



CLIMATE

FIELD NOTES

Insights from a NOAA Sea Grant Network Project

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A report by Oregon Sea Grant in fulfillment of a grant provided by the NOAA Climate Program Office Sectoral Applications Research Program (SARP)

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Text by Joe Cone, Pat Corcoran, Miriah Russo Kelly, and Kirsten Winters. State pages written in collaboration with principals. Project oversight and editing by Joe Cone. Copyediting by Rick Cooper. Design and production by Patricia Andersson. Cover photo by Joe Cone. Questions or comments about this report should be directed to Joe Cone at joe.cone@oregonstate.edu.

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The Role of Sea Grant and Extension in Climate Change

By Mike Liffmann, NOAA Sea Grant Program Director for Extension

In March 2012, at a [Climate Extension Summit](#),¹ a small group of invited experts from Land Grant and Sea Grant's national Extension networks devised broad strategies and approaches to better engage the nation on issues concerning climate change and climate variability. The Summit's summary report can be found at tinyurl.com/ma27o87.

The participants agreed that the complexity of global climate change poses a significant challenge to the scientific and educational communities seeking to inform the American people. But simply providing the public with scientific facts is not enough, and Extension should play a much more prominent role in helping connect climate science and technology with end-user needs. The nation's two major Extension programs, Land Grant (established in 1862) and Sea Grant (1966), have a long history of serving as an interface between scientists and decision makers, building trust-based relationships, connecting constituents to scientists, and translating research results into practical solutions.

Extension's experience is that climate science and ideas to inform adaptation strategies are most effectively delivered at the smallest and most immediate scale possible. This is the basis of NOAA's Sectoral Applications Research Program (SARP), which funded the research culminating in this report. SARP supports interdisciplinary research to advance understanding of how climate variability and change affect key socio-economic sectors, and promotes the application of this new knowledge in climate-related decisions. SARP works with scientists and decision makers (for example, resource managers and policy leaders) to develop

new tools and methodologies they can incorporate into decision-making scenarios. The goal is to help decision makers better prepare for and respond to climate-related impacts.

Americans today are overwhelmed with information of all sorts, and constituents are most receptive to information they are convinced is useful and relevant to them. For the past decade, Land Grant and Sea Grant programs have been supporting more integrated (research, extension, and education) global-change and climate activities that emphasize stakeholders' critical concerns as they relate to these issues. It is crucial that Extension approaches be developed that link climate adaptation to hazard mitigation, recognizing that vulnerability to long-term climate change often implies vulnerability to shorter-term severe weather events as well. Communities of all backgrounds generally support planning for resilience. The need to improve risk communication and analyze risk perception is common to both short- and long-term risks.

In general, Land and Sea Grant Extension agents face many of the same challenges in different contexts. The Summit participants concluded that there is a need to strengthen the connections within and among the two Extension networks and their partners with regard to climate science and ideas to inform adaptation strategies. The two networks also need a greater investment in building capacity through additional internal training for current Extension staff and faculty. Such training would initially focus on providing climate-science basics and development of the most relevant, small-scale climate information and models to share with Extension constituents. Extension agents also would benefit from training in risk communications and risk management. This Oregon-led SARP project provided such risk communication training and tools. Ultimately, Extension staffs will need to be comfortable articulating climate science and implications even when confronted with difficult questions and skepticism.



PHOTO: JOE CONE, OREGON SEA GRANT

¹ Partners: NOAA's National Sea Grant Office and the USDA/NIFA's Institute of Bioenergy, Climate, and Environment.

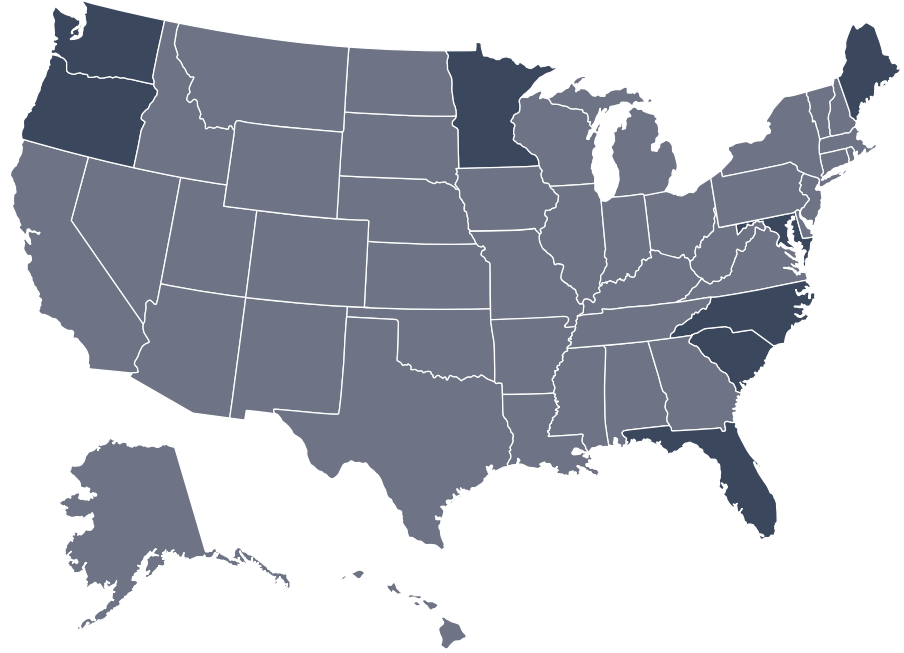
The Background, Objectives, and Methods of the Project

By Joe Cone, Oregon Sea Grant Communications Leader and Project Principal Investigator

Helping coastal communities prepare for climate change is vital, as they face potentially significant effects of climate variability and change during this century. These effects, according to the Nobel-prize-winning Intergovernmental Panel on Climate Change, include sea-level rise, coastal erosion, flooding, increasingly intense storms, and changes to the nearshore ocean environment.¹ At least as important as these events themselves is the expected increase in frequency, intensity, and uncertainty of climate-related extreme events.² For most people, the future climate is very unlikely to look like that of the past.

However, when this project began in 2009, coastal preparations nationally were for the most part only in very early stages. The problem wasn't a lack of public recognition of the risks of climate change. Public polling indicated that while Americans were deeply divided over the causes of global warming, the majority was at least concerned and many were alarmed about its potential consequences.³ That concern has only increased since 2009, particularly under the apparently increasing frequency of extreme weather events that put Americans in harm's way.⁴ But even back then, many local decision makers were acutely concerned about climate-related risks, as clearly demonstrated by surveys of coastal professionals and other stakeholders in California,⁵ Oregon,⁶ and Maine.⁷

The main barriers to effective coastal community preparation for climate change seemed to be two. First, coastal decision makers at all levels were looking for trustworthy information, decision-support, and guidance on how both to assess and to respond to climate risks. Second, a nationwide decision-support infrastructure had yet to be mobilized to assist local coastal communities.



Participants in the projects described included Sea Grant programs and coastal communities in (clockwise from left) Oregon, Washington, Minnesota, Maine, Maryland, North Carolina, South Carolina, and Florida.

I believed those problems could start to be addressed through community engagement facilitated by a trusted national coastal organization grounded in local communities. No surprise: that organization would be the NOAA National Sea Grant program, organized around its cadre of outreach professionals, including Extension and public communication personnel. We knew how it might work, being in the final stages of a prototype project involving Maine and Oregon Sea Grant. At a September 2008 meeting of the Sea Grant Extension Assembly in Seattle, I made a brief presentation about the Oregon–Maine project and invited states that might be interested in participating in a new project to contact me. Ultimately, Washington, Minnesota, Maryland, North Carolina, South Carolina, and Florida asked to participate—which gave us a nice national

representation and diversity by region: West Coast, Great Lakes, Mid-Atlantic, Southeast, and Gulf.

By the following September we had received funding from the NOAA Climate Program Office's SARP Program (Sectoral Applications Research Program) to conduct what we thought of as a pilot project with a promising prospect: "Mobilizing the NOAA Sea Grant Network for Coastal Community Climate Resilience."

As Sea Grant people know, over more than 40 years Sea Grant has earned the reputation, unique among coastal programs, of integrating applied research and stakeholder engagement.⁸ For decades, Sea Grant outreach professionals have supported the two-way process of communication between the producers and users of information that has come to define "decision support." And Sea Grant

is recognized as that crucial entity in the necessary conversation between science, management, and the public—a “boundary organization” that has the trust of all parties as a neutral convener and facilitator of constructive dialogue, mutual understanding, and potentially, the co-production of relevant information.⁹

While public and private decision makers may want trusted information support on coastal climate, and Sea Grant may be a vehicle for providing that support, climate change is a huge, unwieldy issue. To focus it, our pilot project’s overarching goal was to enable coastal communities in several coastal states and regions to take appropriate steps to prepare for anticipated climate changes. The stated objectives of this project were to:

- 1) develop and facilitate local “knowledge-action” networks that assist coastal decision makers with decision-relevant information about climate variability and change;
- 2) help define and assess a management framework of climate resilience for its application to, and use in, local, coastal social-ecological systems to reduce risks;
- 3) distill the results of local (state) project efforts into educational publications and materials that discuss the rationale, objectives, methods, and procedural details for this community engagement process.

This report is our fulfillment of 3) above.

Methods

The main objective that the several participating states focused on was “develop and facilitate local ‘knowledge-action’ networks.” The hyphenated knowledge-to-action notion may have sounded trendy, but any real excitement was in determining what sorts of knowledge were useful and how to obtain them.

