

THE RIGHT PEOPLE IN THE RIGHT ROOM: COASTAL ADAPTATION TO CLIMATE CHANGE IN CALIFORNIA

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California's coast, where the early signs of climate change are already evident, is a magnet for the state's population and economic activity. This region faces numerous climate change impacts including sea level rise, salt water intrusion, ocean acidification, near-shore habitat losses, changes in species composition and distribution, increased droughts, wildfires, and storm intensity, flooding, erosion, water and food supply shortages, continued increases in air and water temperatures, and shifts in precipitation patterns.

A recent study showed that with an estimated 1.4 meter rise in sea-level, approximately 480,000 people and \$100 billion in property are at risk from flooding. Recognizing the considerable and impending challenges, California drafted a statewide Climate Change Adaptation Strategy calling on the state, in coordination with local and federal governments, businesses and the public, to develop adaptation plans that protect public health, critical infrastructure and critical habitats, while ensuring public access and sustainable development. This planning process requires managing entities to understand the policy, economic and physical tools at their disposal to prepare for climate change, as well as the tradeoffs different adaptation approaches represent.

The Center for Ocean Solutions, NOAA National Marine Sanctuary Program, NOAA Coastal Services Center, and the San Francisco Bay Conservation and Development Commission (BCDC) partnered to bring together managers from various departments with a stake in the coastal zone in order to begin the difficult process of developing and implementing effective, coordinated adaptation plans. Training materials and lessons from this inaugural workshop can be applied to coastal adaptation workshops throughout the United States.

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HD.GOV: AN INTERAGENCY WEB PORTAL FOCUSED ON THE HUMAN DIMENSIONS OF NATURAL RESOURCE MANAGEMENT

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Through the Internet, we have access to a large volume and great variety of potentially useful information on the human dimensions of natural resource management. However, much of this information, although produced with public funds, is hard to find and access because it is buried in Web sites scattered across a great number of servers hosted by different governmental and nongovernmental agencies.

The *HD.gov* (*HumanDimensions.gov*) Web portal was developed to address this problem. *HD.gov* provides “one-stop shopping” for credible, peer-reviewed data, tools, methodologies, case studies, and other information that are available for public use. The June 2009 release of *HD.gov* includes a new content management system that makes it easy for users to submit new information to the portal; it also provides a user-friendly interface to facilitate peer review.

The portal provides useful information to users with all levels of knowledge or experience in human dimensions and the social sciences, from novices who wish to learn about terminology, concepts, or methods, to natural resource managers, practitioners of social science methods, and experts. Users can quickly find and access content from natural resource management agencies, nongovernmental organizations, academia, and the private sector.

HD.gov is helping to create a community of practice that includes social science professionals and those seeking to apply social science to the management of natural resources. The engagement and contributions of these two groups are crucial to the value and success of this Web portal.

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GEOVISUALIZATION STRATEGIES TO ANALYZE AND COMMUNICATE INUNDATION RISK FROM STORM SURGES

Thomas R. Allen* and Stephen Sanchagrin

Storm inundation modeling, geospatial data, and web communication technologies are converging to provide new opportunities for emergency managers to make informed decisions on disaster response and to communicate risks to the public. This paper will demonstrate and discuss a system that links high performance computer models to GIS and web-based dissemination of animations and 3D immersive visualizations that extend beyond traditional, 2D maps of storm surges and coastal flooding. Two storm surge models, SLOSH (Sea, Lake and Overland Surge from Hurricanes) and ADICRC (ADvanced CIRCulation), have been evaluated for potential to visualize risk and expose predictions to spatial analysis and decision-making. Each model has advantages and disadvantages with respect to spatial scale, uncertainty, and synchronicity with the time-dependent requirements of emergency management. A prototype developed in Dare County, North Carolina, will provide the emergency manager, media, and the public with 3D-storm surge maps, animations, and online accessible GIS for flood inundation. In addition to enhancing situational awareness in an emergency, these visualizations can inform responders about probable patterns damage, rescue, and recovery needs in the hours following hurricane landfall. The geospatial inundation data are also interoperable spatial data and may be used in conjunction with other emergency management information and software tools, such as HAZUS, Hurrevac, and GIS. Future plans for system evaluation, risk perception, and operationalization and expansion in the coming hurricane season will also be described.

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SHORELINE ARMORING, RISK MANAGEMENT, AND COASTAL RESILIENCE UNDER RISING SEAS

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The land-sea interface is a complex social-ecological system characterized by natural ecological processes and human-induced changes. Holistic management of the shoreline is a critical element of an ecosystem-based approach of the land-sea interface in coastal zone management (CZM) programs. Anthropogenic alteration of shoreline environments has resulted in significant loss of sandy beach ecosystems and eroded the resilience of these systems to disturbance. We tested the efficacy of CZM programs in managing the land-sea interface under current and future challenges by comparing alternative approaches to shoreline management in two US states (Hawaii and North Carolina). Our results show that explicit prohibition of shoreline armoring has been more effective in conserving dynamic coastal environments and communities by passing the risk associated with coastal development from the public trust to private landowners. Over the long-term, robust anti-armoring legislation will de-incentivize risky coastal development projects while preserving coastal environments and the ecological services they provide to society. Policy prescriptions for effective shoreline management and increased coastal resilience under persistent coastal erosion and future sea level rise are proposed.

LIMITED RESOURCES? LET THE HABITAT PRIORITY PLANNER HELP!

Danielle Bamford* and Chrissa Stroh (presented by Bethney Ward)

In this time of scarce resources, coastal resource managers must find ways to prioritize conservation, land use, and restoration efforts. The Habitat Priority Planner (HPP) is a free geospatial tool created by the National Oceanic and Atmospheric Administration's Coastal Services Center that has received wide praise for its ease of use and broad applicability to conservation strategic planning, restoration, climate change scenarios, and other natural resource management actions. Not a geographic information system (GIS) user? Don't worry—this tool was designed to be used in a team setting. One intermediate-level GIS user can push the buttons to show quick results while a roomful of resource managers and stakeholders provide input criteria that determine the results. Tool advocates and users include land trusts, conservation alliances, nonprofit organizations, and select National Estuarine Research Reserves and refuges of the U.S. Fish and Wildlife Service. Participants in this session will learn the basic requirements for HPP use and the multiple ways the HPP has been applied to geographies nationwide.

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COASTAL BROWNFIELDS AND SEA LEVEL RISE (SLR) DUE TO CLIMATE CHANGE: ADDRESSING POTENTIAL THREATS TO THE COASTAL ZONE FROM TOXIC WASTE PLUMES AND SALTWATER INTRUSION

Aaron A. Barnett*

This paper explores potential public and environmental health risks from saltwater intrusion into toxic-waste plumes associated with coastal Brownfields. Approximately 5,000 known chemicals are known to exist in Brownfields – most are insoluble with water – increasing the risk of subterranean toxic-waste plume displacement and exposure to the general public and/or to sensitive environmental places. In addition, chemical reactions with saltwater and/or other chemicals may occur – possibly creating noxious vapors. Since the creation of the Superfund program Brownfield property owners often opted to “mothball” their properties because transaction costs can include the costs of cleanup, which in many cases is more than market value. Some barriers to Brownfield cleanup such as owner liability have been removed or at least lessened, and policies are in place to aid communities in clean up and reintroduction back into the market place. However, in light of anticipated SLR due to climate change, coastal Brownfields may require heightened attention.

This paper employed a multi-goal analysis approach. First, analyzing existing policy and financial tools available for the reintroduction of coastal Brownfields back into the market. Second, analyze existing Brownfield policy with respect to SLR, and third, analyze rates of clean up against projected rate of SLR. Discussion of saltwater intrusion and coastal Brownfields has until recently received minor substantive attention at policy levels. Thusly, the primary intent of this paper is to pose questions and encourage discussion of this potential threat to public and environmental health due to SLR.

