

Public Listening Sessions:

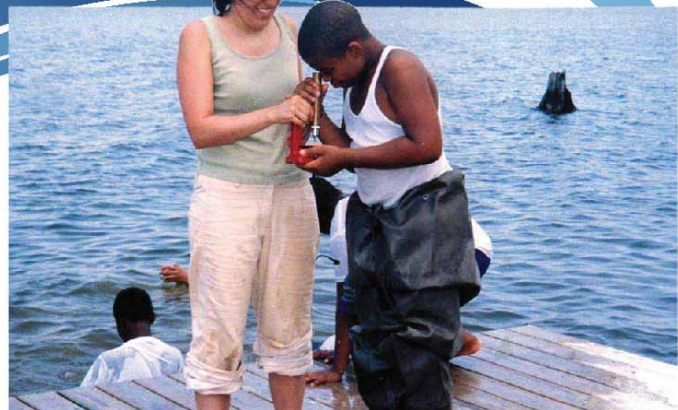
Sea Level Rise and Population Growth in North Carolina



Report

**Co-sponsored by:
The Albemarle - Pamlico Conservation
and Communities Collaborative
&**

**The Albemarle - Pamlico
National Estuary Program**



Executive Summary

The Albemarle-Pamlico Conservation and Communities Collaborative (AP3C) in partnership with the Albemarle-Pamlico National Estuary Program hosted a series of seven public listening sessions during the summer of 2008. The goal of these sessions was to provide residents of the Albemarle-Pamlico watershed with an opportunity to voice their concerns about the combined impacts of sea level rise and population growth and elicit their ideas about solutions. They were also intended to gauge public perceptions about landscape and social change, population growth, and sea level rise for the purpose of improving public outreach and education projects. More than 100 residents attended the sessions, representing a broad array of backgrounds and knowledge about the issues. Their comments illustrate different views about the implications of and solutions to sea level rise and population growth and provide the basis for further education and outreach.

About the Sponsors (*AP3C member sponsors)

The Albemarle-Pamlico Conservation and Communities Collaborative, or AP3C, was established by conservation and community groups to develop approaches that integrate economic and ecological resilience for the lands, waters and communities of the Albemarle-Pamlico region. The AP3C recognizes the challenges presented by economic and social distress, climate change, population change and increasing risks to public health. They implement collaborative, sustainable solutions for regional well-being.

***The Albemarle-Pamlico National Estuary Program**, or APNEP, is a cooperative effort sponsored by the N.C. Department of Environment and Natural Resources and the Environmental Protection Agency and the Virginia Department of Conservation and Recreation. The mission of APNEP is to identify, restore and protect the significant resources of the Albemarle-Pamlico estuarine system.

***Audubon North Carolina** is the state office of the National Audubon Society representing 10,000 grassroots members and nine local chapters across the state. With a century of conservation history in North Carolina, Audubon strives to conserve and restore the habitats we share with all wildlife, focusing on the needs of birds. Audubon North Carolina achieves its mission through a blend of science-based research and conservation, education and outreach, and advocacy.

***The Conservation Fund's Resourceful Communities Program** was established in 1991, to help North Carolina's underserved communities create new economies that protect and restore, rather than extract, natural resources. The **Resourceful Communities** program provides a range of direct assistance to develop the leadership and organizational capacity necessary for sustainable community development. Because **Resourceful Communities** works closely with local partners, including nonprofit, private and public concerns, we help ensure local ownership of long-term economic, social and environmental change.

***Environmental Defense Fund** is a leading national nonprofit organization that represents more than 500,000 members. Since 1967, Environmental Defense Fund has linked science, economics, law and innovative private-sector partnerships to create breakthrough solutions to the most serious environmental problems.

***The Nature Conservancy** is a non-profit organization whose mission is to preserve the plants, animals and natural communities that represent the diversity of life on earth by protecting the lands and waters they need to survive. The Nature Conservancy's office in North Carolina has protected almost 700,000 acres. Working with its partners, the conservancy has helped to protect almost 500,000 acres of property in the Albemarle region - all of which is threatened by sea level rise.

The Natural Resources Leadership Institute is an instructional and community service program of the North Carolina Cooperative Extension Service at N.C. State University. The goal of the Natural Resources Leadership Institute is to improve management and policy decisions affecting North Carolina's communities and natural resources. NRLI works toward this goal by convening forums of stakeholders and decision makers, providing collaborative leadership training, and conducting research.

About the Planning & Facilitation Team

Cynthia Brown, MPA – has 26 years of experience in non-profit management and social justice activism. She is a part-time employee of The Conservation Fund and the founder and lead consultant of The Sojourner Group, whose mission is to increase peoples' ability to build their own organizations, establish effective alliances, and advocate for public policies that address their needs.

Sharon Campbell – is the president of SYNERGY Development and Training Group, an organization that believes holistic knowledge and resources build strong communities through collaborations that result in positive change and sustainable growth. She believes the most effective solutions for communities are within the people who have the greatest stake in the outcome.

Lucy Roberts Henry, MEM – is a watershed management coordinator with the Albemarle-Pamlico National Estuary Program in the N.C. Department of Environment and Natural Resources. She helps coordinate the implementation of APNEP's Comprehensive Conservation and Management Plan by working with APNEP's partners to advance natural resource protection through community-based initiatives in the Albemarle-Pamlico sounds watershed. Henry has more than five years of experience in international, non-profit program management and training in facilitation and environmental leadership.

Marilynn Marsh Robinson – is a program associate with Environmental Defense Fund in Raleigh and works with the Southeast Oceans team on fishery management and the Land, Water, Wildlife team on animal operations, clean water and community engagement. She is interested in seeing the conventional environmental movement engage and build relationships with affected communities in hopes of achieving environmental conservation and economic equity for everyone.

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Glossary of Terms

Adaptation: Ways of coping with the impacts of climate change on species, ecosystems and human society.

AP3C: The Albemarle-Pamlico Conservation and Communities Collaborative

APNEP: The Albemarle-Pamlico National Estuary Program

Biodiversity: Life in all its forms, essential to maintain functioning ecosystems that provide services essential for human survival and quality of life.

Climate: The long-term average weather of a region including typical weather patterns, the frequency and intensity of storms, cold spells, and heat waves. Climate is not the same as weather.

Climate Change: Significant changes from one climatic condition.

Ecology: The science of the relationship between organisms and their environment.

Ecosystem: A community of organisms and its physical environment.

Erosion: The process by which a material is worn away by water or air.

Estuary: A place where fresh and saltwater mix, such as a bay, salt marsh or where a river enters an ocean.

FEMA: Federal Emergency Management Agency. Agency of the U.S. government tasked with disaster mitigation, preparedness, response and recovery planning.

Flood: An overflow of water onto lands that are used or usable by man and not normally covered by water. Floods have two essential characteristics: The inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river, stream, lake or ocean.

Glacier: A huge mass of ice, formed on land by the compaction and re-crystallization of snow that moves slowly downslope or outward due to its own weight.

Green Infrastructure: The use of vegetation and natural areas, such as wetlands and forests, to reduce the impacts of floods, improve water quality and filter stormwater.

Hydrology: The science of the movement, distribution and quality of water.

IPCC: Intergovernmental Panel on Climate Change, the United Nation’s scientific body that investigates the causes and impacts of climate change, and publishes scientific reports.

Mitigation: To make something less intense. In terms of “global warming mitigation,” this term is used to speak about solutions, such as greenhouse gas reduction, which reduce the intensity of global warming.

Sea Level Rise: An increase in the mean level of the ocean.

Storm Surge: An abnormal rise in sea level accompanying a hurricane or intense storm.

Stormwater Runoff: Water from storms that flows over paved and impervious surfaces, carrying with it pollutants and other contaminants.

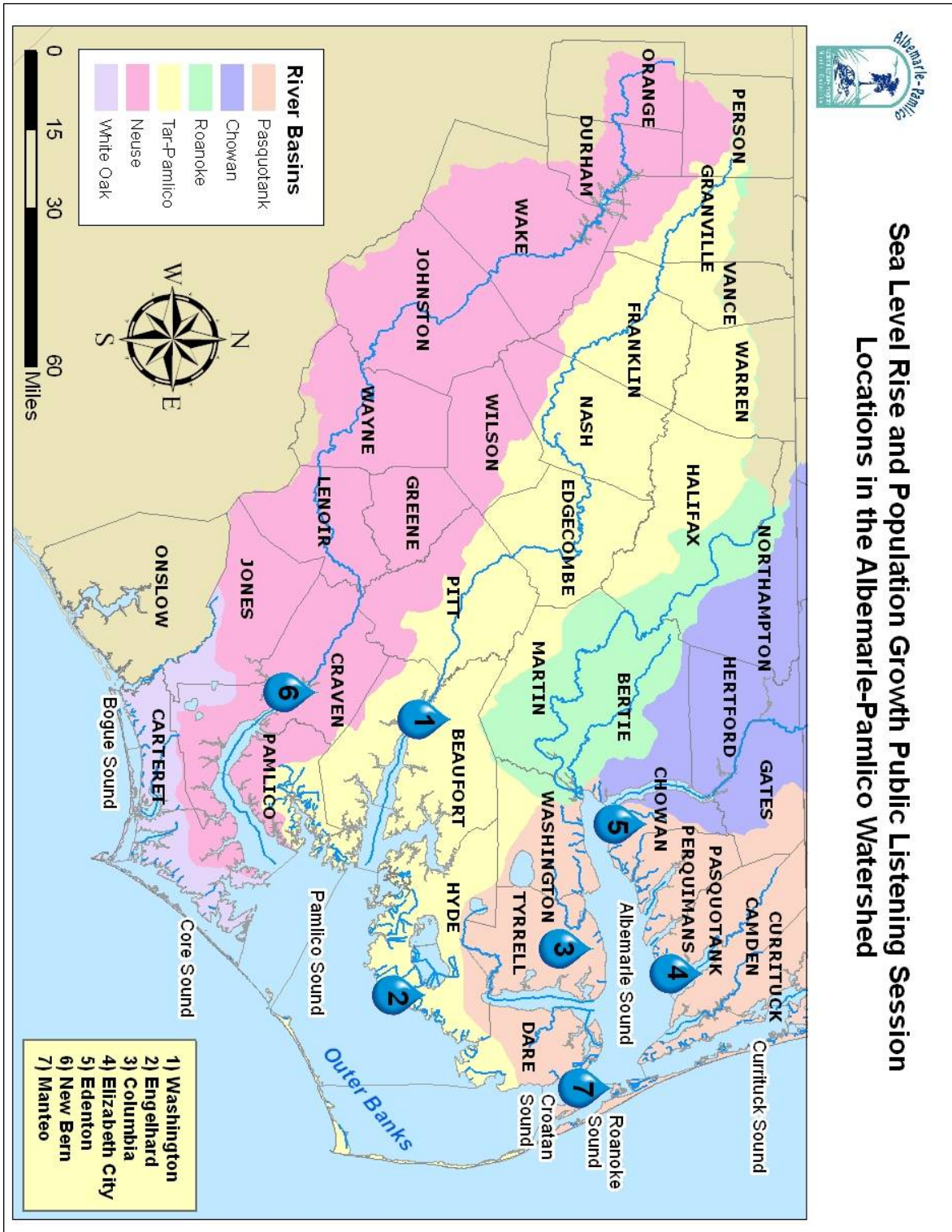
County Tier Designations: The N.C. Department of Commerce annually ranks the state’s 100 counties based on economic well-being and assigns each a tier designation. The 40 *most* distressed counties are designated as Tier 1, the next 40 as Tier 2 and the 20 least distressed as Tier 3.

Watershed: The area of land where all of the water that is under it or drains off of it goes into the same place.

Weather: Describes the short-term (i.e., hourly and daily) state of the atmosphere. Weather is not the same as climate.

Zoning: The way that governments control how land is developed and used.

Map of the Albemarle-Pamlico Watershed and Public Listening Session Locations



I. Introduction

North Carolina's population is growing at an unprecedented rate. By 2050, the population is expected to increase by more than 50 percent. Many new residents are moving to North Carolina's beautiful, but delicate, coastal and estuarine region where retirement and vacation communities are sprouting up on land that was once farm and forest. North Carolina has already started to experience the effects of sea level rise. The Albemarle and Pamlico Sounds region has been identified as one of the top three most threatened areas from sea level rise in the United States. The combined impact of population growth and sea level rise has created a condition of ecological and social vulnerability that calls for holistic solutions that respond to social and ecological concerns.

Natural resource managers have begun to develop strategies for ecological adaptation to sea level rise, such as preserving natural areas along the coast to buffer against rising seas, thereby allowing plants and animals to migrate slowly inland. Residents of the coastal plain face more immediate economic and social concerns. The Albemarle-Pamlico watershed has some of the poorest counties in the state and the loss of traditional industries such as fishing and farming, as well as a decline in manufacturing, are contributing to rising unemployment and changes in local culture. At the same time, the appeal of North Carolina's Outer Banks is drawing people to the shores of the sounds and rivers inland, which are being marketed as the "inner banks."

Despite the apparent disconnect between the issues of population growth and sea level rise, the threats they pose to communities are intertwined. Development is mostly occurring in high-risk areas, along the banks of the sounds and rivers, and eventually coastal communities will have to make difficult decisions about whether they want to put resources into protecting this infrastructure. In order to gain a better understanding of how residents perceive the threats from sea level rise and population growth, and what their priorities are in adapting to them, a series of public listening sessions was held during the summer of 2008. The desired outcome of these sessions was to have a written record of public opinions that could inform conservation and community development in the future.

The Albemarle-Pamlico National Estuary Program, or APNEP, and the Albemarle-Pamlico Conservation and Communities Collaborative, or AP3C, hosted these listening sessions. Their approach was to share basic information about population growth and sea level rise, but more importantly to listen to community members' reactions and suggested strategies. The focus of the sessions was on listening and recording community members' opinions and priorities. The meetings took place in seven communities on the coastal plain of North Carolina, targeted for their vulnerability to sea level rise and their diverse populations and landscapes.

II. Background

Social and Economic Conditions in the Albemarle-Pamlico Watershed

Provided by Mikki Sager, Resourceful Communities Program of The Conservation Fund

The Albemarle-Pamlico watershed is a region of contrasts, including North Carolina's most densely-populated urban centers (625 and 507 people per square mile, respectively, in Durham and Wake Counties) and our most sparsely-populated rural areas (9 and 8 people per square mile, respectively, in Hyde and Tyrrell Counties). It is rich in environmental resources, and has been economically- and socially-distressed for generations. Fully 50 percent of the state's most economically-distressed Tier One counties are in the region, which comprises only 37 percent of the land base in the entire state, and almost all of those Tier One counties are located in northeastern North Carolina.

The 36-county region includes the largest cluster of persistently poor counties in the state, along with some of the most affluent areas, as seasonal and second home development crops up along the Outer Banks. The 2006 average unemployment rate for the region is 5.25 percent (9 percent higher than the state average) with county rates ranging from a low of 3.3 percent in Orange County to a high of 8.6 percent in Edgecombe County and 7.2 percent in Wilson and Chowan counties. Urban economies can better withstand business closings: Wake County's 2006 unemployment rate was 3.6 percent, despite the loss of 4,814 jobs in two years and Edgecombe County's was 8.1 percent, having lost 360 jobs.

There are also disparities in pay levels: the average wage for workers in education and health services ranges from \$44,815 in Orange County down to \$19,685 in Bertie County. The average wage for workers in natural resources and mining is significantly higher in the urban areas, with highs of \$65,884 for the 0.1 percent of workers employed in Durham County, and \$43,192 for the 0.2 percent of workers in Wake County. In the northeastern part of the region, natural resources and mining employs a much higher percentage of the workforce but pays significantly less. By comparison, the 10.7 percent of workers in Washington County who are employed in this sector receive an average wage of \$22,053; the 10 percent of Tyrrell County's workers average \$24,332; and the 7.7 percent of Hyde County's workers employed in this sector are paid an average of \$18,704.

More than 20 percent of the residents of the region's eight northeastern counties live in poverty. Persistent poverty is a constant issue, with the regional poverty rate (15.91 percent) averaging 29 percent higher than the state average and skewed by low rates in Wake (7.8 percent) and Dare (8.0 percent) counties. The young, elderly and people of color disproportionately bear the social and economic burdens. The average child poverty rate, at 20.85 percent, is 32 percent higher than the state average, and ranges from a low of 8.6 percent and 9 percent in Wake and Orange counties, respectively, to highs of 33 percent in Halifax County and 31.5 percent in Tyrrell and Washington counties. The

average elderly poverty rate for the region is 31.75 percent higher than the state average, with Orange and Wake Counties at the low end (7.4 percent and 8.9 percent, respectively) and Gates at 26.2 percent and Bertie County at 28.3 percent, more than twice the state average.

Even accounting for significant differences in poverty and income rates in the urban and northeastern counties, white residents (average 9.45 percent) in the region are much less likely to live in poverty than residents who are Hispanic (29.54 percent), black (26.03 percent), or American Indian (17.9 percent). In 14 of the northeastern counties, more than one-third of Hispanic residents live in poverty and in seven of the northeastern counties, more than one-third of black residents live in poverty. Fifteen of the Albemarle-Pamlico region's counties, all in the northeastern part of the state, have more than twice the state's average percentage of residents living with no plumbing.