The Oregon project team (initially Cone, Corcoran, Winters; later Russo

Kelly) knew that our Sea Grant colleagues in other states have a great deal of diverse professional and disciplinary expertise, local knowledge of their states and coastal communities, and often well-established relationships with coastal decision makers and stakeholders. Since we surveyed them, what we also knew at the start was that two-thirds of our Sea Grant colleagues were interested in “how social science can improve my professional practice” but that fewer than half had taken social science courses at the college or graduate level in the past 10 years. We recognized that adding some current social science tools to their toolkits could be of potential value to our group.

The “tools” could be thought of as contained in a metaphorical “bin” made of materials that are fundamental to Extension programming on the one hand, and on the other, academic research on decision making and risk communication. Since climate change involves risk assessment and decision making, and there have been numerous studies and guidance pertaining to each, that framework made sense to us.

With each of the states separately and with all together, we discussed and, when desired, gave training in the tools of (1)

planning how to conduct the local project, what to focus on, and how to evaluate it; (2) forming a representative and activist stakeholder advisory committee; (3) understanding and using models of decision making; (4) organizing and conducting qualitative research with key audiences to gather baseline knowledge and perceptions of climate issues; and (5) developing an “expert” model of local climate issues to help frame the critical decisions that key, identified audiences might want to make.

Sea Grant partners in the states used many of these tools, applying them slightly differently in a range of different situations, as is discussed further throughout this publication. Just to flag perhaps the highlight: the most-used, most-appreciated of these tools was the technique of conducting “mental model interviews.” Certainly Extension professionals and many others are familiar with conducting interviews as part of their normal activities. Our technique,¹⁰ derived directly from the benchmark risk-communication methods developed at Carnegie Mellon University,¹¹ is somewhat different, more disciplined in approach, more focused in purpose.

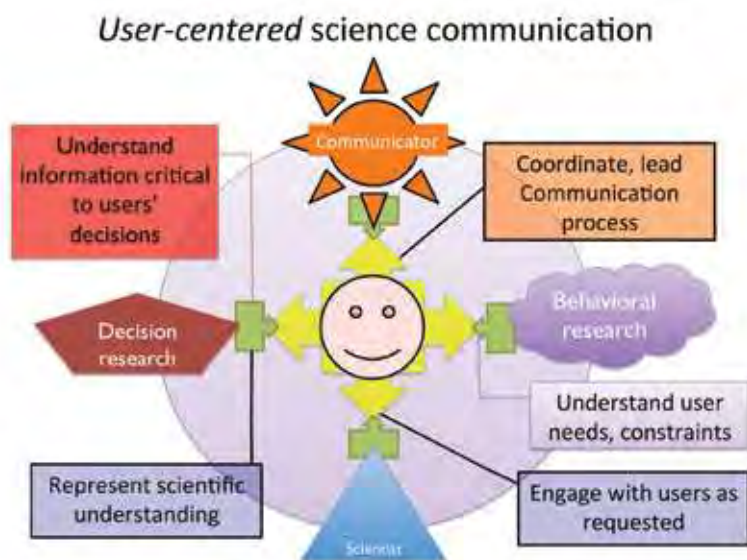


ILLUSTRATION © JOE CONE, OREGON SEA GRANT. BASED ON MORGAN ET AL. (2002), *RISK COMMUNICATION*. CAMBRIDGE.

The purpose is to understand through a series of carefully structured questions how the other person understands—“models”—the phenomenon of interest, in this case, a maybe-changing local climate. His or her model may be quite different from that of topical experts—the climate scientists—and understanding *that* difference can be very important in coherent communication going forward. The discipline comes from keeping oneself as neutral as possible as an interviewer: not “leading the witness,” so as to understand what’s really in *his* or *her* thinking. Easier said than done.

Of course, this project, like all others, never really stood alone, either in terms of the rest of the work that the individuals involved were doing, or in terms of similar work being done by others at the time. In the former case, Extension professionals, like their outreach and engagement counterparts—communicators and educators—rarely have the luxury of working on just one project: there are always others, competing for attention, for time, for priority. In Sea Grant programs, with their typically intense local focus, a national “network” project is an exception and an additional challenge.

The good news is that during the four years of the project (2009–2013), climate change became a concern for an increasing number of stakeholders and potential partners. Partly because of the stakeholder concerns and the opportunities to do good work, the National Sea Grant Office separately funded climate initiatives that, in fact, all of the states involved in this project used to supplement the NOAA grant funds. And Sea Grant engagement professionals began to develop specific climate planning expertise, establishing a Sea Grant Climate Network which held biennial meetings and a website and a *community of practice* in which individuals could learn from each other. We intend that this publication be an asset for that community of practice—not that our work stands apart but rather that it may add a particular Sea Grant story and

insights to the evolving professional discourse about climate adaptation planning.

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Lessons Learned

Intro by Kirsten Winters, Oregon Sea Grant; Project Research Assistant

The title of this report, *Climate Field Notes*, aptly describes the work of the research partners in this study, whose contributions to the SARP project appear on the following pages. These partners work primarily in the *field*. They are keenly aware of the cares and needs of the communities they serve. At first glance, this report might seem to be a culmination of related projects that began in 2007; but really, the work has just begun. In the following pages about the various research sites are *field notes* encapsulating a dynamic process. One key challenge that remains for participants and most communities is, indeed, how to define what successful adaptation to climate change looks like, how it would be defined and locally expressed.¹ Progress was made, but even now, after the project's tenure, work continues.

A major objective of the SARP project was to expand research partners' "toolkits" for engaging communities by introducing methods for, in this case, engaging communities in the topic of climate risks and hazards. The learning activities included planning, conducting, and evaluating a local project; forming an advisory committee from the community; understanding behavioral decision models; conducting qualitative research; developing an expert model of climate risks and community vulnerability; and conducting a survey. Project partners customized their respective learning and "toolkit" based on a number of mediating factors, such as the level of support by project personnel or leadership already present in the pilot community. Project



Participants in the Port Orford, Oregon, project collaborate on a concept-mapping activity. (PHOTO: JOE CONE, OREGON SEA GRANT)

outcomes and learning, as represented in the following state reports, are unique to each particular place and project.

Beyond the scope of this project, partners have stated a desire to continue using the methods we introduced, and will be well-equipped to design and conduct a community engagement project using the toolkit we set out to create. Additionally, project partners and the members of the communities represented in this report have nurtured their working relationship, strengthening a network that will continue to develop.

¹ "Successful adaptation to climate change" is the title and focus of a regional social science research project underway in Oregon, Washington, and California. See tinyurl.com/mefdsf5.

Sea Grant and Extension readers are encouraged to check back during 2013-14 to the websites of these state SG programs for updates and findings of this project.

LESSONS LEARNED: Florida Sea Grant

Project leads: Thomas Ruppert, coastal planning specialist; and Stuart Carlton, research assistant

Crystal River, Florida, demographics (2010 Census)

Population: 3,501

Persons/sq. mile: 615

Median household income: \$37,447

Below poverty level (county): 13.5%



CRYSTAL RIVER, FLORIDA

Located on Kings Bay, off the west coast of Florida, Crystal River is a small community that has a tourism-based economy. The city is run by a mayor and city council. Frequent wildlife visitors to Crystal River and Kings Bay are hundreds of manatees that are drawn to the area's spring-fed waters, critical habitat protected through the Crystal River National Wildlife Refuge. This refuge also happens to be the last undeveloped habitat in Kings Bay. Florida coastal communities face multiple potential sources of hazards over short-, medium-, and long-term timescales. Oil contamination, damaged ecosystems, decreased fishery populations, hurricanes, erosion, and sea-level rise may all threaten coastal communities.

Climate-related risks

Risks to water quality and subsequent effects, such as increased invasive plant species and reduced tourism, are important considerations for Crystal River. The causes of water quality degradation are both directly and indirectly related to



A view across Kings Bay in Crystal River, Florida. (PHOTO: KINGSBAYFISHERMAN)

climate. Examples include nitrification, reduced flow, shoreline hardening, and increasing salinity. The concern is that community adaptation will have to take into account potential decreased livability and tourism.

Project participants

Crystal River was chosen as a pilot community because researchers had previously connected with local leaders. A relationship had been built. County administration staff were queried. During the research process, a graduate student worked with Sea Grant Extension to conduct interviews with policy makers, then took the findings and created a confirmatory survey, which was completed by students at the university.



A West Indian manatee in Florida. Preserving water quality for recreation and tourism, revolving in part around manatees, was the local concern.

(PHOTO: ©ISTOCKPHOTO.COM/BISSELL)

LESSONS LEARNED: Maine Sea Grant

and University of Maine
Cooperative Extension

Project leads: Kristen Grant, marine Extension associate, Maine Sea Grant and University of Maine Cooperative Extension; and Esperanza Stancioff, associate Extension professor

Project locations: Diverse communities involved in this project included the counties of Lincolnville, Camden, Rockport, Rockland, and York; and the cities of Kittery, York, Wells, Kennebunk, Biddeford, Saco, and Scarborough.

COASTAL COMMUNITY RESILIENCE IN MAINE

With concerns about climate change and its effects on sea-level rise, shoreline erosion, and coastal flooding, Maine residents and towns are struggling to find strategies on how to prepare for and adapt to these changes. Maine Sea Grant and University of Maine Cooperative Extension have focused on identifying the barriers to preparing for the impacts of climate variability faced by two target audiences: coastal property owners and municipal officials. The ultimate goal is to move these groups toward decisive action to make their communities more resilient to climate variability and coastal hazards.

