreed or strongly agreed with this statement and 38% disagreed or strongly disagreed. The modal responses were “agree” and “disagree,” and the mean response was “undecided.”

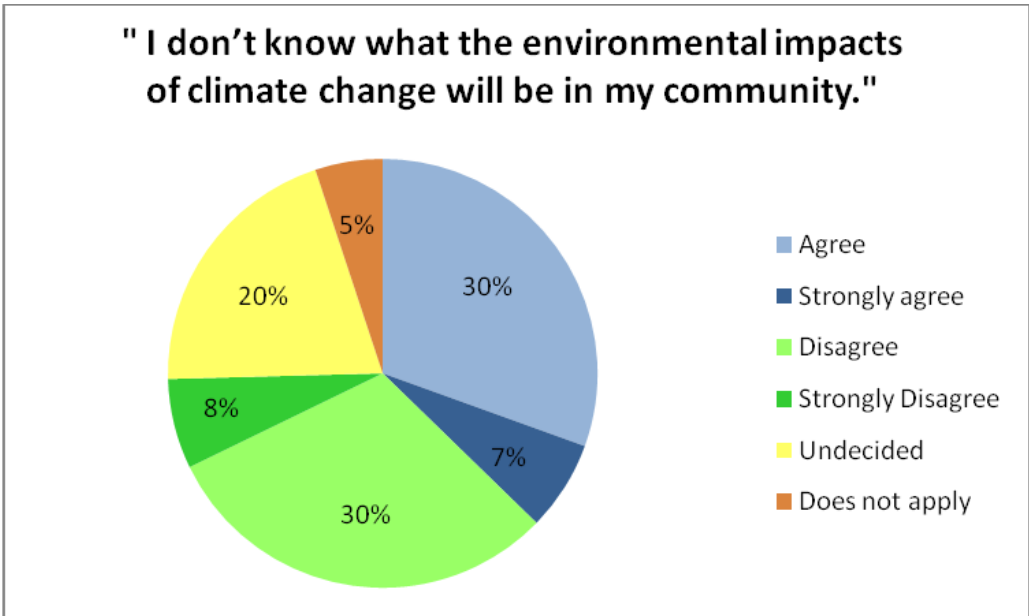


Figure 7. Respondent knowledge about impacts of climate change in their communities.

Respondents were asked to identify the environmental effects they expect their community to experience due to climate change. Figure 8 shows that highest percentages of respondents identified the following environmental effects: sea level rise (70%), shore erosion (50%), increase in storm surge (48%), increasing intensity of storms (45%), and warmer winters (43%). A relatively smaller percentage of respondents identified environmental effects such as land area loss (29%), increasing frequency of floods (32%), saltwater intrusion into groundwater (38%), increasing intensity of floods (16%), biodiversity loss (16%), cooler winters (7%), forest fires (7%), biodiversity increase (0%).

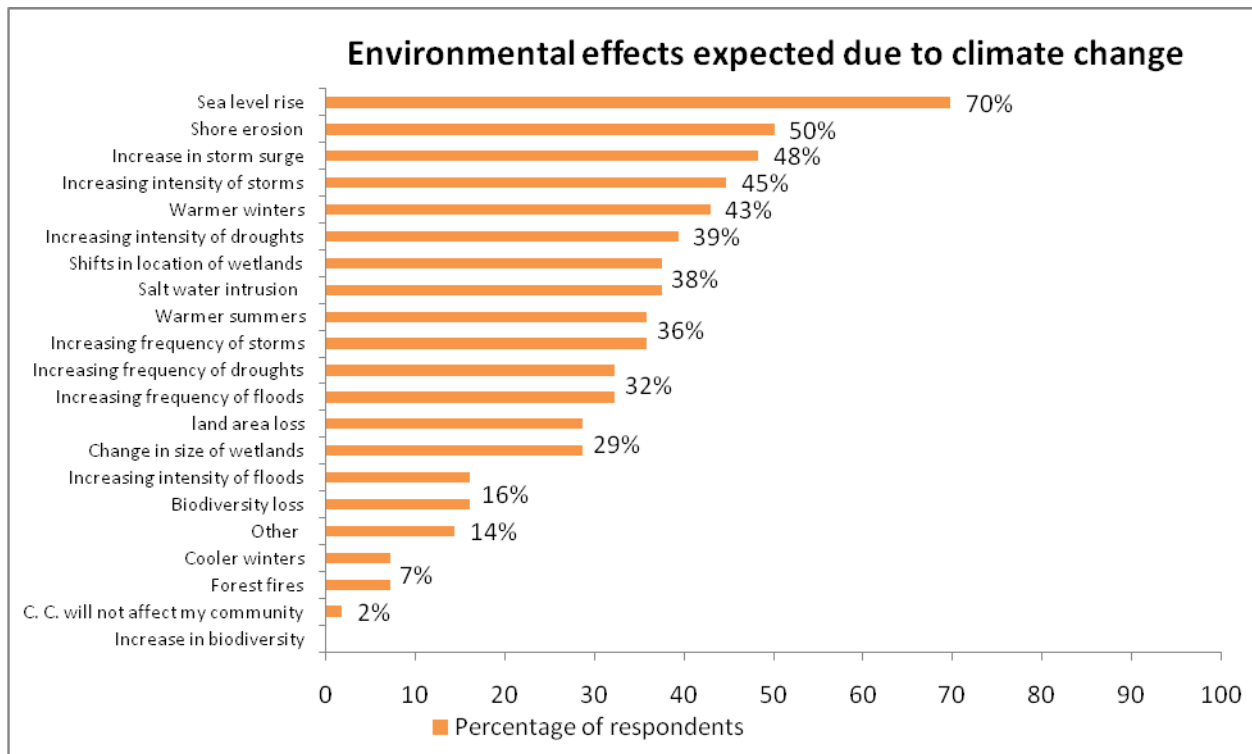


Figure 8. Environmental effects respondents expect their communities to experience due to climate change.

Respondents were asked about the extent to which they think climate change will increase their community’s vulnerability to drought, shore erosion, flooding, forest fires, intense storms, saltwater intrusion to aquifers, and sea level rise. The mean response was “not sure,” for all events except for forest fires, for which the mean answer was “somewhat.” The modal answer for sea level rise was “a great deal” and the modal answer for all other events was either “not sure” (drought, forest fires, saltwater intrusion into aquifers) or “somewhat” (shore erosion, flooding, intense storms).

Capacity and Resources

Respondents were asked to identify (from a list provided by the researchers) activities that could help prepare their community for the impacts of climate, and to specify whether the activity has or has not already been undertaken (Table 1). The modal response for each activity is highlighted in pink. The

modal response for four activities (pushing the coastal construction setback line landward, updating water supply models, educating community members, and considering climate change when developing local land use plans) was that the activity could help prepare the community for the impacts of climate change, but that the activity had not yet been undertaken. The modal response for four activities (protecting wetlands within floodplains, updating floodplain maps, updating storm water controls, updating wastewater effluent standards) was that the activity could help prepare the community for the impacts of climate change and that the activity had already been undertaken. Fifty percent of respondents indicated that beach renourishment can help prepare their community for climate change; 25% of those respondents indicated that this activity has already been undertaken in their community. The only activity for which the modal response was that it could not help local government prepare their communities for climate change is hardening of shorelines.

Table 1. Percentage of respondents who indicated whether or not particular activities may help prepare their communities for the potential effects of climate change. The modal responses for each activity are highlighted in orange.

	Not Sure	Yes, not yet undertaken	No	Yes, already undertaken	Does not apply
Restoring wetlands within floodplains	35%	26%	14%	14%	11%
Renourishing beaches	14%	25%	15%	25%	20%
Protecting wetlands within floodplains	27%	15%	8%	39%	10%
Pushing the coastal construction setback line landward	25%	27%	17%	19%	12%
Updating floodplain maps	14%	8%	8%	59%	10%
Hardening of shorelines (e.g. seawall construction)	19%	20%	36%	7%	19%
Updating water supply models	22%	29%	10%	26%	12%
Updating storm water controls	10%	24%	12%	44%	10%
Educating community members	17%	44%	5%	25%	8%
Updating wastewater effluent standards	24%	20%	12%	25%	19%
Considering climate change when developing local land use plans	24%	36%	19%	9%	12%

Respondents were asked to list additional activities that they consider useful in preparing their communities for the impacts of climate change. Nine people responded to this question. Three respondents did not answer the question, but commented on the lack of scientific proof for climate change. One person answered “not sure” and five respondents provided comments (Table 2).