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ASSESSING SOCIETAL VULNERABILITY OF U.S. PACIFIC NORTHWEST COMMUNITIES TO CLIMATE CHANGE-ENHANCED COASTAL HAZARDS

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Progressive increases in storm intensities and generated wave heights along the U.S. West Coast are likely controlled by changes in the Earth's climate as is the expected acceleration of global sea-level-rise. As climate change-related processes continue to enhance coastal hazards (e.g., erosion and flooding), communities in the Pacific Northwest (PNW) need to know where and how to respond to best protect lives, livelihoods, infrastructure, and resources. Vulnerability to climate change-enhanced hazards is not simply a matter of characterizing threatening physical processes but also involves assessing the exposure, sensitivity, and adaptive capacity of human-environmental systems that influence the potential for future impacts. The threats posed by climate change to PNW coastal communities can be more accurately communicated by integrating improved hazard models that incorporate climate-change controls with information on the vulnerability of communities to these hazards. To examine the influence of climate-change on community vulnerability to coastal hazards, we assessed variations in current and future societal vulnerability in Tillamook (Oregon) and Pacific (Washington) Counties. Model predictions of natural hazards under various climate-change scenarios are combined with current and projected socioeconomic indices using geographic-information-system (GIS) tools. Results suggest variations in exposure and sensitivity to hazards relate to city size—larger communities may experience great losses to future coastal hazards that reflect only a small portion of their community while smaller communities may experience relatively smaller losses that devastate them. Community vulnerability information can be used to further develop local land-use, hazard-mitigation, and emergency-management plans to incorporate risks posed by climate change-induced hazards.

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IMPACTS OF CLIMATE CHANGE ON SEAPORTS: A SURVEY OF KNOWLEDGE, PERCEPTIONS, AND PLANNING EFFORTS AMONG PORT ADMINISTRATORS

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Port authorities from around the world were surveyed to ascertain how administrators feel that climate change might impact their operations, what level of change presents as problematic, and how they plan to adapt to new conditions. The survey was distributed to 350 major ports through two leading international port organizations, the International Association of Ports and Harbors and the American Association of Port Authorities. Climate change will disproportionately affect ports and port-based economies, depending on their geographic location and the institutional capacities of the ports themselves and the communities in which they are located. Ports in a hurricane belt will face different challenges than those on emergent coastlines far removed from storm-impacts. Ports in developing nations will have a different suite of options available to them than those in developed nations. Ports located in estuaries that provide nursery environments for marine life have an even greater responsibility to protect coastal waters. A recent EPA report on climate impacts on seaports states, “most ports do not appear to be thinking about, let alone actively preparing to address, the effects of climate change.” To meet these challenges, decision makers must understand the nature of the problem and what options may be considered. This global survey of port authorities provides insights into how the ports community perceives potential climate impacts. Little research has been done in this area and results of this survey serve as an important step to understanding where this audience stands and what information they require to increase resiliency.

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EXPERTISE AND POLICY CHANGE IN MANAGING THE GREAT BARRIER REEF MARINE PARK: THE ROLES OF INTERNATIONAL AND DOMESTIC POLICY ARENAS

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This research analyzes major policy change initiated by the Great Barrier Reef Marine Park Authority (GBRMPA) in re-zoning the Great Barrier Reef Marine Park (the Park), which established the world's largest network of fully protected marine areas that prohibit extractive activities and extends over 100,000 km². This paper argues that GBRMPA was able to put into effect the new zoning scheme as it had been able to facilitate changes in thinking about marine management and develop a strong reputation and broadly based constituency both domestically and internationally. It was a process that developed over decades by an organization whose attention to issue areas shifted subject to focusing events. By engaging in issue areas outside of the Park boundaries—developing international guidelines for marine management, consulting in foreign venues, contributing to domestic policy development in marine areas outside of the Park boundaries—the Authority helped create expectations both domestically and internationally about what was appropriate marine management. This research extends understandings of the role of knowledge and scientific expertise in influencing policy change. Instead of focusing on specific scientific arguments for particular policies, it takes a broader spatial and temporal view demonstrating that expertise in policy design is a product of a larger political dynamic that extends beyond bureaucratic, issue, and political boundaries.

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MINIMIZING PRIVATE VESSEL INTERACTION WITH ENDANGERED SOUTHERN RESIDENT KILLER WHALES IN THE SALISH SEA

Barbara Lyon Bennett*

Critical habitats of endangered or threatened marine species often overlay heavily used coastal areas. Such is the case of the southern resident killer whale, *Orcinus orca*, an iconic mega-fauna of the Pacific Northwest and distinct population segment listed as endangered in the United States (2005 ESA) and in Canada (2004 SARA).

The southern resident killer whale's primary summer habitat is the Salish Sea, a transboundary area that is a prime vacation, tourist and residential destination. While in the Salish Sea, killer whales are the focus of commercial and recreational whale watching, and are incidentally impacted by commercial and recreational fishing, boating, cruising and kayaking. The number of vessel interactions with killer whales in the Salish Sea has increased 3 fold in 10 years, with the majority involving private vessels (Soundwatch 2008).

The US Northwest Marine Fisheries Service's recovery plan, released January 2008, identifies vessel interactions as one stressor in a pattern of cumulative stress on this endangered population segment. Public response to draft regulations to restrict vessel behavior in relation to killer whales in US waters has questioned practicality, enforceability, impact on subpopulation recovery and impact on the regional economy.

The presentation will focus on lessons learned specific to private vessels in this case study. Topics will include the roles of informal, voluntary and nongovernmental organizations, Official County, state and federal entities and stakeholder groups. Discussion will consider impact of engaging the Endangered Species Act, coalescence of stakeholder groups and emergence of additional policy options.

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STATE HAZARD MITIGATION PLAN EVALUATION AND MODEL PRACTICES: ANALYSIS OF FEDERAL MITIGATION POLICY IN THE U.S.: MITIGATION PLANS, EXPENDITURES, CIVIC ENGAGEMENT, AND LOCAL CAPABILITY

Philip Berke*, Gavin Smith, and Ward Lyles

The nation is making a major investment in hazard mitigation planning since adoption of the Federal Disaster Mitigation Act (DMA) of 2000, which strongly encourages all state and local governments to prepare hazard mitigation plans. No national-level studies have assessed the quality and variability of the effects of the plans completed since the passage of the DMA. This study has three objectives: 1) assess the quality of the state and local hazard mitigation plans; 2) examine the factors explaining the variability of the quality of the state and local plans; and 3) examine the factors motivating state and local jurisdictions to enact incentives and disincentives and use federal funds to mitigate hazards. We report our findings on the quality of state hazard mitigation plans (objective 1) in this report. We conducted a content analysis of 30 coastal state plans, using a coding instrument drawn from Federal Emergency Management Agency (FEMA) guidance documents and the hazard mitigation literature. Descriptive statistics and qualitative observations are reported. First, while state hazard mitigation plans met basic FEMA requirements there was wide variability in plan quality. A few plans included innovative model elements. Second, the Risk Assessments (RAs) summarizing the hazard context were the strongest elements of the plans, while monitoring and implementation elements were the weakest. Third, the plans exhibited strong emergency management perspectives, but most lacked thorough incorporation of land use planning perspectives. A clear opportunity exists to draw on information, expertise, and techniques from land use planning practice and exemplary model plan elements from several states.

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STORMWATER RUNOFF – MODELING IMPACTS OF URBANIZATION AND CLIMATE CHANGE

Anne Blair*, Denise Sanger, A. Frederick Holland, David White, Lisa Vandiver, Susan White

Given that growth pressure in the coastal southeastern US continues to build and that climate change magnifies effects of urbanization, a science-based system for evaluating the relative impacts of both urbanization and climate change on stormwater runoff at the local scale is warranted. Coastal development alters watershed hydrology by covering land with surfaces impervious to rain. Pollutants accumulate on impervious surfaces and are swept into waterways by runoff, resulting in water quality degradation as watershed development increases. Climate change models for the southeast indicate increased frequency and intensity of storm events, exacerbating urbanization's impact by further increasing the quantity of polluted runoff. We developed a fairly simple method to model the impacts of urbanization and climate change on stormwater runoff by using United States Department of Agriculture, Natural Resources Conservation Services models. Calibrations were made to reflect coastal southeastern US conditions, and subsequent validations supported the appropriateness of the calibrated models. Templates were developed to provide modeling flexibility, and applications include using various urbanization and climate change scenarios to investigate relative differences in runoff among watersheds and within watersheds at existing development levels as well as forecasting runoff from future development levels. Different rainfall amounts and storm durations can be modeled to simulate the changes in climate. Annual runoff can be modeled and forecasts made for various urbanization and climate change conditions. This modeling method can be developed into a tool that would benefit decision makers, research scientists, and the public.