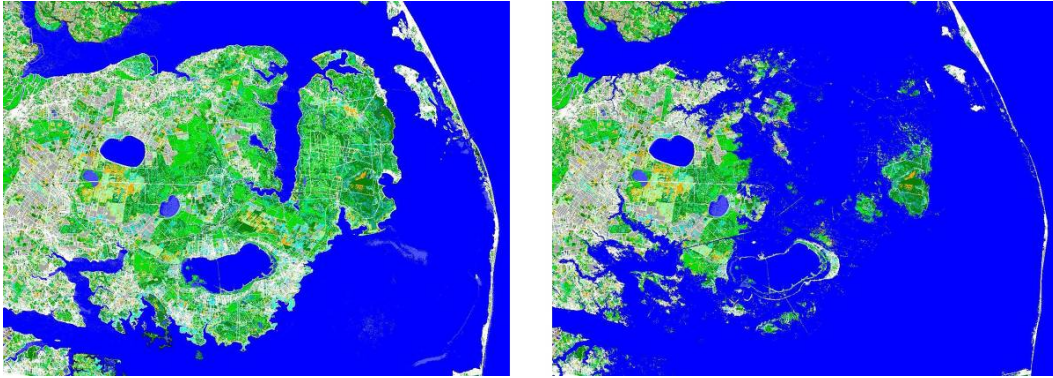
Note: All statistics are from the N.C. Rural Center Data Bank (<http://www.ncruralcenter.org/databank/>)

Climate Change and Sea Level Rise Impacts on Natural Resources in Coastal North Carolina

Provided by Sam Pearsall, Environmental Defense Fund

Climate change, caused primarily by the release of heat-trapping gases such as carbon dioxide, is literally changing the world we live in. Around the globe, temperatures are climbing, seas rising and seasons shifting. Climate change is altering landscapes, putting wildlife at risk and increasing the likelihood of drought, floods, storms and wildfires. But ecological damage is not the only consequence of climate change. The human health and economic impacts are also potentially catastrophic.

Among landscapes vulnerable to the effects of climate change, few are in as precarious a position as North Carolina's Albemarle peninsula. The Albemarle landscape is a study in balance, where water is as much a part of the landscape as the land itself. Global climate change, however, is upsetting that balance, and rising seas threaten to forever change this complex ecosystem of estuaries, swamp forests, marshes and meandering rivers. The effects of climate change are already visible on the peninsula as the region's peat soils are degrading quickly and natural communities are in retreat from saltwater intrusion. Unless something is done soon to protect the landscape and manage the inevitable ecological changes, we could lose as much as 1 million acres to rising seas within the next 100 years. The two maps below show present conditions on the left and, on the right, the extensive areas that would be flooded by the most conservative projection of 32 inches of sea level rise in the next 100 years.



More than 540,000 acres on the Albemarle peninsula are under conservation protection as national wildlife refuges, N.C. Wildlife Resources Commission game lands, N.C. Coastal Reserves, and other preserves established by The Nature Conservancy, The Conservation Fund, The North Carolina Coastal Land Trust and other private and public agencies. The Albemarle and Pamlico sounds are part of the largest lagoon, or enclosed shallow body of water, in the world and the healthiest and second largest estuary in the eastern United States.

The effects of climate change threaten decades of work by conservationists on the peninsula. Although we must accept the virtual certainty that the landscape will change with the climate, this doesn't mean we are powerless to preserve its natural diversity and richness. In fact, we can take steps now to make the peninsula's ecosystems more resilient to climate change and to reduce the likelihood of catastrophic changes. These steps must ensure that, as the ecosystems of the peninsula are inevitably transformed by changing climate and rising seas, they are transformed into ecosystems that still support many species and complex natural communities, sequester large volumes of carbon and provide human ecosystem services such as clean air and water, ocean and forest products and outstanding outdoor recreation opportunities.

III. Planning and Implementation

Goals of the Listening Sessions

In an attempt to focus the sessions on local issues and avoid getting into a broad discussion about the causes and effects of climate change, we focused specifically on the issue of sea level rise. We had the following three specific goals:

- 1) To provide participants with basic information about sea level rise and population growth in the Albemarle-Pamlico region.
- 2) To give participants an opportunity to share their concerns about the potential impacts of sea level rise and population growth on their communities.
- 3) To generate potential solutions that could address impacts resulting from sea level rise and population growth.

Site Selection

We held seven listening sessions throughout the Albemarle-Pamlico region. The sites were selected in specific locations to encourage diverse participation and maximize the access, so regional residents would be able to attend at least one of the sessions.

The sessions were held in these North Carolina locations:

- July 17** - Washington
- July 21** - Engelhard
- July 22** - Columbia
- August 4** - Elizabeth City
- August 5** - Edenton
- August 11** - New Bern
- August 18** - Manteo

Outreach and Publicity Strategy

We used a multi-pronged approach for recruiting people to attend the listening sessions. At each of the seven sites, an outreach person:

- mailed flyers to potential participants, then made follow-up telephone calls to them;
- disseminated outreach flyers to local churches;
- requested coverage by local media;
- invited local elected leadership, schoolteachers and chamber representatives; and
- coordinated meals and scheduled a venue for the meeting.

Although the outreach person was a volunteer, we did provide funding for postage and food. The person responsible for outreach targeted councils of government, the N.C. Rural Center, the N.C. Community Development Initiative and the N.C. Association of Community Development Corporations to encourage Community Development Corporations and their constituents to attend the focus groups.

AP3C partners and APNEP staff e-mailed announcements about the listening sessions to their networks and contacts. Before the listening sessions, several AP3C partners were interviewed for radio interviews and newspaper articles.

Setting the Agenda

Meetings were held from 5:30 p.m.-8:30 p.m. to accommodate residents whose work schedules would not allow them to attend daytime meetings. Because the meetings were held during dinner, food was served as an incentive for people to attend. The agenda was divided into five distinct parts to accomplish specific goals: **Opening, Setting the Context, Implications, Solutions and Next Steps.**

In the **Opening**, we welcomed participants, introduced the conveners and participants to each other, and provided a little education about the Albemarle-Pamlico Conservation and Communities Collaborative and the Albemarle-Pamlico National Estuary Program.

We used facilitated open discussion to structure the remainder of the agenda because adults learn best when they participate in the process and when connections are established between new learning and relevant prior knowledge and experience. Summarized comments were recorded on flip charts and in more detailed written notes.

To **Set the Context** for our discussion, we asked the group to respond to the question: “*What changes are you seeing and experiencing in your communities or your environment?*” Starting from this context was important for later discussion about sea level rise and population growth, so that participants could draw on their own experiences and relate the issue to their communities and environment.

Next, we shared maps illustrating projected sea level rise and population growth. We displayed poster-sized maps showing these events at the scale of the entire region and provided participants with 8 ½-by-11-inch local maps of the area where the session was being held. At the final session, Sam Pearsall, then a scientist with The Nature Conservancy and now with Environmental Defense Fund, made a power point presentation on sea level rise and projected population growth. At the other sessions, we deliberately avoided overwhelming participants with information and used visuals with a brief explanation to stimulate discussion. The merits and trade-offs of these two different approaches is discussed in a later section.

Next, we discussed the **Implications** of what had been shared up to that point. In other words, given the actual changes people are experiencing in their communities and the projected sea level rise and population increases that are anticipated, we asked them to brainstorm what might be some of the impacts of a convergence of all of those factors.

We then asked for potential **Solutions** to the issues identified in the implications conversation. In the information packet, we provided a handout of some of the adaptation strategies being used by other communities in order to stimulate conversation as well as case studies of sea level rise adaptation. In the design, we anticipated that the responses would address a full range of issues and decided that we would offer some general suggestions if participants found the subject too overwhelming to come up with solutions. However, participants at all of the sessions did not hesitate with solutions, so the facilitators had little influence on the responses.

Finally, we ended each session by discussing **Next Steps**. Participants were reminded to complete the sign-in sheet indicating their contact information, and whether they wanted to be informed about future AP3C meetings and listening session findings. We felt it was important to give participants an opportunity to stay engaged and feel that their opinions were part of an ongoing process. We also conducted verbal and written evaluations (with the exception of our first session) in order to improve subsequent sessions.

IV. Listening Sessions Results

Methods

During the listening sessions, participants' comments were recorded both on flip charts, as summarized statements, and in more detailed written notes that included direct quotes. Comments were grouped according to the three questions that were presented in the sessions: 1) "What changes are you seeing and experiencing in your communities and in your environment?" 2) "What do you think the impacts of these changes will be on your community, as they relate to sea level rise and population growth?" and 3) "What do you think are some of the solutions to these issues?" The transcript of the sessions was coded, using qualitative analysis, first according to location, then according to major themes, and then according to sub-themes. These coded results were then analyzed for major patterns, ideas, commonalities and contrasts.

Between 10 and 30 participants attended each session. The average number of participants was about 15. The participants represented diverse backgrounds. At most sessions, a handful of attendees were present from out of town, mostly from academic institutions or natural resource management organizations. There were usually at least one or two local residents with extensive knowledge of sea level rise. The target group, those with limited or no knowledge of sea level rise, usually represented an additional few people (unfortunately this group was underrepresented; causes and possible remedies will be discussed later). Participants also represented a diversity of ages, genders and racial backgrounds. Most sessions had at least one senior citizen and one African-American representative, fairly equal gender balance, and a wide range of ages, with a predominance of white professionals.

While the following results depict an informed understanding among participants of the impacts and implications of sea level rise and coastal population growth, this does not mean that communities are widely informed. At each session, at least two participants were well-informed on sea level rise and able to educate their peers on subjects such as saltwater intrusion and stormwater runoff. This phenomenon, of cross-pollinating among participants, was a successful means of educating people about the issues. Instead of hearing the facts from an "outsider," they heard them from a community member and the topic gained legitimacy. If their neighbors witnessed this happening, they seemed more likely to believe it.

Another important point is that these results are meant to represent the diversity of opinions, rather than the prevalence of opinions. Participants were self-selecting and not a statistically significant population. Nevertheless, since outreach was done to diverse groups and attendance incorporated members of widely dispersed social groups, it can be concluded that their ideas represent the opinions of community members from a wide array of backgrounds, education, experience and knowledge.

Results

Question One: What changes are you seeing and experiencing in your communities and in your environment?

Environmental Changes

Given the topic of the sessions, it is not surprising that environmental changes were a dominant theme in the responses to this first question. Water quality changes were central to this discussion. The issue of increased runoff was mentioned at nearly all of the sessions; participants noted that this increase is resulting from population growth, rather than agricultural runoff which they noted has been steadily decreasing. More specifically, participants were concerned with non-point source runoff from development, issues of poor drainage of water on the landscape, and other results of population growth, such as the increase in green lawns and the resulting chemical runoff from these residential areas. Participants were concerned with the impacts resulting from declining water quality, such as closed swimming areas, increased algae blooms, decreased water clarity and detrimental impacts to fisheries.

Another dominant change was the perceived increased salinity in the sounds and saltwater inundation into inland waters. The evidence of this increased salinity was expressed as changing species in the sounds and rivers, such as the presence of porpoises in the Perquimans River and increased blue crabs in the Albemarle Sound, or the damage to agricultural lands from saltwater backing up into drainage ditches. One participant commented, "I can tell by taste. My well went salty." Others also noted saltwater inundation into sewage systems and groundwater aquifers.

Erosion was another oft-noted environmental change. Some individuals commented on evidence of dramatic erosion at Camden Shores, underneath the Perquimans River Route 17 bridge, and at Alligator National Wildlife Refuge. Others noted region-wide erosion problems, with one participant commenting that there are "inland, estuary-side erosion rates that are comparable to the Atlantic coastal side."

Perceived land use and landscape changes took the form of conversion from natural to developed lands and transition of ecosystems resulting from storm, flooding, and weather influences. Participants noted the loss of trees from developing lands, the increase of impervious surfaces, and the changing hydrology that is resulting, causing increased flooding, decreased drainage, and resulting degradation of water quality. One participant commented that marginal lands are being developed because the land that is suitable has already been developed, commenting that "many of these developments would have been unthinkable 10 years ago." A pervasive land use change at most locations was the loss of agricultural lands, mostly due to the conversion to developed lands. In terms of ecosystem transitions, participants were mainly concerned with the loss of coastal wetlands due to encroaching development and/or sea level rise.

"Many of these developments would have been unthinkable 10 years ago."

Wildlife plays an important role in the lives of many coastal plain residents, especially as wildlife and aquatic species have served to support local industries like fishing and hunting. Participants perceived that species that supported these industries were disappearing, most notably shellfish, herring, rockfish and striped bass. Others had noticed decreased bird diversity, “the birds don’t come around and sing anymore,” and more tropical birds occurring on the Outer Banks. In some areas, such as Edenton, participants were noticing an increase in deer and groundhogs in urban areas. Inland areas, such as Elizabeth City and Edenton, reported increased numbers of dolphins, whereas in Manteo and on the Outer Banks, participants noted a decrease in the number of dolphins.

One additional environmental change that participants commented on was the change in weather. Participants noted a change toward a drier, hotter climate. A participant at the Columbia session noted the weather change and said: “In my garden, the food is shaped different.”

Economic Changes

Participants noticed dramatic changes in the local economy, largely resulting from population growth and new development. A common theme was that more development is occurring on the waterfront, bringing new economic challenges in terms of demand for sewage and other infrastructure. Participants commented that “we’re the last cheap land to develop” and that “the world has discovered us.” The economic ramifications of this development influx included loss of traditional industries like farming, and inclination of local government toward pro-development approaches.

“We’re the last cheap land to develop. The world has discovered us.”

Changing demographics are causing local economic changes as well. Commerce is becoming more geared toward retirees, and a new demand for service industries has arisen. One positive outcome has been the revitalization of some downtowns such as New Bern and Washington, with new restaurants and shops. On the flip side, participants also noted increases in taxes and living expenses. One participant commented that the new service-industry jobs that have arisen to serve retirees draw down the local economy because they bring in young families who require additional services. Furthermore, these are often lower wage jobs than the manufacturing jobs that they are replacing.

Cultural Changes

Cultural changes were largely resulting from population growth and demographic changes. Participants noted an increase in baby-boomers, retirees, “people from the north,” second-home owners, and weekend visitors. One participant in New Bern called the area a “retirement Mecca.” Another commented that “newcomers want to change us.”

Some commented on changes to the physical character of communities such as more people living downtown and increased traffic and congestion. Other changes were related to a cultural shift from long-term residents to newcomers and fewer people working in traditional industries like farming and fishing. Participants commented that “traditional

families” are being forced out as a result of higher property taxes and loss of jobs. Not all changes were perceived as negative. Some positive observations included increased diversity of residents, new businesses and more choices of restaurants and services.

Another cultural change was in local governance. Participants noted that fewer long-term residents are serving in local government and that priorities are shifting in favor of development and growth.

Question two: What do you think the impacts of these changes will be on your community, as they relate to sea level rise and population growth?

Equity Impacts

Concern about inequality arising from the combined threat of population growth and sea level rise was a dominant theme. One aspect of equality that participants were concerned about was in regards to “who pays for protection and relocation.” Participants noted that those living on the water tend to be wealthy, but the coastal plain counties in which they live are some of the poorest in the nation. People were concerned that their tax dollars would increasingly be used to sustain private waterfront properties, which many considered a waste of public funds since those properties would be doomed in the end, anyway.

“I don’t think North Carolina’s going to be top federal priority, so [responsibility’s] going to fall to the state.”

Others worried about inequitable decisions occurring in the relocation process, if certain people would be relocated, while others would not. Or, if certain properties would be allowed to flood in order to protect other properties. Another element of relocation was the anticipated impact on inland communities, which might face an influx of relocated coastal residents, causing increases in property values and subsequent increases in taxes. Others suggested that wealthier residents would be able to relocate with their own means, and would have more opportunity to access government financial support, whereas poorer residents would not have the money or the government support to relocate. Hurricane Katrina, and the example of poor residents left stranded and vulnerable, was often mentioned as an example of what might happen.

Lastly, residents expected inequity in federal distribution of funds (many referenced Katrina again here and the inequitable impact on poor New Orleans neighborhoods) and expected that Coastal North Carolina, with its poor and relatively small (compared to New York City, as one participant commented) population, would rank low in national priority. One participant commented: “I don’t think North Carolina’s going to be top federal priority, so [responsibility’s] going to fall to the state.”

Environmental Impacts

Water quality was again a dominant theme of the discussion of environmental impacts. Whereas erosion was perceived as a change that has been occurring, it was not perceived as a consequence of sea level rise by many participants. Instead, the perceived impacts were related to saltwater inundation into freshwater aquifers and general loss of freshwater. Pollution from runoff was perceived as an ongoing impact, but new sources of water contamination were expected from nutrients leaching into the water from peat soils deteriorating and from sewage overflows from rising water levels. Some saw broader implications for the sounds; as one participant suggested: “The Albemarle Sound could become like the Pamlico Sound, saltier and more open, but still an abundant fishery. But [the change] could be negative – the Albemarle-Pamlico is a nationally important resource and it could be lost.” This comment reflects the importance that participants placed on their natural resources, as many commented about the value of the sounds as a “nursery” for important ocean species and as a unique landscape that is home to wildlife, wetlands and forests that are known throughout the state and beyond.

“The Albemarle-Pamlico is a nationally important resource and it could be lost.”

Participants anticipated impacts on wildlife, primarily at the coastline where wetlands were expected to get squeezed between development and rising seas and where damaged infrastructure would contaminate aquatic habitat. One participant commented that “We’re not only going to lose a lot of people, but also freshwater marshes and saltwater wetlands.”

This discussion, like with perceived changes, focused a great deal on impacts to natural resources such as seafood, waterfowl and farmland. Participants were also concerned with the potential loss of conservation areas, such as Alligator National Wildlife Refuge and the national seashore. Another commented on the potential loss of the Outer Banks, calling them the “first line of defense” because they protect coastal residents and habitats from hurricanes. They expected not only ecological ramifications from this, but also the resulting loss of tourism and natural heritage.