A cooperative project with Oregon Sea Grant, funded by NOAA SARP and begun in 2007, set the stage for work in our states and in the later SARP network project described in this report. That project, *Climate Variability and Coastal Community Resilience: Developing and Testing a National Model of State-based Outreach*, assessed information needs and attitudes regarding climate change and its impacts on the coast in order to design effective outreach strategies. The project allowed both the Maine and Oregon programs to knowledgeably target communications and education projects to specific audiences. The project served as a model in Maine's state-wide, legislatively mandated, climate-change adaptation planning process. The Maine research identified barriers to action faced by coastal property owners and municipal officials.

The results of focus groups and surveys informed the

Patriot's Day (2007) storm damage in Saco, Maine. (PHOTO: S. M. DICKSON, MAINE GEOLOGICAL SURVEY)

production of a documentary video series that aired on Maine Public Television, regional community meeting discussions, and other products and projects to be completed with NOAA Coastal Communities Climate Adaptation Initiative funding in 2014. See www.seagrant.umaine.edu/extension/coastal-community-resilience to learn more.

Climate-related risks

On April 16, 2007, New England was hit by one of the largest springtime storms in memory. The Patriot's Day Storm, as it was known, sent 30-foot waves crashing into the northeast coastline, causing significant damage to Maine communities. Astonishingly, the height of the storm tide surpassed even that of the Perfect Storm (October 30, 1991), and pushed many coastal communities past their ability to cope with storms of that magnitude. More recently, Sandy wreaked havoc in the Northeast (2013), although Maine missed the tragic damage that states to the south experienced. Many cities and towns are now confronted with having to adapt current and future development projects to withstand future storms that are projected to increase in both frequency and intensity as the climate changes. Communities



engaged in the project include midcoast communities (Lincolnville, Camden, Rockport, and Rockland) and communities in York County (Kittery, York, Wells, Kennebunk, Biddeford, Saco, and Scarborough).

Implementing a five-year outreach plan

Research findings guide outreach.

Working with stakeholder and technical advisory committees, outreach activities, products, and services are developed and implemented in association with research findings. We determined that **coastal property owners:**

- **will rebuild and need accurate information to make decisions.** Many property owners have a long-term perspective on their properties. They plan to pass it on to family, and plan to rebuild even after serious damage.
- **want to take action, but don't know which strategies are most effective, and moving back and moving up are too expensive.** Many believe they need to take action, but

don't know how to evaluate possible approaches.

- **are motivated by grants, peers, and their towns.** Many look to action taken by neighbors and their town officials for guidance.
- **see government as a barrier.** Many see federal and state government, in particular, as infringing on private property rights.
- **often use traditional resources for information.** Many refer to newspapers, television, Internet, and meetings.

Key accomplishments

- Creation, testing, and launch of *A Property Owner's Guide to Flooding, Erosion, and Other Coastal Hazards*, a hazard mitigation guide for coastal decision makers. Training program implemented using guide for municipal officials coastwide. www.seagrant.umaine.edu/coastal-hazards-guide
- Implementation of demonstration project tours (2011, 2013) to introduce Maine coastal property owners to peers, officials, and professionals who have

modified properties or communities to prepare for flooding, erosion, and storm events.

- Development of a network of climate-adaptation service providers (including university, agencies, and other organizations) to coastal municipalities.
- Instigated further social science and biophysical research focused on vulnerabilities to, impacts of, and potential solutions to extreme storm events, with municipal decision makers funded by the National Science Foundation and NOAA.

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This coastal Maine home was set back behind a berm and raised up on its foundation to offer protection from storm surges and rising seas. (PHOTO: JOE CONE)

Leadership and Climate-Change Adaptation: A CASE STUDY

By Miriah Russo Kelly, Oregon Sea Grant; Project Research Assistant

PROJECT BACKGROUND

Ellsworth, Maine, is a small city at the edge of Acadia National Park in upstate Maine. Since February 2012, city officials have been working with University of Maine Cooperative Extension/Sea Grant to address management difficulties related primarily to stormwater. Extreme rain events have damaged culverts and washed out roads; polluted stormwater has harmed in-stream water quality; and plans to grow the city have caused land-use planning dilemmas, including the presence of holding ponds in the city center where the city would like to develop.

The City of Ellsworth is pressed to adapt to changing conditions, and leadership is playing a major role in the decisions of this community as they address these issues. It was our hypothesis that leadership would be critical to determining the resilience of a community—community resilience defined here as a process that links networks with adaptive capacities and resources for the purpose of adapting to a disturbance or adversity.¹ Without leadership, communities are unable to address the complex challenges they face. “Leadership is a driver for change, showing a direction and motivating others to follow.”² Leadership affects the ability of a community to respond to or anticipate disturbances in the environment over time. It also serves an integral function in the management of acute natural hazards and plays a major part in the process of making decisions, as well as the outcomes of those decisions.

Leadership in the context of institutional adaptation, according to Gupta et. al.,³ is defined by three attributes: leaders that support adaptation are visionary, entrepreneurial, and collaborative. Visionary describes the long-term focus of the leader; entrepreneurial refers to the leader taking action and undertaking assignments, or leading by example; collaborative refers to the leader’s capacity to get people to work together.

RESEARCH PROFILE

To further investigate the role of leaders and leadership in climate-change adaptation projects, we conducted interviews with participants in the Ellsworth adaptation project. In total, eight participants agreed to be interviewed. We interviewed two biophysical scientists/engineers, one city

manager, one county planner, two city planners, and two UMaine Extension/Sea Grant professionals. To investigate the nature of leadership in this project, we wanted first to identify who the leaders were. We then set out to identify the characteristics or actions of those leaders.

RESEARCH FINDINGS

We used the visionary, entrepreneurial, and collaborative attributes as themes in our review of responses. After reviewing the responses from each of the interviewees, two key leaders emerged. Both leaders identified had long-term goals for the project, took on tasks and roles in an effort to move the group along, and were able to reach out to others and get them involved in the process. Although both leaders maintained the three attributes, one leader, the UMaine Cooperative Extension and Sea Grant agent, was stronger in all three realms. Interviewees added that the leaders associated with the project were organized, knowledgeable, and managed expectations well.

CONCLUSION

Communities around the country are under pressure to adapt to changing social, economic, and ecological conditions. Leadership is very likely a key component of community success in becoming more resilient to long-term and short-term changes. Visionary, entrepreneurial, and collaborative leaders play important roles in guiding the community toward its adaptation goals. We should not only seek these characteristics in leaders but practice them ourselves as we engage in projects aimed at building community resilience.

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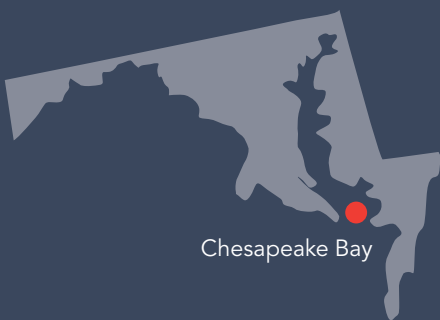
3 Ibid.

LESSONS LEARNED: Maryland Sea Grant

Project lead: Vicky Carrasco,
coastal communities specialist

Greater Chesapeake Bay Area demographics (2010 Census)

Population: 17 million
Persons/sq. mile: 266
Median household income: \$59,000
Below poverty level (multi-county
median): 11.6%



GREATER CHESAPEAKE BAY AREA

Maryland is unique in that every county in the state, except for a portion of the westernmost county, is considered a Coastal Zone county. The Maryland coastal zone includes 16 counties and Baltimore City, bordering different water bodies, including the Chesapeake Bay, Atlantic Coastal Bays, and the Atlantic Ocean. This area is two-thirds of the State's land area, yet it is home to almost 70 percent of Maryland's residents. Given this coastal context, many communities in Maryland are located in low-lying coastal areas that may be vulnerable to the effects of climate-change, such as changing tides, storm surges, flooding, and sea-level rise. Over the past few years, the state has begun to direct significant resources toward issues such as climate-change science, adaptation, and mitigation: the establishment of the Maryland Commission on Climate Change (2007), the Maryland

Climate Action Plan (2008, updated in November 2009), and the report Building Resilience to Climate Change (2010), which articulated anticipated effects of global warming, recommended actions, and policies.

Climate-related risks

The climate-related risks include storm surges, flooding, and sea-level rise. Sea-level rise in Maryland also adds to the effect of land subsidence. These risks have been identified in previous state agency studies and were reiterated at a forum held in 2012, which included climate researchers and community representatives.

Project participants

In recent years, a unique Climate Adaptation Partnership was developed in Maryland between three NOAA-funded programs working on overlapping goals—University of Maryland Sea Grant Extension, Maryland's Coastal Training Program (CB NERRS for MD) and Maryland's Chesapeake and Coastal Service (MD DNR)—to understand local governments' level of knowledge, their attitudes, and the barriers (for implementation) around climate-change adaptation. The partnership began with several pieces falling into place at the same time, including the state establishing the CoastSmart program, a small grant from Oregon Sea Grant through NOAA's SARP (Sectoral Applications Research Program) program, and Sea Grant's CCCAI (Coastal Communities Climate Adaptation Initiative) projects. Additionally, a partnership was developed with the Center of Watershed Protection and the Climate Information Responding to Users Needs (CIRUN) group, to assist with a local climate-outreach forum.