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Sea-Level Rise in Hawaii, Implications for Future Shoreline Locations and Hawaii Coastal Management

Chris Conger and Dolan Eversole (presented by James Bohlanger)

Management of coastal development in Hawaii is based on the location of the certified shoreline, which is representative of the upper limit of marine inundation. Though the certified shoreline location is significantly more variable than long-term erosion indicators, its migration will still follow the coastline's general trend. The long-term migration of Hawaii's coasts will be significantly controlled by rising sea level. However, land use decisions adjacent to the shoreline and the shape and nature of the nearshore environment are also important controls to coastal migration. Though each of the islands has experienced local sea-level rise over the course of the last century, there are still locations across the islands of Kauai, Oahu, and Maui, which show long-term accretion or anomalously high erosion rates relative to their regions. As a result, engineering rules of thumb such as the Brunn rule do not always predict coastal migration and beach profile equilibrium in Hawaii.

With coastlines facing all points of the compass rose, anthropogenic alteration of the coasts, complex coastal environments such as coral reefs, and the limited capacity to predict coastal change, Hawaii will require a more robust suite of proactive coastal management policies to weather future changes to its coastline. Continuing to use the current certified shoreline, adopting more stringent coastal setback rules similar to Kauai County, adding realistic sea-level rise components for all types of coastal planning, and developing regional beach management plans are some of the recommended adaptation strategies for Hawaii.

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CLIMATE CHANGE ADAPTATION AND PLANNING- AN EXAMPLE FROM KAILUA BEACH, OAHU, HAWAII

Dolan Eversole (presented by James Bohlander)

The University of Hawaii Sea Grant College Program (UHSG) in partnership with the Hawaii Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) is developing a beach and dune management plan for Kailua Beach on the eastern shoreline of Oahu. The objective of the plan is to develop a comprehensive beach management and land use development plan for Kailua Beach that reflects the state of scientific understanding of beach processes in Kailua Bay and abutting shoreline areas and is intended to provide long-term recommendations to adapting to climate change including potential coastal hazards such as sea level rise. The development of the plan has led to wider recognition of the significance of projected sea level rise to the region and provides the rationale behind some of the land use conservation strategies. The plan takes on a critical light given global predictions for continued, possibly accelerated, sea-level rise and the ongoing focus of intense development along the Hawaiian shoreline. Hawaii's coastal resource managers are faced with the daunting prospect of managing the effects of erosion while simultaneously monitoring and regulating high-risk coastal development that often impacts the shoreline. The beach and dune preservation plan is the first step in a more comprehensive effort to prepare for and adapt to sea level rise and ensure the preservation of the beach and dune ecosystem for the benefit of present and future generations. The Kailua Beach and Dune Management plan is intended to be the first in a series of regional plans in Hawaii to address climate change adaptation through land use planning.

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VARIATIONS IN COMMUNITY EXPOSURE AND SENSITIVITY TO SEA-LEVEL RISE ON THE ISLAND OF HAWAII

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Climate change has rapidly emerged as a significant threat to coastal areas around the world. While uncertainty regarding distribution, intensity, and timescale inhibits our ability to anticipate possible future impacts at the local and regional levels, it is widely accepted that changes in global climate will result in a variety of significant environmental, social, and economic impacts. Coastal communities in the County of Hawaii are particularly vulnerable to the impacts of global sea-level rise and are actively pursuing solutions to address this emerging threat. Global sea-level rise has a wide range of potential economic, social, and environmental impacts. The ability of coastal communities on Hawaii to effectively adapt to sea-level rise and variability will depend greatly on their ability to address vulnerability at the community level. This study utilizes geographic information systems (GIS) to assess vulnerability at the community level and to document variations in land cover, demographics, economic assets, and critical facilities among Hawaii's coastal communities. This study seeks to quantify vulnerability in terms of exposure and sensitivity and to recommend strategies to address specific vulnerabilities. The results of this study will directly support ongoing planning activities such as the County of Hawaii Hazard Mitigation Plan, and the Community Development Planning (CDP) process.

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NATIONAL PERSPECTIVES ON CLIMATE CHANGE ADAPTATION: A PANEL DISCUSSION OF CLIMATE CHANGE ADAPTATION EFFORTS IN DIVERSE COASTAL REGIONS OF THE UNITED STATES

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Climate change has rapidly emerged as a significant threat to coastal areas around the world. While uncertainty regarding distribution, intensity, and timescale inhibits our ability to anticipate possible future impacts at the local and regional levels, it is widely accepted that changes in global climate will result in a variety of significant environmental, social, and economic impacts. Coastal areas are particularly vulnerable to the effects of climate change and the implications of sea-level rise. The U.S. coastal zone is home to the majority of the U.S. population with coastal counties representing 53% of the nation's population and is also a major contributor to the national economy, representing approximately 40% of the nation's economic output. Given the economic, social and environmental significance of the U.S. coastal zone, there is consensus that coastal communities must develop their capacity to adapt to climate change in order to protect people, property, and the environment along our nation's coasts. The U.S. coastal zone is highly complex and variable, consisting of several regions that are characterized by unique geographic, economic, social and environmental factors. The degree of risk and vulnerability associated with climate change will vary greatly depending on the exposure and sensitivity of coastal resources within a given area. These factors have a direct influence on the ability of coastal communities to adapt to the anticipated impacts of global climate change. The ability of coastal communities to effectively adapt to climate change will depend greatly on their ability to develop and implement feasible strategies that address unique local and regional factors. A wide variety of resources are available to assist coastal states in developing their approach to climate change adaptation. However, given the complex and variable nature of the U.S. coastline, it is unlikely that a single set of guidelines can adequately address the full range of adaptation needs at the local and regional levels. Panel members will discuss the following issues as they pertain to their respective coastal regions:

- Unique local and regional factors that characterize their coastal zone
- Anticipated physical changes due to climate change
- Anticipated social, economic and environmental impacts
- Existing resources and guidelines for climate change adaptation
- Current approach to climate change adaptation planning
- Observed or anticipated challenges in developing adaptation strategies

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POST-STORM REDEVELOPMENT PLANS AND COMMUNITY RESILIENCE

Patricia J. Bowie*

Much of New York's marine coast is developed and vulnerable to coastal storms and sea level rise. Due to climate change and coastal migration, levels of risk in respect to coastal hazards are increasing. The standard response is to protect coastal areas from storms and erosion with structures. Federal and State assistance can increase risk as property owners rely on shore defense projects and disaster relief rather than avoiding high risk areas. In addition, shoreline structures tend to damage natural resources, compromising the environment and future quality of life. Recognizing the increasing costs and need to transform our communities to achieve resilience, the New York State Department of State advocates advance planning to adapt coastal development and reduce storm and sea level rise impacts. Post-storm redevelopment plans are comprehensive land-use plans that allow communities to direct capital spending and redevelopment in a resilient manner. Advance planning allows time to identify risks to social, economic, cultural, and natural assets on which communities depend. A realistic assessment of risk enables local governments to understand their vulnerability and select appropriate land use and construction measures. By implementing the plans over time communities can leverage the value of existing investment while evolving to achieve sustainability. The conservation of valuable cultural and ecological resources as well as development is key to fostering community resilience and promoting safety and livability. Post-storm redevelopment plans offer communities the opportunity to take charge of their future, rather than waiting for storm damages and sea level rise to dictate conditions.

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DEWATERING SHORELINES

Dennison Kidder Breese*

Research has proven that Shoreline Erosion is caused by excess water contained within the shore face. This Research presents an opportunity to control erosion by managing the near shore water table. Our Research on Bogue Banks North Carolina suggests that our buildings and other impervious surfaces collect and concentrate water from storm rain runoff into the surface water table and within the critical beach front water exit point.

Presently our Potable Fresh Water is supplied from deep wells located beneath an impervious layer of Marl. After our use, the Waste water is drained into the Surface Aquifer, the combined waste and storm rain water raises the Surface Aquifer water table and produces Erosion.

The Deep Aquifers presently supplying our Potable Water have an unknown recharge rate, with increasing reports of Salt Water intrusion. We believe our Vital Fresh water supply system should be modified by providing shallow wells that will lower the Surface Water Table by supplying a Reverse Osmosis water treatment plant. These Shallow wells, either horizontal or vertical, are best located within the beach front, adjacent to high erosion risk properties.

Beach Drains and Reverse Osmosis Water systems are new and proven technologies. By combining these technologies we can reduce or reverse Shore Erosion, ensure a safe Potable Water supply, reduce requirements for periodic beach nourishment, reduce taxes and protect our property well into the Future.

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METHANE HYDRATE: THE END OF THE ENERGY CRISIS OR A CRISIS IN ITSELF?

