

**Maine Sea Grant College Program
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**Climate Variability and Coastal Community Resilience:
Developing and Testing a National Model of State-based
Outreach**



Photo: S. M. Dickson

FINAL REPORT

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Climate Variability and Coastal Community Resilience: Developing and Testing a National Model of State-based Outreach

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INTRODUCTION

The Maine Sea Grant College Program, in partnership with the Oregon Sea Grant College Program,¹ conducted a two-year NOAA-funded project: 1) to explore how climate variability and coastal hazards may be affecting our coastal regions and how these relate to coastal development in the two states; 2) to encourage and facilitate collaboration among and between decision makers and coastal property owners to determine and implement appropriate responses to climate variability on short and longer timescales; 3) to discover the barriers that targeted audiences in the states have to taking action to either prepare for or mitigate the effects of climate variability; and 4) to develop educational and informational materials and strategies concerning these issues. The ultimate goal of the project is to move behavior toward decisive action that results in coastal communities that are more resilient to climate variability at all scales.

In Maine, two groups were targeted with these strategies and materials: coastal property owners (CPOs); and municipal elected and appointed officials, including local and regional planning agency personnel. For the purposes of this report, “coastal hazards” include shoreline erosion, sea-level rise, higher tides, increased storm severity, and coastal flooding. **This technical report covers only the Maine component of the project.**

RATIONALE

Maine Sea Grant has been working with the Maine Coastal Program at the State Planning Office to develop a program aimed at uncovering the barriers and benefits (McKenzie-Mohr 1999) that coastal property owners and town officials associate with implementing coastal erosion hazard mitigation strategies. The primary focus area for this project is the southern coastal region (Casco Bay to the New Hampshire border) that is home to the vast majority of the state’s sand beaches and, secondarily, the midcoast region where there are numerous bluffs and landslides have historically occurred (Maine Geological Survey 1996).

When imagining the Maine waterfront, the rocky coast comes to mind and, indeed, sand beaches are a rare and highly valued resource to the state, covering only about 35 miles of Maine’s 5,300-mile long coastline (Maine Coastal Program 2006). But sand beaches are a major economic driver in the state, exhibiting some of the most intensely developed and visited areas in Maine. Sand beaches are also the state’s coastal ecosystem most threatened by the effects of climate change. All of Maine’s sand beaches are eroding, and sea-level rise predictions in the range of two feet (as adopted for planning purposes by the State) would result in shoreline retreat of approximately 600 feet along sand beaches (Maine State Planning Office and U.S. EPA 1995).

Private ownership of the coast brings an added dimension to the complexity of coastal resource management. Most of Maine's shoreline is privately owned, and unlike most other coastal states, a private landowner may own the intertidal zone, the land area between mean high and mean low tide lines.

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Maine’s coastal development regulations for sand dune systems, established in 1983 (Coastal Sand Dune Rules—<http://www.maine.gov/sos/cec/rules/06/096/096c355.doc>) have earned the state national recognition for its exemplary approach to planning for climate change and associated sea-level rise and coastal erosion. These rules state that “in order to protect valuable coastal sand dune systems, the Department of Environmental Protection will evaluate proposed developments with considerations given to future sea-level rise (anticipated at approximately two feet in the next 100 years) and will impose restrictions on the “density and location of development and on the size of structures” (Maine Department of Environmental Protection 2006). These restrictions include prohibition on new seawalls and a limit of a single rebuild for structures within the “velocity zone,” damaged in a coastal storm, by greater than 50 percent of the building’s value. Strategies promoted by the rules include removing existing seawalls and restoring dunes, and elevating or relocating structures landward.

In addition to sound regulations, however, implementation of numerous strategies at various levels of government and by private property owners are needed to achieve mitigation of coastal hazards. Data that track the use of erosion hazard mitigation strategies is not available, and on-the-ground examples of “soft” alternatives to hardened shorelines in Maine are few.

Indeed, the need to focus erosion hazard educational outreach on municipal elected and appointed officials (including local and regional planning agencies), coastal property owners, and Maine state and county agencies has been identified for over a decade. The 1995 report produced by the Maine State Planning Office, *Anticipatory Planning for Sea-Level Rise Along the Coast of Maine*, targets these groups for education on “the hazards of coastal erosion and inundation, possible impacts of accelerated sea-level rise, the costs of engineered ‘solutions,’ and the benefits of the soft coasts as resilient natural systems.”

METHODOLOGY

Working with the Center for Research and Evaluation (CRE) at the University of Maine, the project team (authors of this report) developed (1) a needs assessment and (2) an outreach plan and (3) evaluation of the two target audiences (coastal property owners and municipal officials) to answer the following questions:

- Prior to the design and implementation of Sea Grant’s educational program, what level of knowledge of climate variability, coastal hazards, and coastal development characterizes each of the two target groups?
- Prior to the design and implementation of Sea Grant’s educational program, what beliefs and perceptions related to climate variability, coastal hazards, and coastal development characterize each of the target groups?
- Do the target groups’ levels of knowledge and perceptions about climate variability, coastal hazards, and coastal development change subsequent to the implementation of Sea Grant’s educational program?

- Does the behavior of the target groups change subsequent to the implementation of Sea Grant’s educational program (e.g., are they using or willing to become involved in erosion hazard mitigation strategies?)

The methodology involved a three-pronged approach. The needs assessment (pre-test) determined the message to be delivered in the educational outreach materials, as well as the format for the materials. Secondly, through the outreach plan, scenarios were provided for ways extension staff could deliver the informational materials to the targeted audiences. Finally, the evaluation (post-test) determined the effectiveness of the outreach activities in affecting the audiences’ beliefs and opinions and will determine, ultimately, their change in behavior—although this last goal is beyond the scope of this two-year project.