Table 2. Free-response answers to the following question: “Please list any other activities that you think would help prepare your community for the potential impacts of climate change.”

Respondent	Comments
1	“Release studies of cycle changes over time.”
2	“Incentives for green building practices/energy efficiency, encourage bicycle and pedestrian use, improve flood damage prevention ordinance, update hazard mitigation plan.”
3	“Floodplain mapping and storm surge modeling on recurrent basis”
4	“Tsunami-tidal wave indicator/early warning system for Atlantic seaboard; coordinated mass evacuation exercises; dramatically improved building code requirements for structures within one mile of the ocean; contingency planning for long-term displaced residents similar to Katrina and Rita evacuations; promotion of disaster planning by residents and businesses along the coast.”
5	“An honest objective study not based on government grants.”

Respondents were asked to indicate the extent to which particular factors limit their local government's ability to prepare their community for climate change. These factors included: 1) lack of scientific information, 2) lack of support from other local politicians, 3) lack of political support from constituents, 4) lack of funding, 5) lack of staff, 6) lack of regulatory authority, and 7) lack of local policy models. The percentage of respondents who indicated that the listed factors affect their local government's ability to prepare their community for climate change *a great deal* is shown in Figure 9. The modal response for lack of scientific information, political support from constituents, and funding was that these factors *greatly affect* local government's ability to prepare the community for climate change. The modal response for lack of support from other local politicians, regulatory authority, staff, and local policy models was that these factors *somewhat* affect local government's ability to prepare the community for climate change. See Appendix E for additional data.

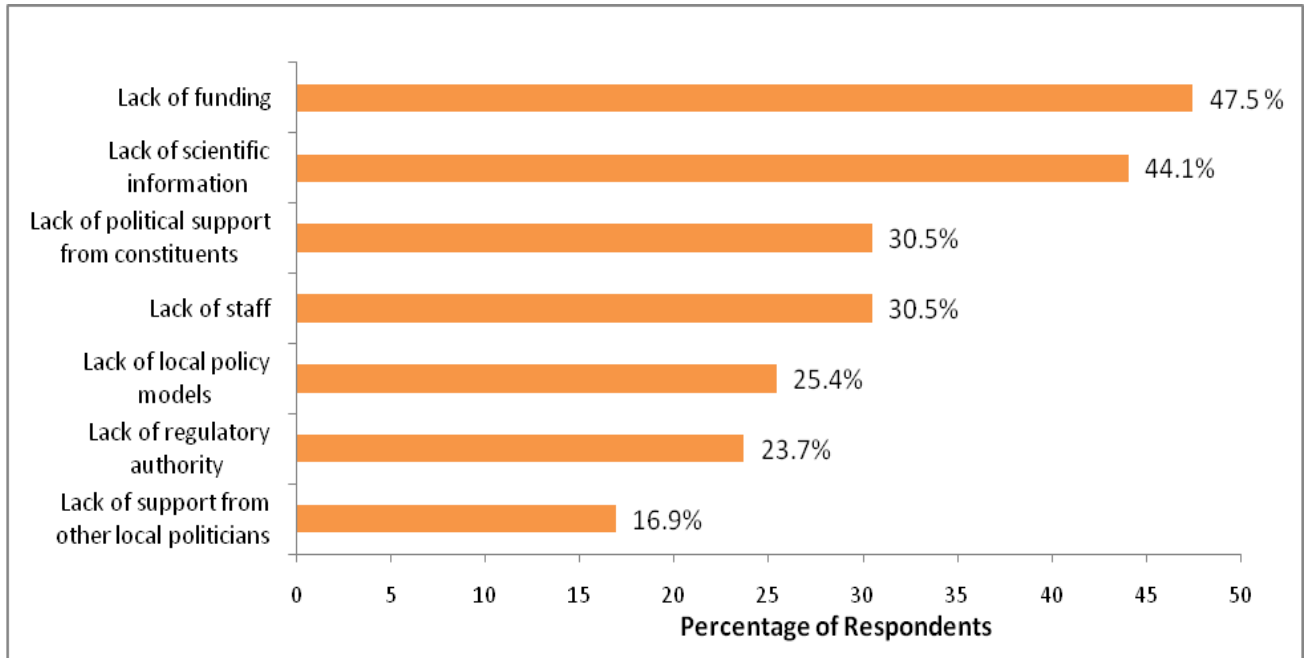


Figure 9. Percentage of respondents who indicated that the listed factor limits their local government’s ability to prepare their community for climate change “a great deal.”

Ninety-one percent of respondents indicated that their local government does not currently receive any state, federal, non-governmental, or private support to help prepare their community for climate change. Nine percent of respondents receive some support for preparing for climate change. The respondents described this support as follows: public information, UNC-W information and policy assistance, and support for creating wetlands to slow runoff/flooding.

Next, respondents were asked if they were aware of any state, federal, non-governmental or private support to help local communities prepare for climate change. Thirteen people responded to this question. Six of these respondents indicated that they were not aware of any support. Four of these respondents identified problems that affect them (“NOT ENOUGH fundinhg (sic) assistance for stormwater runoff...”) or commented on their belief in the occurrence of climate change (“Again, the science is not supporting climate change. Just politicians and departments being funded with government grants to reach desired outcome.”) Three respondents mentioned FEMA, NFIP and NC DEM and disaster relief operations. One mentioned federal and county funding for beach renourishment but noted that a significant portion of this activity is supported locally through accommodation taxes. The same respondent mentioned some availability of support for stormwater and water quality monitoring, but noted that it is not enough to “...purchase tracts of land to devote to wetlands or floodplains....”

Motivation

Respondents were asked to identify the components of their community that they expect climate change to impact. Figure 10 shows that respondents expect climate change to affect tourism (74%), future generations (72%), economy (72%), property values (67%), infrastructure (63%), ecosystems and

wildlife (63%), and jobs (43%). Under 40% of the respondents expect climate change to affect public health, public safety, local politics, agriculture, and inland populations.

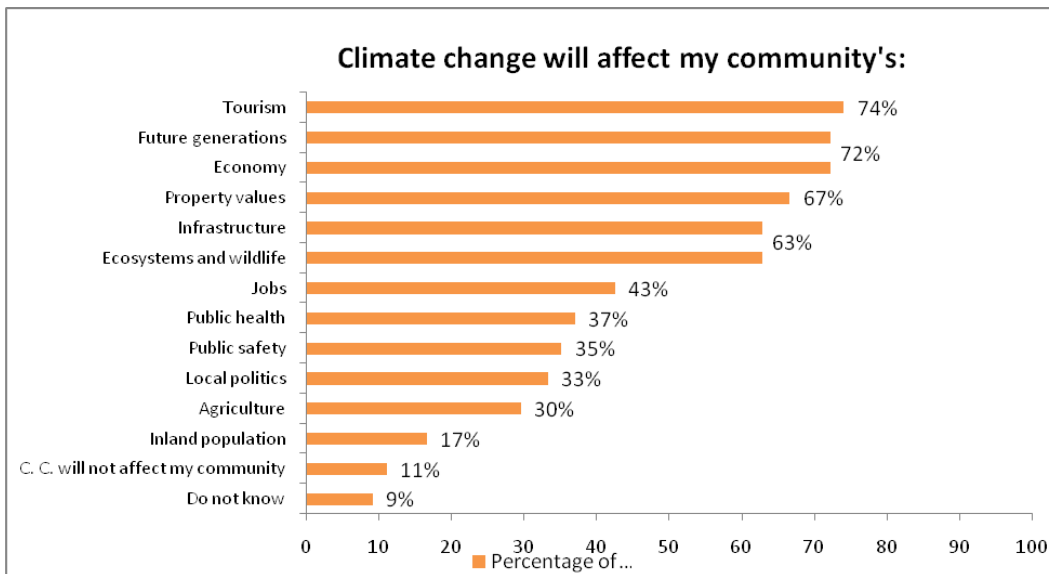


Figure 10. Respondent views on how climate change will affect their community.