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Beneath the Arctic permafrost and just off the Outer Continental Shelf enormous methane hydrate deposits may fill the next century's energy needs. Environmental concerns about disturbing these reservoirs include large influxes of greenhouse gases into the atmosphere or seabed collapse and resultant tsunamis. This paper reviews the current scientific, environmental, economic, geological, and political aspects of tapping methane hydrate for future energy needs.

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POLICY ANALYSIS OF SHORELINE RESTORATION OPTIONS ON PRIVATE SHORELINES OF PUGET SOUND

Joe Burcar

Puget Sound shorelines have historically provided a diversity of habitats that support a variety of aquatic resources throughout the region. These valued natural resources, as well as their aesthetic attributes, characterize the region and remain central to both the economic vitality and community appreciation of Puget Sound. Deterioration of shoreline habitats and increased inputs of pollutants have placed severe stress on many aquatic resources within the region (PSAT, 2007). Since a majority of Washington state shorelines are privately owned, regulatory authority to require restoration of impaired shorelines is limited. Current shoreline regulatory authority is limited in the ability to require restoration of ecologically impaired areas. Without improvements to key ecological functions, overall ecosystem improvements are limited in scope and frequency. The Shoreline Management Act (RCW 90.58) requires that jurisdictions plan for appropriate shoreline uses, however a majority of the state's shorelines are privately owned for which future development is inevitable. Because shoreline rules are intended to lessen overall impacts while allowing for appropriate use of private property, a long term question remains as to the ecological carrying capacity of the region when considering cumulative effect of future shoreline development. In light of this question, this analysis will explore opportunities for changes to shoreline management policy to promote additional restoration on private shorelines within Puget Sound. These efforts are intended to promote more efficient ecosystem management and improve ecosystem-wide ecological conditions.

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NEW PARTNERSHIP MODELS FOR COASTAL PRIORITIES

Paul M. Butler-Nalin * and William T. Rohring

Coastal issues are among the most complex. Innovative new approaches are needed to address priorities, unfunded mandates, underfunded and understaffed public programs, and often uncoordinated multi-jurisdictional problems.

This paper proposes new public/private partnership models to deal with major impediments to effective coastal, watershed and natural resource management. The paper describes new ways to respond to critical environmental issues by establishing public/private partnerships and a system of incentives to address coastal management and coastal community development issues in a more proactive manner.

The paper presents results of a comprehensive survey of Coastal Zone Management Programs across the country to identify CZM priorities and to determine which issues are not being adequately addressed due to lack of funding, staff reductions, or other organizational constraints. The paper also highlights case studies of organizations and companies that are partnering on coastal issues in various regions, states and US territories.

The paper identifies potential opportunities for private companies and nonprofit organizations to work together on important environmental problems and solutions. Taking a comprehensive, all-encompassing watershed approach to addressing key issues will encourage the creation of more long-term and larger scale, multi-jurisdictional projects requiring sophisticated coordination, collaboration and communication. Strategies identified here should stimulate considerable interest and lead to significant funding opportunities for new (multi-jurisdictional) strategic initiatives, as well as smaller-scale and highly targeted local projects.

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LOOKING FOR SAFE HARBOR IN A CROWDED SEA: MARINE SPATIAL PLANNING, MARINE CONFLICT AND ITS AVOIDANCE

Holly V. Campbell,* Michael J. Harte

Environmental conflicts arise over the spatial allocation of coastal and marine resources. These conflicts share common traits with land-based resource conflicts, yet are distinct and these differences require special consideration. The tools that are emerging for preventing or mitigating marine conflicts as part of marine spatial planning include stakeholder consultations, decision-support software models, ocean zoning, regulation, negotiated settlements, incentive instruments, and others. This paper will:

- explain existing tools, and evaluate their effectiveness from multiple perspectives,
- examine lessons learned,
- present selected case studies of recent and contemporary marine conflict, and
- discuss what other approaches or combined approaches might be effective to anticipate and address marine spatial conflict.

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ADAPTATION OF COASTAL COMMUNITIES IN THE PHILIPPINES TO THE IMPACTS OF CLIMATE CHANGE

Maria Rebecca A. Campos*

More than half a million small fishers in the Philippines have been availing of loans from Quedancor, the credit arm of the Department of Agriculture. The financing scheme has been quite successful with repayment rate at 95%. However, the occurrence of natural calamities such as typhoons; as well as pests and diseases has affected the productivity of fisheries, thus, hindering fishers from paying and renewing their loans. Failure to access credit could disable them to continue venturing on fishing activities and could eventually jeopardize the welfare of their entire household. The inability of creditors to pay their loans and meet their obligations also impair, to a large extent, the financial operation and viability of the lending institutions. This study analyzes the natural risks and risk management practices of these fishers. It recommends mitigation mechanisms to minimize the impact of natural calamities. Moreover, it suggests a bridge financing scheme that can be an effective and efficient instrument to enable fishers to carry on their livelihood activities and support their families' basic needs and slowly recover from their losses.

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DEVELOPING A NATIONAL ASSESSMENT OF COASTAL AND OCEAN RESOURCES: FINDING THE RIGHT SCALE

Ralph Cantral*

In 2006-7 the National Oceanic and Atmospheric Administration (NOAA), in cooperation with the Coastal States Organization (CSO), conducted an 18 month process to envision the future of coastal management in the United States. The results of this process included recommendations that the Coastal Zone Management Act (CZMA) should become more strategic and accountable.

To support the achievement of these recommendations, NOAA is proposing to conduct a periodic assessment of coastal and ocean resources at least once every five years. To determine the spatial extent of coastal and ocean assessments, NOAA conducted a workshop in February 2009. In October 2009, NOAA conducted another workshop to examine parameters that might be included in a comprehensive assessment. Although the workshops yielded a great deal of information that will prove useful, one issue that was not resolved was the appropriate scale for conducting assessments that could support management efforts at the federal, state, and local level.

The purpose of this panel is to examine the roles of the various coastal management entities and the public, and consider their need for management-related information. These needs will be discussed in light of the availability of information, the ability of agencies to provide training and technical assistance to use the information, and the ability to tell the story of the “state of the coast” at the national level.

The panel members will include representatives of NOAA, the coastal states, the science community, and coastal residents.

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CROSS CULTURE EDUCATION AS CRITICAL TO PROFESSIONAL DEVELOPMENT

Patrick Christie*, Rehana Lanewala, Brian Compton

Cross cultural communication and cultural literacy are vital skills for coastal and fisheries managers, especially in the Puget Sound region given tribal treaty rights to fish. Non-Native students of coastal and fisheries management generally receive very little training on the history, cultural dimensions, and practicalities of working with tribes. Similarly, tribal students have little opportunity to collaborate with non-tribal institutions. With Washington Sea Grant support, a joint University of Washington School of Marine Affairs and Northwest Indian College course was created and implemented to address this gap. This presentation highlights the outcomes of this two-year collaboration and draws lessons based on teaching evaluations, interviews, and personal reflection by the teachers. Pedagogical challenges emerged--frequently a result of cultural difference. One challenge was how to provide both technical content and multicultural sensitivity in the classroom. Over time and by focusing on joint social science research projects a foundation of mutual understanding developed among students and faculty. Students conducted multi-disciplinary research on whether tribes have right to lethally remove seals (protected under the Marine Mammal Protection Act) which eat salmon from their nets. They conducted interviews of animal rights activists, environmentalists, tribal fishers, and government officials and presented their findings to government, tribal, and educational leaders. The conduct of an applied and engaging participatory research project outside the classroom provided this opportunity for collaboration and cross cultural dialogue among students. This presentation will present narratives from students who participated in this process.

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REFORMING STATE-LEVEL COASTAL MANAGEMENT AND DEVELOPMENT POLICIES: STRATEGIC RETREAT AS AN INNOVATIVE, PROACTIVE AND EQUITABLE COASTAL ENVIRONMENTAL MANAGEMENT STRATEGY

Andrew S. Coburn, John Whitehead

Atlantic and Gulf Coast shorelines include some of the most unique and biologically rich ecosystems in the United States that provide immeasurable aesthetic, habitat and economic benefits. Natural coastal ecosystems, however, are under increasing threat from rampant and irresponsible growth and development. Once a boon to local economies, complex natural forces – enhanced by global climate change and sea level rise - are now eroding the very foundation upon which coastal development is based.