1. Needs Assessment

Focus Groups

The project team worked with CRE staff to identify key issues and formulate the presentation of these issues as discussion topics/questions for six focus groups that targeted 11 coastal communities in the southern and midcoast regions of the state:

- Coastal property owners-southern (Kittery, York, Wells; 17 September 2007, York Harbor Inn, York)
- Coastal property owners-southern (Kennebunk, Biddeford, Saco, Scarborough; 18 September 2007, Wormwoods Restaurant, Saco)
- Coastal property owners-midcoast (Rockland, Lincolnville, Camden, Rockport; 24 September 2007, Tavern on the Falls, Camden)
- Town officials (6 November 2007, Wormwood’s Restaurant, Saco)
- Mixed (coastal property owners, municipal officials, recreational users; 5 November 2007, York Harbor Inn, York)
- Mixed (coastal property owners, municipal officials, recreational users; 13 November 2007, Tavern on the Falls, Camden)

To obtain names of coastal property owners (CPOs) to invite to the groups, town managers in each of the 11 communities were contacted by letter, phone, and e-mail and asked to supply names of residents who were either *commercial coastal property owners* (business where a waterfront location is beneficial to their business, but not required for their business, such as a restaurant, retail business, or lodging) or *residential coastal property owners* (primary year-round longtime or new residents, seasonal residents, vacation home/income property owner, high- and lower-valued property owners). Most managers (or town tax assessors) supplied a list of coastal property owner names. The goal was to have 10-12 participants per group. Focus group meetings were held early in the week (Monday-Tuesday) at comfortable and attractive restaurants. Invitation letters were sent to CPOs asking them to RSVP to confirm their participation. To obtain the optimal number of participants for each group, the project team made phone calls to those invited. Staff at the Maine Coastal Program compiled a list of names of all town officials in the 11 targeted communities (from the Maine Municipal Directory) and names of

recreational users were obtained from several lists maintained by beach recreational and coastal interest groups, and from the database of participants at the biennial Maine Beaches Conference. Invitation letters were sent to prospective participants and followed up with phone calls as with the previous groups.

Mail Surveys

CRE staff consulted with the project team and, using data obtained from the focus groups, constructed two surveys to collect data from expanded samples of each of the two target groups—coastal property owners and town officials. Survey data were used to validate and provide a quantitative dimension to focus group data to assess target audience knowledge about climate variability and climate change; beliefs and perceptions about climate variability and change; and current barriers to action.

During January and February 2008, the project team met with CRE staff to develop a mail survey for coastal property owners. For the mailing list, CRE staff obtained names of CPOs (residents east of US Route 1) from the 11 towns targeted in the study. The survey was sent out to 6,967 coastal property owners and 548 responses were received.

From April through June 2008, the project team worked with CRE to develop another survey targeting elected and appointed town officials, which was sent out to 250 officials in the 11 targeted towns. From this pool, 55 completed surveys were received. At the end of both surveys, participants were asked to provide their names and addresses if they wanted to be entered in a drawing for an L.L. Bean gift certificate, and would be willing to participate in an educational program in the coming year, about the issues raised in the survey. From the CPO survey, 238 provided their names and from the town official survey, 34 provided names. These individuals were invited to participate in an educational program in June 2009 where a post-test (survey) was administered to participants to evaluate the effectiveness of the program and materials presented.

2. Outreach

In developing the project proposal, partners agreed that the long-term goal of the public outreach effort would be to have communities that are resilient in the face of climate change impacts; the short-term goal would be to prepare communities and individual decision-makers to plan for climate change impacts.

Outreach on climate variability is more complex than that on other topics, partly due to the episodic nature of short-term climate variability, the relatively gradual nature of climate warming impacts, and a tendency to inertia or resistance on the part of individuals who may be affected (Climate Impacts Group 2007). A key element of this project's outreach approach was—through the focus groups and surveys—to identify and address the barriers to constructive action faced by the target audiences.

CRE staff compiled the survey data and produced a synthesis comparing the information obtained from the focus groups to the data in the survey analyses. The project team used all of these reports to find common themes and develop messages that informed the content, as well as the design (format), of educational materials and strategies, and to

develop a draft outreach plan. Based on both the focus groups and the mailed surveys, the project team created profiles of the target audiences and their information needs.

To further validate the focus group and survey results and to obtain input on their outreach strategies and materials, the project team assembled two advisory groups: a stakeholder advisory committee (comprised of a coastal property owner, town manager, municipal code enforcement officer, and a regional planner) and a technical advisory committee (Maine Geological Survey geologists and University of Maine faculty in the Climate Change Institute, Department of Earth Sciences, and Department of Communication and Journalism). Before the project team met with their two advisory committees in late 2008-early 2009, they took the themes from the focus group feedback and survey data and translated these themes into messages to guide the outreach discussion in the two meetings.

The *stakeholder advisory committee* helped to review the findings from the focus groups and surveys and identify any gaps in or issues with the findings. The committee also helped to translate the themes from the research findings into action-oriented messages that would be compelling to coastal property owners and municipal officials, and to identify the most effective tools, venues, and partners for communicating these messages among those groups. The committee was asked to consider the following questions:

- What do the data tell us about our two targeted audiences (coastal property owners and municipal officials)?
- What do you think about the data? Are these findings consistent with your experience?
- Have we missed any important themes? Are we misinterpreting any of the themes?
- How do we translate these themes into messages compelling to coastal property owners? To municipal officials?
- What should we focus on? What should we avoid?
- What tools do you think we should we use (besides DVD) to reach coastal property owners? To reach municipal officials?
- What venues and partners would be most effective in helping us to disseminate these tools?

The *technical advisory committee* was convened to identify any gaps in or issues with the findings and to further refine the action-oriented messages that would be compelling to coastal property owners and municipal officials, and to prioritize the most effective approaches for communicating these messages among those groups. They were asked to consider the following questions:

- What do you think about the data? Are these findings consistent with your experience?
- Have we missed any important themes? Are we misinterpreting any?
- How should these messages be refined to ensure that they are compelling to the audiences?

The input from the two advisory committees, the synthesis document (comparing the information received from the focus groups to survey results), and the individual focus group and survey reports provided valuable guidance when the project team developed their final outreach plan for coastal property owners and municipal officials.

3. Evaluation

Evaluation of the project (outreach/education plan) took place at two regional educational workshops in June 2009. One workshop was held in the southern region of the state (Kennebunk) and the other in the midcoast area (Rockland). All participants in the pre-test surveys who provided names and addresses were invited to attend one of the workshops. There were a total of 45 participants in the two workshops.

Participants viewed the DVD *Building a Resilient Coast: Maine Confronts Climate Change*, which was followed by peer-to-peer discussion and a question/answer period with a panel of resource people. To measure the impact of the programming, workshop participants completed the post-test at the conclusion of the workshop. The post-test consisted of a subset of questions taken from the original pre-test survey.