Participants also expected to see new environmental health impacts occurring from sea level rise and population growth. One participant cited Bangladesh as an example, where water inundation into populated areas is bringing disease and destruction as well as stress from land and property loss. Increased mosquito-borne diseases were expected, such as West Nile virus and malaria.

Lastly, participants commented on positive impacts such as new opportunities for innovation and conserving natural resources as a means of buffering the rising seas along with increased stimulus for sea level rise science.

Economic Impacts

Property loss was a dominant theme in the discussion of impacts. Not only did participants expect that shoreline properties would be destroyed as a result of sea level rise, but they expected that private property rights would be encroached upon. One

participant commented that, because public property begins at the mean high tide mark, there will be complex legal issues as that line moves further and further onto existing private property. Another commented that “North Carolina residents value private property rights and there would be takings issues from sea level rise.” Others worried that a “grandfather clause” would allow people to continue living in areas where they should not be living and that this would be stimulus for people to harden shorelines and fight the inevitability of sea level rise. Most thought that eventually those houses would be abandoned and end up submerged, wreaking environmental havoc on water quality. To the contrary, some participants suggested that new wealth would be created by a changing coastline, with some inland areas eventually ending up as waterfront. Despite this realization, one participant noted that: “I’m not optimistic that people will think twice about buying waterfront lots.”

“I’m not optimistic that people will think twice about buying waterfront lots.”

In conjunction with property losses, participants also expected a loss of, or damage to, other coastal infrastructure. Damage to sewer systems, drinking water infrastructure, transportation, and military bases were dominant concerns. Others expected new infrastructure, such as dikes, hardened shorelines, and new desalinization plants. Mostly, participants were pessimistic about the ability to create infrastructure that would be resilient to sea level rise and saw the potential for a slow deterioration in municipal services such as sewer and water.

Participants were also concerned with impacts to the local economy resulting from property loss, changing demographics, and increased costs of sustaining infrastructure. They expected that property loss would impact the financial stability of future generations, as their family heritage disappeared. They also expected decreased tax base in communities where property was converting from private to public land or where people were moving away. At the same time as the tax base is decreasing, participants thought that residents would expect to be bailed out, causing an increase in local and state taxes.

Other local economic impacts were expected to result from increased job losses in fisheries, loss of agricultural land and the farming industry, loss of manufacturing plants on the water, and loss of tourism. While participants often commented on the fact that people would want to be compensated for their losses, their idea of who might compensate ranged from the expectation that the Federal Emergency Management Agency would provide this restitution (although one person commented that the North Carolina coastal plain is too unpopulated and poor to get FEMA’s attention), to the state government, to local taxpayers.

Governance Impacts

Participants expressed a pervasive lack of confidence in the ability of local and state government to deal with the issue of sea level rise; at the same time, they thought it was the responsibility of government to manage a relocation and adaptation process. One participant summed it up as “It comes back to strong local government, with good

incentives from Raleigh leading to good decisions.” Some expressed a need for stronger regulations to “force uncomfortable changes on communities to help them adapt.” Others worried that increased regulations will “hamper the local ability to adapt...because localities will lose their influence over decisions.” In general, participants agreed that the problem with getting the government to act on the issue of sea level rise results from the long-term and slowly encroaching nature of the issue, whereas government remains focused on the short-term and elected officials are bound by their terms in office and the immediate issues that are important to their constituents.

“It comes back to strong local government, with good incentives from Raleigh leading to good decisions.”

Culture and Community Impacts

People anticipated cultural impacts from sea level rise and population growth that were similar to what they expressed as changes in the first section of the listening session.

“Family dynamics will change and communities will change.”

These included demographic changes from people moving into the area, in particular issues of new wealth, gentrification, influx of retirees, and loss of traditional natural resource-based industries like agriculture and fishing. One participant articulated these changes as follows: “fish-houses will continue to be sold to development leading to cultural changes – those people will begin working in other service jobs - family dynamics will change and communities will change.”

The new topics that came up in this discussion of future impacts were related to cultural changes that might result from displaced people, if communities are uprooted and/or have new residents moving inland because of lost coastal properties. One participant commented that there would be “new cultural mixing...as communities that have previously been separate will be merged together.” Some anticipated cultural clashes from this mixing and others noted that those who are moving in, and who will continue to move in, “aren’t aware of the risks of coastal living.” In conjunction with these changes, participants expected a loss of community cohesion and/or the complete dissolution of communities. Others thought increased domestic violence would occur from the stress of property loss and loss of economic security.

Participants were also concerned about impacts to their tradition and history. Many mentioned the loss of historic places, resources and monuments as a detrimental impact of sea level rise.

Other Comments about Impacts

It is worth noting that some participants expressed feelings of hopelessness or apathy about the impacts of sea level rise. By way of example, one person commented that “My house will be under water from 1 foot [of sea level rise], so nothing else matters.” This feeling of hopelessness was expressed by many, while some saw an opportunity in sea level rise, joking that they may eventually have valuable waterfront

“I’m not going to live long enough to care.”

property. Another participant expressed a sentiment that captures the difficulty in engaging people about sea level rise and climate change, noting that “I’m not going to live long enough to care” or another’s comment that “people don’t believe in this!”

Question Three: What do you think are some of the solutions to these issues?

Infrastructure Solutions

Green infrastructure, or the use of vegetation to mediate impacts such as water quality degradation, was a commonly suggested solution. One strategy often mentioned was the use of oyster beds to buffer shorelines from increasing wave energy from rising seas, another was to facilitate the transition of submerged aquatic vegetation to more shallow waters. Another solution, related to the concerns about stormwater runoff, was to use “nature-based solutions” to reduce the inundation of pollutants from stormwater, such as rain gardens and ditch buffers. A farmer in Hyde County suggested that the agricultural cost share program that funded tide gates be reinstated to reduce saltwater inundation.

Participants saw an opportunity in keeping shorelines natural, as noted by one participant, “protect[ing] waterfronts for aesthetic purposes...will increase the value of the waterfront as a public resource and keep people from living there.” One option for protecting waterfronts was to expand on the Estuarine Reserve system and the Croatan Forest. Another suggestion was to identify and conserve areas where wetlands can migrate. Similarly, participants saw an opportunity on coastal agricultural land, suggesting it be allowed to transition to marsh. One participant noted that barriers to natural shorelines need to be removed, saying that there’s a “need to shift from the current situation where it’s easier to get a permit to harden the shoreline to one where it’s easier to put natural shorelines in place, like a sill or other stabilization method that will allow wetland migration inland.”

“Protect[ing] waterfronts for aesthetic purposes ... will increase the value of the waterfront as a public resource and keep people from living there.”

Less commonly suggested were engineered solutions, such as dikes, sandbags and bulkheads. However, participants noted limitations in these solutions. One person noted that “there are physical solutions like flood proof structures, raising houses, raising bulkheads, building dikes and hardening shorelines. But these solutions don’t last forever and they could become a lost investment.” A Hyde county resident noted that “we can build dikes to pump water off the land, but that won’t hold back a category three hurricane.” Participants also realized that these hardened structures can have detrimental effects on neighboring properties, in terms of increasing erosion in areas that are not hardened.

Planning and Zoning Solutions

Participants noted a great need for planning that incorporates sea level rise projections. Many expressed a need for community input into these plans, while another participant suggested a more regional approach and “getting local governments together to talk about regional strategies ... and regional impacts to economies and communities.” Part of this

planning would require the incorporation of future projections into floodplain maps, and likewise into zoning restrictions to discourage building in low-lying areas. Setbacks were offered as a solution, as was a shift to using elevation as a zoning approach instead of setbacks, which would focus planning more on sea level rise rather than just on water quality.

The overarching theme was that communities need to stop development in areas that will be impacted. In addition to planning and zoning, many suggested that residents and developers need to be educated about the risks. One suggested that an “ocean hazard notice” be instituted for estuarine coast developments and for transfer of ownership transactions, requiring new residents to acknowledge the hazard of living on the water. Another suggested that the state should “mandate a disclaimer on deeds to alert property buyers to the timeframe and risk of sea level rise inundation.” Others suggested limiting the construction of new septic tanks, thereby restricting growth. Many comments implied a need for a strong government role, both local and state, in this process.

Another element of planning for sea level rise that was discussed was retreat. Many suggested that people should be relocated. One thought this should be FEMA’s responsibility. Others suggested that the government should facilitate managed, organized and incremental retreat.

Finally, a few participants focused on adaptation. Some thought that it would be up to individuals to adapt, saying that “they will move when they have to,” while others thought that adaptation should be a more comprehensive process involving local governments and communities.

Policy Solutions

Participants noted the important role of government in offering solutions to the sea level rise and population growth issues. Many suggested stronger regulations that limit shoreline development and mitigate the impact of current shoreline development. There was an emphasis on local government’s role in developing ordinances and regulating developers. State government was most often named as responsible for facilitating planned retreat and regional cooperation. FEMA was frequently suggested as a source of funding.

Education Solutions

Education was the most commonly suggested solution. Participants saw a need for educating the public, elected officials, schoolchildren, business, churches and conservation and environmental groups. To educate the public, participants suggested using the press, community groups and awareness raising events. As noted in the evaluations (Appendix D), many were disappointed that attendance was low at these sessions and felt that more people need to attend events where they can discuss these issues and solutions. A common suggestion was that the approach should not incite fear, but instead offer people an opportunity to brainstorm solutions.

Elected officials were often suggested as a target for education programs. Some thought that U.S. senators needed to be engaged, while others thought that the focus should be on local government and suggested that county commissioners needed to be briefed individually. Many sought more coordinated education by bringing together local, state, and federal government representatives around the issue, as well as a need for a more engaged public in the discussions.

Youth education was also important. One person said “these discussions need to be happening in schools,” and others echoed the sentiment that schools were not teaching children about the issue of climate change and sea level rise. Many offered specific solutions such as creating a comic book for children explaining sea level rise, getting children out on field trips to see the impacts of sea level rise firsthand, and others thought the issue should be integrated into science curricula.

**“These discussions
need to be happening
in schools.”**

Many also noted a need for more education of the development, banking and insurance sectors to help them understand the risk involved in financing coastal development in high risk areas. Another stressed the importance of educating people “upstream” in Raleigh and areas more distanced from the coast about their influence on coastal waters.

An overarching issue in terms of education was that the approach should address the feeling of hopelessness that people feel when thinking about this issue. Some ways that people suggested dealing with the issue of hopelessness was to reframe the issue as a people issue “to allow for innovation and creativity,” to get people to understand how the issue affects them in a direct way, to engage with diverse groups and focus on community-based solutions, and to change individual actions through awareness building.

Another suggested approach was to reframe the issue of sea level rise. Most liked the separation of sea level rise from climate change. Many felt that the issue should be looked at through a social justice lens and there was widespread belief that more people and more diverse groups need to be at the table.

Mitigation Solutions

Since the focus was largely on sea level rise, discussion about mitigating climate change in a broader sense was limited. It did, however, come up at all of the sessions and there was widespread belief that actions need to be taken at a global scale to reduce greenhouse gasses, change energy policies and practices, and increase alternative energy sources such as wind and solar.

Findings

Changes

- One of the primary environmental changes that people are seeing is increasing erosion rates. They also noted changes in salinity and vegetation, species presence, and saltwater inundation onto farmlands and into aquifers.
- Water quality concerns are high on the list for residents in the region, since water factors prominently in the culture and the local economy. Participants noted a change in the primary water pollution source – once due to farming – now seen to be a result of runoff from development.
- Cultural change was also a big topic of discussion. The influx of retirees and wealthier residents to estuarine coast communities has changed them – for both positive and negative. There was a predominant feeling of lost traditions and way of life.
- Development was seen as playing an increasingly prominent role in landscape change, environmental degradation and local government decision-making.
- The increase in retirees is not seen as an economic boon to the region; rather, residents perceive cultural changes and potential economic liability resulting from this influx.

Impacts

- Even though participants talked about erosion as a change they are currently seeing, they did not focus on erosion as an expected impact of rising seas. Instead, they saw impact in terms of water quality — such as increased salinity and runoff — and water quantity — in terms of more flooding and bigger storm surges.
- People are concerned with water-related impacts on tourism, fisheries and culture.
- Many saw the loss of traditional, natural resource-based jobs such as farming and fishing, as related to development and a changing environment and expected that the loss of these jobs would be exacerbated by the current sea level rise and population growth trends.
- Without government intervention, people don't expect that development will slow in conjunction with sea level rise. Instead, they see an increasing lack of understanding of risk inherent in coastal living in the attitudes of the people moving in.
- There is tremendous fear that the increasing divide between wealthy coastal residents and economically depressed inland residents will foster inequality in the response to sea level rise. Participants expected that poor coastal communities will bear the burden of protecting and relocating wealthy residents living on the shoreline.
- Many feared that short-term solutions would be the focus of adaptation, leading to public investment that would eventually be lost.

Solutions

- While participants seemed to think that the responsibility for solutions and action falls to the state and federal government, they also see locally-driven planning as a solution and a necessity.
- There was widespread belief that more people need to be part of the discussion, but many felt that people don't think that sea level rise is going to happen in their lifetime. Therefore, any awareness raising must link the issue to individuals and communities in a way that does not create a sense of hopelessness or fear, but instead helps people understand how it applies to them. This can be done by framing it in terms of local economy, community planning and new opportunity.
- Education was a dominant theme in the solutions discussion. People thought there was limited knowledge in the public about the nature of sea level rise, so many of the suggestions for educating the general public focused on providing basic information to them about the what/when/how/why of sea level rise. In contrast, the education that was recommended for government was more about mobilizing them to take action, plan for and manage the process of community adaptation to sea level rise.
- People see more opportunity in nature-based solutions than in hardened shoreline solutions, which are perceived as a short-term fix.
- Since the loss of natural resource-based jobs was a large concern in the discussion of changes and impacts, it's worth noting how it factored into the solutions discussion. Solutions such as oyster beds, wetlands and submerged aquatic vegetation were offered, as a means of buffering shorelines, but their restoration would also bolster the fisheries industry. Participants also suggested working with coastal farmers to preserve large areas for transition to wetlands because it could have positive benefits for preserving farmland.

V. Recommendations

Outreach

As was mentioned earlier, the outreach strategy consisted of selecting local volunteers who were provided funds for postage and were in charge of arranging for a facility and food. They sent out flyers to approximately 250 individuals at each location and followed up with phone calls. This outreach strategy was designed to access individuals who would not otherwise find out about the sessions through e-mail, radio or the newspaper and who would not regularly attend meetings about environmental issues.

Nevertheless, attendance at the sessions was lower than the facilitation team desired. Some residents couldn't see why they should be concerned about the issue of sea level rise, so they didn't feel compelled to attend. For that reason, training outreach volunteers how to communicate the issue's importance to coastal plain residents is necessary for future sessions. Furthermore, additional volunteers would have allowed for more direct access to communities and elected officials, who were missing from most sessions. It would also have been helpful to select outreach volunteers with more capacity and resources, or to offer individuals stipends to do the outreach.

Meeting Agenda

The facilitation team debated how much information we should include in the sessions about sea level rise. Since our target audience included people with limited or no knowledge of sea level rise, we felt that it was important to simply present the projected amount and location of sea level rise using maps, rather than spending significant time discussing the complexity of the issue. This would enable us to focus on issues and implications rather than details of sea level rise science. Our audiences tended to be well-educated and informed, making the session more challenging in terms of balancing information needs of multiple groups. Many of the participants attended the session for more information. While we provided packets of information (Appendix B) with in-depth information about projected sea level rise, climate change science and resources for more information, we fell short in providing these individuals with the depth of information they desired. Nevertheless, those participants who came with no prior knowledge benefited from the unexpected outcome of information sharing among participants. Those with substantial knowledge felt compelled, most likely from the deficit in information they perceived, to share what they understood about the issue. This proved extremely effective in some locations for providing just enough added information, articulated in a non-technical and non-lectured way. In fact, there were two locations where informed participants managed to convince “skeptics” who were attending with the purpose of refuting the information (only to find that they were not attending a lecture and the facilitators were there to listen), of the reality of sea level. The facilitation team observed how this unexpected outcome was a very powerful learning moment.

At the final session in Manteo, Sam Pearsall, a scientist from The Nature Conservancy, gave a 20-minute presentation about sea level rise. Participants were enthusiastic about the presentation and were grateful for the information. The facilitation team concluded that it would have been helpful to meet somewhere in the middle and include a more detailed description of the sea level rise issue. That would have satisfied the informed contingent, while not overwhelming those who were new to the issue, and would have still allowed for the shared learning that went on among participants.

Next Steps

Based on the solutions presented by the participants, and the facilitation team’s understanding of the priorities and capacity of the AP3C and APNEP, they would make the following recommendations to further the effort to help North Carolina meet the demands of a growing coastal population and a rising sea:

Build a green economy

- Provide job training to residents of the coastal plain, in particular targeting lower income residents, to provide them with skills to build green infrastructure and provide other sea level rise adaptation services.
- Provide contracting and certification assistance to coastal plain residents so that they can access state and federal funds for sea level rise adaptation and mitigation projects.
- Promote incentive programs to pay coastal residents, in particular farmers, for managing their land in a way that allows for wetlands to migrate inland.