For nearly a century, erosion control structures and beach restoration were used to stabilize shorelines in an effort to protect structures and infrastructure. Traditional responses to coastal erosion - along with archaic federal and state policies, subsidies and development incentives - are costly, inequitable, encourage risky development, damaging to coastal ecosystems and becoming increasingly unsustainable. Communities, managers and property owners face increasingly complex and difficult challenges brought on by the emplacement of static economic development along dynamic shorelines, and there is an emerging public and political awareness that, without meaningful policy reforms, coastal ecosystems and economies are in jeopardy.

Strategic retreat is a sustainable, interdisciplinary management strategy that supports the proactive, planned removal of vulnerable coastal development; reduces risk; increases shoreline resiliency and ensures long term protection of coastal systems. Public policies and management strategies that can overcome common economic misperceptions and promote the proactive removal of vulnerable development will provide state and local policy makers and coastal managers with an effective management tool that concomitantly addresses the economic, environmental, legal and political issues along developed shorelines.

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TOWARD RESILIENCE TO CLIMATE CHANGE: CONDUCTING COMMUNITY RESEARCH & ENGAGEMENT

Joseph Cone

For social-ecological systems to be resilient not only scientists and managers but citizens and communities must be constructively engaged. But how? Multidisciplinary teams formed by several Sea Grant programs are using social science methods to help coastal communities identify decisions that will contribute to resilience to climate change.

Communicating with non-specialists about responding to the risks associated with climate change is categorically a “risk communication” challenge. The project uses a well-established model of risk communication as the conceptual framework. An output of the model is communication that helps the audience make well-informed decisions about their concerns.

The research leader on this national project will describe the project’s stepwise “mental models” approach, involving 1) the assembly of the climate scientists’ expert model; 2) the use of surveys, focus groups, and interviews to establish a baseline of empirical knowledge about the communities of interest; 3) the use of concept maps, influence diagrams and other modes of decision support to engage and assist communities in deciding about prudent actions that could contribute to resilience.

This user-driven approach is different from much public communication about science in its focus on what decisions the individual user or community wishes to make rather than on what subject experts might like to tell them. Resilience to climate change needs capable “boundary organizations” that can facilitate communication, understanding, and collaboration among and between natural and social scientists, managers, and communities.

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CHANGING PLACE, CHANGING SPACE: MARINE ENERGY AND COASTAL COMMUNITIES IN OREGON

Flaxen D.L. Conway*, Holly Campbell, Zack Covell, Daniel Hunter, John Stevenson, Maria Stephanovich, and Yao Yin

The Pacific Ocean – once viewed as vast, open – is valuable real estate. Fights over the space resemble frontier days. Decision-makers require diverse scientific and experiential data as they integrate new uses (such as marine renewable energy) with existing commercial and recreational uses. Having ecological/physical data is vital. Yet permitting processes rarely fail on technical or natural science grounds; rather because of a failure to attend to the human dimension. A comprehensive understanding of the role of socioeconomic and sociopolitical perceptions is useful for legislators and resource managers.

Previous research notes that public knowledge is crucial for citizens to determine their real interests and civic opportunities. Some have stated that an informed and engaged public in coastal policy issues is vital for making progress on environmental protection and sustainable development.

This paper highlights the results of a research program (six projects) studying: the scope and depth of policy-relevant knowledge among stakeholders and the public; where they acquire their information about wave energy; environmental, social, and economic sustainability; and the link between policy-relevant knowledge and understanding and acceptance of wave energy generation. By specifying the connection between knowledge holding and support for wave energy, purposeful public education and information dissemination efforts could be targeted effectively, and policy processes could be designed to maximize policy input and meet citizen and community concerns.

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PLANNING FOR HURRICANES IN COASTAL NORTH CAROLINA: A TYPOLOGY OF ORGANIZATIONAL DECISION MAKING

Michelle Covi* and Donna Kain

Understanding the hurricane decision making and planning process for organizations located in coastal areas can help officials to better anticipate community preparedness and resilience. While the factors associated with household hurricane preparation and evacuation behavior have been examined, few researchers have studied the planning and behaviors of organizations and businesses, which can have an important influence on the behavior of residents. As part of a Sea Grant funded risk perception and emergency communications study, county officials, organizations and businesses in six coastal counties of North Carolina were interviewed to discern their decision making and communication practices. A range of types of decision makers emerged which could be placed on a two dimensional continuum with axes indicating the organization's level of involvement in group decision-making and the decision maker's access to information. Four types of decision makers can be distinguished: independent and collaborative, both with high access to predictive information, but varying on the scale of involvement and dependent and cooperative decision makers, both with lower access to information, with a wide range of involvement in group decision making. While the majority of managers interviewed (66%) had a written disaster plan, the potential exists for better planning and communications between decision-making types to improve community hurricane preparedness.

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ANALYZING SHORELINE CHANGE IN THE NEW RIVER ESTUARY, NC

Cowart, L.*, Currin, C., Fonseca, M., Malhotra, A.

Shoreline erosion is a concern not only for the cost of lost infrastructure, but also for the potential loss and degradation of coastal habitats and the ecosystem services they provide. We examined shoreline erosion rates and shoreline composition along the estuarine shoreline of Marine Corps Base Camp Lejeune, located in Jacksonville, NC. Shoreline change was calculated using Geographic Information Systems (GIS) software and aerial photography from multiple time periods, including 1956, 1989, and 2004. Over this period, the average erosion rate for the New River Estuary shoreline was -0.28 m yr^{-1} , and 10% of the shoreline exhibited an erosion rate $>1 \text{ m yr}^{-1}$. Additionally, the wave exposure of the shoreline was determined, using a Wave Exposure Model (WEMo), and the shoreline was characterized in the field using Geographic Positioning System equipment and GIS software. The shoreline-change rates, wave exposure, and shoreline characterization data were statistically analyzed to further understand the relationship between the shoreline change that has occurred, shoreline composition, and the processes acting on the shoreline. These results will be incorporated into a Shoreline Management Plan for Marine Corps Base Camp Lejeune.

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PHYSICAL CIRCULATION MEASUREMENTS IN PAMLICO SOUND, USED TO LOCATE NEW OYSTER SANCTUARIES

Cynthia N. Cudaback* and Amy T. Haase

The population of eastern oyster, *C. virginica*, has declined over the last century on most areas of the east and gulf coasts. North Carolina's restoration efforts depend on the construction of subtidal oyster reefs to be used as broodstock sanctuaries in Pamlico Sound, NC. Successful restoration of the oyster population requires several thriving reefs connected as a meta-population. *C. virginica* has a 2-3 week larval stage, during which it gradually settles through the water column. Larvae that can travel from one reef to another during that stage form the basis of a meta-population.

Larval transport can be predicted from physical measurements. In the summers of 2005 and 2006, we combined moored current measurements with freely drifting buoys to map the currents in Pamlico Sound. We can now describe the wind-driven circulation in the Sound in more detail than was previously possible. Furthermore, our measurements indicated strong larval transport along the western shore of central Pamlico Sound, and suggested the site for a new oyster sanctuary. The new reef is now under construction at the site we recommended.

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BUILDING A SUSTAINABLE COMMUNITY OF COASTAL LEADERS TO DEAL WITH SEA LEVEL RISE AND INUNDATION

Mary Culver*, Jerry Schubel, Margaret Davidson, John Haines

In early December 2009 NOAA and the USGS will convene a three-day workshop entitled: “Sea Level Rise—Inundation Community Workshop.” The goal of the workshop is to produce a strategic framework for supporting the development and integration of science-based data, information, and products, and make them readily available in appropriate forms to enable a community-level response to sea level rise, tidal flooding, and inundation. The framework will inform federal, state, regional, and local agencies; academic institutions; nonprofits; and other organizations that can influence the development and dissemination of data, information, and informational products, and the adoption of policies and budgets that support the implementation of the proposed framework and recommended actions.

We will describe the outputs of the workshop and work with participants in The Coastal Society meeting to refine those outputs and to try to recruit people to join this community dedicated to working together to develop information and products and to execute strategies to enable local communities to deal effectively with sea level rise and inundation by creating resilient coastal communities.