As additional outreach strategies are implemented beyond the two-year scope of this project and final report, specifically tailored evaluation tools will be employed to measure the effect of the outreach effort and to guide its revision.

RESULTS

1. Needs Assessment (Center for Research and Evaluation 2008)

Focus Groups - Coastal Property Owners

Issues discussed by coastal property owners in the focus groups focused on six major themes:

- 1) **Attitudes** towards sea-level rise and climate change.
- 2) **Personal behaviors** of property owners, including shoreline protection strategies, construction siting, vegetation control/management, and construction methods.
- 3) **Changes** to the shoreline over time, including significant erosion.
- 4) **Communication** with DEP, Army Corps of Engineers, Maine Geological Survey, local officials, and the Federal Emergency Management Agency.
- 5) **Action and inaction** of public agencies and government.
- 6) **Private property rights** and the limits of those rights.

Attitudes towards Sea-level Rise and Climate Change: In general, participants had relatively little knowledge of climate change and sea-level rise. While participants in all three groups commented on the change in sea level, all participants seemed unsure how they might logically react to these changes. All groups agreed that both sea level and storm surges were reaching higher and higher levels than they remembered in the past. More than one participant wondered if it was primarily due to increased sea level, land subsidence, or both. Despite a keen awareness that storm surges were more severe, and tides seemed to be higher, these groups were at a loss as to what they could really do about these issues—although several participants talked about specific measures they had taken to counter these erosional forces.

Personal Behaviors of Property Owners: In all three groups, individuals expressed their concern for protecting their properties. Several of the participants described the steps they had taken to protect their shoreline and/or the structures on their properties. These measures included:

Owner made changes to shoreline to try to limit erosion:

- Placed riprap following the Patriot's Day storm. This suggestion was followed by the comment: "You have to get the really big boulders. Those are the ones that work."
- Cut large tree trunks and embedded them in the bank to control erosion (this was eventually washed away in a large storm, but the owner felt the measure was "successful" until this large weather event).
- Planted beach grass following the Patriot's day storm. This was successful, however; when this owner then tried to add sand to the beach a few months later, the application was denied by the DEP because it would cover the beach grass the owner had just planted.

- Performed major reconstruction on the embankment of the property, including the placement of riprap, reinforcing soils, interlocking blocks, landscaping fabrics, trenches, and other strategies.
- Trucked in sand to replenish front dune.
- Rebuilt seawall, or increased height of seawall.
- Extensively trenched and drained embankment.
- Dug 20'-deep trench and filled with 30' of riprap.
- Planted trees along embankment.
- Allowed lawn to revert to wild growth.
- Diverted upland runoff to minimize erosion from major rainfalls.

Owner made changes to structures:

- Sunk piers into soil.
- Used 2x10 front walls.
- Installed blowout walls in rear of house.
- Anchored roof and porch using hurricane ties.
- Used hurricane rated shingles.
- Relocated all utilities to 12 feet above average high water mark.
- Elevated house 12 feet above grade.
- Created blowout panels to allow wind to travel under house.
- Moved house back from water; elevated and reinforced structure.

Changes to shoreline/structures made by other owners, as reported by participants:

- Filling in shoreline erosion using fill from construction excavation.
- Cutting trees that blocked view of water. When that owner was informed by the DEP that they would be billed \$50 for each tree, they made arrangements to have the remainder of the trees cut down and paid the fine.
- Cutting embankment to permit walkways and stairways.

Changes to the shoreline and high tide line:

- Several owners noted rocks that were previously visible at high tide were now almost completely covered by the water.
- Several individuals reported seeing large sections of the embankment slide into the ocean. One participant saw his neighbor's entire lot slide into the ocean.
- Several participants reported the erosion of a substantial portion of the frontal dunes in both York and Camp Ellis.
- Two participants reported seeing "several" houses lost at Camp Ellis.
- Several participants in Rockland group noted significant retreat of bluffs.
- One participant witnessed the slide of his neighbor's home into the ocean.
- Several Rockland participants noted the erosional effect of upland runoff on their properties.
- All participants witnessed what they considered to be higher tides and higher storm surges.

Communication with public agencies/government: This issue was discussed for longer and in more detail than any of the other concerns addressed in these focus groups. In general, CPOs were frustrated in their dealings with local, state, and federal agencies. In several cases, owners received differing (and conflicting) instructions from different agencies. They also were unsure of the exact chain of command when dealing with these groups. For one resident, it was unclear what authority the town had versus the DEP versus the Army Corps of Engineers. For another participant, an issue brought before the same agency was decided in two different ways. A significant majority of the participants expressed an unfavorable view of Maine DEP, FEMA, and the Army Corps of Engineers. The attitudes of CPOs toward local officials were more mixed. In some cases, individuals expressed camaraderie with local officials while others were simply frustrated.

Action and inaction of public agencies and government: Several participants expressed frustration with the actions (and inactions) of agencies and government. While this issue is tied closely with the “communication” issue, several participants noted specific instances where local governments and agencies were aware of problems but did not deal with them in a timely manner, if at all. This issue tended to be coupled with the communication issue above, but usually involved specific events where public entities failed to act or acted inappropriately.

Personal property rights: Another area of significant discussion was personal property rights. Members of these groups felt almost universally that their rights as property owners were being usurped by the state and federal government. Although owners understood the rules and regulations, they did not agree with the restrictiveness of these limitations. Owners also shared a common sentiment that they were bearing a disproportional amount of the tax burden, yet were not allowed to protect that highly valued, highly taxed property.

Educational preferences: Participants reported a variety of sources of information about sea-level rise, climate change, mitigation strategies, construction techniques, and other issues related to their waterfront properties. These participants received a good deal of their information from the Internet. Several stated they would “Google” terms they were interested in. Others got most of their information from television. To a lesser degree, they got information from the newspaper. Only a few participants sought out information in scientific journals or through official government channels. Age did not appear to be associated with the mode of communication sought by participants; however, it was clear they used a number of channels to gather information.

When asked what sources of information they trusted most and least, the participants gave differing responses, but the group suggested they were wary of most sources of information. They specifically mentioned being unsure of the data from the University of Maine. When queried further, several participants felt a certain scientist had an “agenda” and that his conclusions were not entirely unbiased. Others mentioned the DEP, MGS, and Army Corps as also having an “agenda.” When pressed what this agenda might be, these participants felt the state and federal agencies were pushing a policy of

abandonment (in other words, let erosion happen unchecked and force people to abandon their properties). One group spoke very favorably of Sea Grant, and the Maine Beaches Conference, where they said they had learned much from the speakers. In sum, participants did not have a single favored source of information, and they did not universally trust the information provided by local, state, or federal agencies.