Education and outreach

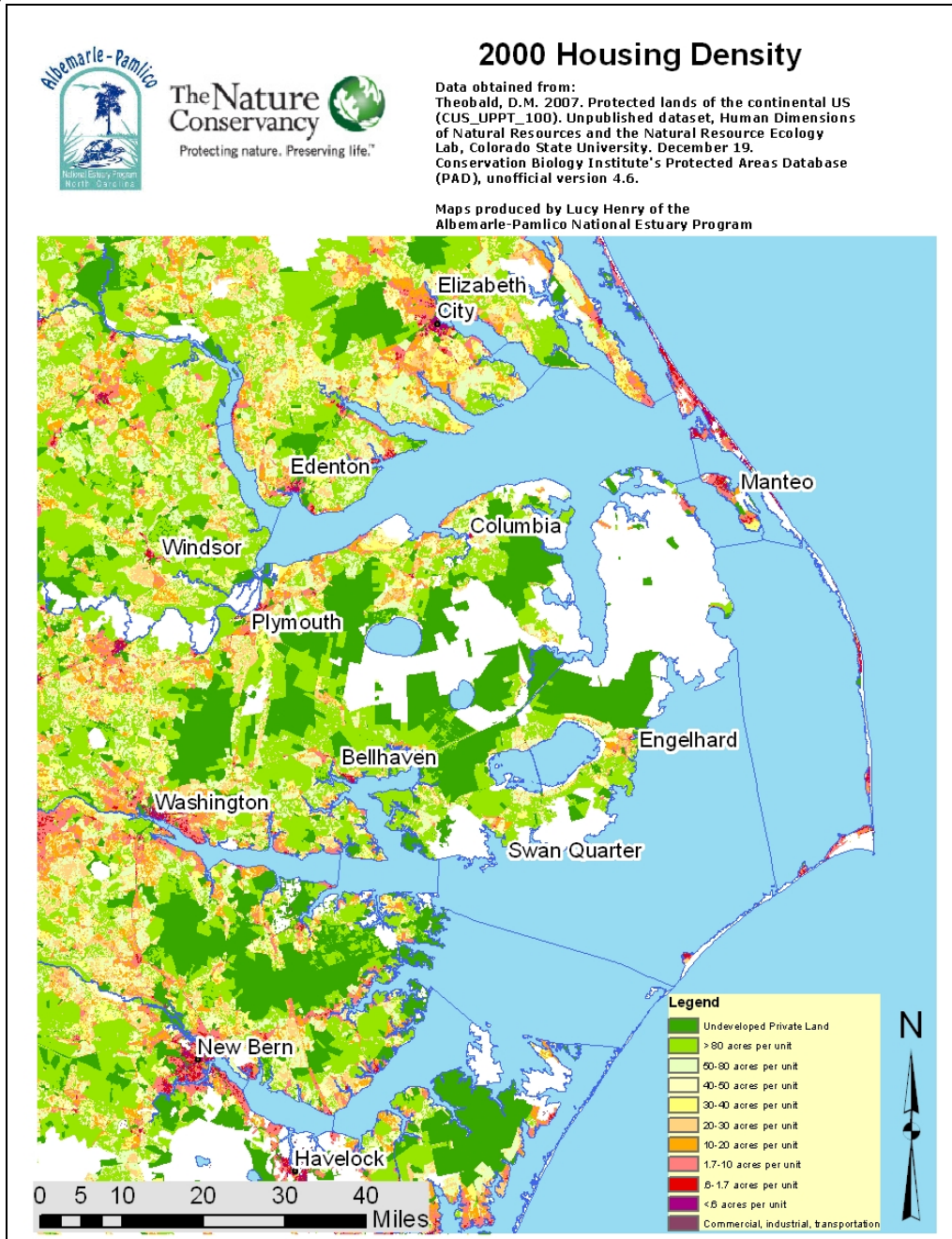
- Improve outreach to underprivileged communities about the implications of sea level rise. Meet people where they are, in their churches, community groups and associations in order to educate them about these issues.
- Encourage the incorporation of sea level rise education in the Institute of Government curriculum.
- Reach out to local governments about the impacts of sea level rise and the concerns of their constituents.
- Develop educational materials for schools so science teachers can incorporate discussion about sea level rise and climate change in their curriculum.
- Provide coastal residents who have an interest in taking action, with the materials from the listening sessions so that they can hold discussions in their own communities.

Conclusion

These listening sessions were only the beginning of what should be a comprehensive outreach campaign to develop solutions to the challenges of sea level rise and population growth. The modest level of participation in the sessions, despite concerted outreach effort, is evidence that inland residents don't think this issue affects them. However, upon hearing about the projections and beginning to contemplate the implications these changes will have on their communities, participants were transformed. This suggests that residents are responsive to the information. After the sessions, several people said they thought this issue only impacted people with homes on the water, but in thinking about the broader social and economic issues they realized that it would affect them in a direct way. This indicates a need for education and outreach to communities that are not yet engaged.

Appendix A: Regional Maps of Population Growth and Sea Level Rise

Only two examples each of population and sea level rise maps are included here. Additional maps can be obtained from the Albemarle-Pamlico National Estuary Program.



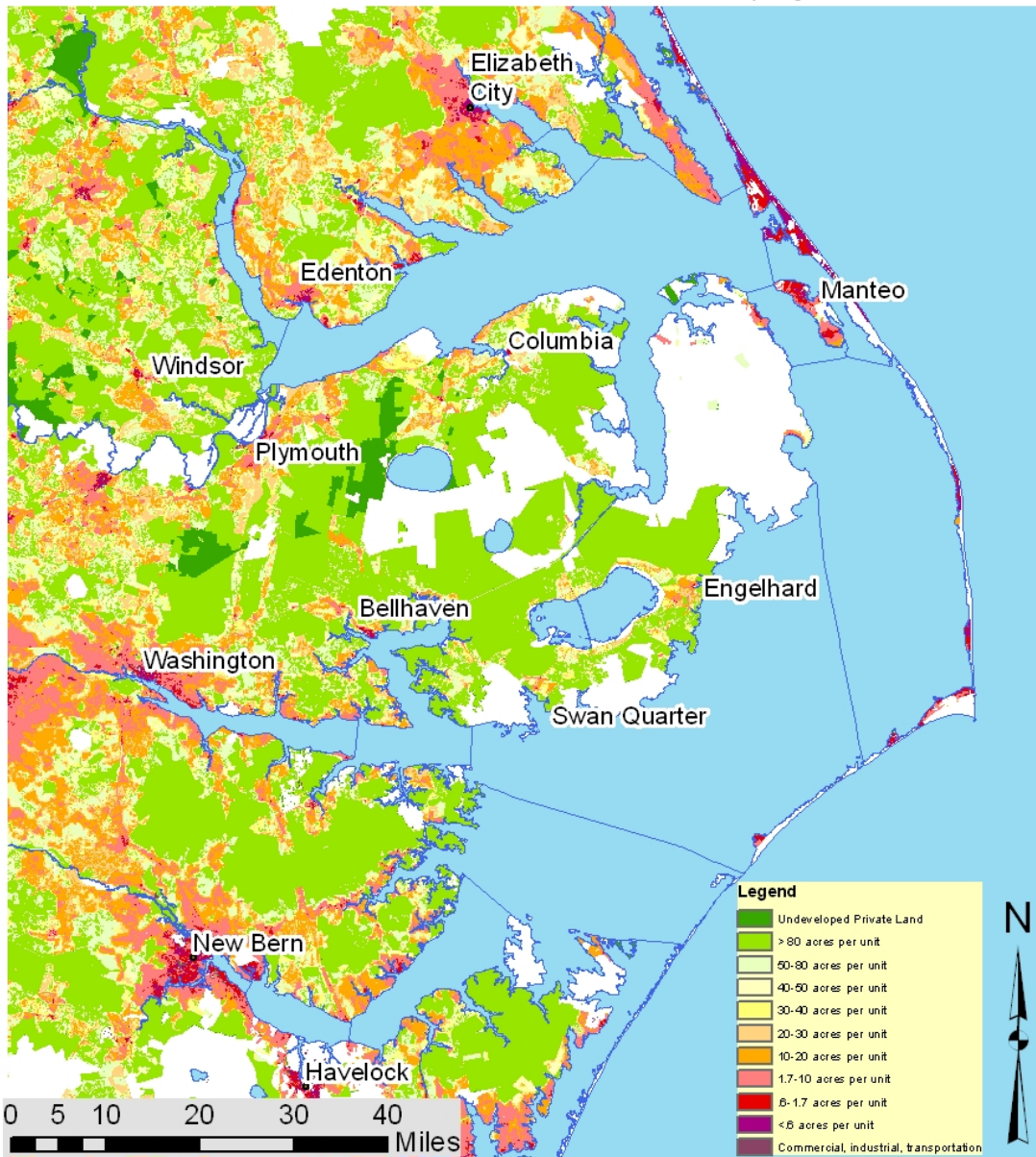
White areas indicate conservation lands.



2030 Projected Housing Density

Data obtained from:
Theobald, D.M. 2007. Protected lands of the continental US (CUS_UPPT_100). Unpublished dataset, Human Dimensions of Natural Resources and the Natural Resource Ecology Lab, Colorado State University. December 19.
Conservation Biology Institute's Protected Areas Database (PAD), unofficial version 4.6.

Maps produced by Lucy Henry of the
Albemarle-Pamlico National Estuary Program



White areas indicate conservation lands.

Potential Inundation from 1 foot Sea Level Rise



Potential Inundation from 5 feet Sea Level Rise



Appendix B: Handouts

Handout 1: Agenda

AGENDA

Sea Level Rise and Population Growth in North Carolina Public Listening Sessions

Facilitated by: Cynthia Brown, Lucy Henry,
Sharon Campbell, and Marilyn Marsh-Robinson

Opening

- Welcome and Introductions
- Why we are here and who are AP3C and APNEP

Setting the Context

- What are you seeing in your community in terms of sea level rise and population growth?
- What are the projections? Looking at a visual representation of sea level rise and population growth through map series.

Implications

- How will this change affect you and your community? Small group discussions.
- Report out and synthesize

Solutions

- What are other communities doing to address sea level rise? What do you think your community should do? What considerations do you think are important for decision-makers to take into account about your community when thinking about adaptation?

Closing

- Next steps
- AP3C opportunities for engagement

Handout 2: Frequently Asked Questions

Frequently Asked Questions: **Sea Level Rise and Population Growth in North Carolina**

How fast is sea level rising?

Current estimates of the rate of sea level rise in North Carolina range from 1.0 to 1.5 feet every 100 years. However, melting ice from glaciers and expanding seas from warmer ocean water temperatures are projected to increase that rate. If the rate of sea level rise continues to increase at today's pace, a 1-foot rise could take as little as 35 years.

For more information, see the publication: "Drowning the North Carolina Coast: Sea-Level Rise and Estuarine Dynamics" by North Carolina Sea Grant Researcher Stanley R. Riggs and East Carolina University Research Associate Dorothea V. Ames. The publication is available from North Carolina Sea Grant by calling (919) 515-2454 or at <http://nsgl.gso.uri.edu/ncu/ncub03002.pdf>. Also see page 2 for more informational resources on sea level rise science.

Does 1 foot of sea level rise mean that the water will move 1 foot onto shore?

No. One foot of sea level rise means that the water will rise vertically by 1 foot. This could mean that the water moves miles onto land, depending on the number of ditches, the elevation of the surrounding land, and the impacts of storms on the coastal landscape.

What impact will sea level rise have on North Carolina's coastline?

As sea level rises along North Carolina's coast, there will be increased erosion, greater economic losses from flooding and storm damage, and damage to coastal wetlands and habitats.

How vulnerable is North Carolina's coastline to sea level rise?

Because of low lying areas, especially in the northeastern section that surrounds the Albemarle and Pamlico sounds, the North Carolina coastline is expected to be in the top three areas in the United States most affected by sea level rise. More than 2,000 square miles of North Carolina's coast is less than 3 feet in elevation.

How fast is North Carolina's coastal population growing?

North Carolina's population is expected to increase 50 percent by 2025. Much of this growth is happening in the Piedmont, but the coastal areas of North Carolina continue to attract new development. During the last 30 years, the coastal counties have experienced more than 100 percent growth in new housing units and are expected to continue experiencing growth in services for seasonal residents and retirees.

Where can I learn more about the science behind sea level rise?

“Drowning the North Carolina Coast: Sea-Level Rise and Estuarine Dynamics” by North Carolina Sea Grant Researcher Stanley R. Riggs and East Carolina University Research Associate Dorothea V. Ames, is available from North Carolina Sea Grant by visiting www.ncseagrant.com/index.cfm?fuseaction=page&filename=Drowning_Coast.html or by calling (919) 515-2454.

Visit the Environmental Protection Agency’s sea level rise Web site at: yosemite.epa.gov/oar/GlobalWarming.nsf/content/ResourceCenterPublicationsSeaLevelRiseIndex.html.

See this report from the National Academy of Sciences, “Understanding and Responding to Climate Change,” 2008 edition available at: http://dels.nas.edu/dels/rpt_briefs/climate_change_2008_final.pdf.

Visit the Intergovernmental Panel on Climate Change Web site, www.ipcc.ch.

Visit the Pew Center on Climate Change Web site, www.pewclimate.org.

Visit the North Carolina Office of Environmental Education Informed Consumer Web site for links to information on climate change: www.eenorthcarolina.org/consumer/global.html.

Pearsall, S. and B. Poulter (2005) Adapting coastal lowlands to rising seas. A Case Study in M.J. Groom, Meffe, G.K. and Carroll, C.R. (Editors). “Principles of Conservation Biology” (3rd Edition), Sinauer Press, Sunderland, Mass. Available from Sam Pearsall at the Nature Conservancy at sampearsall@TNC.ORG.

Rahmstorf, S. 2006. "A Semi-Empirical Approach to Projecting Future Sea-Level Rise." Science:DOI: 10.1126/science.1135456.

Bin, O., Poulter, B., Dumas, C., and John Whitehead. “Measuring the Impacts of Climate Change on North Carolina Coastal Resources.” “Final Report to the National Commission on Energy Policy.” March 15, 2007. Available at <http://econ.appstate.edu/climate/NC-NCEP%20final%20report.031507.pdf>.

Frequently Asked Questions:
Adaptation to Sea Level Rise in North Carolina

How is North Carolina planning for sea level rise?

1. Passed by the North Carolina General Assembly in 1974, the Coastal Area Management Act, or CAMA, establishes policies, guidelines and standards to manage the natural ecological conditions of the coastal environment as well as to regulate development and preservation of the land and water resources of the coastal area. Rules that govern coastal development are public record under chapter 132 of the North Carolina General Statutes. Although neither CAMA nor the Administrative Code address

sea level rise directly, both emphasize an understanding that the state's shorelines are in a constant state of flux. Examples of this emphasis include:

- a. The ban on hardened oceanfront structures (CAMA).
- b. The significance and primary causes of coastal hazards in North Carolina, and acknowledgement that landforms (in particular beaches, dunes, and inlets) are in a permanent state of flux (section 07H .0302).
- c. Oceanfront setbacks are tied to erosion rates (section 07H.0306). By their very nature, setbacks tied to long-term erosion rates take sea level rise into account, as it is one of the drivers of shoreline change from which erosion rates are determined.
- d. New development along estuarine and public trust shorelines shall be located a distance of 30 feet landward of the normal water level or normal high water level, with the exception of water-dependent uses (section 07H .0209 D10).
- e. The reference to normal high water or normal water level (e.g. section 07H .0106) as opposed to mean high water. Normal high water is the ordinary extent of high tide based on site conditions such as presence and location of vegetation, which has its distribution influenced by tidal action, and the location of the apparent high tide line.
- f. The state's Coastal Resource Commission requirement that all local communities prepare and adopt a land use plan conforming to CAMA. As part of this condition, section 07B.0702 includes an objective that local land-use plans are to address natural hazards towards minimizing risks. An example of one such natural hazard is sea level rise.

For more information on the North Carolina Administrative Code (Title 15A, Chapter 7, Coastal Management), go to: www.nccoastalmanagement.net/Rules/current.htm.

For more information on the Coastal Area Management Act, go to: www.nccoastalmanagement.net/Rules/cama.htm.

2. In 2007, the North Carolina Administrative Code (Title 15A, Chapter 7, Coastal Management) was expanded to address changes in shoreline configuration. Specifically, the passage states that permits for development in Subchapter 7H Section .0300 - Ocean Hazard Area, "shall include the condition that any structure shall be relocated or dismantled when it becomes imminently threatened by changes in shoreline configuration."

For more information on rule 15A NCAC 07H .0306 - General Use Standards for Ocean Hazard Areas under chapter 132 of the North Carolina General Statutes, go to: www.dcm2.enr.state.nc.us/Rules/current.htm.

3. A North Carolina legislative commission on climate change was convened in 2005, called the Climate Action Plan Advisory Group, or CAPAG. The group released policy recommendations in 2007 detailing how North Carolina's industries could limit their climate change impacts.

For more information on CAPAG, visit www.ncclimatechange.us.

4. In 2008, the Albemarle-Pamlico National Estuary Program was selected to be part of EPA's Climate Ready Estuaries pilot project. This initiative will involve the creation of a climate adaptation plan for the Albemarle-Pamlico region.

For more information on the Climate Ready Estuaries project, visit www.epa.gov/owow/estuaries/cre.html or www.apnep.org.

Numbers 1 and 2 are extracted from: Rubinoff, P., Vinhateiro, N. D., and C. Piecuch. Summary of Coastal Program Initiatives that address Sea Level Rise as a result of Global Climate Change. February, 2008. Rhode Island Sea Grant/Coastal Resources Center University of Rhode Island. Available at <http://seagrant.gso.uri.edu/ccd/haz.html>

What initiatives are going on in North Carolina to study sea level rise impacts?