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A SEA CHANGE: USING THE COMMON LAW TO PROTECT COASTAL PROPERTY FROM EFFECTS OF GREENHOUSE GASES

Robert H. Cutting,* Lawrence B. Cahoon,* Jack Charles Hall

There is significant consensus in the scientific community that global warming is real, most likely due to anthropogenic sources, and that it is likely to cost trillions of dollars in health effects, loss of human life, property, crops, and species, especially in coastal locales (Intergovernmental Panel on Climate Change (IPCC) report, 2007). Sectors such as power generation and transportation emit Greenhouse gases (GHG) as wastes to save the cost of containment at the expense of ground receptors and the planet. In response to federal inactivity during the Bush years, states: (1) initiated creative legislative schemes, and (2) filed common law public nuisance actions to protect populations that suffer damages, such as flooding in coastal states. The Kivalina Inuit also alleged that the generators misled the public by misrepresenting the science.

The U.S. Court of Appeals validated the states' actions but the US Supreme Court has yet to rule. Even if unsuccessful, the states' cases: (1) provide information and identify necessary research; (2) identify the real costs of climate change; and (3) spotlight actions legislative or executive branches should take.

We explore common law concepts as additional tools to protect coastal property. We argue that trespass will better compel the internalization of the real costs by halting trans-boundary migration of pollutants at generators' boundaries unless adequate science and financial responsibility are included. Trespass efficiently reconciles the law with science and economics. Government may actually incur liability for an unconstitutional Taking of receptors' rights if it permits the emissions.

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NOAA'S STATE OF THE COAST: HIGHLIGHTING CONNECTIONS ACROSS ECONOMY, ECOLOGY, COMMUNITIES, AND, CLIMATE

Christopher David*, Kristen Crossett, Tonya Kane, Brent Ache

Within that narrow strip of land and water we call our coast, there is a nationally-significant story to tell. Human well-being depends on a suite of benefits that flow from healthy coasts – food, clean water, jobs, recreation, and protection from hurricanes. The extensive environmental alterations we have made to our coastal ecosystem are eroding the delivery of these benefits, and therefore compromising human well-being. In many cases, these benefits are being further eroded by a changing climate.

The purpose of NOAA's State of the Coast (SOTC) Web site is to communicate to high-level policy makers – in a simple, yet highly-engaging Web destination – the crucial importance of a healthy coastal ecosystem to a robust U.S. economy, a safe population, and a sustainable quality of life for coastal residents. The desired outcome for visitors to this site is to gain an appreciation for the need to better understand, manage, and protect our Nation's coastal resources.

The SOTC Web site offers information about and highlights connections across four themes that collectively tell the story of the coast's extraordinary benefits to society, but also its degraded state and continuing threats to its health. The site presents memorable sound bites and interactive indicator assessment visualizations that convey compelling stories within each theme. The site is national in scope with data provided by a number of federal agencies, and offers pointed successful management case studies.

This poster will highlight the key elements of the SOTC Web site.

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SOUTH CAROLINA'S SHORELINE CHANGE ADVISORY COMMITTEE: RECOMMENDATIONS FOR IMPROVED MANAGEMENT AND PLANNING

Braxton C. Davis* and Matthew J. Slagel

The South Carolina Beachfront Management Act and associated regulations were adopted in 1988, and over the past two decades, these rules have significantly limited development and hard stabilization of the beachfront in many areas. Continued renourishment efforts have kept pace with erosion, but are costly and considered by many to be a mid-term solution to chronic erosion. Estuarine shorelines face similar threats from erosion, sea level rise, and storm events, and have experienced an increasing demand for erosion control structures and other alterations. Complex regulatory, economic, environmental, and legal issues, together with natural and socioeconomic data limitations, result in an unclear understanding of future shoreline changes in South Carolina, and our ability to adapt to those changes.

In 2007, SCDHEC-OCRM established a 23-member Shoreline Change Advisory Committee comprised of a broad cross-section of coastal professionals and stakeholders. The Committee met over a two-year period to identify and explore new ways to resolve use conflicts and reduce socioeconomic and environmental vulnerabilities related to shoreline changes in the South Carolina coastal zone. The Committee developed several policy recommendations that are specific to SCDHEC-OCRM authorities and activities, and some recommendations related to other federal, state, regional, or local authorities. The Committee's final report was released in late 2009 and covers a range of topic areas including beachfront retreat policies and incentives, beach renourishment planning, hard erosion control alternatives, local coordination, and estuarine shoreline management.

Website: http://www.scdhec.gov/environment/ocrm/science/shoreline_comm.htm

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THE SOUTH ATLANTIC ALLIANCE: A SOUTHEASTERN U.S. STATE GOVERNORS INITIATIVE TO ADDRESS OPPORTUNITIES AND CHALLENGES EMBODIED IN THE REGION'S COASTAL AND OCEAN DOMAIN

M. Richard DeVoe*

(On behalf of the States and the Alliance's 25-member Executive Planning Team)

The pressures placed on the natural, environmental, economic, and cultural sectors from continued growth, population shifts, weather and climate, and environmental quality are increasing exponentially in the southeastern U.S. region. Our growing understanding of the relationship of humans with the marine environment is leading us to explore new ecosystem-based approaches to coastal management, marine resources planning, and coastal adaptation that engages multiple state jurisdictions. The urgency of the situation calls for coordinated regional actions by the states, in conjunction with supporting partners and leveraging a diversity of resources, to address critical issues in sustaining our coastal and ocean ecosystems and enhancing the quality of life of our citizens. The South Atlantic Alliance has been established to “implement science-based policies and solutions that enhance and protect the value of coastal and ocean resources of the southeastern United States which support the region's culture and economy now and for future generations.” The Alliance, which includes North Carolina, South Carolina, Georgia, and Florida, will provide a regional mechanism for collaborating, coordinating, and sharing information in support of resource sustainability; improved regional alignment; cooperative planning and leveraging resources; integrated research, observations, and mapping; increased awareness of the challenges facing the South Atlantic region; and inclusiveness and integration at all levels. The Alliance has identified four priority areas to serve as the foundation for its initial set of programs. The development of the Governors South Atlantic Alliance Action Plan will include implementation strategies and action items for the four issue areas.

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TOWARD A MEASURE OF SOCIAL-ECOLOGICAL RESILIENCE FOR HUMAN COMMUNITIES

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Resilience, when applied to ecological or social-ecological systems, is defined by the following properties: Amount of change that can be absorbed while still maintaining control of function and structure; Degree to which the system can self-organize; And, the capability of the system to build capacity for learning and adaptation (Holling 1973). This paper aims to clarify the theoretical understanding, as well as the empirical application of the concept, and arises from consideration of innovative applications of social science to address the complex problems of human communities. The conceptualization and valid measurement of social-ecological resilience have great utility for providing insights about the ways in which communities anticipate and respond to changing conditions (Adger 2000; Carpenter et al. 2001). Currently, the use of resilience is highly theoretical, rarely taken beyond the abstract level of metaphor to the construction of an applied measure (Carpenter et al. 2001). However, a well-developed conceptual framework and a consistent set of valid empirical indicators would allow researchers and policy makers to evaluate a community's potential to implement, adapt, and/or support change with recommended policies. The goal of this work is the development of a measure of social-ecological resilience aimed at policy makers, communities, and others. As research and policy are in need of an agenda that more effectively links the social and ecological systems of the world together in a way that advances our understanding, planning, and response to major crises like climate change (Redman 1999), the concept of social-ecological resilience serves an important purpose.

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MULTIPLE-AGENCY MANAGEMENT, MARINE PROTECTED AREAS, AND MONUMENTAL SURPRISE IN THE NORTHWESTERN HAWAIIAN ISLANDS

John N. Kittinger, Per Olsson, Anne Dowling,* Andrew R. Purves

Critical issues in marine conservation are confronting the scaling-up of marine protected areas to regional levels of ecosystem protection. The protection of regional ecosystems, through “large-scale” MPAs and MPA networks, presents different challenges than locally or community-based MPAs, particularly in the areas of management and governance. An emerging theme in large-scale MPA management is the prevalence of governance structures that require institutional co-trusteeship, presenting new challenges as agencies with differing mandates and cultures work together. We trace the evolution of conservation strategies in the Northwestern Hawaiian Islands (NWHI), focusing on the transition from the proposed NWHI national marine sanctuary to the establishment of the Papahānaumokuākea Marine National Monument. The monument is the largest MPA under U.S. jurisdiction and protects an intact coral reef and regional archipelagic ecosystem in the U.S. Pacific. The governance of the monument represents a new model in MPA management, requiring two federal agencies (NOAA, USFWS) and a state agency to work together as “Co-Trustees” of the NWHI ecosystem. The differing legislative mandates, policy, and cultures of the co-trustee agencies have represented significant challenges to the management of the NWHI. We highlight the historical development of conservation strategies in the NWHI, assess the impact of the “surprise” Monument designation, and elucidate the principal barriers and bridges to institutional co-trusteeship of the large-scale NWHI MPA. The lessons learned from the NWHI governance arrangement are critical as new national monuments have been established in the U.S. Pacific, and large MPAs requiring multiple agency management become a prevalent feature on the global seascape.