Maryland Sea Grant's initial focus was to work with both urban and rural counties in the Chesapeake Bay area, within its



Evening light on a marshy area in Calvert Cliffs State Park, along the Chesapeake Bay in Maryland. (PHOTO: © ISTOCKPHOTO.COM/ APPALACHIAN VIEWS)

partnership with other organizations addressing climate-change needs and adaptation. Specific participation in the SARP project by Maryland Sea Grant included a survey of the staff within Maryland's coastal zone (i.e., planners, public works, natural-resource managers, and environmental health staff). The survey on the risks related to climate and related adaptation planning was conducted in late 2011 and 2012.

Findings from the survey will be compared to a similar survey conducted nationally by other Sea Grant states and led by Oregon, and this will guide further work in Maryland communities.

Maryland worked to improve and solidify planning and communication by organizing a Climate Outreach Forum and establishing the forum's Advisory Committee consisting of Sea Grant, DNR (MD Dept. of Natural Resources: Coastal Training Program, Coastal Program), University of Maryland Extension, Center for Watershed Protection, and experts in the physical and social sciences with known expertise in relevant disciplines. This and future forums and collaboration with key DNR partners will help guide development of outreach tools and materials on climate change in Maryland and be used to disseminate survey results, based on analysis.

GRAND MARAIS, MINNESOTA

Grand Marais, Minnesota, is a focal point for tourism and recreation on the Lake Superior coast. The most northerly community in the SARP project, and the only one on fresh water, Grand Marais is situated on a bay and harbor, and accessed by the sole, main Highway 61, also known as the North Shore Scenic Drive. The community itself is a small town of 1,351 nestled in the Superior National Forest and situated at the edge of the Boundary Waters Canoe Area Wilderness. Tourism and recreation are the economic drivers in the community, though other industries, such as logging and commercial fishing, are also critical for the economy and culture. Grand Marais has a reputation for being a friendly small town, full of natural beauty and bountiful outdoor recreation opportunities.

Climate-related risks

The state of the forests, wildlife, streams, and Lake Superior play a vital role in bringing visitors to this area, and any changes to these could affect people's decisions to make the trek to this relatively isolated outpost. This isolation also means few backups when it comes to transportation or communication, so maintaining functioning infrastructure is also important. For the long winter season, many businesses rely on those who enjoy winter recreation, thus having passable snowmobile and ski trails and good ice cover on inland lakes is vital.

Grand Marais, Minnesota.
(PHOTO: KIRSTEN WINTERS)



Project participants

Members of the Cook County Local Energy Project (CCLEP) were interested and engaged in climate-change issues facing the community already, and agreed to assist Minnesota Sea Grant in the project. CCLEP members provided us with their insights to help us select a variety of civic, business, and cultural leaders in the community and ensure that we were asking relevant questions. After key issues were identified through the interviews and surveys, CCLEP members helped publicize a series of scientific talks focused on these top-tier concerns in the community: climate impacts on forests, extreme storm events, and winter tourism.

Related publications and Web links

Climate change talks: tinyurl.com/moeqwyp

Project leads: Jesse Schomberg, program leader and coastal communities and land-use planning Extension educator

Grand Marais, Minnesota, demographics (2010 Census)

Population: 1,351
Persons/sq. mile: 466
Median household income: \$41,000
Below poverty level (county): 16.6%



LESSONS LEARNED: North Carolina Sea Grant

Project leads: Gloria Putnam, coastal resources and communities specialist; Jessica Whitehead, regional climate Extension specialist; Jack Thigpen, Extension director; and Michelle Covi, research assistant

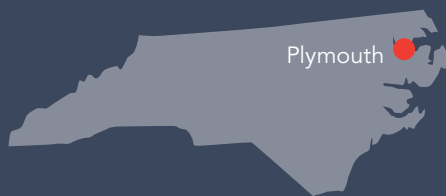
Plymouth, North Carolina demographics (2010 Census)

Population: 3,798

Persons/sq. mile: 982

Median household income: \$24,347

Below poverty level (county): 24.8%



PLYMOUTH, NORTH CAROLINA

The coastal town we worked with is Plymouth, the county seat of Washington County, North Carolina.

It is located near the mouth of the Roanoke River and the head of the Albemarle Sound. It has a population of 4,100, with a majority of citizens being Black or African American (64 percent) and White (35 percent) (U.S.

Census Bureau, Census 2000). The 2009 household median income was \$24,347 (U.S. Census Bureau, Census 2009). With an average elevation of 13 feet above mean sea level, many parts of the town are much lower and prone to flooding, in particular important infrastructure.

Climate-related risks

Climate-related risks identified via interviews by local leaders included erosion, localized flooding/stormwater management/drainage systems, saltwater intrusion to the river, drought, sea-level rise, weather patterns, groundwater management, river flow fluctuations, wetland/marshes, and infrastructure maintenance. These are climate-related risks pertaining to both ecological and social (built) environments.

A sewage pump station floods in the Town of Plymouth during Hurricane Irene on August 27, 2011.
(PHOTO: PLYMOUTH MAYOR BRIAN ROTH)



Plymouth, North Carolina, Mayor Brian Roth shows Sea Grant's Jack Thigpen and Jessica Whitehead areas that flood in town along the Roanoke River. (PHOTO: GLORIA PUTNAM, NC SEA GRANT)

Project participants

Interviews with local leaders helped clarify concerns and knowledge about risks and the map of inundation zones in town. Findings from these interviews were presented to the city council. One council member and the mayor then participated in a structured decision-making process with community members and a facilitator from the Social and Environmental Research Institute (SERI). The workshop acted as a way to structure a conversation about vulnerabilities, to share knowledge about the town and environment, and to pool knowledge for the purpose of long-term stormwater management planning. New maps were created, as well as a report that was distributed to the town leaders for use in other projects and grants.

Related publications and Web links

Coastwatch article, spring 2012 edition, "Plymouth Prepares for the Future: Flooding Threats in a Changing Climate." tinyurl.com/ktxvzv2

Project Report for the town of Plymouth: "Facing the Future in Plymouth, NC: Preparing for Increased Flood Risks." Sea Grant 2012, UNC-SG-12-05. tinyurl.com/k9cdpmb

Or, go to www.ncseagrants.org and type Town of Plymouth in the search box.



PORT ORFORD, OREGON

Project participants

By design, this project (2009–10) was locally coordinated and led by the Port Orford Ocean Resource Team, an NGO (which happened to win NOAA’s NGO of the Year award in 2011). This local organization was assisted by natural and social scientists and practitioners affiliated with Oregon Sea Grant. Although the working group of 10 interested Port Orford residents and leaders had no official capacity, they shared an interest in how the town might adapt to a changing climate. The development of group “concept maps” provided an equal opportunity for participants to present, share, and discuss their understanding of the risks associated with environmental change and the responses the community might consider. Participants’ views of the climate risks were then compared to the available information from climate scientists, and were found to be in very close agreement. This approach was intentional: community participants should have the opportunity to identify problems about which they want to make decisions, rather than being told by scientists in advance what those problems or decisions should be.

Climate-related risks

The working group was chiefly concerned about risks related to sea-level rise, increases in extreme weather, ocean and freshwater temperature changes, and atmospheric temperature. Wanting to focus on critical local vulnerabilities in the natural environment, the working group highlighted potential breaching of a local lake during flooding events. Such flooding, which might be triggered by increased winter storminess associated with a changing climate, could break a high-pressure sewer line, causing significant spillage and environmental harm.

The group renewed its interest in finding solutions to this complex set of issues. In addition, the group persuaded the city planning commission to consider changes to the climate when making future decisions and to include language to that effect in its comprehensive plan.

Related publications and Web links

- Cone, J., S. Rowe, J. Borberg, and B. Goodwin. 2012. Community Planning for Climate Change: Visible Thinking Tools Facilitate Shared Understanding. *Journal of Community Engagement and Scholarship*, 5(2), 5–17.
- Cone, J., and B. Goodwin. 2011. *Working Group Consider Effects of a Changing Climate: A Report to the Port Orford Community*. Corvallis, OR: Oregon Sea Grant. Online at tinyurl.com/kzl5zbj
- Oregon Sea Grant climate page: seagrant.oregonstate.edu/climate-change

Project leads: Joe Cone, communications leader; Pat Corcoran, Extension coastal hazards specialist; Michael Harte, professor and director, Marine Resource Management Program, Oregon State University; Shawn Rowe, marine education learning specialist; Jenna Borberg and Joy Irby, graduate students; and Briana Goodwin, local NGO coordinator

Port Orford, Oregon, demographics (2010 Census)

Population: 1,090
Persons/sq. mile: 680
Median household income: \$37,472
Below poverty level (county): 13.9%



The port of Port Orford is a key community asset. (PHOTO: JOE CONE, OREGON SEA GRANT)



LESSONS LEARNED: South Carolina Sea Grant

Project leads: Jessica Whitehead, regional climate extension specialist; Robert Bacon, Extension program leader; and David Stoney, president, Kitchen Table Climate Study Group

McClellanville, South Carolina, demographics (2010 Census)

Population: 499

Persons/sq.mile: 248

Median household income: \$48,433

Below poverty level (county): 16.5%



McCLELLANVILLE, SOUTH CAROLINA

The Town of McClellanville, South Carolina, has a history of vulnerability to natural hazards, and community managers will need to adapt their practices to accommodate climate change in ways that balance its historical character with changing economic and demographic realities. McClellanville is a small fishing village that still advertises having “an economy largely dependent upon the sea” (McClellanville Business Association, n.d.), but it is becoming an attractive option for retirement homes. Much of the town lies at or below 10 feet in elevation, and in 1989 the low-lying topography contributed to the severe damage the town sustained due to the storm surge and winds of Hurricane Hugo. More than 20 years after this historic storm, residents reported flooding near commercial docks during very high tides and in problem drainage areas during heavy rains, and expressed concerns about erosion of favorite beach spots, marsh dieback during droughts, and water quality issues that may someday impact shellfish harvesting. Accelerated sea-level rise caused by global climate change has the potential to exacerbate other forcings, subjecting the town to more-frequent inundation and encroachment from marshes attempting to move upland as the sea level rises.