Thirty-five respondents (59.4%) think that climate change will affect their constituents, while 15 respondents (25%) were undecided (Figure 11). Nine respondents (15%) do not think that climate change will affect their constituents. The modal and mean response was that respondents think that climate change will affect their constituents.

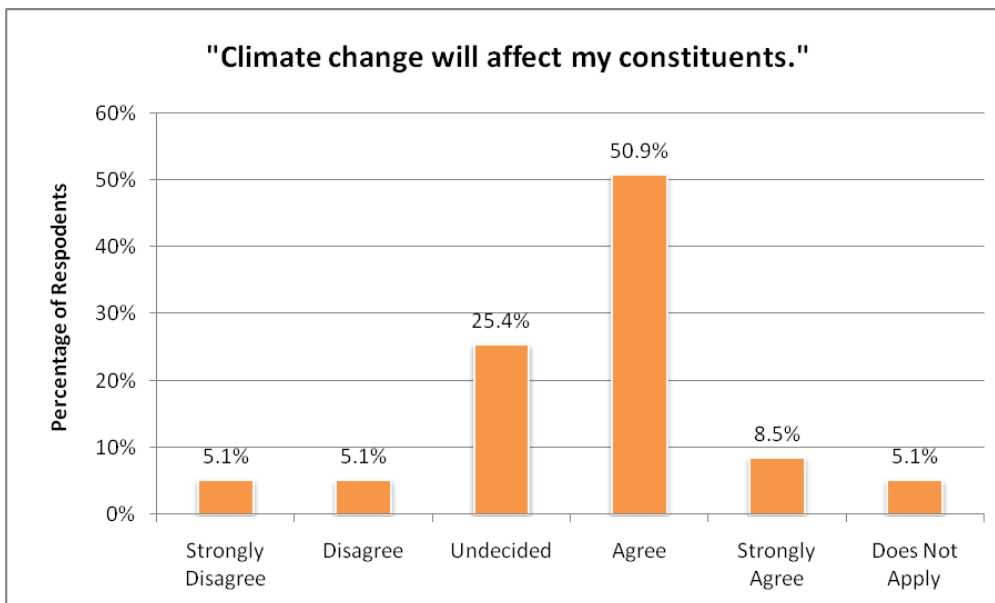


Figure 11. Respondent perceptions of whether climate change will affect their constituents.

Respondents were asked how important it is to their constituents that local government take action to prepare their communities for climate change. A total of 28 respondents (48%) indicated that it is somewhat or very important to their constituents that the local government take action to prepare for climate change. Sixteen respondents (27%) believe that it is not important, and 15 respondents (30%), said that they were not sure (Figure 12).

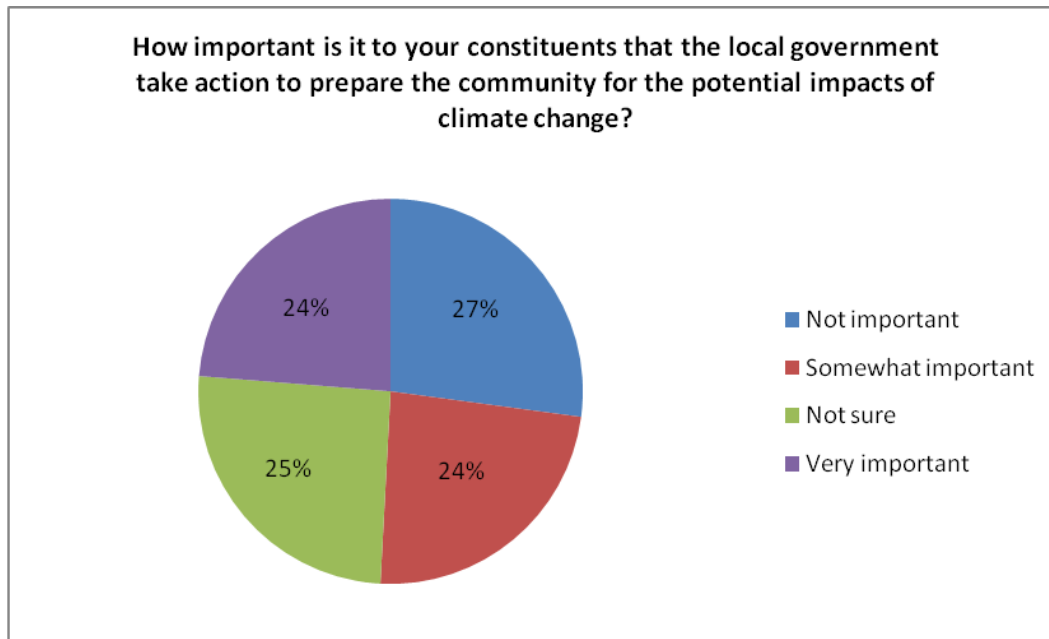


Figure 12. Perceived constituent demand for climate change adaptation.

Thirty-six respondents (60%) think that there is something they can do as local government officials to prepare their communities for climate change while eight respondents (13%) think that there is nothing they can do (Figure 13). Eleven respondents (18%) were undecided about the issue. The modal and median response is that respondents think there is something they can do to prepare their community for climate change.

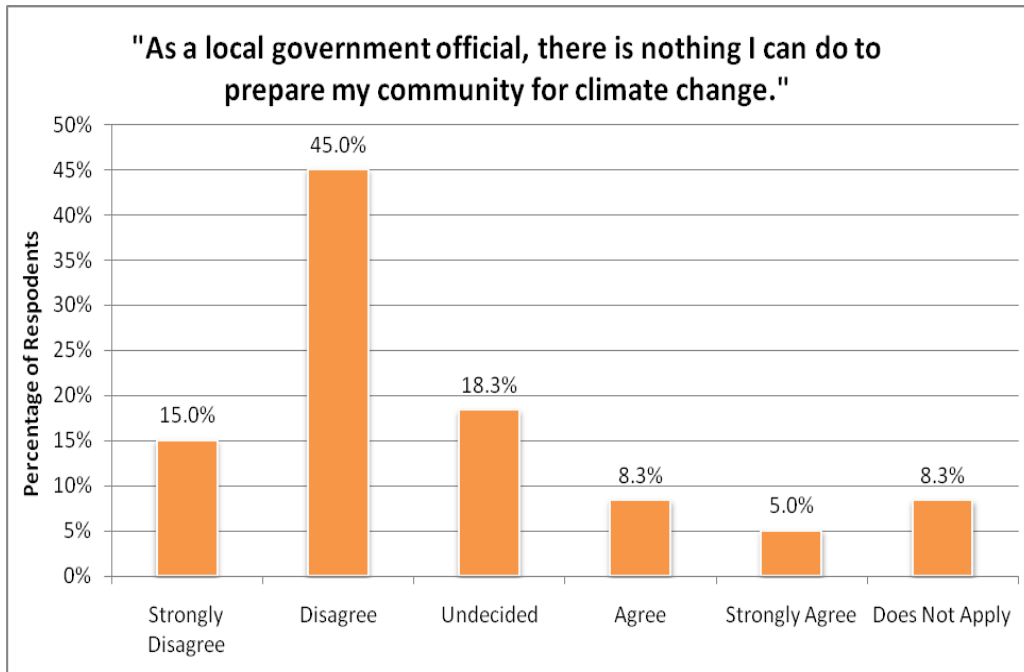


Figure 13. Respondent perceptions about their ability to prepare their community for climate change.

Twenty-eight respondents (48%) disagreed that it is up to higher levels of government to prepare their communities for climate change (Figure 14). Sixteen respondents (27%) agreed that higher levels of government should prepare their community for climate change, and 19% of respondents were undecided about the issue. The modal response was that respondents disagree that higher levels of government should prepare their community for climate change; the mean response is that respondents are undecided.