Specific sources of media information included local news broadcasts, local newspapers, *National Geographic*, *Time* magazine, public radio, Google, and *An Inconvenient Truth*. When asked whom they would ask specific questions (such as what they could/could not do with their property) participants listed the following individuals:

- Realtors
- Code enforcement officers
- Local planning board members
- Maine DEP
- Army Corps of Engineers
- Local land trusts

Focus Groups - Town Officials

Issues discussed by municipal/town officials in the focus groups focused on information needs and communication issues. Focus group participants indicated they needed information on the following issues:

Erosion mitigation issues

- Strategies for funding beach restoration/conservation activities.
- Information about the relative impact of different strategies (e.g., dredging, barrier construction, planting beach grass or other vegetation).
- Strategies to address the differences in how local governments handle problems versus the ways the state and federal agencies handle these same issues.
- Strategies to educate homeowners and builder as to what kinds of construction are likely to be effective and resilient and what kinds are likely to fail.

Climate change issues

- Clear and convincing evidence about the impact of climate change on these issues that addresses some of the current critics of the concept of global warming.

Planning issues

- Information about ways to address issues where houses and other structures (including infrastructure) are in areas prone to flooding and erosion.
- Strategies to get local officials to start thinking in a “big picture” that is – to make sure they are thinking beyond the one year timeframe.
- Addressing the need for building codes that are based on the future demands on a property, not just the current demands.
- Suggestions for a common set of elevation maps for local planning; some municipalities are using 100-year floodplain maps, which can be highly inaccurate.

- Information to help towns better plan their infrastructure to meet the changing environment of the future.
- Strategies to deal with rampant development; Wells had over 400 cottages go into a single development.
- More information about the need for emergency evacuation routes and emergency preparedness.

Town management issues

- How to strike a balance between individual property rights and the need to plan for the future in a way that is sustainable?
- Inability of local governments to purchase land for the fair market value.
- How to address equity issues in towns where some properties, by virtue of their location near the shore, are worth much more than inland properties; coastal owners are paying a greater share of taxes than those living farther from the water.
- Strategies to get people (the townspeople) to take the future challenges of sea-level rise seriously.
- Ways to deal with property owners who are primarily interested in the value of their place as well as the investment potential of it, and those people not wanting to see that investment infringed upon because of local, state or federal regulations.
- How to build trust between residents and local officials (state officials too).
- How to get a read on the local values and how to work on shifting those values to place a higher priority on things like a better environment.
- Helping residents to understand that the coast of Maine is not a fixed thing – that it is constantly shifting and changing.
- Ways to discuss that taxes paid do not equal services received.

Town officials also discussed what kind of information they thought was needed by property owners, include a single clearinghouse for information about building codes and regulations, beach nourishment / protection strategies, projected changes in the coastline over time, most and least effective strategies for controlling erosion, etc. Town officials recommended a streamlined process or “one-stop shopping” for homeowners to gather information and apply for permits. Town officials in the focus groups suggest that Sea Grant produce “credible, pragmatic” materials that provide information about the economic impact of Maine’s beaches as a strategy to influence lawmakers, as well as others. Suggested target audiences for this information included real estate agents and developers, builders/contractors, city managers, planning boards, and conservation commissions. There were also suggestions to focus on young people.

Mail Survey Results (Center for Research and Evaluation 2008)

Mail Survey - Coastal Property Owners

A total of 6,967 surveys were sent to homeowners in the 11 selected towns. A sample of residents east of Route 1 was invited to participate in the survey if they owned, as opposed to rented, the property. A total of 548 homeowners responded to the survey, resulting in an overall response rate of 7.9%. The response rate by town varied from 4.7% to 9.4%.

With the response rate for the coastal property owners being lower than one would have hoped for at 7.9%, it is important to note that many of the survey recipients simply may not have viewed themselves as “coastal property owners” and disregarded the survey. The property owners who did respond appear to fit the demographics one would associate with coastal property owners. More than half of the respondents had a household income above \$75,000 (59.8%) and/or owned their property more than ten years (55.3%). Half of the respondents (49.4%) indicated they held a graduate degree, while nearly three-quarters (72.9%) were over the age of 50.

A very large majority of property owners were concerned about the reported changes and variability in the Earth’s climate. They felt that the government and individuals should take immediate steps to reduce the apparent causes of global climate change. They also felt that the government and individuals should prepare for the effects of climate change that are predicted to occur. Nearly one-third indicated though that they were not “well-informed” about the expected effects of global climate change in Maine.

Of coastal erosion, sea-level rise, flooding, and increased high tides, respondents viewed coastal erosion as the most problematic for shorelines closest to them. When looking at the subset of respondents who had shoreline or waterfront property, one-third indicated natural forces had affected their property adversely. Erosion appeared to be the most common cause of damage to their personal property.

Almost two-thirds of property owners felt the town should create a plan to deal with coastal natural forces. When asked what measures they had already taken to protect their property, the highest percentage stated they had already become familiar with floodplain maps and other information that describes their property. Over 60% indicated they would not be willing to move their structures farther away from the shore. A low interest loan did not appear to be a motivator to take action against damage for many of the respondents. Conversely, nearly half of the respondents indicated they would be very motivated if a grant was available to them. Over two-thirds indicated they would rebuild on their property with storm resistant strategies if their property were severely damaged due to natural forces. Many others simply stated they did not know what they would do.

Nearly half of the coastal property owners indicated they trusted the information colleges/universities supplied about coastal erosion, sea-level rise, flooding and high tides. They also trusted information provided by environmental organizations. About half preferred to receive their information through newspapers.

Mail Survey - Town Officials

A total of 236 surveys were sent to public officials in the 11 selected towns. Elected and appointed municipal officials, municipal staff, and county officials who had the potential to be involved with climate change, were invited to participate in the survey. A total of 55 public officials responded to the survey, resulting in an overall return rate of 23%. Return rate by town varied greatly from 43% (York) to 5% (Kennebunk). Of those responding, 80% were male, had at least a bachelor's degree (70%), and had been in their current job for less than six years (53%). One-fifth of the respondents indicated they were planning board members.