1. In North Carolina, NOAA's Center for Sponsored Coastal Ocean Research has partnered with local research institutions with the goal of enhancing managers' ability to analyze and use climate-relevant information in their decision-making through sustained science. The Sea Level Rise - North Carolina Pilot Project aims to inform state and local decision-makers and the public in North Carolina about the local and regional effects of current and future sea level rise. The following studies (partners indicated in parentheses) are examples of this effort:

a. *Climate Change and Intertidal Risk Analysis: Forecasting the Effects of Climate Change on the Biogeography of Foundation Species in Estuarine and Rocky Intertidal Ecosystems* (University of South Carolina Research Foundation);

b. *Ecological Effects of Sea-Level Rise on Coastal North Carolina Marshes* (University of South Carolina, Vanderbilt University, East Carolina University, and the U.S. Geological Survey);

c. *Modeling Estuarine Habitat Response to Rising Water Level* (University of North Carolina at Chapel Hill, UNC Institute of Marine Sciences); and

d. *Shore-Zone Modification in Response to Sea Level Rise in North Carolina Estuaries* (East Carolina University and University of Pennsylvania).

Extracted from: Rubinoff, P., Vinhateiro, N. D., and C. Piecuch. Summary of Coastal Program Initiatives that address Sea Level Rise as a result of Global Climate Change. February, 2008. Rhode Island Sea Grant/Coastal Resources Center University of Rhode Island. Available at <http://seagrant.gso.uri.edu/ccd/haz.html>.

For more information about the Sea Level Rise – North Carolina Pilot Project, go to: www.cop.noaa.gov/stressors/climatechange/current/slr/welcome.html.

2. The “Planning for the Impacts of Sea Level Rise and Climate Change Workshop” (January 31 – February 1, 2007) brought together more than 50 coastal managers and stakeholders to discuss and identify potential modeling and mapping tools to help plan for and mitigate future sea level rise. As stated in the workshop summary, the attendees identified five key concerns and needs:

- a. Tools should incorporate information ascertained through scientific research and modeling that can be easily applied by state and local governments and large land owners when planning future land use and deciding on policy and regulations that affect coastal resources;
- b. Tools should forecast expected habitat changes, especially potential loss of habitats important for ecological services;
- c. Tools easy to translate to decision-makers;
- d. Tools to enable easy understanding of potential risks to people and development due to future flooding and related hazards; and
- e. Continued engagement of NOAA and their research partners with workshop attendees via email and the web.

For more information on the workshop, go to:

www.cop.noaa.gov/stressors/climatechange/current/slr/SLR_mgr_mtg_summary.pdf.

3. Published by the North Carolina Department of Environmental and Natural Resources/North Carolina Sea Grant, “Drowning the North Carolina Coast: Sea-Level Rise and Estuarine Dynamics” provides in-depth information about erosion processes and rates along North Carolina’s northeastern estuarine shoreline. The authors also examine sea level rise and its role in changing the shoreline, as well as the evolution of the estuarine system. The book was funded with grants from the National Oceanic and Atmospheric Administration, the N.C. Division of Coastal Management, and the Albemarle-Pamlico National Estuary Program.

For more information on “Drowning the North Carolina Coast: Sea-Level Rise and Estuarine Dynamics,” go to: nsgl.gso.uri.edu/ncu/ncub03002.pdf.

4. The North Carolina Coastal Program serves on the state Legislative Commission on Global Climate Change. The North Carolina Coastal Program, in collaboration with the N.C. Division of Water Resources, will address sea level rise and other issues in the state’s first comprehensive beach and inlet management plan (to be completed by March

2009).

For more information on the Legislative Commission on Global Climate Change, go to: www.ncga.state.nc.us/gascripts/Committees/Committees.asp?sAction=ViewCommittees>ActionDetails=Non-Standing_6268.

5. A report entitled “Measuring the Impacts of Climate Change on North Carolina Coastal Resources” was released in March 2007 to the National Commission on Energy Policy. The report was prepared by a team of representatives from East Carolina University, the University of North Carolina at Wilmington, Duke University, and Appalachian State University.

For more information on the report, go to: econ.appstate.edu/climate/.

6. The North Carolina Beach, Inlet & Waterway Association’s 2007 Annual Conference theme was “Everything You Always Wanted to Know about Sea Level Rise, But Were Afraid to Ask (and Other Timely Topics).” Conference presenters and attendees included local government officials, scientists, engineers, contractors, policy makers, managers, and other interested parties.

For more information on the conference presentations, go to: www.coastalplanning.net/projects/NCBIWA/NCBIWA07.html.

7. The N.C. Division of Coastal Management is working on a project that will map the estuarine shoreline, shoreline types and coastal structures. It is hoped that this project will succeed in mapping the entire North Carolina estuarine system. The maps will be used as a tool to monitor and manage sea level rise, wetland retreat and loss, erosion, and development impacts.

8. As a result of the Coastal Habitat Protection Plan, meetings held with marine contractors in 2007 and a report submitted by the North Carolina Estuarine Biological and Physical Processes Workshop in 2006, the Division of Coastal Management is working towards updating shoreline stabilization rules in order to encourage alternatives to vertical shoreline protective structures, such as living shorelines, as well as shoreline stabilization measures that will allow more of the natural shoreline to remain. Further, the DCM has produced a set of proposed rule changes as well as other recommendations for shoreline stabilization structures for various shoreline types, and presented these recommendations to the Implementation and Standards Committee in September 2007.

For more information on the report, go to: www.nccoastalmanagement.net/Hazards/EWG%20Final%20Report%20082106.pdf.

For more information on the estuarine shoreline programs, go to: www.nccoastalmanagement.net/Hazards/estuarine.htm.

Handout 3: Strategies for Adaptation to Sea Level Rise

Adapted from:
Report of the Coastal Zone Management Subgroup
STRATEGIES FOR ADAPTION TO SEA LEVEL RISE
Intergovernmental Panel on Climate Change
Response Strategies Working Group
November, 1990

Types of Responses:

The responses required to protect human life and property fall broadly into three categories: retreat, accommodation and protection.

Retreat involves no effort to protect the land from the sea. The coastal zone is abandoned and ecosystems shift landward. This choice can be motivated by excessive economic or environmental impacts of protection. In the extreme case, an entire area may be abandoned.

Accommodation implies that people continue to use the land at risk but do not attempt to prevent the land from being flooded. This option includes erecting emergency flood shelters, elevating buildings on piles, converting agriculture to fish farming, or growing flood or salt-tolerant crops.

Protection involves hard structures such as sea walls and dikes, as well as soft solutions such as dunes and vegetation, to protect the land from the sea so that existing land uses can continue.

Types of Solutions:

Technical, Engineering, and Structural options

- Develop improved flood drainage and water management techniques
- Develop low-cost, low-technical protection including artificial reefs and oyster bed restoration

Biological options

- Allow wetlands to migrate onto unoccupied upland areas, such as agricultural land, as sea level rises
- Plant salt-tolerant plants that will adapt to changing conditions

Non-structural options

- Educate the public and government officials concerning the potential impact of sea level rise
- Retreat to allow roll over of dunes and allow vulnerable land to return to nature

Handout 4: Case Studies in Sea Level Rise Adaptation

Case Studies in Sea Level Rise Adaptation

Protecting Historic Resources – North Carolina

Cape Hatteras Lighthouse, the tallest brick lighthouse in the United States, stood 1,500 feet from the Outer Banks shoreline in North Carolina when it was built in 1870. By 1998, the lighthouse stood only 120 feet from the sea. Using predictions of future sea-level rise, analysts expected the lighthouse would be lost to the sea by the year 2018 if no action were taken. The lighthouse is an important historical site with intrinsic value. The National Park Service determined that the most feasible way to save the lighthouse was to move it 2,900 feet farther inland at a cost of \$4.6 million.

Scientists expect sea-level rise in the region of at least 2.4 inches by the year 2018, which would cause the North Carolina shoreline to retreat a minimum of 157 feet. This amount of retreat would have ensured the destruction of the lighthouse. North Carolina, along with the National Park Service, commissioned several studies on how to protect the lighthouse from being lost to the sea.

The National Academy of Sciences asked a panel of experts to recommend the best long-term solution to save the lighthouse. The panel determined that relocating the lighthouse was the most cost-effective way to save this national historic landmark. The relocation process began on Dec. 14, 1998 and the lighthouse was reopened at its new location, 2,900 feet inland, on May 26, 2000.

Given the rate of sea-level rise, the panel also noted that future moves of the lighthouse probably would be necessary. Therefore, steel lifting beams were left under the lighthouse so that reliable and cost-effective incremental relocation can be undertaken as the need arises.

For more information, see http://www.cara.psu.edu/case_studies/actionexamples.asp.

Adaptation Planning - King County, Washington

On Oct. 27, 2005, King County in the state of Washington convened a conference about climate change impacts and adaptation options that involved Washington state governments, businesses, tribes, farmers, non-profits and the community. More than 650 people attended the conference. Stemming from this conference, they developed a King County Climate Plan in 2007 in which they identified six priority impact areas. The climate plan details impacts to each of these areas, but also sets forth goals to adapt in each area. They identified the following priority areas:

- Climate science
- Public health, safety and emergency preparedness
- Surface water management, freshwater quality and water supply
- Land use, buildings and transportation
- Financial and economic impacts

– Biodiversity and ecosystems

One goal in the area of land use, buildings and transportation includes a commitment to review all county plans, policies and investments for consideration or inclusion of climate change impacts (e.g. Regional Hazard Mitigation Plan, Shoreline Master Plan, River and Floodplain Management Program, transportation infrastructure plans, etc.). Actions under this goal include strategies to deal with coastal flooding and sea level rise.

For more information, go to www.kingcounty.gov/globalwarming.

Adaptation in State Policy - Natural Resources Protection Act, Maine

Erosion has reduced the recreational and economic value of beaches and caused considerable damage to coastal properties in Maine. Because of sea-level rise and the landward migration of the ocean, the state enacted the Natural Resources Protection Act in 1988. The act requires anyone wishing to construct or change a structure within a protected natural resource area or land adjacent to water or a wetland, to obtain a permit (at a fee of \$50) and maintain a 25-foot buffer between the project area and the protected land.

The state of Maine concluded that “hard structures” such as groins, jetties, breakwaters, seawalls, and dune development prevent the beach and ocean’s natural migration/adaptation process and have a negative impact on the coast. The state also concluded that sea level is rising, which will increase the rates of shoreline erosion, flooding and risk of damage to coastal property.

To protect and enhance Maine’s coastal resources, (while simultaneously preventing any unreasonable impact, degradation or destruction of these resources), the Natural Resources Protection Act prohibits construction of “hard structures” as well as new development in frontal dune areas adjacent to the beach. The act also requires that a 25-foot buffer be maintained between the site of any activity and protected waterways.

Because it is often not practical to move structures in areas expected to be affected by a rise in sea level, the act prohibits construction of large buildings in such areas unless there is evidence that the site will be stable after a 3-foot sea-level rise. The act directs the overseeing board to consider future sea-level rise in determining the density, location and size of structures.

The state anticipates that enforcement of the Natural Resources Protection Act will protect the natural supply and movement of sand, will prevent creation of new flood hazard areas and stabilize the beach. In turn, this is expected to prevent further erosion and loss of recreational and economic value.

For more information, go to http://www.cara.psu.edu/case_studies/actionexamples.asp.

Protection Engineering - Absecon Island Shore Project, New Jersey

To reduce beach erosion along the oceanfront and protect homes and businesses from the rising sea, in 2003 the U.S. Army Corps of Engineers together with the New Jersey Department of Environmental Protection began a \$63 million beach and dune system along the 8.5-mile oceanfront of Absecon Island. Absecon Island is home to Atlantic City, Ventor, Margate and Longport.

During coastal storms, the oceanfront of Absecon Island has been one of the hardest hit of New Jersey's barrier islands, especially during nor'easters. Numerous shoreline protection projects including seawalls, beach nourishment and bulkheads have been completed in this area. But much of the shoreline continued to erode, and storms continued to cause flooding from the ocean side, despite the bulkheads.

In 1992, the U.S. Army Corps of Engineers and the New Jersey Department of Environmental Protection studied ways to reduce Absecon Island's storm damage due to flooding and wave attack and to minimize shoreline erosion. Objectives included:

- * Reducing the impacts of long-term beach erosion along the oceanfront
- * Improving the stability and longevity of beaches and shore protection structures
- * Reducing storm flooding and wave damage along both ocean and inlet frontages

Using a computer model that simulated storm events from 5- to 500-year frequency, the study team estimated monetary damages from storm-induced erosion, wave attack and inundation (flooding) under different protection scenarios. They concluded that building a 16-foot-high dune and 200-foot-wide berm in Atlantic City would yield net benefits of \$957,000. For the secondary project area of Ventor, Margate and Longport, a 14-foot-high dune and 100-foot-wide berm would yield net benefits of \$592,000.

For more information, go to http://www.cara.psu.edu/case_studies/actionexamples.asp.

Managed Retreat – United Kingdom

For many years, coastal landowners in Britain have tried to protect their land and homes by building seawalls. However, sea levels are rising faster than humans can keep the water out. At Abbott's Hall Farm in Essex, England, five holes have been made in the existing seawall, creating up to 300 acres of salt marsh and grazing marsh at a cost of £3 million.

This sacrificed land would have turned into mud flats or salt marshes on its own years ago (but had been protected by the seawall before it deliberately was breached). Sacrificing land acts to absorb energy from incoming waves, reducing their impact farther inland. As long as the ground is left alone, it will absorb water and prevent it from traveling so far inland. Thus sacrificing low-lying land actually protects (or saves) nearby slightly higher land.

Sacrificing poorly used land also creates a healthy and rich environment for marine species. Salt marshes and estuaries face increased erosion pressure as sea levels rise;

England has experienced a 40 percent loss of salt marshes during the last 25 years. Sacrificing marginal lands can help to replace some of these salt marshes.

For more information, go to http://www.cara.psu.edu/case_studies/actionexamples.asp.

Water Management - FRaME: Flood Risk Management in Estuaries – European Union

FRaME is a European Union initiative that aims to reduce flood risk by employing methods such as flood control areas. Flood control areas store seawater when levels are high and later release the water in a controlled way. A number of demonstration sites were developed. The United Kingdom site is Alkborough Flats. Community involvement is key to the success of the project. The public is kept well-informed and benefits such as economic opportunities and recreational activities are promoted. Low-lying land near Alkborough village (1,000 acres) was reclaimed from the estuary and embanked to make it usable for farming.

For more information, go to <http://www.frameproject.eu/>.

Urban Drainage - AUDACIOUS Project – United Kingdom

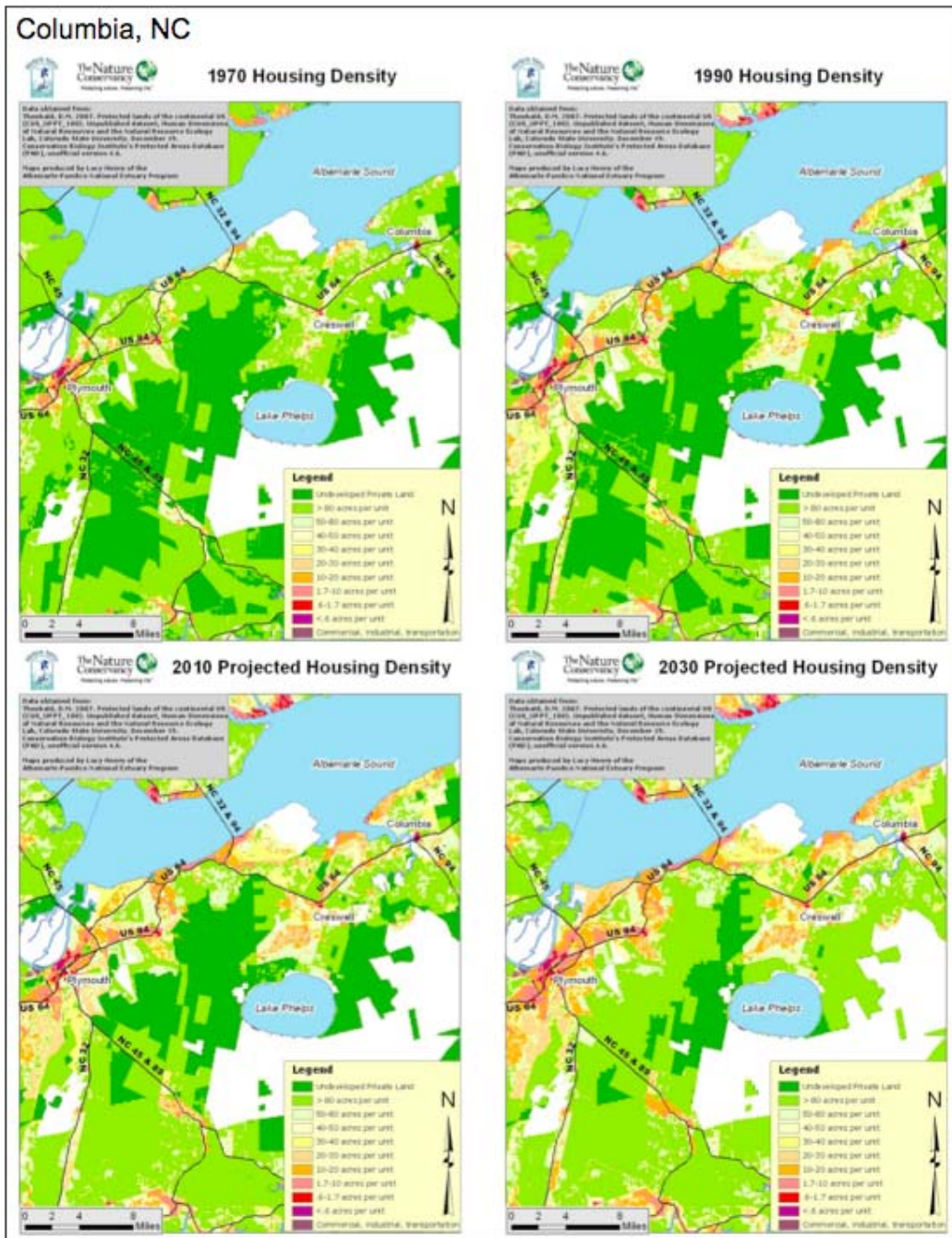
Adaptable Urban Drainage - Addressing Change In Intensity, Occurrence And Uncertainty of Stormwater, or AUDACIOUS, brings together hydrologists, building drainage and sewer engineers, health, social and infrastructure economic specialists, to develop tools and procedures for the assessment and mitigation of the effects of climate change on urban drainage systems. AUDACIOUS aims to investigate key aspects of the effects of climate change on existing drainage in urban areas and provide tools for drainage managers and operators to adapt to uncertain future climate change scenarios. This plugs a gap in current drainage related research, in that it is proposed to establish a rational framework for problem-oriented, cost-efficient, adaptable and sustainable decision-making for those owning and responsible for managing, operating, regulating and developing urban drainage systems to mitigate likely future problems arising as a result of climate change.