Climate-related risks

Climate-related risks were identified through two processes: a Vulnerability, Consequences, and Adaptation Planning Scenarios (VCAPS)

process with McClellanville decision-makers, and interviews with town residents. VCAPS participants focused on

stormwater management and infrastructure, and identified rainfall variability, increased rainfall, and sea-level rise as relevant climate stressors. Consequences of these stressors include increased pollutants, drought, runoff, standing water, flooding, and subsequent water-quality issues. In addition, community consequences might include closing of shellfish beds, health issues, increased mosquito population, and loss of property value. The McClellanville process of identifying risks and consequences included both immediate and long-term risks to the environment. Residents interviewed identified flooding, drought, erosion, water quality, and hurricanes as issues of concern. These are tied to potential changes in rainfall variability, sea-level rise, and tropical cyclone intensity.

Project participants

The Kitchen Table Climate Study Group (KTCSG) is a grassroots group dedicated to teaching itself and the residents of McClellanville about climate change, and one of the group’s goals is to promote effective adaptation planning that increases the community’s resilience. In addition to serving as the key informant for identifying participants, the KTCSG worked with South Carolina Sea Grant Extension to use the project results to develop a set of displays for Town Hall on climate issues in McClellanville and to host a town hall meeting on climate change. The KTCSG hopes the displays and community workshop will provide a foundation for engaging with McClellanville town managers to begin developing an adaptation plan for the town.

Related publication

Bath, S., L. Wood, and J. Whitehead. 2013. *Protecting McClellanville’s Natural Resources in a Changing World*. Poster series prepared for display in McClellanville Town Hall, McClellanville, SC.



Flooding during abnormally high tides in McClellanville on Nov. 14, 2012.

(PHOTO: S. D. STONEY, 2012)

NORTHWEST FISHERIES

Washington Sea Grant and the University of Washington's Climate Impacts Group worked together with a consortium of west coast federal, academic, and non-profit organizations. This community is not so much of place, but of practice, including west coast fisheries dealing with canary rockfish, sablefish, Pacific whiting, and Dungeness crab.

Climate-related risks

Marine waters along the U.S. west coast are highly productive, supporting many important fisheries. Changing climatic conditions may affect the productivity of these fisheries, however. Impacts of concern include alteration of coastal habitats due to sea-level rise and ocean acidification, shifts in the abundance and distribution of marine species, changes in life-cycle stages such as breeding and migration, increased incidence of harmful algal blooms, and increased competition from invasive or other nuisance species. These changes will add to the existing long-term sustainability challenges already facing west coast fisheries.

Project participants

Action outcomes for this project included a workshop on the vulnerability of west coast fisheries to climate change, and pre-workshop interviews with a subset of workshop participants to get a better understanding of participant perspectives on perceptions, knowledge, and opinions about fisheries, fisheries management, climate change, and climate-change preparedness. A post-workshop online survey was also conducted. The results of the pre-workshop interviews and the post-workshop survey are documented in Whitely Binder 2012.

More than 50 people representing the four fisheries and different interests within those fisheries (e.g., tribal research agencies, federal and state agents, commercial fishers, trade groups, fishermen, and pro-

cessors) participated in the workshop. In preparation for the workshop, three white papers were prepared summarizing what is known about the exposure and sensitivity of each fishery to climate change. Participants received the white paper relevant to their fishery prior to the workshop and had the opportunity at the workshop to provide feedback on the white paper's assessment of exposure and sensitivity for the fishery.

After brief review and feedback on the exposure and sensitivity assessments, each fishery focused on identifying and evaluating factors affecting their fishery's capacity to adapt to climate impacts. These discussions drew on participant knowledge of the fishery and, among other things, observations of how fisheries have responded to past climate variations (such as El Niño events) and stresses consistent with projected climate change. Participants then applied a qualitative (high/medium/low) rating to factors affecting adaptive capacity. These ratings were combined at the workshop with exposure and sensitivity ratings to provide an overall assessment of each fishery's vulnerability to climate change.

Learning outcomes at the workshop included information on climate-change adaptation options for the fisheries, adaptive capacity of stocks and in human communities, and fisheries management issues.

Related publications and Web links

A final workshop paper is in preparation as of fall 2013, as are possible fishery-specific papers based on the white papers.

WHITE PAPERS CITATIONS:

Each of the first three articles listed below was included in Draft Preparatory White Paper for Assessing Vulnerability of West Coast Fisheries to a Changing Climate Workshop, Seattle, Washington, May 25–26, 2011. Washington Sea Grant and Climate Impacts Group, University of Washington.

Project leads: Lara Whitely Binder, outreach specialist, University of Washington Climate Impacts Group



Fisheries represented in this project include



Pacific whiting



Sablefish



Dungeness crab



Canary rockfish

LESSONS LEARNED:
WASHINGTON SEA GRANT *continued*

Cardinal, K. M., L. Whitely Binder, E. Timmins-Schiffman, and P. S. McDonald. 2011. Climate impacts on the Pacific whiting fishery: A preliminary assessment.

McDonald, P. S., L. Whitely Binder, E. Timmins-Schiffman, and K. Cardinal. 2011. Climate impacts on the Dungeness crab fishery: A preliminary assessment.

Timmins-Schiffman, E., L. Whitely Binder, P. S. McDonald, and K. Cardinal. 2011. Climate impacts on the canary rockfish and sablefish fisheries: A preliminary assessment.

Whitely Binder, L. 2012. Laying the Foundation for Integrating Climate Change Impacts and Adaptation into Fishery Management Decisions: SARP Project Report. Prepared for Oregon Sea Grant's "Mobilizing the NOAA Sea Grant Network for Coastal Community Climate Resilience" SARP Grant (NOAA Subgrant No. NA221A-F), University of Washington Climate Impacts Group.

Making Sense of Resilience in a Climate of Change

By Miriah Russo Kelly, Oregon Sea Grant;
Project Research Assistant

The ability to withstand, cope with, or adjust to disturbances seems very useful in a world affected by global warming. But the word "resilience," or as some say, "resiliency," means quite different things to different people, as the range of uses of the terms is pretty wide. For example, if I understand resilience as depicted in one cosmetics commercial (as merely "long lasting"), I might find it difficult to understand the complexity of resilience as presented in the professional literature (as a conceptual framework that makes sense of change at a variety of spatial and temporal scales). Having an array of definitions in common circulation affects our ability to communicate effectively with the communities we serve. If individual definitions of resilience are not aligned, purposes, outcomes, and expectations associated with a project that hopes to achieve resilience may be unclear to participants.

A DELUGE OF DEFINITIONS

Mainstream popular media presents resilience in athletic, political, economic, military, environmental, and social-psychological contexts. My research using Google Analytics revealed that "resilience" is most frequently used in popular media as a synonym

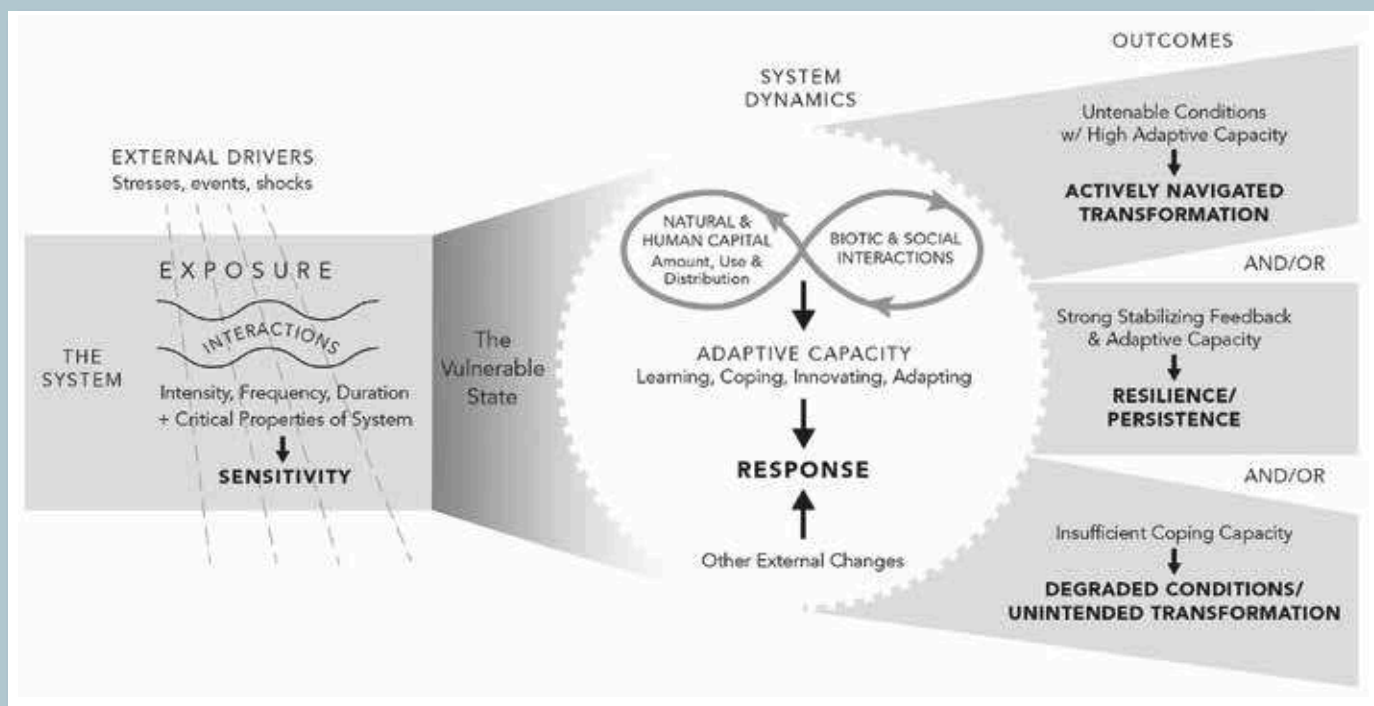
for "strength" or "endurance."

