Outreach and Adaptive Strategies for Climate Change:

The Role of NOAA Sea Grant Extension in Engaging Coastal Residents and Communities

Sea Grant
Coastal residents will need to make decisions in the coming years and generations about how to adapt to a changing climate. Effective preparation for possible effects of climate change includes engagement of resource managers, planners, public works officials, coastal zone managers, community development specialists, fishermen, mariners, seafood processors, coastal transport businesses, tourists, coastal businesses, resident and property owners.

Identifying local needs is a necessary first step in helping coastal communities prepare for climate changes. Also, identifying local adaptation strategies is needed to enable communities to cope with these changes. However, merely identifying needs, adaptive strategies and making the information available is not sufficient.

The NOAA Sea Grant mission is to ensure implementation of these strategies. NOAA Sea Grant is ideally suited to determining local information needs, identifying adaptive strategies and barriers to the adoption of these strategies. Sea Grant forms the link between researchers and coastal communities and residents and provides a mechanism for productive dialogue.

This paper begins to develop a comprehensive, long-term climate outreach plan by integrating NOAA at the national level with regional, state and local scales.
Helping People Who Live and Work In Coastal and Marine Environments

An important part of adapting to a changing climate is helping people think through and adopt new practices applicable to their respective regions. Coastal residents will need to make decisions in the coming years and generations – how can they adapt to a changing climate? Effective preparation for possible effects of climate change includes engagement of resource managers, planners, public works officials, coastal zone managers, community development specialists, fishermen, mariners, seafood processors, coastal transport businesses, tourists, coastal businesses, resident and property owners.

Separate from educational efforts, climate information must be presented as locally relevant before it can result in significant adaptations in behavior and practices. Management decisions must be based on unique local ecosystem and stakeholder variations.

Examples of climate change information, localized adaptation strategies and response actions:

- **Heat waves** – resulting in health concerns, safe drinking water and food security;
- **Storm surges** – infrastructure to withstand them, best ways to prepare for Nor-easters;
- **Sea level change** – flood prevention techniques; erosion prevention; impact on transportation systems; impact on coastal beaches and tourism; inundation of fresh water with salt water, declining Great Lakes water levels;
- **Elevated sea water temperatures** resulting in sea level rise; invasive species through range changes and potential impacts on commercial or recreationally valuable resources; bacterial infections of marine life through elevated sea water temperature; and changing fisheries through range changes;
- **Hurricanes, other wind events** – hurricane preparedness education;
- **Change in practices of subsistence harvest of marine mammals**; and
- **Ocean acidification** impacting marine ecosystem and shellfish

According to the Intergovernmental Panel on Climate Change Fourth Assessment Report (2007), some of the many regional impacts of climate change that either are being felt or may be felt in the future by coastal stakeholders around the United States include:

**In the Northeast:**
- Northward shifts in the ranges of species resulting from warmer temperatures;
- Coastal erosion, loss of wetland habitat, increased storm surges from sea level rise; and
- Increase vulnerability of infrastructure (e.g., roads) from extreme events such as coastal flooding.

**In the Southeast, Caribbean and Gulf Coast:**
- Increased coastal erosion including loss of barrier islands and wetlands; and
- Intense coastal zone development placing coastal floodplains at risk to flooding from sea level rise, storm surge, and extreme precipitation events.

**In the Midwest and Great Lakes:**
- Lowered lake and river levels, resulting from warmer temperatures and increased evaporation impacting recreation and shipping;
- Warming lake and river temperatures leading to reductions in many fish stocks; and
- Decrease in water quality leading to habitat loss and eutrophication.

**In the West:**
- Changes in natural ecosystems resulting from higher temperatures and possibly intensified winter precipitation; and
- Increased stress on groundwater systems leading to decreased recharge

**In Alaska:**
- General increase in biological production from warming; reduced sea ice and warming disrupting polar bears, marine mammals, and other wildlife; and
- Retreating sea ice and earlier snowmelt altering native people’s traditional life styles.

