NOAA SEA GRANT AND CLIMATE CHANGE:

Helping the Nation Prepare

Local credibility. That's a distinctive strength of the National Sea Grant College Program.

As a network of university-based programs in every coastal and Great Lakes state, NOAA Sea Grant has earned a reputation as a trusted source of science in coastal communities. NOAA Sea Grant funds competitive scientific research of the highest caliber and also helps coastal knowledge-users make timely use of research results. Now, recognizing the local diversity and complexity of issues associated with coastal climate change, Sea Grant has emerged as a national leader in preparing for its effects.

One of four national strategic priorities through 2013 is to improve the resilience of coastal communities to hazards, including the effects of climate change. This report highlights three crucial roles that NOAA Sea Grant plays locally and nationally—Informing Policy and Management, Helping Communities Prepare, and Supporting Economic Resilience and Opportunity—and outlines the resulting benefits. Note that the following projects are only examples[1] and in many cases the work described is ongoing. For more information on any of the items mentioned here, contact the National Sea Grant Office.

Informing Policy and Management

Social scientists have identified the value of "boundary organizations" that provide essential functions between the domains of science, policy, management, and the public. NOAA Sea Grant is well recognized[2] as such an organization, acting often as a catalyst by convening parties to discussions based on science; generating research relevant to policy and management; and clarifying, translating, and mediating understanding between interested parties to public decisions, including scientists, policy makers, and citizens. All these roles are evident in Sea Grant's climate-related activities to date.

Several examples demonstrate Sea Grant's role as a trusted convener. In winter 2006, when Native villages along the Bering Sea were being damaged by the effects of climate change, Alaska Sea Grant sponsored a coastal erosion workshop to help guide a response. In 2007 Puerto Rico Sea Grant organized the first major expert consultation that led to formation of a Governor's climate commission, and produced a set of policy guidelines. Also in 2007, the New Jersey Marine Sciences Consortium/New Jersey Sea Grant coordinated an international workshop to help urban coastal managers better understand the physical and fiscal effects of sea-level rise. Since 2008 the Mississippi-Alabama Sea Grant Consortium has coordinated the establishment of a Gulf of Mexico Climate and Resiliency Engagement Panel (C-REP) for the NOAA Regional Collaboration Team. This 30-member C-REP will help guide climate-change programs.

The trust accorded NOAA Sea Grant programs in their states is reflected in numerous climate policy initiatives and resulting publications. As requested by the state's Governor, Maine Sea Grant collaborated with the University of Maine Climate Change Institute and other partners to edit and produce *Maine's Climate Future*. This document serves as the foundation for statewide climate preparation. Similarly, Oregon Sea Grant assisted the state's Coastal Management Program in developing *Climate Ready Communities*. Rhode Island Sea Grant worked with its state's Coastal Management

1 Source: *Sea Grant's Role in Understanding and Preparing for Climate Change along America's Coast*. Compiled by the Sea Grant Association, December 18, 2008, and updated October 9, 2009.

2 Tribbia, John and Susanne C. Moser (2008). "More Than Information: What Coastal Managers Need to Plan for Climate Change." *Environmental Science & Policy* 11(4):315–328.

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Program to formulate a new sea-level-rise policy that became law, and also helped a state working group develop new coastal construction requirements. Florida Sea Grant partnered with the Florida Oceans and Coastal Council in developing a *Climate Primer* for the Florida Legislature and provided the primer to all state representatives as well as local and regional elected officials.

Local knowledge and relevance are revealed by other policy and planning actions. North Carolina Sea Grant helped lead a two-year review of the state's ocean policies, which resulted in numerous recommendations for improved management, including creation of a coastal vulnerability index. Hawaii Sea Grant helped establish improved, science-based, construction setback rules for Kauai and Maui counties. Texas Sea Grant's policy guidance, *Resilient Coast,* is contributing to planning for "smart growth" along the Gulf coast, as is the Louisiana Sea Grant Legal Program's *Louisiana Coastal Hazard Mitigation Guidebook*. Wisconsin Sea Grant, Woods Hole Sea Grant, and Washington Sea Grant are all participating with government and other partners in their states in statewide climate-change planning.

Policy and planning are strongest when grounded in sound science, and Sea Grant programs around the country are targeting research to aid climate-change planning. For example, a California climate researcher has documented that climate change is melting the Sierra snowpack, dramatically altering future water supplies and water storage opportunities. A California Sea Grant researcher has linked west coast seabird die-offs to declines in their oceanic food sources related to global warming, and this ecologist is using this relationship of "trophic equivalency" to annually forecast salmon numbers.