The information gathered from the public official mail survey falls within three separate categories: 1) level of concern and responsibility regarding climate change, 2) knowledge of the subject, and 3) resources used and needed to gain information. The respondents were very concerned about the issue of climate change and its effects. Seventy-two percent of respondents indicated that climate change will require action from them in the next year or two. The majority of respondents (85.4%) felt that the *causes* of climate change are issues that need to be dealt with immediately. Additionally, nearly 90% of municipal officials indicated their municipalities need to prepare for the *effects* of changes in the earth's climate that are predicted to occur.

Not only were the public officials concerned about climate change and its effects, they also felt a responsibility to take action. Even though approximately half of the respondents indicated they already had a full load at work and couldn't add another activity, a majority indicated they would be willing to take action in their work if they had compelling information about anticipated risks (83.6%) and if there was adequate funding (81.5%).

Municipal officials indicated there is a need for information and/or training surrounding the issues involved with climate change. More than 80% of all respondents indicated there is either a moderate or high need within the next two years for: information to better understand or predict the effects of climate change on coastal communities (88.8%); assistance with assessing the vulnerable of their own municipality (87.0%); planning assistance to adapt to the anticipated effects of climate change (81.5%); funding to assess vulnerability, develop adaptation plans or to implement adaptation measures (83.4%); and credible informational materials to provide to the public (90.5%). When asked to indicate the level of importance for gaining information or training surrounding specific topics, over half of the respondents indicated it was *very important* in the areas of: effects of sea-level rise on shoreline armoring (56.4%), sea-level rise predictions (50.9%) and effects on community infrastructure (50.9%).

Respondents were much more likely to receive information about climate change from non-scientific/technical sources than they were from scientific/technical ones. The most frequently used source of non-scientific/technical information for municipal officials was the newspaper followed closely by TV news. As for scientific/technical sources, respondents indicated they most frequently used the National Weather Service or the National Oceanic and Atmospheric Administration. When asked how they would prefer

to receive information, the majority (86.8%) indicated they were “likely to” or would “definitely” use printed material mailed to them. Public officials identified the following information needs:

- Convincing climate change impact evidence: clear and convincing evidence about the impact of climate change on these issues that address some of the current critics of the concept of global warming
- Erosion mitigation strategies: funding for implementation; impacts of various strategies, BMPs, approaches used by various agencies
- Emergency preparation and municipal planning: information, maps, data on flood prone areas, upgrading building codes for future climate change, etc.
- Management strategies: Balancing individual property rights and the public good for sustainability; tax equity issues; lack of funding for buy outs

In addition to identifying their own needs, public officials also identified a need for a clearinghouse for information on best management practices (BMPs) and permitting for coastal property owners. Survey respondents said that Sea Grant could provide information on economic impact of beaches; and also address the need for educational outreach to realtors, developers, and builders.

2. Outreach & Evaluation

The outreach plan extends beyond the two-year lifetime of this project. For a listing of outreach activities and the their status, see Appendix I.

One strategy identified in the outreach plan was a DVD or other form of video material. Oregon Sea Grant produced the DVD, *Building a Resilient Coast: Maine Confronts Climate Change*, with assistance from the Maine project team, in 2008-2009. The Maine project team, the technical advisory committee, and some stakeholder advisory members reviewed and provided input on the draft DVD segments in winter 2009. After incorporating suggestions from the reviewers and many revisions, the program was completed in May 2009. A users/viewers guide was created to assist community groups that might show the documentary program at meetings or events.

Participants in two workshops viewed the DVD *Building a Resilient Coast: Maine Confronts Climate Change*, which was followed by peer-to-peer discussion and a question/answer period with a panel of resource people. To measure the impact of the programming, workshop participants completed the post-test at the conclusion of the workshop. The post-test consisted of a subset of questions taken from the original pre-test mail survey.

Analysis of these pre- and post-tests indicate several notable changes in knowledge, beliefs, and attitudes. Coastal property owners and municipal officials taking the post-test reported significant change in their perceptions of sea-level rise and flooding following the workshop. With respect to both of these issues, respondents reported that they viewed

these issues as significantly more of a problem in the post-test administered following the workshop, than they had in the pre-test phase.

Participation in the post-test workshop appears to have influenced property owners' need for information regarding impacts of climate change and effective adaptation strategies. Pre- and post-test scores indicate that respondents increasingly believed that building new seawalls or reinforcing existing seawalls were not effective strategies, and conversely, that raising homes above flood level was an effective strategy following the post-test workshop.

Also, significantly higher scores were found among post-test versus pre-test that it is important for governments to prepare for the effects of climate change. Following the post-test workshop, respondents were significantly more likely to agree that government action was important.

DISCUSSION

The central purpose of focus group and survey research conducted in this study was to uncover the barriers coastal property owners and municipal officials in Maine face in taking action to prepare for the impacts of climate variability, and to develop educational and informational materials and strategies concerning these issues. The ultimate goal of the project is to move behavior toward decisive action that results in coastal communities that are more resilient to climate variability at all scales.

It should be noted that these findings are not intended to characterize all coastal property owners or even all coastal property owners in Maine. The participant sample captured in this study should be understood as a specific subset of coastal property owners in the state, which is unlikely to accurately represent a general cross section of this population. As described earlier in this report, participants recruited to the focus groups were initially intended to be matched by town managers with specific types of profiles, such as *primary home; long-time, year-round resident; working; or retiree*. While managers provided such contacts to the best of their ability, their references did not always match the criteria precisely. To further complicate recruitment, efforts to contact those individuals referenced were often not successful, so B and C lists of references were developed. Ultimately, when it was prohibitively difficult to recruit individuals with profiles that might have helped to promote diversity among participants in the focus groups, a more general coastal property owner profile was used in order to increase the invitation acceptance rate.

While participation by coastal property owners in the focus groups and post-test workshops were not without benefits (complimentary dinner at a renowned venue, opportunities to speak directly with experts, etc.), the inconvenience of traveling some distance, and investing roughly four hours of one's time probably also biased the profile of the participants. Many focus groups financially compensate their participants, in part to ensure that they are not pre-selecting an audience already highly motivated on the topic; however, budget constraints associated with this project made this impossible.

Therefore, it is probable that without more notable personal benefits to participants, those coastal property owners who took part in the focus groups might have been already predisposed to do so.