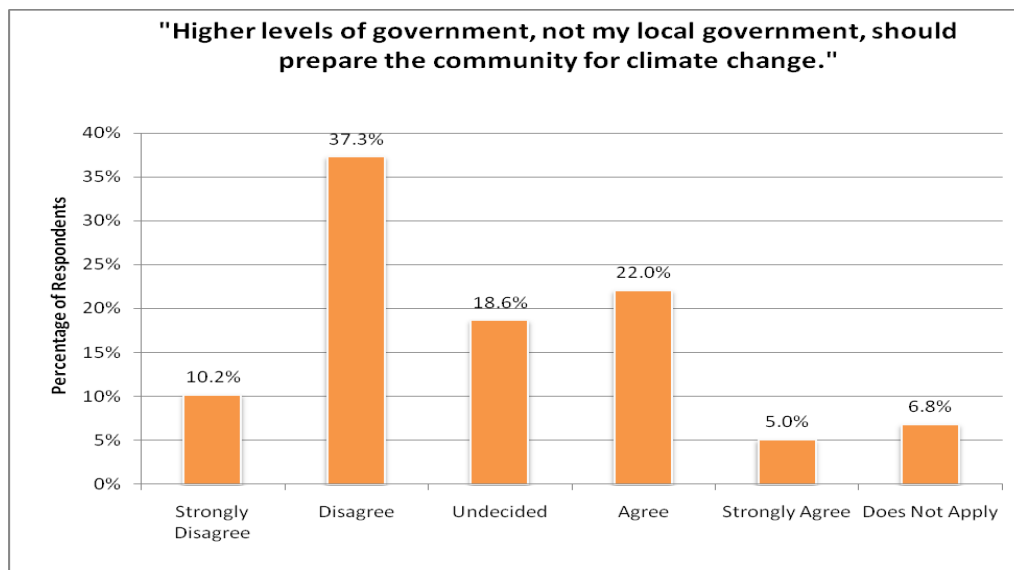


Figure 14. Views of respondents regarding the level of government that should prepare communities for climate change.

Thirty-seven respondents (63%) indicated that their local government does not currently consider climate change when making decisions, while twelve respondents (8.5%) indicated that their local government does consider climate change when making decisions (Figure 15). Seven respondents (18%) were undecided. The modal and mean response is that local government does not consider climate change when making decisions.

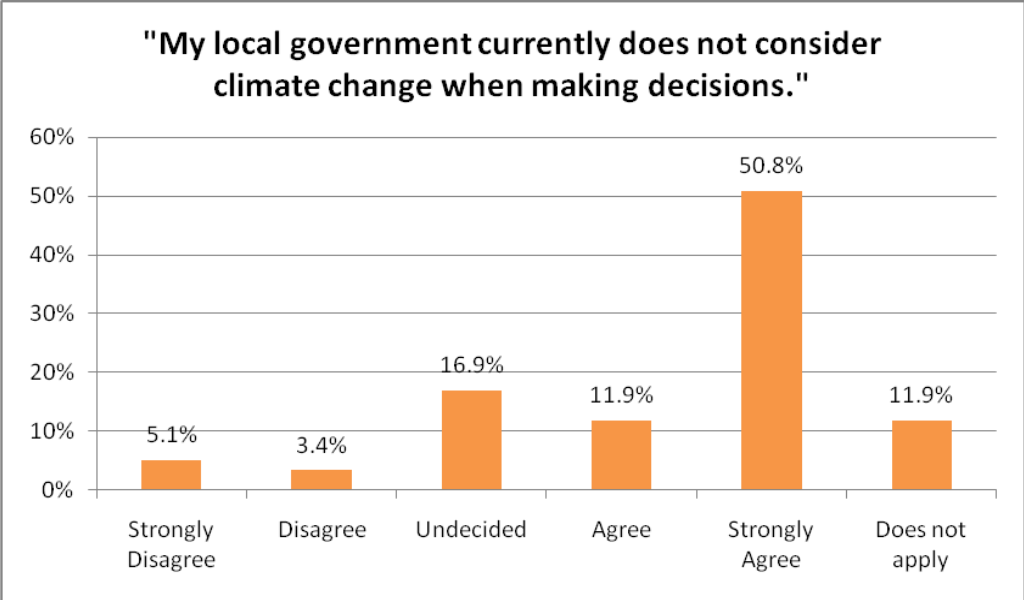


Figure 15. Local government’s consideration of climate change when making decisions.

Finally, respondents were asked about the timeframe within which local government should take action to address specific potential impacts of climate change. The modal responses for each impact are highlighted in Table 3. The majority of respondents indicated that they were not sure when local government should create programs or policies to address drought, forest fires, saltwater intrusion, and sea level rise. A majority of respondents indicated that programs and policies for addressing shore erosion, flooding, and storms are already in progress in their communities.

Table 3. Percentage of respondents who selected particular timeframes for local government action to address potential effects of climate change.

	Already in progress	1-5 years	6-10 years	10+ years	Never	Not sure	Does not apply
Drought	18%	20%	5%	5%	5%	27%	18%
Shore Erosion	37%	17%	5%	3%	3%	14%	20%
Flooding	41%	19%	9%	2%	0%	17%	12%
Forest Fires	9%	22%	5%	4%	2%	35%	24%
Storms	38%	29%	2%	0%	4%	16%	13%
Saltwater intrusion into aquifers	18%	21%	5%	5%	4%	32%	16%
Sea level rise	14%	24%	7%	5%	3%	32%	15%

At the end of the survey, the respondents were asked to share any additional comments that they had about the survey or the research. Twenty-six people provided comments. Several themes were mentioned by more than one respondent (Table 4). These themes included: 1) scientific information with a negative connotation; 2) regulations with negative connotation; 3) climate change as a natural cycle; 4) joint efforts between levels of government; 5) study bias; 6) support/share information; 7) negative; 8) nothing man can do and 9) good effort. Some comments were coded with more than one theme. The most referenced themes were themes 1, 3 and 6 and 9.

Table 4. Coding themes for the open-ended “additional comments” question of the survey. The most referenced themes are shaded in gray.

Number	Theme
1	Scientific information with a negative connotation
2	Regulations with negative connotation
3	Climate change as a natural cycle
4	Joint efforts between levels of government
5	Study bias
6	Support/share information
7	Negative
8	Nothing man can do
9	Good effort

Lack of sound scientific information was mentioned by 5 respondents; quoting one of these responses “Studies and other information seem to conflict on this subject. Whatever your viewpoint is, can be supported by some scientists' research and refuted by others. When the scientists all get on the same page, I'll be more supportive.”

Four people mentioned that although they believed climate change is occurring, climate change is a natural cycle. As an example, the following quote was selected: “I believe there is climate change. I also believe as many scientist (sic) have stated that it is cyclical in nature....”

Four people mentioned they would like to see the results of this survey or get support from Duke.

Two people shared very skeptical comments about climate change (i.e., “I think its (sic) another hoax by the environmental community to justify their existence (sic)”) and another two commented that there's nothing man can do about climate change. Two people also mentioned the bias in the research project: “I hope that your stude (sic) is un=biased (sic) and not being used to perpetuate Dr. Pilkey's argument that people should (sic) not live on the coast. I also hope that the data being collected is pure and not slanted to personal agendas.” See Appendix E for more detailed responses.

IMPLICATIONS

Knowledge and Beliefs

Our results have two important implications for our first hypothesis that local officials lack information on the impacts of climate change in their communities. First, because the majority of respondents (73%) think that climate change is occurring or is probably occurring (Figure 6), the Nicholas Institute should not focus their education effort on convincing public officials that climate change is occurring. Second, only 37% of respondents believe that they know what the impacts of climate change in their community will be (Figure 7); however, when asked about potential environmental impacts expected in coastal communities in North Carolina, many respondents identified sea level rise, shore erosion and increase in storm surge as expected environmental effects caused by climate change. Numerous experts concur that in the state's shores, the impacts from climate change will be sea level rise, shore erosion, greater frequency and intensity of storms and flooding (Poulter et al., 2008; Bingham et al. 2008; Titus et al. 2009). These findings imply that although local decision-makers think they do not know what the potential impacts of climate change may be in their communities, many of them do have at least some knowledge of the most important expected impacts. Therefore, education efforts could be focused on affirming and building upon a base of existing knowledge.