**In the Pacific Islands:**
- Increased coastal erosion and flooding resulting from storm surge, combined effects of high tides and meso-scale eddies, sea level rise and natural hazards (e.g., tsunamis and hurricanes); and
- Ocean acidification.
Identifying local needs is a necessary first step in helping coastal communities prepare for climate changes. Also identifying adaptation strategies is needed to enable communities to cope with these changes. However, merely identifying needs, adaptive strategies and making the information available is not sufficient. The NOAA Sea Grant mission is to ensure implementation of these strategies.

The Sea Grant engagement model (Figure 1) is ideally suited to determining local information needs, identifying adaptive strategies and barriers to the adoption of these strategies. Sea Grant forms the link between researchers and coastal communities and residents and provides a mechanism for productive dialogue.

What Is Sea Grant?

NOAA’s Sea Grant program is a university-based program that applies knowledge and understanding gained through locally-relevant research to aid individuals and groups. This engagement program has 40 years of success stories. Today its outreach program consists of Sea Grant Extension (SGE), Communications and Education efforts. Specifically, SGE consists of roughly 350 agents and specialists who conduct extension, communication and educational programming throughout the 31 coastal and Great Lakes states.

SGE program professionals interpret scientific knowledge for policy makers, managers, the media, and the public using the following methods: obtain data from researchers and extending it to a particular audience; communicating information to researchers regarding problems or issues that have been identified by industry and agencies; and providing feedback from users to researchers regarding the efficacy of applied technologies and information as well as the shortfalls and remaining needs.

The SGE program has been successful by implementing a model of collaborative problem solving that features continuous building of linkages with many sister NOAA programs and other organizations. SGE professionals have excelled at developing small, informal networks that with peers from other programs to solve distinct problems locally, regionally and nationally.
**Climate Extension Regional Specialist Pilot Project.**
The South Carolina and North Carolina Sea Grant Extension Programs and the Carolinas Integrated Science Assessment (CISA) Program, a NOAA-supported program housed at the University of South Carolina, have combined to develop the Coastal Carolina Climate Program. Funded through the National Sea Grant Office by NOAA’s Sectoral Analysis and Research Program, the major objectives of this regional program are to develop, evaluate and provide key information on how climatic conditions in Coastal Carolina may be changing at present and what may be expected to happen in the future. Through the activities of a regional climate extension specialist, this information will be made available to the public, stakeholders, government agencies and educational programs. Differentiating regional climatic variability and changes from global changes will be a significant part of this undertaking.

**Preparing Coastal Communities for Climate Change.**
Translating Model Results to Prepare Ports, Harbors and Stormwater Management Facilities in an Era of Climate Variability and Scientific Uncertainty: A proposed project with NOAA Sectoral Applications Research Program (SARP), the Great Lakes Sea Grant Network, and NOAA’s Great Lakes Environmental Research Laboratory will undertake a two-faceted approach to address the obstacles inherent in preparing for climate change: a scientific component addressing translation of global effects to relevant scales and reducing uncertainty of specific key forecasts or scenarios; and an outreach component addressing communication of uncertainty, variability and building a planning paradigm addressing uncertainty and variability.

**Enhancing Sea Grant Climate Engagement Capabilities through Training and Increased Interaction with NOAA Scientists.**
This proposed project is a two-phased approach: first, the Cooperative Program for Operational Meteorology, Education and Training (COMET®) at University Corporation for Atmospheric Research (UCAR) and Wisconsin Sea Grant, in collaboration with an Advisory Committee consisting of selected NOAA climate scientists and Sea Grant extension personnel, as well as one or more National Center for Atmospheric Research climate researchers, will develop an online training course for coastal engagement agents. Second, an interactive website will be developed to serve as a portal for the training course and selected additional COMET products to enhance Sea Grant climate engagement efforts.

**Climate Variability and Coastal Community Resilience.**
In fall 2008, Oregon Sea Grant and Maine Sea Grant are mid-way in a two-year project funded by the NOAA Climate Office; the project is Climate Variability and Coastal Community Resilience: Testing a National Model of State-Based Outreach. The project team is developing an approach in these two states that could be the foundation of nationwide strategy for other Sea Grant programs.