The term is also used to describe the ability to hold up under pressure or the ability to bounce back quickly after an abrupt change. The array of interpretations as displayed by popular media is enough to confuse anyone. Adding to the complexity is academic literature that describes resilience in highly technical social, ecological, biological, and institutional terms.

The idea of linked social-ecological resilience has emerged in academic literature over the past decade, and it has appeared increasingly as issues of environmental change



PHOTO: JOE CONE, OREGON SEA GRANT



A conceptual framework that puts resilience in context shows, from the left, that the System of interest (e.g., household, community) responds to a suite of interacting Drivers (stresses, events) that may put it into a Vulnerable State in which the Adaptive Capacity of the system will determine potential outcomes: (1) actively navigated transformation to a new, potentially more beneficial state; (2) persistence of the existing system through resilience; or (3) unintended transformation to a new state (often degraded) due to vulnerability and the failure to adapt or transform.

GRAPHIC AND CAPTION ADAPTED FROM CHAPIN, F. STUART, CARL FOLKE, AND GARY P. KOFINAS. 2009. A FRAMEWORK FOR UNDERSTANDING CHANGE. IN *PRINCIPLES OF ECOSYSTEM STEWARDSHIP: RESILIENCE-BASED NATURAL RESOURCE MANAGEMENT IN A CHANGING WORLD*, EDITED BY F. S. CHAPIN, G. P. KOFINAS AND C. E. FOLKE. NEW YORK: SPRINGER. GRAPHIC: PATRICIA ANDERSSON

have become more pervasive and real. The coupling of the social (human) and ecological (environmental) realms is relatively new to the academic literature on resilience, which has a long history of being applied in the fields of biology, psychology, and engineering.

In 2010 Oregon Sea Grant convened a teleconference of 13 coastal professionals working in the area of resilience. The discussion highlighted that the term “resilience” is subject to interpretation and that community perceptions and academic definitions are drastically different. Coastal professionals have a unique challenge of translating academic literature steeped in jargon and complexity to diverse publics who may understand the concept in their own way. Further, we are expected to utilize such scientific concepts in the process of implementing practices that would then improve resilience. Many professionals are focused on simplifying, but not oversimplifying, the concept of resilience, and using it as a conceptual framework for practical application. For many, this means using a definition of the term that supports the practices intended to improve resilience.

IMPLICATIONS FOR COMMUNICATION AND PRACTICE

To be accurate in communicating resilience, and implementing resilient practices, one must first determine resilience of what and to what? For example, I might be working on a project about climate-change resilience, but when I narrow the focus using those two questions in a coastal community, I might find that I am really talking about the resilience of a community of ~5,000 property owners to acute coastline erosion. Specifying the source of the change and the scope and nature of the appropriate system allows for a more concrete understanding and improved application of the concept.

Because there are so many different derivations of the concept of resilience, we need to be very careful in how we present climate-change resilience projects to the communities with which we work. Regardless of the manner in which we extrapolate perceptions from our audiences, we must do so, and then use findings to develop more-precise messages about the intended outcomes or expectations associated with the actions taken to improve resilience.

Adapting to Climate Change: Some Continuing Challenges

By Joe Cone

While this report is largely about the practice of adapting to climate change and, particularly, about assisting coastal communities in that effort, it's good to know that a small number of scholars are also conducting research on climate adaptation success, with the ultimate goal of helping practitioners and communities do better, as there's much still to learn. Among those researchers is a group that received funding from the Sea Grant programs in Washington, Oregon, and California, as part of a regional solicitation of social science projects in 2011. The investigators' project, "Successful adaptation to climate change," convened workshops of climate-change practitioners and researchers as part of an effort to understand both the special challenges and strategies of successfully adapting to this change.

For a portion of their work, the researchers drew on relevant literature for insights, including *The Practice of Adaptive Leadership: Tools and Tactics for Changing Your Organization and the World*. Item 1 below, Distinguishing Technical Problems from Adaptive Challenges, is an extract from this book. Item 2, Four Common Adaptive Challenges, is adapted from a handout used in one of the five project workshops.

1 Heifetz, R. A., A. Grashow, and M. Linsky. 2009. *The Practice of Adaptive Leadership: Tools and Tactics for Changing Your Organization and the World*. Boston, MA: Harvard Business Review Press.

2 Used by permission, with thanks to Susanne Moser, Ph.D.: Susanne Moser Research & Consulting and Stanford University. The original handout cites the 2009 book by Heifetz et al. (above) as a source.

1. Distinguishing Technical Problems from Adaptive Challenges

The most common cause of failure in leadership is treating adaptive challenges as if they were technical problems. What's the difference? While technical problems may be very complex and critically important (like replacing a faulty heart valve during cardiac surgery), they have known solutions that can be implemented through current know-how. They can be resolved through the application of authoritative expertise and through the organization's

current structure, procedures, and ways of doing things. Adaptive challenges can be addressed only through changes in people's priorities, beliefs, habits, and loyalties. Making progress requires going beyond any authoritative expertise to mobilize discovery, shedding certain entrenched ways, tolerating losses, and generating the capacity to thrive anew. The figure below lays out some distinctions between technical problems and adaptive challenges.

KIND OF CHALLENGE	PROBLEM DEFINITION	SOLUTION	LOCUS OF WORK
TECHNICAL	Clear	Clear	Authority
TECHNICAL AND ADAPTIVE	Clear	Requires learning	Authority and stakeholders
ADAPTIVE	Requires learning	Requires learning	Stakeholders

2. Four Common Adaptive Challenges

CHALLENGE	CHARACTERIZED BY...	ONE REASON FOR...
VALUES-BEHAVIOR GAP	People espouse different values and goals than they actually enact or implement	Socially or politically expedient to espouse the ideal (combined with lack of accountability)
COMPETING COMMITMENTS	Plans are not implemented, decisions not taken because of perceived conflicts or tradeoffs	Choice between commitments is painful
AVOIDING THE UNSPEAKABLE	People avoid raising the most difficult issues	Speaking the unspeakable creates tension, discomfort, or conflict
WORK OR CHANGE AVOIDANCE	People do everything to avoid change	Distractions and diverting attention (e.g., focus on easy parts, denial, proxy fight, take options off table)

REFLECTIONS...on the practice of climate change outreach and engagement among participants involved in this project

By Pat Corcoran, Oregon Sea Grant Extension Coastal Hazards Specialist and Project Co-Principal Investigator

The Sea Grant Climate Change Network exists for Extension, education, and communications professionals interested in climate-change outreach and engagement to share experiences and perspectives on our work and receive feedback and guidance from our colleagues. The National Sea Grant Office offers grant funding for Sea Grant personnel to engage local stakeholders in learning about the impacts of climate-driven environmental change and exploring ways to mitigate and adapt to the impacts of those changes. With core funding from the NOAA Climate Program office, a number of state Sea Grant programs, led by Oregon, collaborated on this pilot project.

The national network of Sea Grant Extension educators is a diverse group. We are diverse in our local geography and our topical expertise, as well as culturally within our organizations (researchers, statewide specialists, field faculty, etc.). We span nearly the entire spectrum of geographic locales and coastal environments. Yet, we have a couple of important things in common when it comes to climate-change outreach and engagement.

One common characteristic among Sea Grant Extension personnel: most of us have degrees in the biological or physical sciences. Few of us have academic

“We’ve been able to get enough information [from interviews] that we’ll be able to craft some specific communications that will be effective and touch on their concerns in a way that I think will be relevant to the community.”

– Jessica Whitehead, Regional Climate Extension Specialist, South Carolina Sea Grant Consortium

backgrounds in climate-related fields. Yet, most of our program interests are being affected by changes in the environment increasingly attributed to climate change (ecosystem health, fisheries, waterfronts, hazards).

Another common characteristic among Sea Grant educators: few of us have academic backgrounds in the social sciences. Yet, many of our stakeholders are asking for help thinking through the issues and identifying ways to mitigate or adapt to environmental changes. We are being drawn into a new subject matter on the margins of our expertise, and compelled to use new tools to help our stakeholders grapple with environmental change.