The same bias may be true for coastal property owners completing the initial written survey or pre-test. Nearly 7,000 surveys were mailed to residents living east of US Route 1 in the 11 targeted towns, and only 548 responses were received, an 8% return rate. The survey was also extensive (four pages and 23 questions) and, as such, completing it required a time commitment. Therefore, the survey's length was likely a liability and may have influenced the low return rate, and possibly biased the responses in favor of those with a keen investment in the topic. Furthermore, the coastal property owner focus group and survey participants' general expression of concern about reported changes in the Earth's climate, the impacts these changes may have on the Maine coast, and the need to prepare for these impacts, may also support the suggestion that the study's participant sample may be biased in favor of the subject. High levels of concern regarding these issues were particularly notable in written survey responses. Yet, written response return rates were low, so bias may also be evident in this respect. Therefore, coastal property owners participating in this study, the focus group and post-test workshop portions in particular, probably represent a subset population more highly knowledgeable of, and engaged in, the topic of climate change and its impacts than the average coastal property owner in Maine.

Summary of Findings: Coastal Property Owners

Coastal property owners residing in 11 towns in southern and midcoast Maine were the primary target audience of this study. In general, these results show a high level of agreement between coastal property owner responses gathered through the focus groups and responses collected through the survey methodologies.

Both methods had similar representation of men and women, and persons over the age of 50 dominated the makeup of both groups. The majority of respondents in both groups had lived on (or planned to live on) their property for 20 years or more (Center for Research and Evaluation 2008).

This study's findings suggest that the attitudes and values of these decision makers significantly impact their initiative to act. Coastal property owners participating in both focus groups and surveys tended to value their properties as long-term investments that would remain within families, suggesting that these properties are valued beyond their potential short-term financial return. This is corroborated by actions coastal property owners most often indicated they have taken, or would take, if their properties were seriously damaged by storm impacts. The majority reported that they would rebuild at the same site using storm-resistant construction techniques, suggesting that the place itself has significance and that relocation to a less vulnerable coastal site or an inland site is seen as an undesirable alternative, if an alternative at all.

Those owners located nearest the shoreline itself also showed, in both focus groups and surveys, to have heightened awareness of existing climate change impacts on the coast

compared to participants living farther from the shoreline. This is understandable since these are the shoreline owners who often experience such impacts. Yet the vast majority of owners holding property throughout the study area (regardless of the specific location of their properties) expressed concern regarding climate change and related impacts in Maine, as well as concern that government and individuals should take action to prepare.

One significant point of *disagreement* between survey respondents as a whole and focus group members was on the degree of impact of different erosional forces. Participants in the focus groups were very concerned about observed damage resulting from higher tides, stronger storm surges, and other erosion occurring on their properties. Survey respondents indicated a much lower level of concern. This is likely due to the fact that only one-third of survey responses came from individuals whose properties were located on waterfront and, of these, only 25% (approximately 8% of the total sample; Center for Research and Evaluation 2008) had beachfront property—the location most susceptible to these destructive forces.

Focus group and survey respondents who also later participated in an educational program that involved showing the *Building a Resilient Coast: Maine Confronts Climate Change* DVD, followed by a question and answer period with peers and resource people, (the *post-test* workshop) indicated a significant change in their perceptions of sea-level rise and flooding following the workshop. With respect to both of these issues, respondents reported that they viewed these issues as significantly more of a problem in the post-test administered following the workshop, than they had in the pre-test (initially mailed survey) phase. It is not possible to discern if this shift in attitude is a result of viewing the DVD's information on sea-level rise and flooding, or due to focused discussion with professionals and peers with expertise on these topics following the DVD, or a combination of both.

It is apparent that most coastal property owners lack information regarding the effectiveness of various *hard* and *soft* erosion and/or flooding mitigation strategies and, therefore, are at a disadvantage when faced with the need to address these conditions on their properties. It is notable that among the owners participating in the pre-test, beach nourishment was the least favored strategy. Beach nourishment is a commonly applied approach in many places outside of Maine, but the strategy was not well received by this study's sample population, although receptivity to this approach was somewhat higher in the post-test.

Several key barriers to action emerged for coastal property owners. High cost and low feasibility were most often cited. Thus, while the data indicate that coastal property owners have a high level of concern regarding the impacts of climate change, this concern does not directly translate into action. This finding is consistent with a report by the *Task Force on the Interface Between Psychology and Global Climate Change* in which perception of the risks from climate change were found to be uncertain and mostly in the future, while the costs of mitigation were found to be certain and immediate (American Psychological Association 2009). Major structural changes needed to raise buildings up above flood levels or move them back on the lot were viewed as

prohibitively expensive and, frequently, small lot size precluded the option of relocating on the same property. As such, owners may not be inclined to voluntarily adapt their structures by these means, and may be more likely to hope for the best with the expectation of rebuilding as necessary (Daniels, Kettl, Kunreuther 2006).

Considering these barriers, outreach activities might begin by promoting actions that, while they may be lower in effectiveness, require less investment from owners to implement, thus increasing the likelihood of action. Similarly, these activities should provide owners with estimates of actual implementation costs, as well as promote resources that can be accessed when employing higher impact, greater investment actions (such as raising a home on pilings).

Lack of information also served to block owners' ability to take action. While they largely expressed concern about the impacts of climate change on the Maine coast, owner responses indicated that they are not well informed on what those impacts are likely to be, or what effective mitigation alternatives are available to them. However, participation in the post-test workshop appears to have influenced owners' need for information in this area. Pre- and post-test scores indicate that respondents increasingly believed that building new seawalls or reinforcing existing seawalls were not effective strategies and, following the post-test workshop, that raising homes above flood level was an effective strategy. To address this need for information, a suite of outreach activities is anticipated. Because this audience indicated a preference for information delivered through traditional media outlets, local and regional newspapers and network news will be employed. Additionally, in-person meetings and an online hazard mitigation guide for property owners will be developed.

As a group, property owners indicated little knowledge of the federal, state, and/or local regulations governing their coastal property. This last point may relate directly to owners reporting that government (primarily at the federal and state levels) is viewed as a barrier to owners' ability to protect their property. Confusing and conflicting government regulatory regimes were cited as highly problematic and, as such, may potentially foster inaction. Government was also seen to infringe on private property rights, and regulations were even viewed by some to border on government takings of property.