New analytical and modeling tools are responding to critical local concerns. Delaware Sea Grant scientists developed and tested an "earth system modeling framework" that couples meteorological, oceanic, and coastal models for use in predicting coastal inundation in the Mid-Atlantic region. Results are now available for use by coastal planners and managers. Georgia Sea Grant research produced new software (Ambur) for analyzing and visualizing past and future shoreline change; and the state program is developing detailed hazard maps for each county and barrier island. New York Sea Grant partnered with NOAA's Northeast Regional Climate Center at Cornell University to develop the East Coast Winter Storms climatological and forecasting data Web site, which is being used by coastal managers and emergency personnel.

Finally, perhaps nothing demonstrates a sustained commitment to climate-change preparation better than Hawaii Sea Grant's establishment of a Center of Excellence in Island Climate Adaptation and Policy. This center at University of Hawaii offers expertise in law, policy, planning, and science while embracing the wisdom of local, traditional cultures—a combination that promises real advantages for island peoples facing the challenges of climate change.

Helping Communities Prepare

Local credibility can only be earned, and the key to earning credibility is providing value through knowledge. Sea Grant often provides this value through workshops and other forms of engagement that assist decision makers. While others may be talking about preparing

communities for climate change, Sea Grant has been doing that fieldwork.

From 2007 to the present, Oregon Sea Grant and Maine Sea Grant have collaborated on a research-and-engagement project funded by the NOAA Climate Program Office (CPO). The project is informing public- and private-sector decision makers and coastal property owners about coastal climate change in the two states, and is guiding these groups in preparing for anticipated effects. Critically, the project is grounded in social science research on decision making and behavior change, and it began with substantial survey research with target populations to understand their needs and constraints. The approach is currently being expanded to six other Sea Grant states through a second CPO grant. Also showing leadership in assisting other programs is Washington Sea Grant, which partnered with NOAA's Padilla Bay National Estuarine Research Reserve to develop a climate-change adaptation workshop that any coastal training program can customize and use to inform shoreline planners about climate change. Meanwhile, Georgia Sea Grant has conducted training workshops both for civic groups, to teach beach profiling and hazard assessment techniques, and for county governments, to develop coastal hazard assessment strategies.

Several other states are working very closely and constructively with local stakeholders. California Sea Grant Extension is leading a comprehensive ecosystem-based management planning effort in the Humboldt Bay watershed that incorporates climate change and sea-level rise to guide land use and resource management. A project of University of Southern California Sea Grant not only examined the potential impacts of sea-level rise in low-lying areas of Ventura County but also assisted county officials in planning for these impacts. Likewise, Connecticut Sea Grant has assisted the Town of Groton and a task force in planning and developing municipal strategies regarding climate change. The Town of Dauphin Island, Alabama, working with Sea Grant, included climate-change scenarios during the town's strategic and implementation planning. Florida Sea Grant legal specialists have worked with the city of Punta Gorda to identify specific adaptation strategies to sea-level rise, which led to the city's selection as a pilot community in the nation's first Climate Ready Estuary Adaptation Plan. New York Sea Grant's assistance to two Long Island communities already resulted in changed ordinances to address rising sea levels. More broadly, North Carolina Sea Grant's sustained efforts in Extension and applied research over the past 20 years have resulted not only in improved, research-based, coastal building-setback requirements but also in well-accepted dune revegetation approaches to manage oceanfront erosion. Building on these strengths, the Sea Grant programs in the Carolinas are sharing an Extension climate specialist who assists communities in determining specific information needs and strategies.

Sea Grant's significant national cadre of professional communicators and educators has begun making important contributions to the ongoing American discussion about climate change. While Americans have a wide range of beliefs and opinions about "global warming,"[3] preliminary indications from surveys of coastal populations[4] suggest that prudent preparation for "the effects of climate change" is more widely accepted. Several states have developed mass-media programming to help improve public understanding of coastal climate change. Oregon Sea Grant has produced DVDs and online versions of five video segments addressing local concerns in Oregon and, with Maine Sea Grant, five for that state. Both Oregon and California have developed rich Web sites devoted to climate-change information, including extensive audio and video

3 Maibach, Edward, Connie Roser-Renouf, et al. (2009). *Global Warming's Six Americas 2009: An Audience Segmentation Analysis*. New Haven, CT, Yale Project on Climate Change George Mason University Center for Climate Change Communication.