For more information, go to <http://www.eng.brad.ac.uk/audacious/>.

Other case studies can be found at:

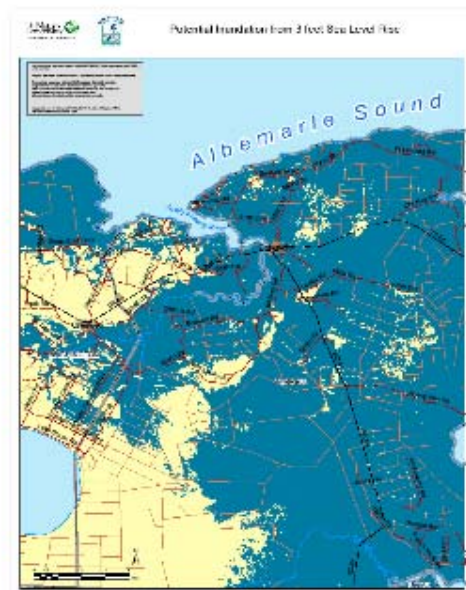
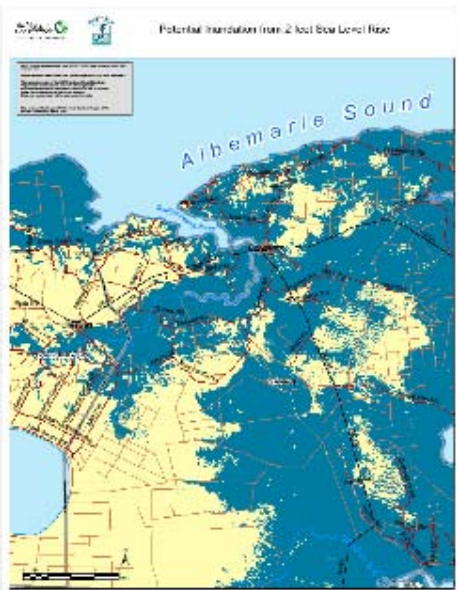
The Consortium for Atlantic Regional Assessment is at http://www.cara.psu.edu/case_studies/.

Handout 5: Local Maps of Population Growth and Sea Level Rise

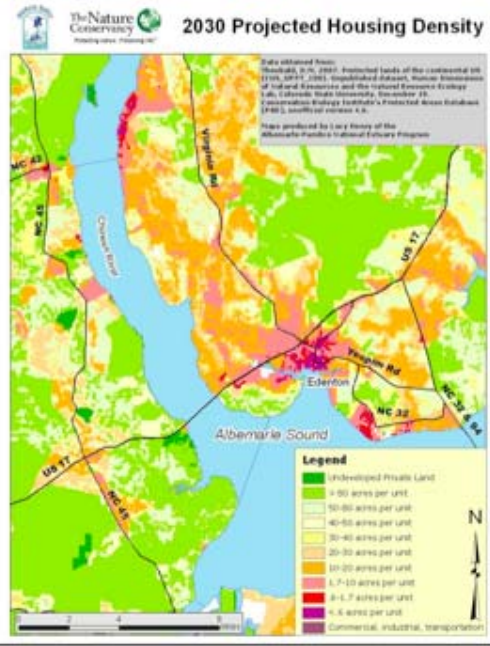
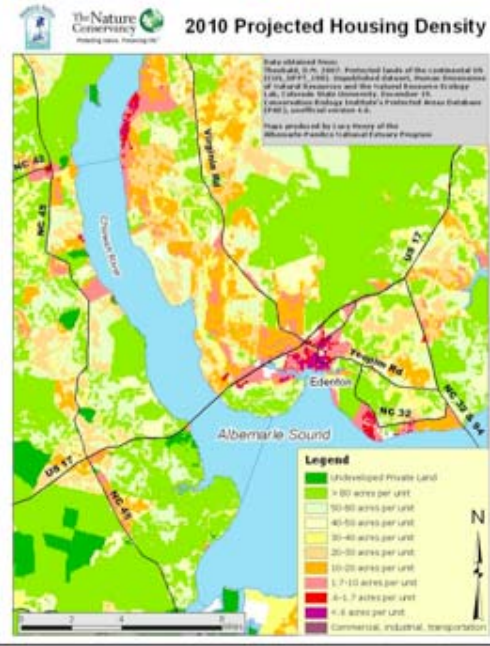
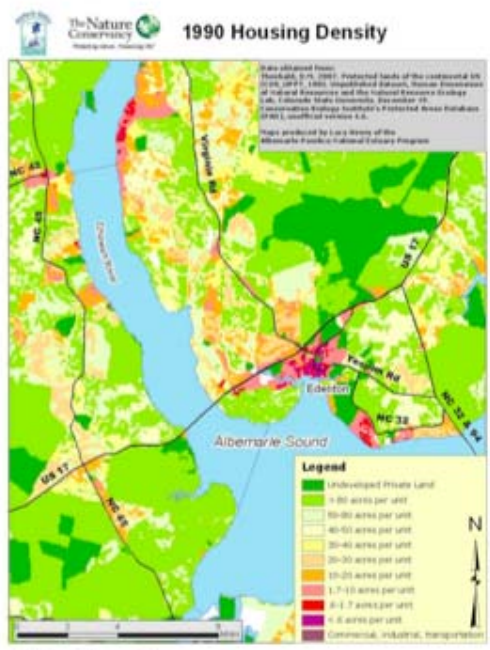


White areas indicate conservation lands.

Columbia, NC



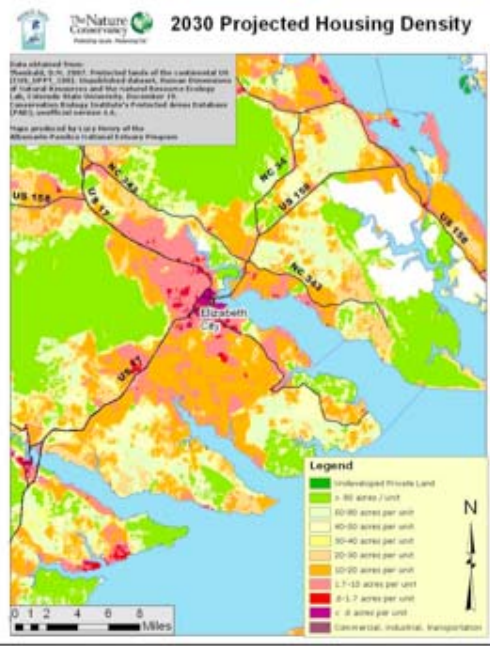
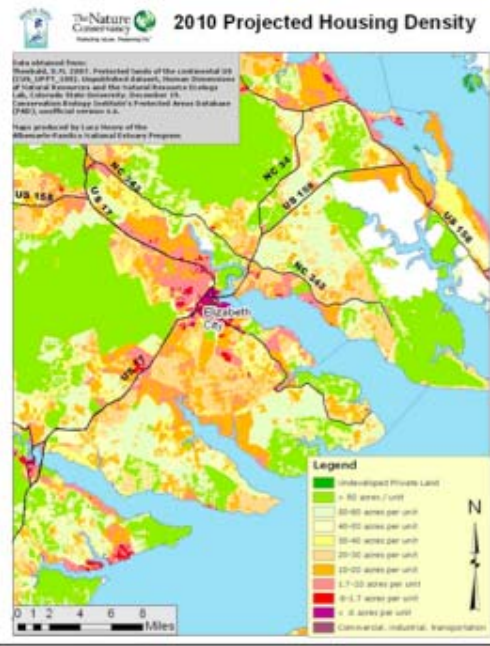
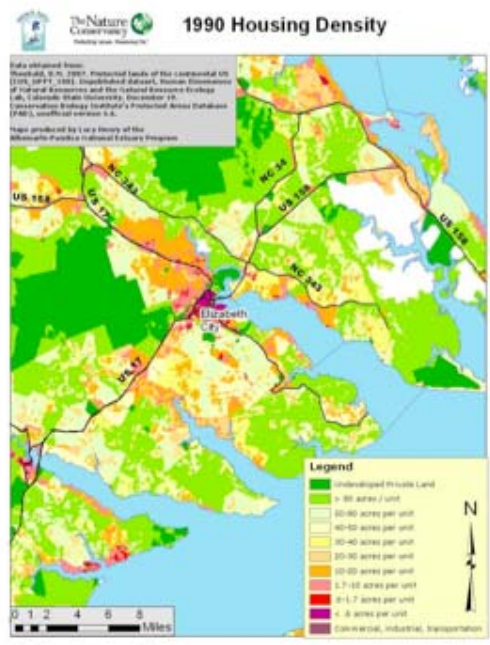
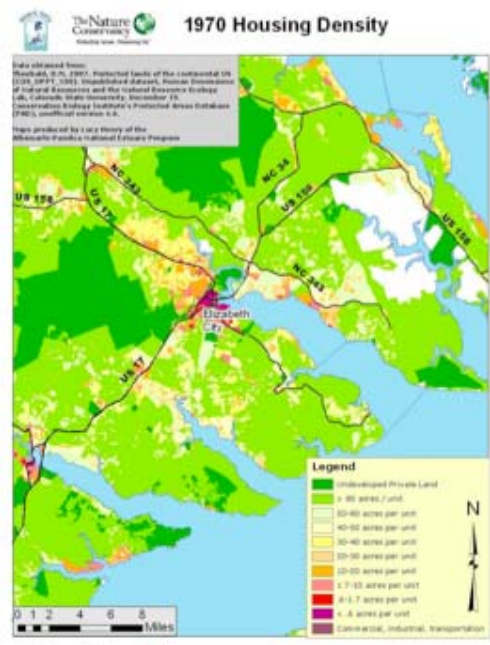
Edenton, NC



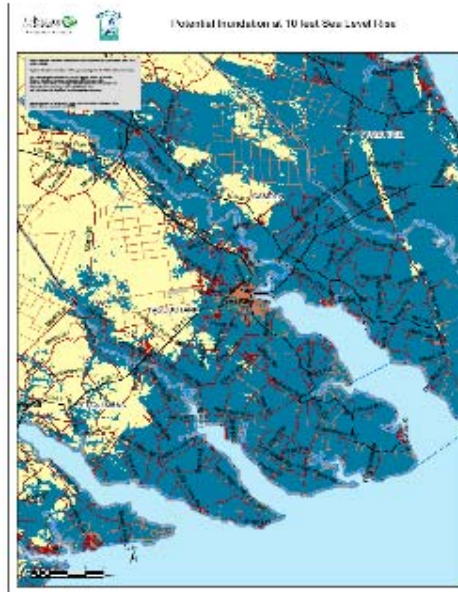
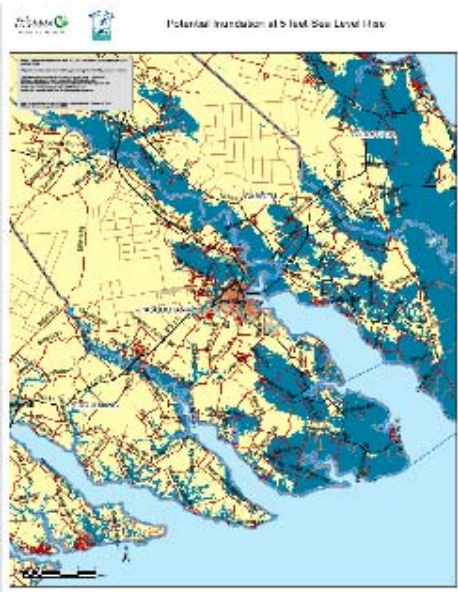
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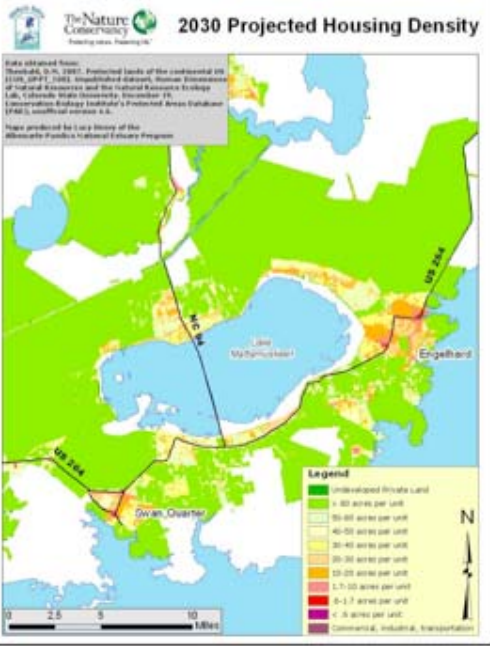
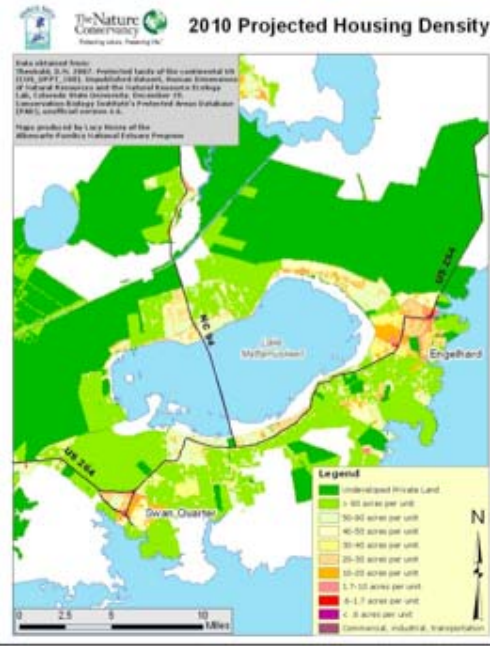
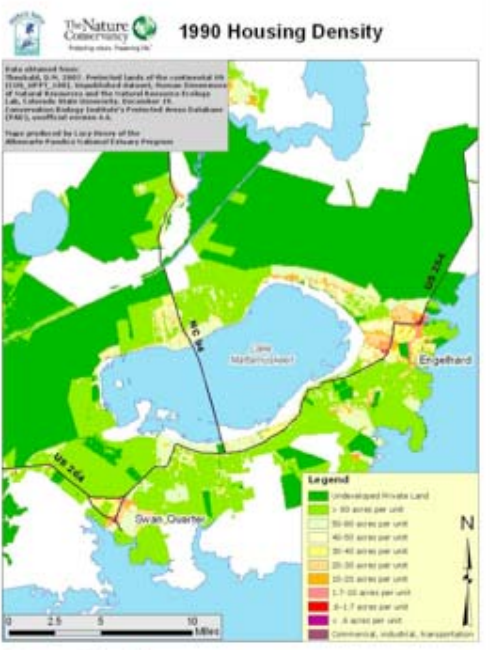
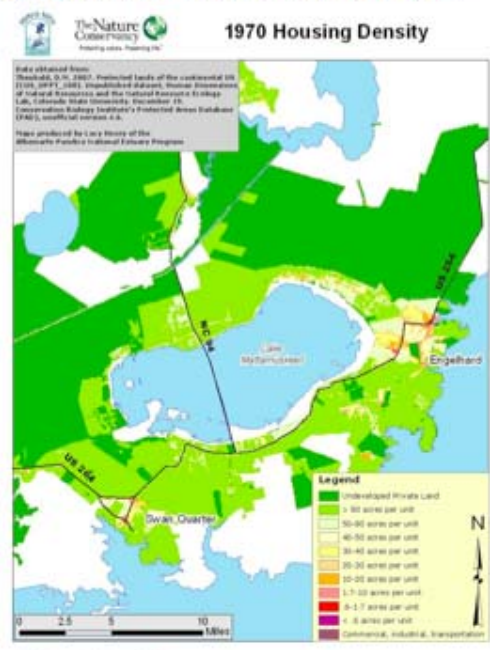
Elizabeth City, NC