Capacity and Resources

As mentioned previously, 91% of surveyed local officials stated that their local government does not receive any support to help prepare for their community for climate change impacts. This finding paired with the fact that approximately 47% of respondents indicated lack of funding as a factor that

affects them greatly in preparing for climate change impacts (Figure 13) supports our hypothesis that there is a lack of funding for climate change adaptation at the local level.

Respondents also mentioned the lack of scientific information as another factor that greatly affects them in preparing for climate change impacts, so it is reasonable to assume that they lack information on state, federal, and non-governmental support that is available. The low response rate to the open-ended question that directly asks respondents about their knowledge of available programs corroborates this conclusion. One component of the Nicholas Institute's outreach program could focus on pointing local decision-makers to reliable data sources, whether generated within different levels of government or in the non-governmental sector (which would include academic institutions) as well as financial resources available other than those allotted for disaster relief. Finally, respondents identify some activities that have not yet been undertaken but could be helpful in preparing their communities for climate change effects. Among these, the most popular were educating community members (although one quarter is already doing this), considering climate change when developing land use plans (less than 10% are already doing this) and updating water supply models (one quarter of respondents is already doing this). These could be suitable activities to begin helping local governments prepare for climate change because there is at least some political awareness of the need for them, which could translate into political will.

Motivation

The majority of local officials (approximately 60%) concur that climate change will affect their constituents and the same percentage believes that as local government there is something they can do to prepare their community for potential climate change impacts. In addition, only 27% said higher levels of government should prepare the community for potential impacts of climate change. However, 63% of respondents mentioned that they do not consider climate change when making decisions as local government. Considered together, these findings are important because although local decision-makers currently do not consider climate change, they perceive that they have the ability and right to act, which is why approaches for adaptation and mitigation of climate change should not be top-down, but rather nested among different levels of government, including the local level.

One third of surveyed local officials perceive that they do not have enough political support from their constituents to prepare their community for climate change; however almost half of the respondents indicated that preparing the community for the potential impacts of climate change is at least somewhat important to their constituents. A study of the perceptions of adult residents of Roanoke Island and the Outer Banks in North Carolina found that 70% of respondents think that sea level risk is occurring in the Outer Banks; 72% of respondents are concerned about sea level rise; and 84% think that government should consider sea level rise when making decisions, including those regarding development in the Outer Banks.⁴ Considered together, these findings suggest that there may be a disconnect between the preferences of constituents and local government's perception of those preferences. While many officials may recognize that it is at least somewhat important to their constituents that they prepare their communities for climate change, local officials may think that their constituents are not willing to make economic sacrifices or lifestyle changes to prepare their community for the potential impacts of climate change. It is also worth mentioning that a quarter of the respondents do not know what the viewpoint of their constituents is regarding local government's preparation towards climate change effects. We

⁴ Unpublished results from a study conducted by students at the University of North Carolina shared during a presentation at the William and Ida Friday Center for Continuing Education in Chapel Hill, North Carolina on January 30, 2009.

conclude that it is not possible to confirm or reject our second hypothesis that local officials perceive that their constituents have little interest in preparing the community for climate change. A final important point regarding motivation is that local decision-makers are unsure of the appropriate timeframes within which to address potential impacts from climate change. Therefore, an important component of an education program should be to inform local governments of when various impacts are expected to occur and, accordingly, when local government should initiate action to prepare for these impacts.

Recommendations/ Next Steps

This survey provides a useful starting point for gauging local decision-makers' knowledge, beliefs, and motivation regarding the potential impacts of climate change in their communities. However, we recommend that the Nicholas Institute or other researchers conduct a follow-up survey using random sampling and a more inclusive sample (include state and local officials) so that findings can be used to generalize about the state of knowledge/beliefs/motivations among decision-makers in North Carolina. A follow-up survey could also address the need to learn more about interest groups in the region. It is important to identify what groups are politically active and therefore influence actions of local governments. It would also be useful in a follow-up survey to include more specific questions about local governments' actions and inactions, their opinion on what roles other levels of government and non-governmental actors should play, the timeframe of climate change threats, and whether they need more pressure from constituents to take action to prepare for climate change. In addition, for future survey research on this topic, we recommend convening focus groups comprised of participants who more accurately represent the population.

The research team used the results from this survey to brainstorm next steps that may be undertaken by the Nicholas Institute to launch an education/outreach program for local decision-makers in coastal North Carolina communities:

- Create a **master document** that compiles information on potential climate change impacts for coastal North Carolina communities; estimates timeframes for impacts and step-by-step actions to prepare for them; and identifies reliable sources of scientific information, technical support, financial support, etc., from state or federal government or non-governmental sources. This document could be created with input and help from local officials. There are some resources already available that could be adapted for application in coastal North Carolina communities.
- Determine where local officials obtain information for decision-making and **educate officials indirectly** by educating their information sources.
- Create a **model plan or guidance document** for preparing for coastal climate change impacts at the local level. This plan could be based on a plan that has already been developed in another state or region
- Conduct and disseminate results from a **case study** of a state or county that has developed and implemented a plan for preparing their coastal community for climate change. It would be important to use the participatory approach when disseminating results among local officials in coastal North Carolina. The Nicholas Institute may invite at least one of the people who were involved in developing the plan to talk about the steps they undertook and lessons learned.

- Develop a **strategy to get everyone involved**. Provide incentives that may not be related to climate change but that may appeal to people who are not concerned about climate change. One idea is to frame all this work around issues that are already salient such as development and land use issues, the economy, and tourism.
 - **Identify and recruit extant organizations/cooperatives** to help promote a participatory approach.
- Offer a **series of workshops for local decision-makers** that serve as a forum for sharing concerns/interests/information/knowledge. Before conducting workshops, expert working groups could be convened to define the appropriate activities to conduct and material to share at the workshops and to identify the appropriate people to invite from coastal communities.
 - Workshops could involve presentations on climate change impacts that are already occurring on counties (perhaps presented by local representatives themselves); presenting the information from a case study (mentioned previously); bringing experts to talk about scientific information on climate change and its expected impacts on the Atlantic coast; discussing potential solutions and timeframes for climate change impacts; or working as a group to develop a model plan or guidance document for local officials to consult when preparing their communities for potential climate change impacts.

REFERENCES

- Bin, O., Dumas, C., Poulter, B., Whitehead, J. (2007). Measuring the Impacts of Climate Change on North Carolina Coastal Resources. Final Report Prepared for the National Commission on Energy Policy.
- Bingham, F. M.; L. B. Cahoon, W. J. Cleary, E. K. Covan, R. Cutting, C. F. Dumas, D. W. Gamble, J. Lambert, L. Leonard, S. L. McFarland, M.H. Posey, R. D. Shew, S. A. Skrabal, Alina M. Szmant, C. R. Tobias, C. R. Tomas and D. Webster (2008). “The Potential Impacts of Climate Change on Coastal North Carolina: A Report by the Faculty of the University of North Carolina Wilmington For Erskine Bowles, President.” The University of North Carolina. 104 p.p. URL: <http://www.uncwil.edu/aa/documents/UNCW%20Global%20Climate%20Change%20Final%20Report.pdf>
- North Carolina Department of Environment and Natural Resources (DENR) , Division of Coastal Management, Coastal Facts, *available at* <http://dcm2.enr.state.nc.us/News/facts.htm>
- North Carolina Department of Environment and Natural Resources (DENR) , Division of Coastal Management, *available at* <http://dcm2.enr.state.nc.us/handbook/section1.htm>.
- Poulter, B.; R. L. Feldman, M. M. Brinson , B. P. Horton, M.I K. Orbach, S. H. Pearsall, E. Reyes, S. R. Riggs, J. C. Whitehead (2009). “Sea-level rise research and dialogue in North Carolina: Creating windows for policy change” *Ocean & Coastal Management* 52 (2009) 147–153 p.p.
- Rea, L. M. and R. A. Parker (2005). “Designing and Conducting Survey Research: A Comprehensive Guide.” 3rd Edition, San Francisco. Jossey-Bass Publishers.
- Titus, J. G. (Coordinating Lead Author), K. E. Anderson, D. R. Cahoon, D. B. Gesch, S. K. Gill, B. T. Gutierrez, E. R. Thieler, and S. J. Williams (Lead Authors). SAP 4.1 Cover CCSP, (2009). “Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region. A report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research”. U.S. Environmental Protection Agency, Washington D.C., USA. 784 p.p.