4 Borberg, Jenna, Joe Cone, et al. (2009). *An Analysis of a Survey of Oregon Coast Decision Makers Regarding Climate Change*. Corvallis, Ore., Oregon Sea Grant; Center for Research and Evaluation, University of Maine (2008). *Climate Variability and Coastal Community Resilience: Results of Coastal Property Owner and Public Official Surveys*. Orono, Maine, University of Maine.

interviews with experts. The Puerto Rico Sea Grant-sponsored television program "GeoAmbiente" has highlighted climate-change issues (and in 2007 the program won a regional Emmy award). Mississippi-Alabama Sea Grant supported development of three television programs on storm resiliency for the Gulf Coast, broadcast during the 2009 storm season to more than 98,000 residents. Distributed to 76 radio stations in the Mid-Atlantic region, Delaware Sea Grant's bimonthly "SeaTalk" radio series has included segments on climate change, beach erosion, and coastal wind-energy resources. Ohio Sea Grant formed a climate-change outreach team with Ohio State University climate research and education personnel to benefit Ohioans. Of course, in addition, thousands of Internet users daily visit Sea Grant Web sites, including those pages devoted to climate, such as Wisconsin's "Climate Change in the Great Lakes Region: Starting a Public Discussion."

Supporting Economic Resilience and Opportunity

As climate change portends shocks and surprises, economic activities will need to be alert to the potential threats but also seize novel opportunities. Because of Sea Grant's unique combination of insight from university-based research and credibility with coastal users, the program is already helping ensure economic resilience. Some examples: Anticipating future changes in precipitation patterns, California Sea Grant researchers have worked with coastal dairy farmers to plant vegetative buffers around their operations to reduce runoff into shellfish farming areas. As a result of Alaska Sea Grant research, shellfish farming practices in Alaska have been modified and regulations developed to prevent human disease outbreaks caused by bacteria that occur during abnormally warm ocean temperatures. Changes in estuarine

conditions, due in part to variability in seasonal extremes, have led New Hampshire Sea Grant researchers to study microbial interactions that influence oyster pathogens in a region not previously at risk. And since the shellfish industry will likely be adversely affected by increasing ocean acidification, Connecticut Sea Grant and the East Coast Shellfish Growers Association are hosting two informational workshops to connect acidification modeling and prediction to what is actually occurring in the environment.

On the opportunity side of the ledger, Delaware Sea Grant's assessment of offshore wind-power potential influenced the state's approval of a power purchase agreement that enabled construction of a commercial wind farm off the Delaware coast. Meanwhile, both Delaware and innovative MIT Sea Grant are examining the potential of biofuel from marine plants to reduce the use of fossil fuels. And Oregon Sea Grant's early support for wave-energy research led to the 2008 establishment of the Northwest National Marine Renewable Energy Center, which is supporting both wave- and tidal-energy development. And in recent years, Sea Grant-sponsored students at the University of New Hampshire have developed wind- and tidal-energy projects. Clearly, in the transition to an economy powered by renewable energy, the nation's universities have a critical role, and Sea Grant universities are a focused, creative resource.

In sum, the best current science informs us that over the next generation the effects of the changing climate will require significant adjustments and preparation, which in many instances need to be accomplished locally. NOAA Sea Grant's unique and acknowledged strengths in targeting research and engaging communities are critical national assets.

Sea Grant
National Sea Grant College Program

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Written by Joe Cone, Oregon Sea Grant, with assistance from Kristin Rasmussen, based on reports by local Sea Grant programs. Edited by Rick Cooper and designed by Patricia Andersson, Oregon Sea Grant. Photo credits: p. 1, Joe Cone; p. 2, Oregon Sea Grant; p. 3, © iStockphoto.com/David Mitchell; p. 4, © Bill Wagner, *Washington State Magazine*. This report was prepared by Oregon Sea Grant under award number NA06OAR4170010 (project number M/A-1) from the National Oceanic and Atmospheric Administration's National Sea Grant College Program, U.S. Department of Commerce, and by appropriations made by the Oregon State Legislature. The statements, findings, conclusions, and recommendations are those of the authors and do not necessarily reflect the views of these funders. ORESU-Q-10-002