Elizabeth City, NC



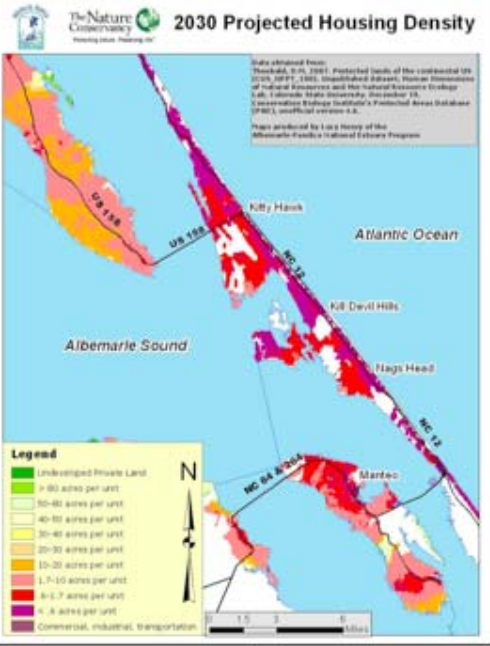
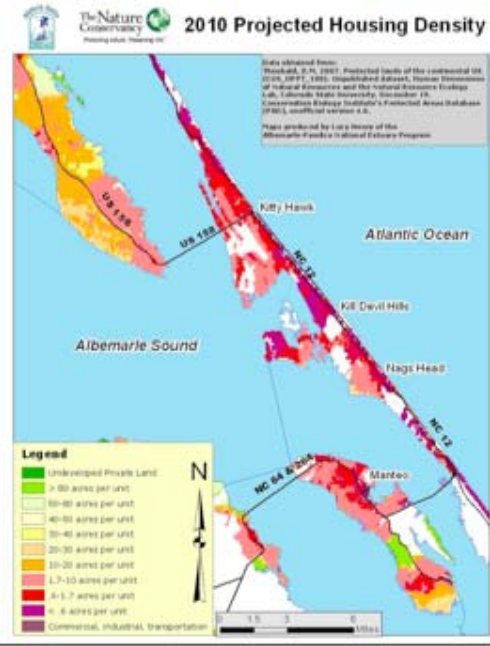
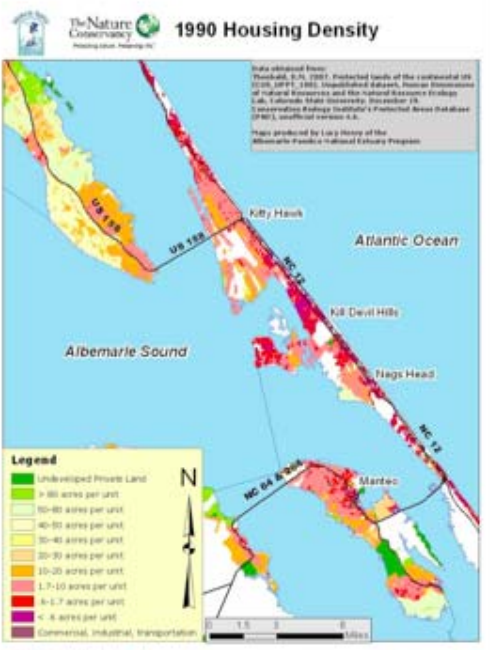
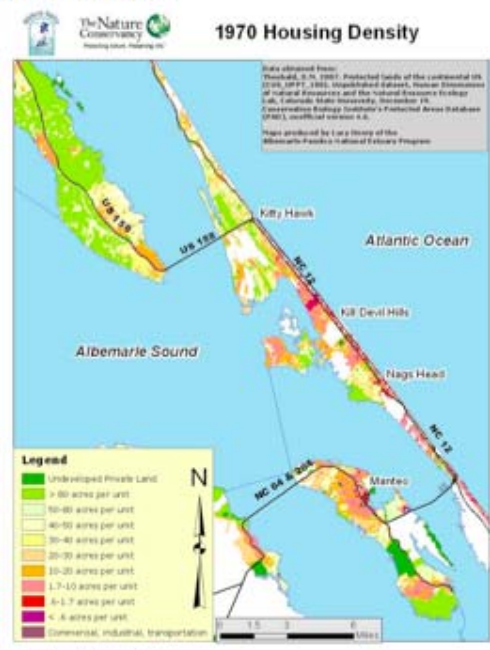
Engelhard and Swan Quarter, NC



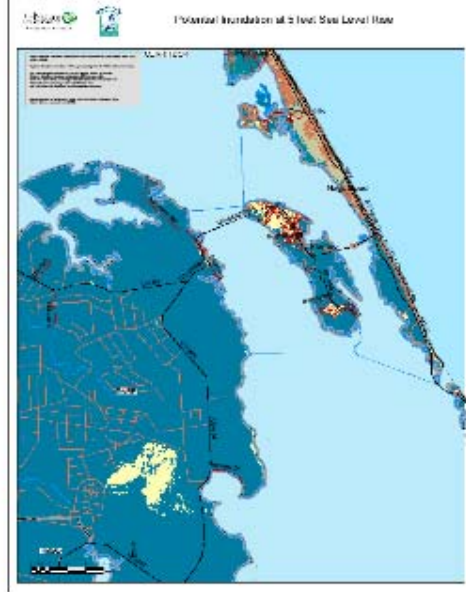
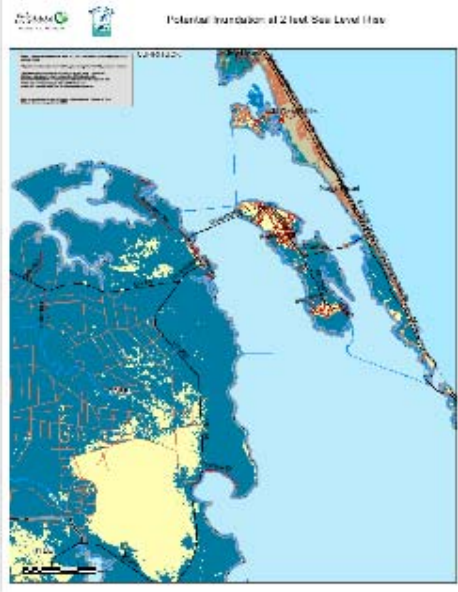
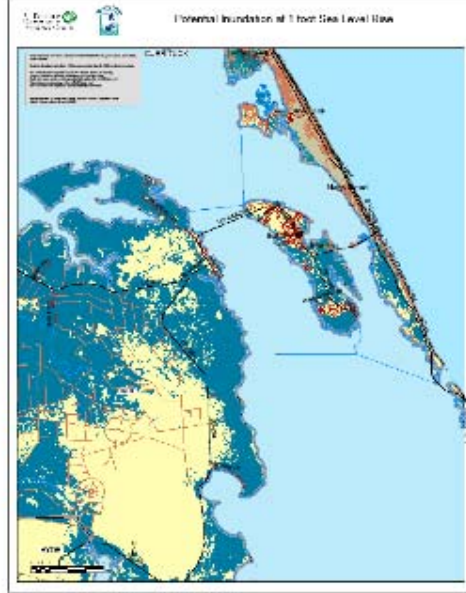
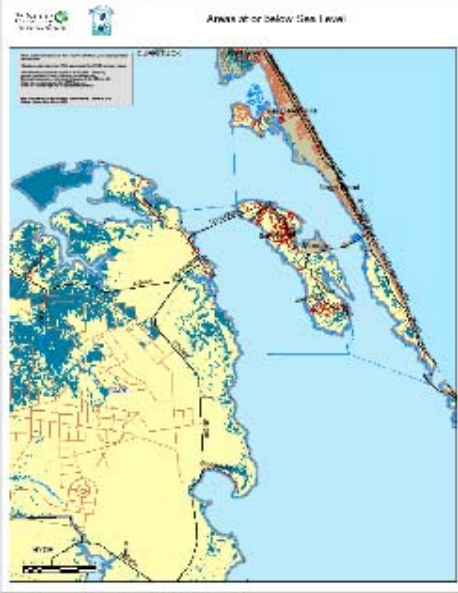
Engelhard, NC



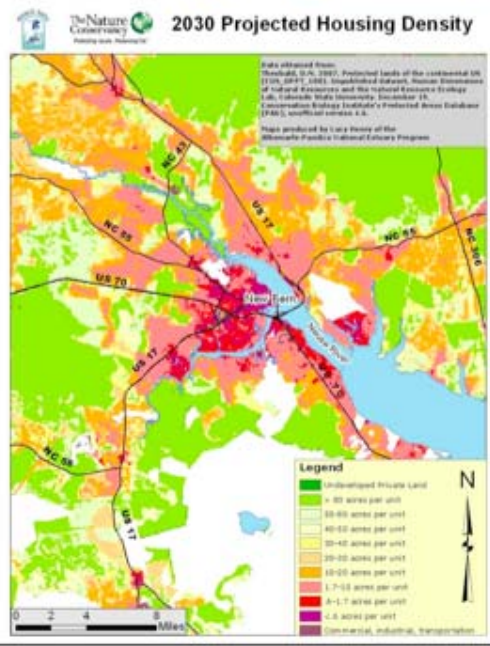
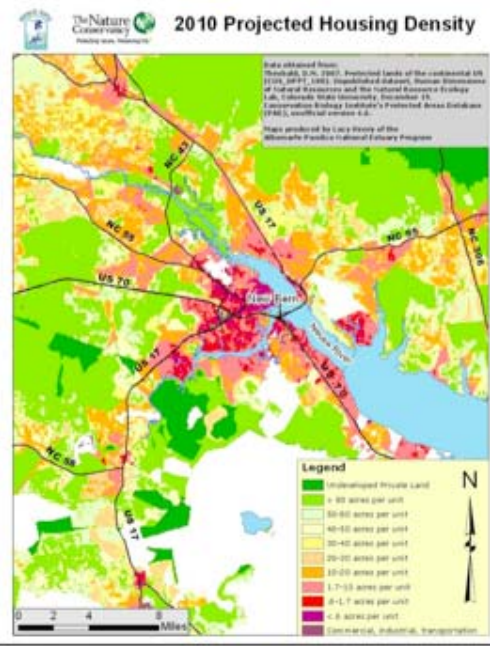
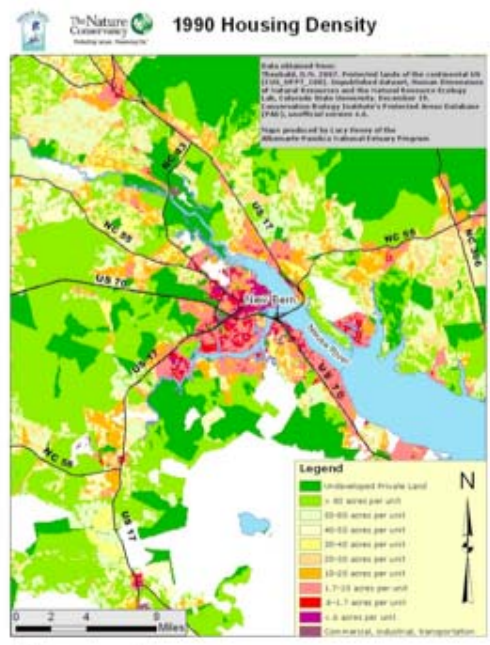
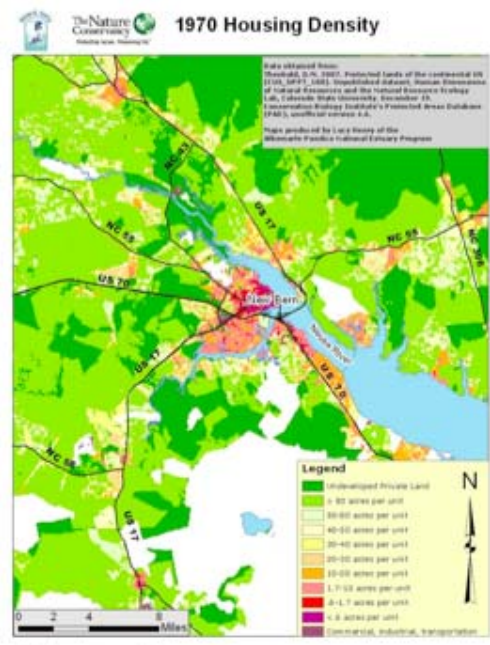
Manteo, NC



Manteo, NC



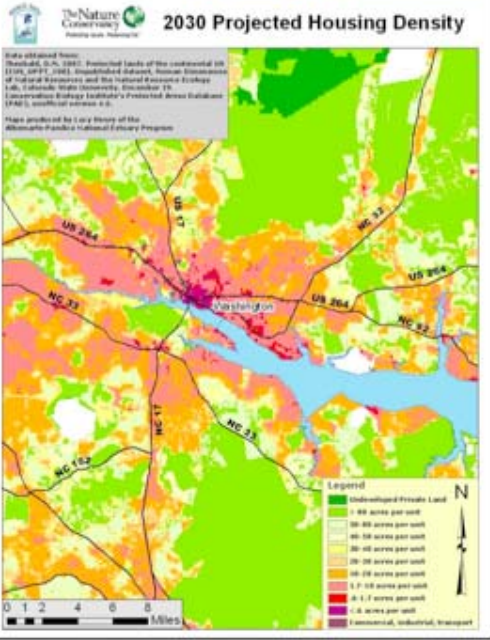
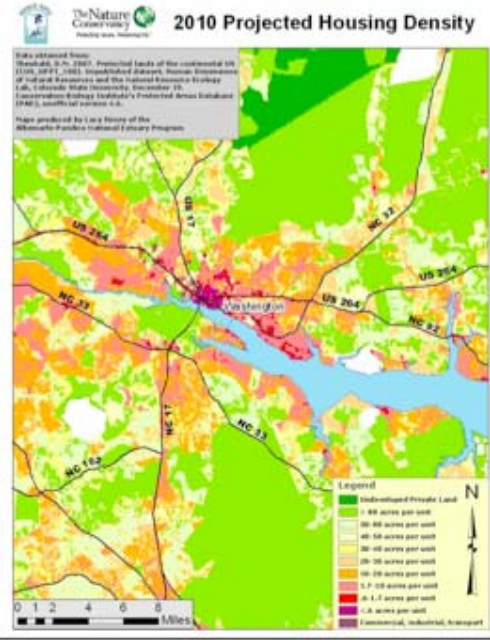
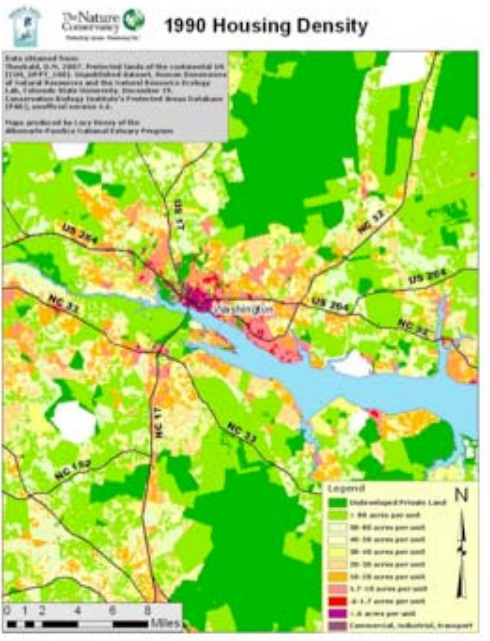
New Bern, NC



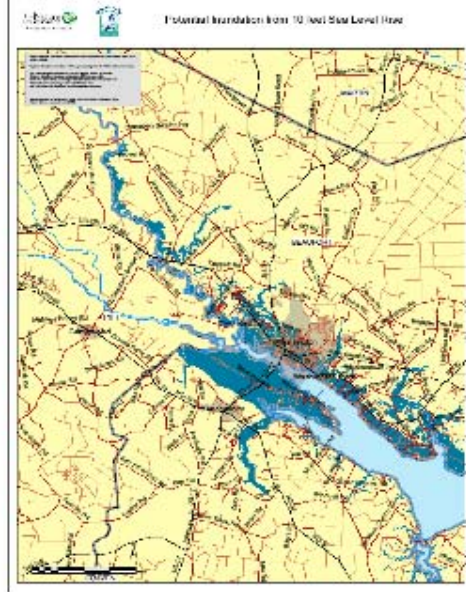
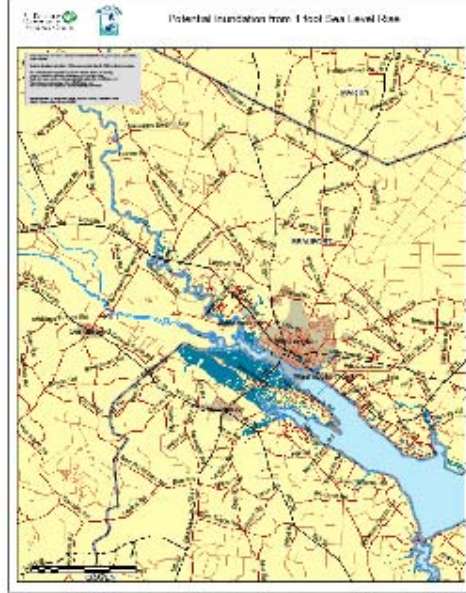
New Bern, NC



Washington, NC



Washington, NC



Appendix C: Who's involved in the Albemarle-Pamlico Conservation and Communities Collaborative?