This project provided educators with examples of and training on tools and methods drawn from the social sciences. These included mental models interviewing, survey development and implementa-

tion, and stakeholder concept-mapping. The tools were less focused on problem solving, and more focused on collaborative learning and the co-production of knowledge. These activities helped identify both the collective understanding among stakeholders about specific climate-change impacts, and the “frame of reference” or “context” within which these impacts are understood by local stakeholders. This context is critically important to identify in order to craft appropriate messages and learning experiences.

Most of us recognized these tools but had not used them ourselves. This project provided a process, structure, the tools, and some guidance for participants to adapt to their local circumstances. We were able to listen to, interact with, and provide feedback to our colleagues as the projects unfolded. This provided a network of support for participants to draw upon, and reduced the feeling of isolation among participants as they tried out some new things.

A boundary organization

Sea Grant Extension has been referred to as a boundary organization. This term describes the role of Sea Grant as an entity that spans gaps between stakeholders. Sea Grant spans the boundaries between researchers and state and federal agency staff, social sciences and natural sciences, researchers and municipal staff, urban

“The SARP funds in Washington supported three key areas of work related to our workshop [assessing vulnerability of fisheries to climate change]. The workshop planning activities helped ensure that we engaged a broad audience of stakeholders; the pre-workshop interviews helped with understanding stakeholder perspectives on issues related to the workshop and the workshop itself; and the post-workshop survey measured the effectiveness of the workshop and related activities.”

– Lara Whitely Binder, Outreach and Adaptation Specialist, Climate Impacts Group, University of Washington

BOUNDARY ORGANIZATIONS

Boundary organizations have the overall dual purpose of protecting but also transcending the divide between science and practice (e.g., protection from the politicization of science, transcending for improved information flow). To do so they perform four critical functions, which help manage and maintain the relationship between information producers and users. The first is a convening function: bringing stakeholder parties together for face-to-face contact to foster trust-building and mutual understanding, which is the foundation of effective information production, transfer and ultimate use. The second function of boundary organizations—translation—assures that information and resources are comprehensible for co-operating individuals and organizations. The third function of boundary organizations is to facilitate collaboration so that co-operating groups can be brought together for frank and transparent dialogue to make possible effective working relationships that co-produce relevant and scientifically credible, applied knowledge. The final function that boundary organizations sometimes play is mediation to assure that various interests of stakeholders, information producers and users are fairly represented.

—Adapted from Tribbia, John, and Susanne C. Moser [2008], “More than information: what coastal managers need to plan for climate change,” *Environmental Science and Policy* 11 [4]:315–328).



and rural interests, regulators and the regulated, and science and policy, among others. Boundary organizations are well suited to outreach and engagement about climate change and climate adaptation, because such organizations can help stakeholders develop a scientifically grounded “context” or “frame” with which to interpret current and ongoing research findings.

Advocacy

Historically, guidance to Sea Grant Extension educators has been to serve as “neutral conveyors” or “honest brokers” of information, the idea being that “educators” are to help people make informed choices, not to persuade them to make particular choices nor make their choices for them. This seems reasonable and has rarely surfaced as an issue. However, the topic of climate change is challenging for one to participate in without being pigeonholed as either a “believer” or a “denier”—by both colleagues and stakeholders. Sea Grant institutions and programs are mindful of these risks and are moving forward with caution to maintain program integrity.

Finding a niche

Hence, Sea Grant educators seek to develop an appropriate practice focused on inquiry and understanding. There are many niches to fill, and this should not be a problem. This project is one example of an effort of inquiry: a collaborative learning project with researchers and stake-

holders did roughly similar projects but in very different natural and cultural environments. Some educators worked with familiar partners; others engaged entirely new ones. Some common themes, or lessons learned, emerged. These themes arose from the mental models interviews and survey work conducted with stake-

“It’s been valuable for us to really know what particular issues locally are of most concern, and that’s been a help in getting folks involved and interested in looking at climate change.”

— Jesse Schomberg, Coastal Communities and Land Use Planning Extension Educator, Minnesota Sea Grant

holders co-producing knowledge that provides a scientifically grounded context for local decision making. The slight shift from expert to collaborator helps keep the focus on inquiry, not advocacy.

Lessons learned

The project allowed considerable flexibility in the local application of the tools and techniques, based on the educators’ local knowledge of issues and potential partners and stakeholders. Each educator

holders in each state and developed during the conversations among the network. Oregon Sea Grant support personnel conducted exit interviews with network participants and transcribed recordings of our conference calls.

One of the obvious areas of interest was what their local stakeholders know about climate science and what they don’t. This project was reported as an entrée for educators to survey new stakeholders about their views on climate-related

changes—many of whom they might not otherwise engage (e.g., elected leaders and policy makers). This also provided a high-quality needs assessment for future programming.

Negotiating the political polarity of the subject with a wide range of people was a continual education. Educators learned to appreciate sensitivity around terms we use such as climate change, sea-level rise, mitigation, adaptation, etc. Economics is always just under the surface of climate conversations, as are power relationships between levels of government. A key lesson was to speak accurately about what is happening, without referencing too many popular terms that have developed baggage among many stakeholders.

The difference between urban and rural contexts was mostly a lesson in resources and capacity. The climate impacts and vulnerabilities are similar, but as is typical, larger places have more people and resources and can do more things. Sea Grant’s efforts in smaller locales were very much appreciated by stakeholders and managers. Relatively small investments were more visible in rural areas than in larger cities or as part of a statewide project.

The legal authority to address a particular climate impact on a resource was the de facto “decider” on the issue. Sometimes the entity was collaborative, sometimes a gatekeeper. Our independence allows Sea Grant some latitude to add educational value to the activities of agencies that otherwise would not occur (see “Boundary organization”). Participants in this project found it more



Keith Harding, University of Minnesota Ph.D. student, talks about extreme storms during a Minnesota Sea Grant/SARP-sponsored presentation in Grand Marais. (PHOTO: JESSE SCHOMBERG)

effective to integrate Sea Grant education in the context of the ongoing work of the legal authority (state, county, city, agency) than to have a standalone Sea Grant initiative.

We learned again that local governments are understaffed and overworked, and this is particularly true for small rural places. However, they move quickly on projects they’re focused on and do not value projects that take years to produce actionable information. They need information on *their* schedule, not ours.

Local leaders and staff tend not to make the cognitive connection between the issues they see (impacts) and the causes (drivers) of those issues. Thus, locals tend to speak more in terms of the “impacts” of climate change (flooding, erosion, wildfires, lack of snow, etc.), while researchers and Sea Grant

faculty tend to speak more in terms of the “drivers” of the impacts (global climate change, sea-level rise, changing storm regimes, etc.). Accordingly, locals tended to focus on short-term “coping” strategies to deal with the pressing issue of today. Researchers and Sea Grant educators might be said to focus more on longer-term “buffering” strategies to create systems to deal with the issues of tomorrow. Interestingly, local actions currently being taken that Sea Grant educators would consider “adaptation” are not referred to as adaptation locally (e.g., upgrading leaky septic systems, replacing small culverts with larger ones, etc.). We learned to apply labels lightly.

Several lessons were learned related to the procedures and skills specifically involved in the project. Several noted that there was great value in conducting interviews face-to-face and using open-ended questions to solicit authentic responses. The way in which people responded to open questions was very informative. A key was maintaining personal discipline when interviewing, so as to remain neutral and avoid asking leading follow-up questions. Mental models interviewing was seen as a revealing and valuable way to understand how people think about

“We developed a climate forum for researchers and we’ve been asked a lot by the researchers to share with them the results of the survey so that when they go for funding they can use this [survey] as a foundation for research on some of the specific needs of the communities.”

– Vicky Carrasco, Coastal Communities Specialist,
Maryland Sea Grant Extension Program

issues such as climate change. Having a template to use for the interviews was very helpful. Also helpful was having a network of colleagues to call. Still, we learned that this work is very labor-intensive and time-consuming—but could be an excellent experience for graduate students or other assistants.

Despite climate change not being their topical expertise, most felt good about “integrating climate education into my ongoing work.” Also, Sea Grant was seen in some areas as having a new or additional area of expertise in “dealing with the local impacts of climate change.” Finally, campus researchers are motivated by funders to connect research proposals to community efforts. So, there is an entrée for Sea Grant educators to play a familiar role, but with some new disciplines.

Funding

The different states used their SARP dollars differently. The availability of SARP dollars was used in some states to leverage other dollars. Those states that leveraged SARP dollars with other funds did more work and achieved more outcomes. But

bigger is not always better. Some states arguably had a more positive experience by pursuing a more limited program with more limited exposure. This pilot indicates that there are niches for Sea Grant educators at virtually every scale and level

of complexity and funding. A good project design, a ready network of support, and a little bit of courage were key to the success of local programs.

“I think it’s important as you’re moving forward with any sort of planning, [rather than] a stand-alone climate change planning process it needs to be integrated into something that’s ongoing or something they [the community] are concerned about...They also move on a pretty quick time frame, so when you’re going in, make sure that you have time to devote to them to follow up. It is important to not lose momentum.”

– Gloria Putnam, Coastal Resources and Communities Specialist, North Carolina Sea Grant

“For the investment of time and money, you get a lot of really good information from mental models interviewing — ground-truth information. When we compare an expert model [of climate change] to the community [concerns], we often find that the expert model has very little do with what they’re actually concerned about in the communities. Building trust is really important when you want to do outreach and communication on controversial topics, and this interview process began building trust in a new community for us.”