Yet our findings suggest that participating coastal property owners were more likely to favor government planning approaches, over individual actions, to prepare for climate change. This suggests that coastal property owners may favor government action that protects their property. This is further corroborated by the significant difference between pre- and post-test scores. Following the post-test workshop, respondents were significantly more likely to agree that government action was important to prepare for the effects of climate change. Therefore, to facilitate coastal property owners' ability to take independent steps, local demonstration projects are needed to clarify the effectiveness of alternatives and promote individual action. Furthermore, outreach activities designed to clarify regulations, including a hazard mitigation guide for landowners and meetings with federal and state government officials to communicate study findings, are anticipated.

Coastal property owners indicated that certain criteria would likely motivate them to take action in anticipation of the impacts of climate change. Linking to the finding that owners favor government planning approaches over individual action, they also reported that leadership from municipal government would be the single strongest motivator for their individual action. Possibly this is due to an attitude that, if backed by municipal action, any individual action would be fortified. Similarly, actions taken by other coastal property owners (their peers) also emerged as a strong motivator. The influence of social networks and norms has been cited in research, which indicates they are powerful motivators of behavior that have been underemployed in efforts to enlist individual action (Griskevicius, Cialdini, Goldstein, 2008). Related to indications that high financial investment was a strong deterrent to action, it was found that grants were a strong motivator. Outreach activities then are needed to promote partnerships and cooperation among coastal property owners and municipal decision makers, as well as demonstration projects implemented by peers to bolster owners' sense of self-efficacy.

For information to be viewed as valid to guide decision-making, it must come from a trusted information source. Coastal property owners in our sample were found to primarily trust environmental organizations, property owner groups, municipal staff, and realtors. Notably in the study, the trustworthiness of colleges and universities received mixed reviews, with some focus group members indicating prior experience with what they considered to be biased information from certain university-based sources. Therefore, outreach activities will be implemented in partnership with organizations trusted by this audience, such as Save Our Shores Maine, which is a private, nonprofit "grass-roots, volunteer organization seeking to educate the public to maintain and preserve Maine's coastal heritage" whose membership is primarily coastal property owners.

Summary of Findings: Municipal Officials

Municipal officials were the study's secondary target audience. The demographic makeup of town officials was similar for both focus group and survey participants. In general, these individuals were white, male, and over the age of 40. The representation of towns for both groups was similar; however, the survey had significantly differing response rates among the several towns represented. Similarly, the focus groups had a varying membership from the towns represented in this project (Center for Research and Evaluation, 2008).

Overall, town official attitudinal responses indicated that they believe the time to act is now. Overwhelmingly, this audience is willing to take action in their work when armed with compelling and credible information on the anticipated impacts of climate change. They also indicated that the responsibility to take action falls to their own current generation of decision makers, not only to those in the future. Beyond that, the vast majority of town officials believe that action will be required of them personally in the very near future.

Municipal officials also cited a range of barriers to action, from funding sources to a lack of clear, concise, credible information on evidence of impacts, erosion mitigation

strategies, planning data, and emergency preparedness. Many also reported barriers such as heavy current workload, lack of urgency from leadership, and lack of consensus between government and coastal property owners on a course of action. Outreach activities using municipal officials' preferred information delivery sources of newspaper and network television, technical journals, government documents, and agency websites should provide the specific information they seek. Activities that provide opportunities for municipal leaders and coastal property owners to work in partnership may also help to promote this sense of urgency and foster consensus that eventually brings about local action.

Comparison of Findings: Coastal Property Owners and Municipal Officials

Focus Group Comparison

For the focus groups, there was broad agreement between coastal property owners and town officials on the most significant challenges faced by Maine coastal communities regarding sea-level rise and related erosion and associated damage. Both groups talked extensively about damage due to erosion, mitigation strategies, issues related to property rights, and the need for better government action in response to coastal storms. There were some differences in their perceptions of the importance of human impact on the environment, the need to plan for the future, and the specific needs of the community versus the needs of the individual. In short, both groups expressed concern for most of the same issues, but their opinions about what the right solutions are differed substantially in the areas of government response, property rights, and future planning.

As mentioned earlier, many coastal property owner focus group participants regarded government agencies (particularly at the federal and state levels) as barriers to protecting their properties. Not all coastal property owners in the focus groups felt they should have more latitude from government to protect their properties, but the majority expressed this view. Concerns of some property owners that government officials seek policy to move them away from the shore seems to be at least partially reflected in statements from many, though not all, participating municipal officials. Furthermore, the mandate that municipalities conduct planning that anticipates future changes (such as rise in sea level) is complicated by what coastal property owners feel is their right as landowners to take immediate action required to protect their property. This divergence represents the greatest difference in perspectives between these two groups, clarifying a significant barrier to hazard mitigation planning by coastal property owners. Some (and perhaps many) property owners do not agree with state policies, regulations, or planning horizons, which town officials are mandated to enforce. But, as discussed earlier, cooperation between coastal property owners and government has been identified as a critical need in advancing hazard mitigation planning at the local and individual property owner levels.

Town officials from both groups indicated all potential impacts of climate change (sea-level rise, storm surges, etc.) to be significant challenges to coastal communities during the next decade. This sentiment is consistent with that of coastal property owners participating in the focus group, but not with the overall ratings of this audience's survey responses. This further suggests a difference in the perceived impact of these problems by individuals who do not deal directly with coastal erosion.

Directions for Further Research

This study poses additional questions for future research. Because coastal property owner recruitment to focus groups was difficult and return rate on written surveys was low, it is clear that engagement of this audience on the topic is a challenge. Given the high likelihood that this audience will be among those most affected by any impacts of climate change, why are they intransigent? Additionally, progress toward building the resiliency of coastal communities in Maine will require closely coordinated action between coastal property owners and municipal officials. Yet, these findings indicate that currently in Maine, both audiences are concerned about the effects of climate change, but have divergent perspectives on response approaches. How can cooperation between these two groups be fostered? More specific to this study is the question of notable differences in responses between focus group and survey participants to several key questions. What is the origin of these differences?