**Mobilizing the NOAA Sea Grant Network for Coastal Community Climate Resilience.**
Oregon Sea Grant has proposed a new project to SARP for 2009-11, Mobilizing the NOAA Sea Grant Network for Coastal Community Climate Resilience. This project would extend the learning and results in Maine and Oregon being achieved through the current SARP project to other coastal and Great Lake states of the national Sea Grant network. Sea Grant programs that have confirmed their interest in partnering on the project are Florida (Gulf region), South Carolina and North Carolina (Southeast), Maryland (Mid-Atlantic), Minnesota (Great Lakes), and Washington (West Coast).

**Adapting to Climate Change in Alaska’s Coastal Communities.**
Alaska is feeling the impacts of climate change earlier than the rest of the country. Alaska Sea Grant and in particular, its Marine Advisory Program, is providing a link between scientific information and research and the coastal residents of Alaska. Alaska Sea Grant is an information hub in 10 sites. A two-way flow of information between researchers and local residents will ensure the development of climate-change materials relevant to community members.
Building NOAA Sea Grant Climate Change Engagement Capacity

**Recommendations:**
- Hire regionally-focused climate extension specialists to facilitate transfer of current research and climate forecasts.
- Engage Sea Grant Extension capacity to continually provide NOAA with local and regional coastal climate needs assessments.
- Increase “in reach” climate training for Sea Grant extension agents and specialists with diverse backgrounds.
- Build Sea Grant’s state program capacity to address local climate change needs.
- Transfer climate change tools and technologies using the Sea Grant Extension model.
- Continue to build Sea Grant’s ability to engage stakeholders through a comprehensive research, outreach and education programming.

The need for additional climate change-related outreach has been established, and Sea Grant Extension is the most cost effective way to provide such outreach to coastal constituents throughout the country. The SGE model has evolved over the last 40 years and SGE is uniquely positioned to deliver timely information regarding climate science, likely impacts on resources stemming from change, and mitigation and adaptation measures. An administrative infrastructure, including established regional networks, is in place and operated by NOAA Sea Grant and its state university partner programs. Through a cohesive network of agents and specialists, SGE has created a coastal community-based endeavor that has proven successful in a number of areas including fisheries and seafood, invasive species, water quality and coastal communities’ outreach.

Sea Grant Extension is building on this foundation by increasing the programs’ reach through more regional and national collaborations while striving to maintain the close connections to coastal communities. Climate change issues transcend state boundaries and climate extension presents a great opportunity for such collaboration in the delivery of outreach programs for coastal constituents. SGE programs have created significant regional networks based on geographic location as well as issue-based networking organized around projects of mutual interest. Regional networking is clearly more cost-efficient since subject-matter specialists are shared thus avoiding redundancy. Yet, it is imperative that the model retain a local connection to constituents.

A regional outreach programming approach to climate extension is favored by the 30 SGE leaders that recently responded to the 2008 Climate Outreach Survey. The majority noted that climate change issues clearly vary from region to region. Respondents noted that several NOAA regional climate efforts are already underway. The respondents emphasized that a regional approach would need to dovetail with a national coordinating entity and state-level presence to ensure effective, state-specific, climate outreach efforts. Some states and regions are very large and diverse complicating programming at a regional scale. Regional specialists, by their location and focus, are often hard-pressed to extend their roles evenly in a region unless the region is small and/or homogeneous. Thus, there was strong consensus among leaders that there also needs to be state-level capacity. Each state needs to designate at least one person charged with climate outreach programming in order for the regional specialist to be most effective in his/her technical, facilitation and information-sharing roles.

A comprehensive, long-term climate outreach plan needs to be developed at the national level and implemented at regional, state and local scales. The National Sea Grant Office can continue to lead the development of climate outreach plans. This would include all of the Sea Grant outreach networks (extension, communication and education), NOAA’s climate research community, Sea Grant researchers, NOAA offices with public engagement missions, and interested partners affiliated with the Cooperative Extension Service (CES). The latter is important for inland U.S. considerations where Sea Grant’s presence is limited. Each U.S. state and territory has a CES state office at its land-grant university and a network of local or regional offices. These offices are staffed by one or more experts who provide useful, practical, and research-based information to agricultural producers, small business owners, youth, consumers, and others in rural areas and communities respective of all sizes. Because the majority of Sea Grant Extension programs are administratively or otherwise linked to the states’ coastal CES partners, this plan is also applicable to inland NOAA regions.