APPENDIX A: SURVEY INSTRUMENT

Climate Ready Estuary Program Questionnaire

Greetings _____,

A graduate class at Duke University requests your participation in a questionnaire to determine what local decision-makers in coastal counties in North Carolina think about climate change and how it may affect their communities. The study also seeks to determine what information local decision-makers need about climate change and its potential impacts.

You are one of a small number of individuals being asked to provide information and opinions on this topic by completing a short, web-based questionnaire. It is important that each questionnaire be completed so that the results of the study truly represent the thinking of local decision-makers in coastal North Carolina counties. Even if you do not think climate change is occurring or that your community need not take action to address climate change, your opinions are valuable.

We guarantee that the answers you provide will be kept strictly confidential. The research team will not be able to connect the information you provide with your name or email address. We hope you will be willing to take about 15 minutes to participate in this study.

A User ID and Password has been provided to limit survey access to only people within the sample and will be used to remove your name from our survey emailing list. The User ID and Password will be needed to participate in the survey and will not be linked to your responses.

User ID: _____

Password: _____

If you have any questions, please feel free to email the research team at Cris.Villanueva@duke.edu. If you would like to participate, please click on the following link:
<http://survey.oit.duke.edu/ViewsFlash/servlet/viewsflash?cmd=page&pollid=ClimateReadyEstuarySurvey!Try1>

Survey Questions

1. Which municipality(s) or counties are within your jurisdiction?

2. How many years have you worked in your current position?

3. How many years have you worked within local government?

4. What is your area(s) of expertise? Check all that apply.

- | | |
|--|---|
| <input type="checkbox"/> Land Use Planning | <input type="checkbox"/> Social Services |
| <input type="checkbox"/> Environment | <input type="checkbox"/> Business |
| <input type="checkbox"/> Public Policy | <input type="checkbox"/> Other, please specify: |
| <input type="checkbox"/> Law | _____ |
| <input type="checkbox"/> Economics | |

5. To the best of my knowledge:

- a) Climate change is not occurring.
- b) Climate change is probably not occurring.
- c) Climate change is probably occurring.
- d) Climate change is occurring.
- e) I do not know if climate change is occurring

6. Please indicate the extent to which you agree or disagree with the following statements. Select “does not apply” if you do not think climate change is occurring.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Does Not Apply
I don't know what the environmental impacts of climate change will be in my community.						
Climate change will affect my constituents.						
As a local government official, there is nothing I can do to prepare my community for climate change.						
Higher levels of government, not my local government, should prepare the community for climate change.						
My local government currently does not consider climate change when making decisions.						

7. From the following list, please identify environmental effects that you expect your community to experience due to climate change (check all that apply)

- | | |
|---|---|
| <input type="checkbox"/> sea level rise | <input type="checkbox"/> increasing frequency of floods |
| <input type="checkbox"/> warmer summers | <input type="checkbox"/> increase in biodiversity |
| <input type="checkbox"/> increasing intensity of droughts | <input type="checkbox"/> shifts in location of wetlands |
| <input type="checkbox"/> shore erosion | <input type="checkbox"/> change in size of wetlands |
| <input type="checkbox"/> warmer winters | <input type="checkbox"/> cooler summers |
| <input type="checkbox"/> biodiversity loss | <input type="checkbox"/> increase in storm surge |
| <input type="checkbox"/> increasing intensity of storms | <input type="checkbox"/> increasing frequency of storms |
| <input type="checkbox"/> forest fires | <input type="checkbox"/> salt water intrusion into fresh surface water and groundwater aquifers |
| <input type="checkbox"/> increasing intensity of floods | <input type="checkbox"/> Climate change will not affect my community |
| <input type="checkbox"/> cooler winters | <input type="checkbox"/> Other _____ |
| <input type="checkbox"/> increasing frequency of droughts | |
| <input type="checkbox"/> land area loss | |

8. To what extent do you think climate change will increase your community’s vulnerability to the following events?

	NOT AT ALL	SOMEWHAT	A GREAT DEAL	NOT SURE
Drought	—	—	—	—
Shore erosion	—	—	—	—
Flooding	—	—	—	—
Forest fires	—	—	—	—
Intense storms	—	—	—	—
Salt water intrusion to aquifers	—	—	—	—
Sea level rise	—	—	—	—

9. Please indicate which of the following activities can help prepare your community for the potential effects of climate change. Select “does not apply” if you do not expect your community to experience any effects from climate change.

	No	Yes, and this activity has not been undertaken	Yes, and this activity has already been undertaken	Not Sure	Does Not Apply
Restoring wetlands within floodplains					
Renourishing beaches					
Protecting wetlands within floodplains					
Pushing the coastal construction setback line landward					
Updating floodplain maps					
Hardening of shorelines (e.g. seawall construction, beach groins, etc.)					
Updating water supply models					
Updating storm water controls					
Educating community members					
Updating wastewater effluent standards					
Considering climate change when developing local land use plans					

10. Please list any other activities that you think would help prepare your community for potential impacts of climate change:

11. To what extent do the following factors affect your local government’s ability to prepare your community for the impacts of climate change? Please select “does not apply” if you do not think climate change is occurring.

	Not at all	Somewhat	A great deal	Not sure	Does not apply
Lack of scientific information					
Lack of support from other local politicians					
Lack of political support from constituents					
Lack of funding					
Lack of staff					
Lack of regulatory authority					
Lack of local policy models					

12. Is your local government currently receiving state, federal, non-governmental, or private support to help prepare your community for climate change? Examples of “support” may include technical assistance, financial support, policy assistance, software training, climate expertise, information services, or peer networking opportunities.

[Yes] [No] If yes, please describe: _____

13. Please describe any state, federal, non-governmental, or private support that you are aware of, but not currently receiving, that could help your local government prepare your community for climate change.

14. Climate change will affect my community’s (check any that apply):

- | | |
|---|--|
| <input type="checkbox"/> Future generations | <input type="checkbox"/> Local politics |
| <input type="checkbox"/> Property values | <input type="checkbox"/> Inland population |
| <input type="checkbox"/> Public health | <input type="checkbox"/> Economy |
| <input type="checkbox"/> Infrastructure | <input type="checkbox"/> Ecosystems and wildlife |
| <input type="checkbox"/> Public safety | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> Jobs | |
| <input type="checkbox"/> Tourism | |
| <input type="checkbox"/> Agriculture | |

15. Please indicate how important or not important it is to your constituents that the local government take action to prepare your community for the potential impacts of climate change:

- Not important
- Somewhat important
- Very important
- I'm not sure how important it is to my constituents
- Does not apply

16. When should the local government create new policies and programs to address the following potential effects of climate change? Please select "does not apply" if you do not anticipate any effects from climate change.

Effects	Already in progress	In 1-5 years	In 6-10 years	Greater than 10 years	Never	Not sure	Does Not Apply
Drought							
Shore erosion							
Flooding							
Forest fires							
Storms							
Saltwater intrusion to aquifers							
Sea level rise							

17. Please use the space below to write any comments you have about this survey or our research.

APPENDIX B: FOCUS GROUP SCRIPT

Duke University, Rubenstein Hall
Durham, North Carolina

February 19, 2009
7:30-8:30 pm

Thank you for coming tonight and agreeing to participate in this discussion. What we are doing here tonight is called a focus group. My name is Rebecca, and I will be moderating the discussion. My colleagues Roberto, Michelle, Kelly, and Cristina are also in the room. They will observe the discussion and take notes, but they will not participate. Information from this discussion will be used to develop a survey that we will administer to county commissioners in coastal NC counties.

First, we need to take care of some housekeeping details. I handed you a consent form when you came in. If you have read the form and signed it, please hand it to me. If you need an additional copy of the form, I can give you one. Does anyone have any questions about the information on the consent form?