Albemarle-Pamlico National Estuary Program	N.C. Coastal Land Trust	Recreation
Alion Science & Technology	N.C. Community Development Initiative	Roanoke River National Wildlife Refuge
Alligator Community Action	N.C. Cooperative Extension, Gates County	Roanoke River Partners
Area Wide Health Committee	N.C. Dept. of Environment & Natural Resources	Soil and Water Conservation
Audubon NC	N.C. Department of Agriculture	Southern Environmental Law Center
Black Family Land Trust	N.C. Dept. of Commerce	Student Action with Farmworkers
Choanoke Area Development Authority	N.C. Environmental Justice Network	Sylvan Heights Waterfowl Park and EcoCenter
Clean Water for N.C.	N.C. Farm Transition Network	Synergy Development and Training Group/ ECSU
Clean Water Management Trust Fund	N.C. Institute for Minority Economic Development	Tar River Land Conservancy
Community Gardens	N.C. Rural Center	The Conservation Fund
Concerned Citizens of Tillery	N.C. State Historic Preservation Office	The Nature Conservancy
Conservation Trust for N.C.	N.C. State University	Town of Plymouth
Core Sound Waterfowl Museum and Heritage Center	N.C. Wildlife Resources Commission	Tyrrell County CDC
Domtar Paper Co.	New Life CDC	UHURU CDC
Ducks Unlimited	National Oceanic Atmospheric Association	UNC-CH Kenan Flagler School of Business – Center for Competitive Industries
Duke University - Nicholas School of the Environment	Northampton Extension Services	UNC-CH Institute for the Environment – Center for Sustainable Community Design
Eastern 4-H Environmental Education Center	Ocracoke Foundation	U.S. Air Force
Edenton/ D.F. Walker High Association	Ocracoke Working Watermen Association	U.S. Department of Agriculture
Elizabeth City State University	Operation Spring Plant	U.S. Fish and Wildlife Service
Elon University	Outer Banks CDC	U.S. National Park Service
Environmental Defense Fund	Pamlico Tar River Foundation	U.S. Natural Resources Conservation Services
EXCEED, Inc.	Pantego Area Community Developers, Inc.	U.S. Navy
Gateway CDC	Partnership for the Sounds	Va. Dept. of Conservation and Recreation
Good Work, Inc.	Port Discover Preservation N.C.	Va. State Historic Preservation Office
Halifax County Black Caucus	PWD Oceana Environmental Program	Va. Governor's Office
Hollister REACH	Regional Technology Strategies	Weyerhaeuser
Land Loss Prevention Project	River City CDC	Z. Smith Reynolds Foundation
Life Enhancement	Roanoke Electric Membership Cooperative	
Merchants Millpond State Park, N.C.	Roanoke Rapids Parks and	
Mideast RC&D		
National Audubon Society		
Native Opportunity Way CDC		
N.C. Arts Council		
N.C. Center for the Advancement of Teaching		
N.C. Coastal Federation		

Appendix D. Evaluations

Sea Level Rise and Population Growth in North Carolina Public Listening Session Evaluations

I. Did we accomplish our goals for this session?

1) Provided participants with basic information about Sea Level Rise and Population Growth in the Albemarle Pamlico region?

<u>Engelhard</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	4	1	1

Comments:

- *Need to cleanup the waters of North Carolina; Reduce the chemicals being discharge into waters; People problem instead of sea level rise*
- *Equal time was provided*
- *Maybe some more basic details would be good*
- *I don't know*
- *Very basic information*

<u>Columbia</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	11	0	0

Comments:

- *You needed to say more about population growth and how it relates to sea-level rise*
- *I am really glad that I was invited*

<u>Elizabeth City</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	11	1	1

Comments:

- *Very Informative*
- *I think I missed it. (I came in late)*

<u>Edenton</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	14	0	0

Comments:

- *Not so much with population growth*
- *Maps make the point*

<u>New Bern</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	22	2	1

Comments:

- *Felt this was the weakest part of the session-for those who don't have any background*
- *Needed better paraphrase- too limited*
- *Additional information with general numbers or percentages would have been helpful to conceptualize future*
- *I wish there was more about how we can help the sea level not rise so dramatically*
- *Open venue good - need publicity at all levels, local, county, state, national*
- *Nice job by Cynthia and Lucy, without getting overly complicated*
- *Good use of (and explanation of) maps and charts*
- *I received information on things about the environment that I was not thinking on*

<u>Manteo</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	23	0	0

Comments:

- *Sam Pearsall's presentation was excellent and the organization of the whole session was very effective*
- *Workshops/sessions should be held further inland*
- *Great to have Sam Pearsall!*
- *Yikes!*
- *Very*
- *Good job!*

2) Gave participants an opportunity to share their concerns about the potential impacts of sea level rise and population growth in their communities.

<u>Engelhard</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	6	0	1

Comments:

- *Very fair w/a diverse group*

<u>Columbia</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	10	1	0

Comments:

- *I think it was good that Cynthia went around and asked each person at table to give their comments.*
- *Most definitely!*

<u>Elizabeth City</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	13	0	0

Comments:

- *We all got to share our ideas*
- *Very good input covering a wide range of concerns*

<u>Edenton</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	14	0	0

Comments:

- *Good Interaction*
- *Some more than others*
- *Some informative ideas came forth*

<u>New Bern</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	25	0	0

Comments:

- *A good/positive/thoughtful opportunity to introduce the subject*
- *Good job*
- *Excellent framework for attendees to share*
- *Great format of open floor, combined with offering each participant the opportunity to contribute*
- *Very nice job facilitating*
- *Good to hear everyone voicing an opinion*
- *Good facilitation; encouraged participation*

<u>Manteo</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	23	0	0

Comments:

- *Very well moderated!*
- *Everyone certainly got to speak and yet it was still democratic and not dominated by few*
- *Well facilitated discussions*
- *Very encouraging leadership, great at eliciting response!*

- *Good job!*

3) Generated potential solutions that could address impacts resulting from sea level rise and population growth?

<u>Engelhard</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	6	0	0

Comments:

- *Planting – dikes*
- *But feasibility should be introduced into the discussion*
- *Yes, there were solutions. However, some of these solutions scare me, solutions can be used against development*

<u>Columbia</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	9	1	1

Comments:

- *It was good to see that community members come up with so many good solutions.*
- *Good to address both proactive and reactive measures*
- *Somewhat - this is a very difficult thing to do, however*
- *Not sure because no one knows*

<u>Elizabeth City</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	12	0	0

Comments:

- *Good ideas presented. How they can be implemented is another issue.*
- *I was surprised that little was said about human resource consumption and producing greenhouses gases*

<u>Edenton</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	11	1	2

Comments:

- *Had ideas but fairly simplistic; It will take much more than education*
- *Solutions were general- but I expected that*
- *To a certain extent*
- *Education on this is needed*

<u>New Bern</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	21	2	1

Comments:

- *Some*
- *I believe that retreat and accommodation will be the ultimate solutions to most of these problems*
- *Exchange of ideas always good!*
- *We were not able to move to concrete action. This can be done through a formalized planning process backed up by funds and commitment for successful implementation*
- *Still need to continue the discussion -many different points of view should be heard*
- *Largest solution is education and participation. This is a great start*
- *Education and public participation have to be the first steps*
- *Engaged all participants -regardless of knowledge level, and got to feel comfortable to offer potential solutions*
- *But it is clear that the public really needs more information about this*
- *Yes even on a personal level*

<u>Manteo</u>	<u>Yes</u>	<u>No</u>	<u>No Answer</u>
	23	0	0

Comments:

- *There were not necessarily specific solutions presented and discussed, but the agreement that a plan is needed was a great accomplishment*

- *The discussion on solutions never became specific or led to actual steps to be taken*
- *Some hopefulness as one moved from shock to possibilities*
- *Besides education and awareness, the only solution I heard was retreat. Are there other options?*
- *Now how will we put these solutions into action?*
- *Time to start!*

II. What do you think was the most important thing you learned in this session?

Engelhard

- *This was a great listening forum, learned a great deal*
- *The idea that people consider dikes a viable solution; The lack of pressing nature of the problem as perceived by the general public*
- *Peculiarities of Hyde County*
- *There's no one (easy) answer*

Columbia

- *The possibility of sea level rise within 100 years*
- *The actual impact of the sea level rising*
- *That I need to learn more about the sea level*
- *Education of issues and impact on community*
- *Water level change is in the grand scheme of things, not too far away*
- *I learned about the impacts and concerns of people in the outer banks region*
- *How people were observing changes personally-makes it tangible, real*
- *That the issue is fraught with misunderstanding, denial, fear, and disbelief*
- *About how important this problem is in our future*
- *This importance of the sea level now and in the future*

Elizabeth City

- *It takes many departments to try and view the possible solutions to this problem*
- *The people are interested in sea level rise*
- *That educated people can move the agenda along quickly when it comes to bringing about change in perceptions responses to sea level rise*
- *Our discussions of noted changes, implications and possible solutions was very interesting and informative*
- *Learning about Batts Island*
- *Projected 10 feet sea level rise will take 1,000 years?*
- *Community attitudes/observations*
- *Lots of changes going on*
- *Greater awareness, as a citizen, of the impact of rise in sea level*
- *More familiarity with the region*
- *That there is concern about the impact of sea level rise in this area*
- *Basically that there is an erosion problem in our area*

Edenton

- *Community Input*
- *Local Concerns*
- *Serious sea level rise problems ahead!*
- *Communities up and down the coast are experiencing many of the same changes*
- *Sea level rise from maps*
- *I did not realize how serious this subject was*
- *That only three elected officials came out to sessions so far*
- *There are people who are concerned about this issue*
- *People need to do some serious thinking about these concerns*
- *How important the sea level is*
- *How polluted the rising water will be because of broken flooded septic/sewage systems*
- *Good grasp of overall concerns/problems*

New Bern

- *People think they don't have a say when local officials are involved*
- *APNEP 3- purpose and intent*
- *The variety of questions and concerns of residents was much more broad and community oriented than anticipated*
- *Hearing concerns of people whose perceptions differ from mine*
- *That there is a diverse population that understands the possibilities and the impossibilities before us*
- *We have time to react*
- *That there are people concerned and actively addressing sea level rise issues*
- *Public awareness of implications*
- *We (U&I) have to talk about this with friends, etc.*
- *The issues that concern the local communities most*
- *The incredible cultural dislocations and shifts occurring along the coast which must be addressed to plan for positive change*
- *That many of the concerns/changes I have are common and shared; however solutions are difficult*
- *Good discussion*
- *Value of getting public's attention. Most notification was state employee email. How can we grab the public's goat*
- *Educating the public will be a huge effort. Some people simply refuse to "get it"*
- *People are interested in the issue and solutions*
- *It is an ongoing struggle to obtain positive results*
- *Identification of key issues; discussion of impacts and solutions*
- *Awareness of impending problems within our area*
- *Excellent interaction of participants*
- *Many of the potential effects of sea level rising*
- *All folks that live on the coast have the same concerns about their communities*
- *It is time to start some kind of action*
- *Locals do care and are somewhat informed about climate change/sea level rise*
- *The convictions of citizens*

Manteo

- *The immediacy of this problem. It's not just bothersome, an issue to be considered eventually. It's DIRE!*
- *The importance of raising awareness and education as well as emphasizing the fact that this isn't a problem to large to tackle*
- *Hearing the community's opinion*
- *Interesting to hear about "retreat plans"*
- *Local people's thoughts and concerns regarding this issue*
- *The dramatic pessimism of the public but also the good specific changes witnessed*
- *Everyone is responsible regardless of location*
- *The severe lack of public awareness and participation*
- *Shock to public about extent of sea level rise*
- *There is growing concern for this problem*
- *Need for education*
- *The importance of immediate education and action*
- *That there is little hope for government leadership in this issue*
- *The possible timeline being closer than I thought*
- *Just how broad the impact of sea level rise will be on the region*
- *The most important need for education*
- *That there are efforts addressing this matter*
- *That people can make a difference in affecting long-term impacts of sea level rise and climate change*
- *Better understanding of sea level rise*
- *Potential impact on people, wildlife and agriculture, as well as potential solutions*

- *The information*
- *The information*
- *Lack of faith in the government's ability or willingness to do anything*

III. What did you find least helpful in this session?

Engelhard

- *Impact of this meeting was one-sided*
- *Arguments about who is at fault but that was skillfully diverted by the AP3C/APNEP staff*
- *Same as applies to Dare County*
- *Participants getting bogged down in discussions*

Columbia

- *Nothing*
- *What could happen if the sea level did rise*
- *Losing my train of thought and my rambling on. ha ha...*
- *I didn't think anything was particularly unhelpful.*
- *The lack of definitiveness regarding the degree to which sea level rise really expected to occur – but it's so hard to know this!*
- *Different opinion*

Elizabeth City

- *We mainly react in hindsight instead of being proactive*
- *Long-winded individuals...*
- *It was all good*

Edenton

- *Needed more government*
- *Too many lengthy, non-related public inputs*
- *Some people expressed biased opinions that may or may not have been true*
- *Unknown*

New Bern

- *Over-simplified scientific information did not offer much stimulation to discussion*
- *Those who could not stay on topic and talked a lot*
- *Comments that "things" should stay the way they have always been (life styles)*
- *Would like to hear to from the experts*
- *Nothing*
- *? It delivered based on what it was designed to do*
- *Where are the elected officials?*
- *I did not find anything not helpful*
- *Nothing-it was well done. Did need a few more facts that sea levels are rising.*

Manteo

- *the food was nice, but unnecessary*
- *It does seem like an overwhelming problem without a solution at this point. A more positive, hopeful spin at the end would help people feel more able to tackle this issue*
- *It would have been nice to know where we're going next*
- *The solution phase of conversation*
- *Lack of turnout*
- *A little too long needs to be a bit more zippy*
- *Sometimes the discussion is great, but stops there*
- *All was great!*

IV. How would you rate the facilitation of the workshop?

<u>Engelhard</u>	<u>No Answer</u>	<u>One (poor)</u>	<u>Two</u>	<u>Three</u>	<u>Four</u>	<u>Five (Excellent)</u>
				1	2	2

Comments:

- *Great - facilitators gave a great presentation*

<u>Columbia</u>	<u>No Answer</u>	<u>One (poor)</u>	<u>Two</u>	<u>Three</u>	<u>Four</u>	<u>Five (Excellent)</u>
				1	3	7

Comments:

- *Cynthia and Lucy were terrific*

<u>Elizabeth City</u>	<u>No Answer</u>	<u>One (poor)</u>	<u>Two</u>	<u>Three</u>	<u>Four</u>	<u>Five (Excellent)</u>
					7	6

Comments:

- *Lucy Henry and Cynthia are exceptional!*
- *Good food!*

<u>Edenton</u>	<u>No Answer</u>	<u>One (poor)</u>	<u>Two</u>	<u>Three</u>	<u>Four</u>	<u>Five (Excellent)</u>
				2	3	9

Comments:

- *For awareness*

<u>New Bern</u>	<u>No answer</u>	<u>One (poor)</u>	<u>Two</u>	<u>Three</u>	<u>Four</u>	<u>Five (Excellent)</u>
				1	8	16

Comments:

- *Excellent Skills*
- *Great effort and success in getting everyone involved; getting the meat out of the session, and tying it all together, making everyone feel their voice was heard*
- *Nice work*

<u>Manteo</u>	<u>No answer</u>	<u>One (poor)</u>	<u>Two</u>	<u>Three</u>	<u>Four</u>	<u>Five (Excellent)</u>
					8	15

Comments:

- *Cynthia is awesome!*

V. What would have made the session better for you?

Engelhard

- *How to solve the problems of filtering of N.C. water and raising the height of water in them; Return of wildlife and fishing by cleaning up the water.*
- *More attendance*
- *Many, Many, more people that should have been here regarding this important topic instead of home watching TV*

Columbia

- *Some actual information - a scientific backing on sea levels*
- *Nothing, just thankful for the opportunity to learn more about this subject*
- *Little longer*
- *Greater community participation*
- *More people, wider diversity of backgrounds and vocations*
- *More meetings*
- *To see more people have interest in their future*
- *More attendance*

Elizabeth City

- *Maybe be told what plans are in action to help deal with this issue*
- *Controlling the amount of input from one person ☺*

- *Having some elected officials there!*
- *More participation by our local elected officials*
- *I think the presence of elected officials would have been a good thing*
- *Would like to have heard 5-10 min from 2 speakers-1 on yes sea level rise and 1 on no sea level is not rising*
- *Presentation of more information (The “lecture” that I thought I was coming to) ☺*
- *Some preliminary discussion about natural base line coastal processes*
- *Very well done; Interesting*

Edenton

- *More local government*
- *The organizers are not as effective as need be due to lack of knowledge of environmental issues. You need to understand these things in order to keep on track*
- *More attendance; more scientific data*
- *Seafood Dinner*
- *The NOAA sea level graph*
- *Diet soft drinks*
- *The session was very informative for me*
- *More chances for people who really knew something to talk*

New Bern

- *If elected officials could listen to openness of citizens; A/C on... cookies*
- *Easier to see graphics*
- *Representation of political concerns and priorities*
- *Was fine like it was*
- *It was productive as presented. Thanks!!*
- *Larger space, maybe a 2 or 3 phase workshop over several weeks*
- *A larger turn out and have a general schedule*
- *Providing more “scientific” information on sea level rise modeling*
- *More scientific explanation, maybe just 20 minutes instead of 5 minutes*
- *Hmm, some more information on population changes*
- *More clear information on the projections*
- *More citizen involvement*
- *It got pretty warm after the AC was turned off so people could hear the discussion*
- *small break out sessions or just a break in the middle to allow people to talk informally with others*
- *Enjoyed the session. Very informative from the standpoint that others are experiencing some of the same problems*
- *wine (just kidding)*
- *the venue was a little loud in the background at times*
- *I found it to be very enlightening*
- *A little more information on the technical aspects of global warming and sea level rise. Work with Stan Riggs to develop 3-5 educational slides.*
- *More and diverse group of citizens*

Manteo

- *Asking all soft speakers to speak louder! To turn and address the “congregation”, etc.*
- *Better turnout with more diverse crowd*
- *Figuring out what we’re going to do next. It’s great that we’ve talked about it, now how do we implement the solutions??*
- *More people!*
- *Breakdown of solutions into short, middle, long, personal and communal*
- *Having more government, local and state officials attend*
- *Greater turnout*
- *More effective outreach*
- *More local people! Where was everybody? (NOT your fault)*
- *Take home facts on Sam Pearsall’s presentation*

- *Not held during dinner hour. Maybe offer a session during workday to encourage more professionals to come.*
- *More local people present*
- *Higher level of public participation and cross-section of communities*
- *Community education; Reach 3 counties with 65/75 people maybe more would like to have this session at the church during a large church function sometime in Sept or Oct/Nov*
- *more sessions*
- *more*