CONCLUSION

Points of agreement between target audiences (coastal property owners and municipal officials) and between research methods (focus groups and surveys) are many, yet the points of disagreement are difficult to interpret with certainty, due to the differences in representation of shoreline versus non-shoreline property owners in survey respondents. Both survey and focus group respondents had strong feelings about the importance of climate change, and each group indicated it was important for state and federal agencies to address these issues. Both groups also identified state and federal agencies as being among those they trusted the *least*, while peers and local officials were ranked among those sources of information they trusted the most. Coastal property owners and municipal officials are generally in agreement about the importance of climate change and the need for all levels of government to take immediate action.

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APPENDIX I
OUTREACH PLAN
December 2009

BARRIER or MOTIVATION	ACTION MESSAGE(S) <i>Urgency, Partnerships, Solutions</i> Things are not going to be the way we've known them to be, there are things we can do, but they may cost money, and there are going to be difficult decisions to make. But we can't wait, its time to partner for solutions.	POSSIBLE APPROACHES	AUDIENCE	S (<1 yr) M(1-3yr) L (3-5yr) TERM	TIME FRAME
<u>Lack Information</u> : effects of climate change (CC) in Maine	There is accurate, concise information on climate change effects that is readily available to coastal property owners (CPOs) and municipal officials to help inform their decision-making.	Press releases, feature articles (adapt Maine Climate News online newsletter) in weekly newspapers, coastal magazines, professional journals	CPO Municipal	S	June- Dec 2009
<u>Lack Information</u> : effects of climate change in Maine; mitigation, construction, engineering, restoration costs/alternatives/effectiveness	There is accurate, concise information on climate change effects, mitigation, and coastal construction strategies that is readily available to coastal property owners and municipal officials to help inform their decision-making.	Nightly network news feature; partnership with network meteorologists as trusted sources; MBPN feature; local cable access broadcast; PSAs, radio ads, brochures/fact sheets	CPO Municipal	M	April – Oct 2011
		CC DVD presentation at regional workshops for invited focus group and survey participants including post-test; develop discussion guide; direct mail DVD to key municipal officials with hard copy explanatory info and guide	CPO Municipal	S	May-July 2009
		CC DVD presentation at Save our Shores-Maine, Maine Municipal Assn., MAR meetings, ME Beaches Conf., ME Coastal Waters Conf; local cable access broadcast; brochures/fact sheets	CPO Municipal Realtor	S	June 2009 – Jan 2010
		Develop Web site for project (housing focus group/survey reports, technical report, and DVD segments); e-mail Web link to video segments to CPO and municipal listservs; produce postcard to promote site and distribute	CPO Municipal	S	June- August 2009
		Develop guide with hazard mitigation strategies, costs, and resources available (Summer Intern)	CPO Municipal Realtor	S	June- August 2009

		CC DVD MPBN adapted feature	M	Sept 2010 – March 2011
<p><u>Lack Information:</u> data, evidence and effects of climate change in Maine (include ME inundation mapping, beach scoring system); mitigation, construction, engineering, codes, restoration costs, costs of inaction, funding sources, alternatives, effectiveness referencing local demonstration projects; long-term climate planning strategies for municipalities/states, hazard mitigation “how to” for coastal property owners and municipalities; tips from peers for permitting, contracting</p>	<p>1. There is accurate, concise information on climate change effects, mitigation, and coastal construction strategies that is readily available to coastal property owners and municipal officials to help inform their decision-making.</p> <p>2. There are affordable measures coastal property owners and municipalities can take now to help protect their property/community: there are resources that can be brought to bear for more expensive alternatives.</p>	<p>Interactive Web site based on coastal property owner decision-tree format (Separate sites for CPO and municipalities? Housed by each audience’s most trusted source of info?)</p>	<p>CPO Municipal</p> <p>L</p>	<p>Research begins Sept 2009</p>
<p><u>Lack Information:</u> successful action taken by peers and town government</p>	<p>1. Climate change is a local problem.</p> <p>2. Mitigation strategies have been successfully applied by coastal property owners and municipalities in Maine, and these strategies are available as models demonstrating their effectiveness.</p> <p>3. There are affordable measures coastal property owners and municipalities can take now to help protect their property/community and resources that can be brought to bear for more expensive alternatives.</p> <p>4. There are examples we can refer to now that will provide direction for issues we’ll be dealing with more often.</p>	<p>Public and private property hazard mitigation demonstration projects and tours by mixed groups (owners and town officials) – foster cooperative approaches</p>	<p>CPO Municipal</p> <p>M</p>	<p>Feb – Aug 2010</p>
<p><u>Lack Resources, Support:</u> municipal officials lack time, funding, and directives from leadership</p>	<p>There are actions that can be taken now that will be supported by the public and decision makers. Models and resources are available.</p>	<p>Information sessions with agency and legislative leadership; distribute coastal hazard guide to same groups</p>	<p>Municipal</p> <p>M</p>	<p>April 2011 – Oct 2012</p>
<p><u>Government As Barrier:</u> infringe on private property rights,</p>	<p>1. Municipalities and coastal property owners must partner in efforts to address</p>	<p>Presentations of focus groups and survey findings to state regulatory</p>	<p>State Municipal</p> <p>S</p>	<p>Sept-Dec 2009</p>

conflicting regulations	climate change effects. 2. Federal and state regulatory agencies must partner in efforts to address climate change effects.	agencies and CPO organizations; distribute reports/summaries of findings to agencies and CPO groups	CPOs			
<u>Government As Barrier:</u> infringe on private property rights, conflicting regulations	1. Municipalities and coastal property owners must partner in efforts to address climate change effects. 2. Federal and state regulatory agencies must partner in efforts to address climate change effects.	Enhance code enforcement officer (CEO) training to address issues of conflict among flood plain/sand dune/shoreland regulations, strategies to enable CEOs to facilitate CPOs' permitting process	State Municipal	???		Training on hold currently
<u>Lack Information:</u> scientists need data on studies such as this; communications/extension professionals have interest in outreach methodology (including needs assessment and evaluation techniques); a behavior change model?		Produce a Maine Sea Grant technical report to share the methodology of our research and provide a format for citation, prior to publication of peer-reviewed journal article	Natural/soc. scientists & comm. professionals	S		March – April 2009
<u>Lack Information:</u> natural and social scientists need data on studies such as this; communications/extension professionals have interest in outreach methodology (including needs assessment and evaluation techniques); a behavior change model?		With Oregon Sea Grant, submit journal article to national peer-reviewed publication	Natural/soc scientists & comm. professionals	M		Aug 2009 – Aug 2010