As I mentioned in the form, with your permission our discussion tonight is being audiotaped. This helps me so that I can talk to you and listen without having to frantically write down what you are saying. Your names will not be used in my report of this group, and I can assure you that no one outside of this room will ever hear this tape.

Now, there is an important thing I want you to know about focus groups. There are only right answers. There is no specific answer I am looking for in any of the things we will discuss tonight. You all have had different experiences and have different opinions, and all opinions are truly important. We are looking for different opinions, so please do not be swayed by others in the group if you might feel differently about something we are discussing.

I ask that you please talk one at a time so that everyone gets a chance to share their opinions and that we do not miss anything. Also, please speak up so that we can all hear what you have to say and so we get it on tape. Feel free to address others at the table, you do not need to address all of your comments to me, but please avoid side conversations while others are talking. I may interrupt the discussion from time to time. Please forgive me if I do this. I'm not being rude, it's just that I have a lot that I'm trying to cover with you and I want to get you out of here on time. Lastly, I really encourage everyone to participate equally; I'm very interested to hear what each one of you has to say.

Please help yourself to some food and drinks. Restrooms are located to the left and down the hall I would like to have no more than one person away from the table at a time, so if you want to get up for any reason, please refrain from doing so until no one else is up from the table.

So, let's begin our discussion. First, I know that some of you know each other, but I'd like everyone to introduce themselves to the group. Why don't you tell us your first name (please, only first name), and what you are studying.

We are will be administering the survey to a range of local decision-makers in coastal North Carolina communities, including county commissioners and town council members, county and town managers, county and town planners/engineers, risk/emergency managers, and public health officials.

Issue Area #1: Survey administration

First, is there anything in particular we should say in the email to entice these folks to participate?

Is there anything we should avoid saying?

Is there a better day of the week to send the survey out? How long should we wait before sending out the second, third, and fourth reminders?

What is your thought on decision-makers perceptions of climate change as myth or fact? We are unsure of whether to assume that they believe it is a scientific fact or not. This affects the way we frame our questions.

Issue Area #2: Survey Questions⁵

For the second half of the meeting, I'm going to ask you to read groups of questions on our draft survey and then provide feedback on specific issues I would like to discuss. When you are reading, keep in mind who the respondents will be (local decision-makers).

Please read Questions 1-6.

Questions 5:

Is this an exhaustive list? Anything else we can include?

Question 6:

Should we assume that respondents will answer from their own perspective, or will they try to think of local government in general?

Please Read 7, 8, 9

Question 7:

Are terms clear and self explanatory? Is there anything missing from this list?

Question 9:

Are terms clear and self explanatory? Do you think local decision-makers will know about environmental management in this level of technical detail?

Please Read 10,11,12

Question 11:

Is there anything missing from this list of answer choices?

Question 12:

⁵ Note that question numbers are not the same as those in the final draft of the survey.

Are the ranges appropriate on the time scale?

Please read 13 and 14

Is there anything missing from this list of answer choices?

Overall Questions

What is your opinion of the overall flow of the survey?

Do you think commissioners will know the answers to these questions?

Are there any other relevant questions we should ask in order to answer our research question?

Are there any additional comments you would like to share with the group?

Well, we are out of time. As I promised, we are wrapping up at 8:30. Thank you so much for your time and participation in this meeting!

APPENDIX C: DATA CODING SHEET

Question	ID (Label on Excel data sheet)	Code	Answer Choice
1	JURISDICTION	NA	
2	TENURE (YEARS)	NA	
3	EXPERIENCE	NA	
4	EXPERTISE	NA	
5	KNOWLEDGE	1	is not occurring
		2	is probably not occurring
		3	I do not know if it is occurring
		4	is probably occurring
		5	is occurring
6 (a-e)	AGREEMENT	0	Does not apply
		1	Strong Disagree
		2	Disagree
		3	Undecided
		4	Agree
7	CLIMATE EFFECTS	0	climate change with not affect my community
		1	sea level rise
		2	warmer summers
		3	increasing intensity of droughts
		4	shore erosion
		5	Warmer winters
		6	biodiversity loss
		7	increasing intensity of storms
		8	forest fires
		9	increasing intensity of floods
		10	cooler winters
		11	increasing frequency of droughts
		12	land area loss
		13	increasing frequency of floods
		14	increase in biodiversity
		15	shift in location of wetlands
		16	change in size of wetlands
		18	increasing frequency of storms
		19	saltwater intrusions into fresh surface water and groundwater aquifers

Question	ID (Label on Excel data sheet)	Code	Answer Choice
8 (a-g)	VULN	1	not at all
		2	somewhat
		3	not sure
		4	a great deal
9 (a-k)	PREP ACTIVITY	0	does not apply
		1	no
		2	yes, and this activity has not been undertaken
		3	not sure
10 11 (1-7)	OTHER PREP ACTIVITY LIMIT	NA	
		0	does not apply
		1	not at all
		2	somewhat
		3	not sure
		4	a great deal
		NA	
		NA	
12 13 14	SUPPORT HELP WANTED COMMUNITY EFFECTS	0	climate change will not affect my community
		1	future generations
		2	property values
		3	Public health
		4	infrastructure
		5	Public safety
		6	jobs
		7	tourism
		8	agriculture
		9	local politics
		10	inland population
		11	economy
12	ecosystems and wildlife		
15	ACTION IMPORTANCE	1	not important
		2	Somewhat important
		3	I'm not sure how important it is
		4	very important

Question	ID (Label on Excel data sheet)	Code	Answer Choice
16(1-7)	TIME EFFECT	0	does not apply
		1	not sure
		2	never
		3	Great than 10 years
		4	in 6-10 years
		5	In 1-5 years
		6	already in progress
17	COMMENTS	NA	

APPENDIX D: FREQUENCY OF RESPONSES PER QUESTION

Question #	Number of Responses	Response Rate
1	59	100.0%
2	59	100.0%
3	59	100.0%
4	55	93.20%
5	57	96.6%
6a	58	98.3%
6b	57	96.6%
6c	58	98.3%
6d	57	96.6%
6e	57	96.6%
7	57	96.6%
8a	55	93.2%
8b	56	94.9%
8c	55	93.2%
8d	52	88.1%
8e	54	91.5%
8f	55	93.2%
8g	56	94.9%
9a	55	93.2%
9b	57	96.6%
9c	57	96.6%
9d	57	96.6%
9e	57	96.6%
9f	57	96.6%
9g	56	94.9%
9h	57	96.6%
9i	57	96.6%
9j	57	96.6%
9k	56	94.9%
10	9	15.3%
11a	57	96.6%
11b	56	94.9%
11c	56	94.9%
11d	57	96.6%
11e	57	96.6%
11f	57	96.6%
11g	56	94.9%

Question #	Number of Responses	Response Rate
12	59	100.0%
13	13	22.0%
14	54	91.5%
15	57	96.6%
16a	53	89.8%
16b	57	96.6%
16c	56	94.9%
16d	53	89.8%
16e	54	91.5%
16f	55	93.2%
16g	57	96.6%
17	26	44.1%

APPENDIX E: ADDITIONAL DATA

Table E.1 shows the distribution of responses and the number of responses from each jurisdiction. Overall, 59 of the 160 surveys were completed, yielding a 37% response rate.

Table E.1. Frequency of responses from each jurisdiction.

Jurisdiction	Frequency	Percentage of Total Responses (%)
Town of Manteo	1	1.6
Town of Kitty Hawk	4	6.8
Town of Nags Head	4	6.8
Carteret County	5	8.5
Pender County	1	1.6
Currituck County	5	8.5
Town of Beaufort	2	3.4
New Hanover County	2	3.4
City of Wilmington	3	5.1
Dare County	4	6.8
Town of Duck	4	6.8
New Bern	2	3.4
Town of Atlantic Beach	2	3.4
Camden	3	5.1
Beaufort County	3	5.1
Elizabeth City, Pasquotank County	2	3.4
Jacksonville	4	6.8
Oak Island (Brunswick County)	1	1.6
Craven	1	1.6
Kill Devil Hills	1	1.6
Bertie County	1	1.6
Onslow County	1	1.6
Washington County	1	1.6
Pamlico County	2	3.4
Total	59	100

Table E.2. Free-response answers to question # 13: “Is your local government currently receiving state, federal, non-governmental, or private support to help prepare your community for climate change? Examples of “support” may include technical assistance, financial support, policy assistance, software training, climate expertise, information services, or peer networking opportunities. If so, then please describe”.