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PROMOTING INNOVATIVE STORMWATER SOLUTIONS FOR COASTAL PLAIN COMMUNITIES

Sadie Drescher*, Deb Caraco, Karen Capiella, Kelly Collins, Julie Schneider, Dave Hirschman, and Cecilia Lane

In 2008, the Center for Watershed Protection surveyed seventy three coastal plain communities to determine their current practices and need for watershed planning and low impact development (LID). The survey found communities had varying watershed planning effectiveness and need better stormwater management, land use planning, and watershed management communication. While technical capacity is improving, stormwater programs are under staffed and innovative site designs may be prohibited under current regulations. In addition, the unique site constraints (e.g., sandy soils, low relief, tidal influence, vulnerability to coastal hazards, etc.) and lack of local examples are common LID obstacles along the coast.

This project will develop these simple and discrete tools to overcome LID implementation hurdles in the coastal plain: 1) Get the designs right by producing a design book featuring local case studies that highlight “lessons learned,” feature designs, economics, and photos; 2) Make sure LID are allowed in the community by updating the Codes and Ordinance Worksheet (COW) for coastal communities and help identify the regulatory and programmatic opportunities; 3) Demonstrate their effectiveness to improve local watershed health using an updated coastal version of the Watershed Treatment Model (WTM) to predict nutrient load reductions for stormwater management practices; and 4) Educate local officials about LID benefits through interactive and adaptable products (e.g., webinars, slideshows, and presentations). This project will continue identifying key coastal experts, groups, and collaborators to test draft versions of these tools and shape meaningful products that promote innovative stormwater solutions (LIDs) in coastal plain communities.

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COASTAL HOMEOWNER ADAPTATION TO CHANGING HURRICANE RISK

Robert T. Burrus, Jr., Christopher F. Dumas* and J. Edward Graham, Jr.

In the context of the ongoing financial crisis, “special” risks outside the financial community have recently fallen out of the spotlight; among these risks is the risk of loss for coastal communities exposed to changing geographic and climatological patterns. A coastal property owner is exposed to risks of loss due to hurricane strikes; this risk may be increasing due to climate change and shifting hurricane strike probabilities. The homeowner mitigates expected hurricane losses through combinations of insurance and costly home improvements. The cost-effective mix of insurance, defensive measures and deductibles is a function of the costs of this insurance and these measures relative to the probable costs of hurricane damage. These probable costs of damage are, in turn, a function of the probability of a damaging hurricane strike, the defensive measures employed and the value of the home and its contents. In the midst of public subsidies for the amelioration of widespread catastrophic losses and given historical hurricane strike probabilities and Federal Emergency Management Agency (FEMA) flood insurance subsidies, we find that the risk-neutral cost-minimizing homeowner purchases no defensive measures and relies instead upon high-deductible insurance; the potential for substantial losses being borne by stakeholders other than the homeowner is high. Given this endogenous consumer mitigation, we then discover the stockholder-owned insurer's profit-maximizing premium/deductible mix. We investigate the sensitivity of our results to changes in the hurricane-strike probability distribution over varying FEMA subsidy levels.

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ECONOMIC IMPACTS AND RECREATION VALUE OF THE NORTH CAROLINA CHARTER AND HEADBOAT RECREATIONAL FISHING FLEETS

Christopher F. Dumas^{*}, John Whitehead, Craig Landry, and James Herstine

The North Carolina for-hire ocean fishery consists of approximately 750 charter boat vessels and headboat vessels operating year-round and targeting a succession of fish species depending on seasonal fish abundances and economic conditions. A recent National Research Council (USA) review concluded that economic data for for-hire fishing were inadequate, and the North Carolina Division of Marine Fisheries recently listed the collection of marine recreational fishing data among the top priorities of their strategic plan. The objective of this study is to document the economic impacts and recreation value of the North Carolina for-hire fishing industry. A field/mail survey of 158 for-hire boat captains and a dockside survey of over 1,300 passengers were conducted in 2007-2008 to collect detailed economic data on the for-hire fleet and its impacts. The study assesses the scale of marine for-hire fishing activity, measures the recreation value to anglers (consumer surplus), and estimates the impacts of industry activities on the coastal economy, including economic multiplier effects on sales, employment, labor income, and taxes.

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NORTH CAROLINA COASTAL HOMEOWNER KNOWLEDGE AND ATTITUDES ABOUT CLIMATE CHANGE AND SEA LEVEL RISE RISKS -- CORRESPONDENCE WITH SCIENTIFIC KNOWLEDGE

Christopher F. Dumas^{*}, Douglas Gamble, and Catherine W. Long

With extensive beach and estuarine areas at risk to climate change (CC) and sea level rise (SLR), North Carolina, USA, is assessing potential impacts on the state and its residents. There is uncertainty regarding residents' knowledge and attitudes on these issues. If knowledge and attitudes are mismatched with the evidence, policymakers may find it difficult to achieve public support for appropriate programs. This study assesses coastal NC residents' knowledge and attitudes about CC and SLR and investigates correspondence with recent scientific findings. A random sample survey of NC coastal households on barrier islands or adjacent to coastal waterways was conducted April-June 2009 to collect the following information:

- * coastal residents' beliefs about whether CC and SLR are occurring,
- * the perceived causes of these phenomena,
- * perceived magnitude and speed of SLR,
- * perceived relative risk to each resident's property,
- * willingness to pay for beach nourishment or structure relocation to mitigate SLR,
- * whether state gov't. should do anything about SLR,
- * household sources of information about CC and SLR
- * housing type (home, apt/condo, trailer, etc.) and ownership type (own/rent)
- * standard demographic information

The location of each household is correlated with GIS elevation and distance-to-nearest-water body data to assess correlation of knowledge and attitudes with geographic location, property elevation, distance to water, etc. The analysis determines the correlation between residents' beliefs about their property's vulnerability to SLR and the results of SLR inundation models and identifies information sources used by coastal residents to improve education efforts.

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HABITAT ENHANCING MARINE STRUCTURES: CREATING HABITAT IN URBAN WATERS

Karen Dyson*

Waterfront cities like Seattle and New York City are great places for humans to live, but what about for marine life? Concentrated human populations cause serious impacts on coastal ecosystems, including habitat degradation and the introduction of non native, invasive species. However, the urban waterfront may be capable of supporting a wide range of marine creatures -- if cities recognize the need to design for them.

Habitat enhancing marine structures (HEMS) are one approach that cities can use to address the impact of cities on coastal ecosystems. HEMS are habitat improvement projects that are designed to improve the habitat quality of urban structures, including docks and seawalls, for marine species. They are especially valuable tools where urban structures are vital and cannot be significantly altered or removed.

In this talk, we will first explore how and why incorporating HEMS into urban areas can help address the impact of cities on marine species while providing benefits to humans. Goals that can be addressed with HEMS projects, including sustainable development goals, waterfront aesthetic goals, and public environmental education goals will be explored. We will then consider the potential to integrate HEMS into current and future renovation projects as well as the necessary steps to ensure a successful implementation. Finally, we will survey a suite of different HEMS projects, including some in development or currently in use.

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ONE MAN'S TRASH IS ANOTHER MAN'S TRAWL: AN ASSESSMENT OF DERELICT FISHING GEAR IN THE NORTH CAROLINA CORE SOUND

Chris Ellis*

Marine debris presents a number of threats to marine life, ecosystem diversity, human health, and coastal economic vitality. Despite numerous associated risks, and the documented need to reduce marine debris on a global scale, there is a scarcity of research that pertains to shoreline and ocean littering by specific user groups.

This study attempts to create an understanding of the reasons for commercial fishing gear loss and abandonment. Data presented will assess fisherman knowledge and perceptions of marine debris – derelict fishing gear in particular – and impacts to coastal resources. Additionally, the study aims to quantify the relative amount of derelict, commercial gear types encountered by fishermen and strategies to engage the community in developing and implementing mitigative approaches. Primary types of derelict fishing gear observed in the study area relate to clam aquaculture, pound-net fishing, and crab-trap fishing.