– Stuart Carlton, project doctoral student, Florida Sea Grant

Climate Videos to Motivate Behavior: Our Strategy

By Joe Cone, Project PI and videographer

Americans obtain much of their information through visual media. In today’s Web and broadcast world of ubiquitous video content, it’s fair to ask what distinct value Sea Grant and Extension can bring to the party of non-stop visual presentations.

Short answer: Credibility of content and relevance to the target population.

Check.

So what’s new?

With so many “channels” to watch, focused relevance is important to view-

ers—today more than ever. So, during the first phase of our SARP projects, we developed videos using audience research to structure them for relevance, and we tested them on the intended audiences.

Communications and psychological research offer a set of insights that are critical for building strong connections with intended viewers:

- *Attention is the scarce human resource:* the target population has many other demands on its time and interests.¹
- *To gain attention,* communications do well to appeal to more than just the “head” (intellect, reasoning). Appealing to the emotions, particularly positive emotions, often increases attention.² People make decisions partly on feelings, partly through reasoning.³
- *Influencing a change* in the population’s behavior requires understanding their beliefs, needs, and constraints through empirical research on them.⁴



This screenshot from a Building a Resilient Coast segment shows the coastal property owner discussing the modifications made to her home to defend against storm surge and sea-level rise.

Segments of the Oregon DVD (listed as Climate Change and the Oregon Coast) and excerpts of the Maine DVD can be viewed from links at seagrant.oregonstate.edu/sgpubs/online-video. The entire Building a Resilient Coast can be viewed online at www.seagrant.umaine.edu/program/sarp

half said they did not know about the effectiveness of key property-protection

- *Focus the communications* to address those beliefs, needs, and constraints, providing cognitive and (where possible) emotional supports to decision-making.⁵
- *To encourage deliberation*, the communication must be relevant to choices the target population may wish to make.⁶
- *Present a story* the target viewer “relates to”—one that is compelling enough to motivate them to reflect on the story and act.⁷

These research insights were applied directly to the development of the videos *Building a Resilient Coast: Maine Confronts Climate Change* and *Preparing for Coastal Climate Change: What Oregonians Are Asking*. As the approaches were very similar, we’ll focus on one of the five segments of the Maine video, which was first distributed both as a DVD and online in 2009, aired four times on the Maine Public Broadcasting Network, and is presented in ongoing workshops by Maine Sea Grant and University of Maine Cooperative Extension collaborators.

We followed four specific steps to communicate successfully with the target audience, coastal property owners (CPOs).

(1) **Conduct empirical research.** University of Maine conducted focus groups and then a survey⁸ (548 respondents) of CPOs to better understand their beliefs, needs, and constraints regarding the understanding and behaviors we hoped to affect.

Result of the survey showed, for example, that regarding prudent actions they might take to protect their properties, the predominant response (27 percent) was that they had a *need* for specific information to make such decisions, and about

strategies. Preserving their properties was a very important *value*: 79 percent said they would rebuild the same structure or use storm-resistant strategies [make modifications] if the property were seriously damaged.

(2) **Use research to frame video.**

We knew that CPOs particularly *valued* their property because of family use and traditions, but that they were also highly *sensitive* to being “talked down to” by subject experts or government representatives about their local and personal circumstances. We linked the video story together with an on-camera host who is part of the same demographic as critical viewers [i.e., 50–65, white, male], who is likable⁹ and trustworthy.¹⁰

(3) **Present content relevant to decisions.** To hold attention and encourage deliberation,¹¹ the segment addresses the reasons for and methods of rebuilding homes to withstand climate effects. A demographic peer-homeowner describes in some detail the measures she’s taken at her property. We expected that hearing from a peer would likely influence the homeowner-viewers’ reaction to this presentation.

(4) **Create a story with compelling elements.** Even as we focused elements of the production to address the audience’s key beliefs, needs, and constraints, we also knew that a compelling story with a positive emotional dimension was needed. So we organized all segments around a theme of “what’s at stake about the things you care about.”

How well did our strategy work? It worked well...but space doesn’t permit those details here. Instead, see our journal articles on the results.¹²

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2 Fredrickson, B., and C. Branigan (2005). Positive emotions broaden the scope of attention and thought-action repertoires. *Cognition & Emotion* 19(3): 313–332.

3 Lowenstein, G. F., E. U. Weber, et al. (2001). “Risk as Feelings.” *Psychological Bulletin* 127(2): 267–286.

4 Fishbein, Martin, and Marco C. Yzer (2003). “Using Theory to Design Effective Health Behavior Interventions.” *Communication Theory* 13(2): 164–183.

5 Fischhoff, Baruch (2007). “Nonpersuasive Communication About Matters of Greatest Urgency: Climate Change.” *Environmental Science & Technology A-Page Magazine* 41(21): 7204–7208.

6 Petty, Richard E., John T. Cacioppo, et al. (1983). “Central and Peripheral Routes to Advertising Effectiveness: The Moderating Role of Involvement.” *Journal of Consumer Research* 10(2): 135–146.

7 Chip Heath and Dan Heath (Made to Stick, Random House 2007) dare to assert “the six principles of successful ideas [are] Simple Unexpected Concrete Credentialed Emotional Story.”

8 Center for Research and Evaluation, University of Maine (2008). Sea Grant Project: Fall 2007 Focus Groups and Spring 2008 Surveys Comparative Analysis. Orono, ME, University of Maine.

9 Cialdini, Robert B. (2006). *Influence: The Psychology of Persuasion*. New York: Collins.

10 Twyman, Matt, Nigel Harvey, et al. (2008). “Trust in Motives, Trust in Competence: Separate Factors Determining the Effectiveness of Risk Communication.” *Judgment and Decision Making* 3(1): 111–120.

11 Fischhoff, Baruch (2005). “Decision Research Strategies.” *Health Psychology* 24(4(Suppl.)): S9–S16.

12 Cone, J. (2013). “Creating Research-Based Videos that Can Affect Behavior.” *Journal of Extension* [Online] 51(2): Article 21AW2. Available at www.joe.org/joe/2013april/iw2.php. The article on this page is adapted largely from the *Journal of Extension* one.

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The Changing Climate of Sea Grant's Work on Climate Change

By *Joshua Brown*, NOAA Sea Grant Hazards and Climate Lead



PHOTO: JOE CONE, OREGON SEA GRANT

As a science-driven organization, the National Sea Grant College Program (NSGCP) has always focused on innovative, locally driven responses to critical challenges. Our approach to climate change is no different; we have relied on the feedback of our partners and stakeholders to shape our response.

Starting in the 1990s, increasing awareness of the challenges presented by climate change started a conversation within the Sea Grant Network on how to understand, incorporate, and address these challenges. This led to the first Sea Grant Climate Extension Workshop in 2006, where many participants indicated that they were dealing with climate-driven challenges, despite a lack of formal support for the subject matter.

In recognition of the need for increased climate expertise, 2007 saw a partnership between the NSGCP and NOAA's Regional Integrated Sciences & Assessments (RISA) to competitively establish the first Regional Sea Grant Climate Extension program. The partnership between North Carolina Sea

Grant, the South Carolina Sea Grant Consortium, and the Carolinas Regional Integrated Sciences and Assessments was selected, and included a mandate to help provide expertise and leadership in establishing a national Sea Grant climate network. At the same time, other Sea Grant programs were making efforts to identify the climate needs of their stakeholders, and pursuing ways to share climate information throughout Sea Grant.

Sea Grant programs also successfully competed for funds through NOAA's Sectoral Applications Research Program (SARP). Oregon Sea Grant led one effort to enable coastal communities across several states to take appropriate climate adaptation actions. Wisconsin Sea Grant led another effort to develop an online training module in conjunction with the University Corporation for Atmospheric Research's (UCAR) COMET program.

In 2009, these various efforts had produced a clear consensus that Sea Grant needed to be more involved in climate work, and that a professional network needed to be established so that Sea Grant

Climate activities and best practices could be shared. A second Sea Grant Climate Extension Workshop was held, and the participants formed the core of the newly chartered Sea Grant Climate Network. This organization received national recognition, and has been influential in shaping how climate activities in Sea Grant have evolved.

The following year, the National Sea Grant Office initiated the Sea Grant Community Climate Adaptation Initiative, to give each Sea Grant Program funding to work with communities and start demonstration projects. This effort revealed a serious need for capacity building across the network and for solid examples of community adaptation to serve as models for other communities.

In 2012, the Sea Grant Community Climate Adaptation Initiative was modified, with a Climate Capacity Building component being given to each Sea Grant program and a competitive Community Adaptation component, which was awarded to 10 Sea Grant-Community partnerships, ranging in size from tiny, subsistence villages to major cities (www.seagrants.noaa.gov/whatwedo/climate/cccai.html). This model seems to have been successful, allowing each program to develop idiosyncratic climate capacity while also providing model communities that others can look to.

Going forward, the National Sea Grant College Program will focus on helping communities understand the science behind climate change and how they can adapt to the opportunities and challenges it presents. Our close connections with the people of the coasts, and commitment to sharing the best science so that people can make informed choices, ensures that we will continue to seek opportunities to serve.



PHOTO: JOE CONE, OREGON SEA GRANT

“When I say ‘leaders,’ I’m talking about government leaders. But I’m also talking about leaders from business, finance, and civil society, including youth. It is imperative that the powers of all change-agents be harnessed to tackle climate change—no one group can do it alone.”

– *United Nations Secretary-General Ban Ki-moon, 14 June 2013*



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