Respondent	Comments
1	educational materials, model ordinances/policies, planning grants, updates and revisions of codes on a state (EX - water quality, stormwater management) and federal (EX - floodplain management) level
2	Not currently aware of any.
3	Don't want any more state 'help'. State and federal regulations are already driving us crazy.
4	not sure
5	I do not know.
6	Our city is trying to do it's part by looking at hybrid vehicles, selling wood byproducts to local generation plant, light bulbs, green things around city hall.
7	Unsure
8	?
9	Again, the science is not supporting climate change. Just politicians and depts being funded with government grants to reach desired outcome.
10	As mentioned earlier, the Federal (FEMA, NFIP) and State (NC DEM) take an active role in paying for floodplain mapping and storm surge modeling. Our locality would benefit from this activity more frequently particularly if these Federal/State efforts gave us information specific to climate change impacts.
11	The only assistance our community receives is usually in conjunction with disaster relief operations. There is some funding from Federal and county for beach renourishment but this is significantly supported locally through accomodations taxes. Stormwater and water quality monitoring money is available but not the kinds of funding it would take for the town or even state to purchase tracts of land to devote to wetlands or floodplains. In fact, most open parcels of property are quickly rezoned for residential development, which only aggravates the situation.
12	NOT ENOUGH fundinhg assistance for stormwater runoff control, decrease in federal contributions to waste water trust fund, UNFUNDED MANDATES (MANDATES AT FEDERAL LEVEL WOULD GO FAR TO PREVENTING PROBLEMS BUT THEY THINK ON A SCALE WHICH LOCAL GOVERNMENTS CANNOT FUND.
13	not aware of any real support at this time.

Table E.3. Percentage of respondents who indicated the extent to which various factors limit local government’s ability to prepare their community for the impacts of climate change.

	Not at all	Somewhat	A great deal	Not sure	Does not apply
Lack of scientific information	8%	31%	44%	12%	5%
Lack of support from other local politicians	12%	40%	17%	22%	9%
Lack of political support from constituents	10%	28%	31%	19%	12%
Lack of funding	7%	29%	47%	7%	10%
Lack of staff	14%	36%	31%	10%	10%
Lack of regulatory authority	20%	25%	24%	19%	12%
Lack of local policy models	10%	36%	26%	16%	12%

Table E.4. Free-response answers to question # 17: “Please use the space below to write any comments you have about this survey or our research.

Respondent	Comments
1	please share results with me via email [email address omitted]
2	i didnt fill in most of this stuff
3	Current climate change 'scientific data' and opinion is different from what was 'scientific data' 30 years ago. Until there is conclusive data that is agreed upon, I am not taking any steps to 'prepare' for a 'potential' effect. My fear for my community as a county commissioner is the environmental communities use of non-scientific data to create regulations that are harmful to my community.
4	Good survey-I hope something comes out of it! Go ECU Pirates!!!
5	I believe there is climate change. I also believe as many scientist have stated that it is cyclical in nature. I am concerned about the current movement to spend large funds on this issue. Certainly, we should look at better methods of expending energy, however leading information does not mention all the opinions that are out there.
6	I hope that your research will take into account actual temperature information, and how this information relates to past model predictions. Same for sea level rise. My research indicates that model predictions are taking the place of actual measurements. Predictions are not facts, and I fear that studies of climate change and recommended solutions are victims of GI/GO (Garbage In/Garbage Out).
7	thank you.
8	Local governments cannot act in a vacuum. Any information, procedures and communications on this issue should be done on a regional or state level so that efforts are coordinated and economies of scale can take place. This issue is bigger than any individual local government.

Respondent	Comments (continued)
9	The survey is good, not sure with some of your questions the time period. This is due to the many estimates of the time period in which many models suggest true manifestations of global warming.
10	I am still on the fence regarding the trends in climate change, and potential causes. We are examining such a short time period, in geological terms, and I think it's difficult to determine how much of climate change is a short term, possibly natural, variation, versus a long term, man-made phenomenon.
11	Climate change has no basis in economics or science. The Earth has warmed and cooled over previous periods of time and will continue to warm and cool. Al Gore is always wrong in his weather forecast and will continue to be wrong.
12	I hope that your study is unbiased and not being used to perpetuate Dr. Pilkey's argument that people should not live on the coast. I also hope that the data being collected is pure and not slanted to personal agendas. Renee Cahoon
13	Studies and other information seem to conflict on this subject. Whatever your viewpoint is, can be supported by some scientists' research and refuted by others. When the scientists all get on the same page, I'll be more supportive.
14	Thanks!
15	This was an irrelevant survey because every question was based on the premise that climate change IS occurring and I am not yet convinced that climate change is occurring. Prior to the survey you should have provided the scientific information that lead you to believe that climate change has already started. Surely as cold a winter as we've had this year you can't be talking about 'global warming'? Your survey will be skewed because all the answers are based on the premise that climate change IS happening.
16	Will you offer any support to local government agencies to brainstorm how to address these issues?
17	Your survey did not allow for those of us who think climate change is a natural cycle, thus not allowing us to participate as full partners.
18	I look forward to your efforts to influence decision makers at the state level with regard to accurate predictions about storm surge changes as a result of climate change.
19	Though many people feel climate change will happen slowly, there is usually an assumption that severe storms like Katrina and Rita are indicators of what will come. I think we can boost the 'enthusiasm' for addressing the concerns of damage to the coast by beefing up our preparedness for disasters, relief operations, contingency planning for displaced evacuees, and more. Unfortunately, there is little political will to fund the preservation of wetlands or open space along the coast. The increased density just means that much more will be destroyed or at peril, which will cost the taxpayers far more than better planning. If there is a public education process about the reality of a Katrina or Rita on the NC coast and how many people will require long-term housing away from the disaster area, there could be the beginning of a conversation about changes to improve the overall survival of the area through improved planning. Perhaps the state could initiate a program to integrate coastal planning with climate change in mind, a program that could include regional seminars, as well as websites with community assistance links.

Respondent	Comments (continued)
20	No unified position at state and federal levels plus partisan positions formed and fought out publically through the press by national groups (with little or no local input)create cross-purpose positions. It also fuels in-fighting over almost every attempt to solve any problem at the local level. It creates an almost total stalemate until any given problem has already done some level of irreparable damage at the local level. More funding should be available for remedial projects at the local level. No one in Oregon or Texas cares at all about what is happening in New Bern... they don't even know we exist and can/won't do anything to help. People in New Bern thin k the same about those localities and others. National unity of purpose is very weak... made so b y patrisan politics which increases dramatically as any election, local or nationalk, appears. Too many people just don't really give a damn.
21	I hope this info will be shared with all coastal local governments.
22	Ithink that this survey is a good step. At the local level I think that there is a lot of skepticism about the effects of climate change and when they can (or will) be anticipated. Most of the activities that are going on within our community are not the result of climate change directly but are due to other issues that climate change would exasperate.
23	Bertie is an inland county, sorrounded by rivers, hard hit by Floyd and Isabel. We have experienced high incidence of tornados in recent years.
24	I think its another hoax by the environmental community to justify their existance
25	I do not believe that if there is truely a climate change that we can do anything about it.
26	In a relatively short period of time the conversation has gone from Global Warming to Climate Change, yet most all of the questions in this survey seem to assume Global Warming. I believe in Climate Change, I believe this has been going on for millions of years, most likely in cycles. I am not convinced that there is anything man can do about this. I am very concerned that even in these serious economic times that an environmental agenda is being forced upon our country which incrementally takes away our property and liberties and will likely bankrupt or weaken us, while other worldwide competitors, not adhering to or burdened by similar regulation, will erode our way of life and enslave or destroy us as a nation.