This is part of a National Oceanic and Atmospheric Administration (NOAA) Marine Debris Program-supported study. The Core Sound is generally defined as the shallow body of water in eastern North Carolina located between the mainland of Carteret County and Core Banks, part of the Outer Banks of North Carolina, and located west of the Atlantic Ocean and north of Bogue Sound. Pamlico Sound is located to the north and east. The region is home to an array of public trust lands, including Cape Lookout National Seashore and the Rachel Carson unit of the North Carolina National Estuarine Research Reserve.

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THE BOUNDS OF COMMUNICATION: A SOCIAL NETWORK ANALYSIS OF THE GULF OF MEXICO COASTAL STORMS PROGRAM

Chris Ellis*, Tracie Sempier, Audra Luscher, Tina Sanchez, Heidi Recksiek

The Coastal Storms Program is a networked program designed to increase the resiliency of communities from coastal storms. Key partners in this effort include the Alabama-Mississippi Sea Grant, Louisiana Sea Grant, Gulf of Mexico Alliance, Northern Gulf Institute, and other federal agencies. Products developed as a result of the Coastal Storm Program in the Gulf of Mexico range from community risk and vulnerability assessments to improved weather forecasting and observations. The Coastal Storms Program also helped make the region aware of existing tools and services that could increase the area's resiliency.

A social network analysis of this effort from the Coastal Storms Program is being conducted with assistance from the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center. A primary objective is to determine the role and impacts of the program, particularly in the formation of regional partnerships. Data will be collected in the early stages and then again after a period of time to determine "if" and "how" relationships and interactions may have changed. This longitudinal approach will help officials improve future programs and will provide an understanding of existing relationships and the flow of information between people in the Gulf regarding information related to hazard resilience. Insights into the individual linkages between participants will reveal patterns of hazard resilience information sharing, problem solving, and goal attainment.

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COASTAL CLIMATE ADAPTATION: BUILDING A COMMUNITY OF PRACTICE

Stephanie Fauver* and Heidi Recksiek

“What are others doing about climate change?” is a common question posed by the nation’s coastal officials. The NOAA Coastal Services Center developed the Coastal Climate Adaptation community of practice site in response to this need.

Coastal decision makers listed “interaction with peers” as one of the most common mechanisms used to learn new information. With this site, web 2.0 technologies are being used to connect peer groups virtually. In addition to serving up existing resources focused on climate adaptation, users can submit comments and questions, share lessons learned, suggest new resources, and “talk” with their peers.

The website provides access to existing local and state plans, newly developed policies, case studies, risk and vulnerability assessments, and decision support tools. Being able to review the wording of sea level rise policies, read existing adaptation plans, and interact with those that have made progress in adaptation allows decision makers to benefit from the experiences of others.

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SUSTAINABLE ESTUARINE SHORELINE STABILIZATION: RESEARCH, EDUCATION AND PUBLIC POLICY IN NORTH CAROLINA

John M. Fear* and Carolyn A. Currin

Within North Carolina, a vertical bulkhead is most commonly used to stabilize estuarine shorelines. Despite this trend, there are few comprehensive studies into the ecosystem impacts of bulkheads; resulting in us knowing the least about the most widely used stabilization structure in North Carolina. To address this, a team of federal, state and university scientists are collaborating on a project, funded by CICEET, to 1) conduct research to quantify ecosystem service tradeoffs as a consequence of shoreline stabilization, 2) design and install demonstration projects utilizing non-bulkhead stabilization methods for research and education purposes, 3) develop an approach for evaluating ecological and socioeconomic costs and benefits of shoreline erosion and protection alternatives and 4) develop effective communication methods for exchanging information between scientists, regulatory agencies, politicians and other stakeholders in regard to short and long-term cost-benefits of shoreline stabilization. Work on this project is being conducted in three distinct geomorphological regions of North Carolina, the northern, central, and southern coast. Research modules are examining the sediment elevation and shoreline profile, wave reflection and attenuation, sediment particle size, organic matter and Chl *a* content, sediment denitrification rates, groundwater chemistry, marsh plant composition and biomass, infauna community abundance and composition, and nekton abundance and composition. Education and outreach modules of this project are familiarizing the public and officials with the issues associated with estuarine shoreline erosion and stabilization, and translating project results for incorporation into coastal policy. This presentation will provide a brief synopsis of the year 1 findings and lessons learned.

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THE ROLE OF THE PUBLIC TRUST DOCTRINE IN ADVANCING SOCIAL JUSTICE IN COASTAL COMMUNITIES

Kristen M. Fletcher*

The centuries-old Public Trust Doctrine serves as part of the foundation for modern-day coastal zone management (CZM) in the coastal states and territories of the U.S. Sometimes characterized as an access-based doctrine, it recognizes the state as a trustee that holds the unique coastal resources in trust for use by citizens for fishing, navigation, commerce, and (more recently) recreation. While the doctrine has evolved differently in each state, it is embedded in state policies, regulations, laws and constitutions as a key authority for protection and management of coastal resources. While access to natural resources for commercial use or recreation remains a serious concern, coastal communities face more basic concerns, especially in low income communities and those with a high percentage of people of color: deteriorating housing stock, high rates of unemployment and school drop-outs, crime, chronic flooding and other environmental issues, often caused or exacerbated by surrounding land uses. States, through their coastal management programs, are using CZM tools to tie together basic human needs with environmental management; by drawing on numerous authorities and disciplines, CZM has the potential to tie together resource management with providing basic services and improvements to the lives of coastal residents of all races and socioeconomic backgrounds. Relying on case studies that show the intersection of coastal management and social justice, this presentation will offer a theory for the expanded use of the public trust doctrine by states to address chronic social justice issues in coastal communities.

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INNOVATIONS ON THE COASTS: COASTAL STATES' ROLE IN OCEAN POLICY

Panel Submitters: Kristen M. Fletcher, James H. Gregson

On the celebration of its 40th year, CSO presents this panel as part of a series of events in 2010 as a retrospective of coastal management at the state level. Coastal states are on the front lines of balancing competing uses in the coastal zone, managing development of energy sources, and adapting to climate change impacts. The nation's 35 coastal states and territories have unique Constitutional authorities and jurisdictions over coastal resources and activities: from Public Trust responsibilities for coastal submerged lands and state ocean waters to protecting fish and wildlife resources in these areas, states exercise these responsibilities on behalf of all citizens, including future generations. Almost all coastal states and territories have specific authority under the Coastal Zone Management Act to ensure that activities and permits of federal agencies that may affect their coastal zone are consistent with approved state policies. Because states work with multiple stakeholders and all levels of government – federal, regional, state and local – lessons, successes, and emerging challenges at the state level can yield innovative solutions at the national level. This panel includes offers a state-specific perspective on three essential coastal management topics: The State Role in Implementing a U.S. National Ocean Policy; Innovative Planning through the CZMA; and, Ocean Governance Lessons from Regional Ocean Partnerships. With the nation's economy and security dependent on the health of oceans and coasts and the resilience of coastal communities and environments, states remain at the front lines of coastal issues and a key partner in creating solutions.

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SEA LEVEL RISE AND COASTAL PUBLIC INFRASTRUCTURE: RISKS TO COASTAL SEWAGE COLLECTION SYSTEMS

Jefferson F. Flood* and Lawrence B. Cahoon

Recent projections of sea level rise suggest that coastal communities may face an additional meter of average sea level rise by 2050 and perhaps as much as 2 meters by 2100. Higher than normal water levels from spring tides, syzygy tides, wind tides, and storm surges would periodically increase the hazards from higher average sea levels. Hazards to public infrastructure as well as private property must be considered in these scenarios. We explored the potential vulnerability of sewage collection systems to sea level rise hazards by examining factors controlling inflow and infiltration (I&I) in central sewage collection and treatment systems in several coastal communities in North Carolina. I&I volumes are strongly influenced by short-term rainfall quantities, as expected, but other factors contribute on a longer-term basis. The portion of total flow attributable to I&I, which is flow over and above actual sewage flows, varied from <10% to >100% of base flow during the period 2005-2008. Inundation events, whether from heavy rainfall or from increases in sea level, thus pose three threats to coastal sewer infrastructure: 1) reduction in treatment efficiency with higher flow volumes, 2) increased risk of bypasses as flow capacity is exceeded, and 3) introduction of saline water into treatment systems, with likely negative consequences for the biological processes that treat sewage in conventional systems.

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ENGAGING A COMMUNITY IN THE RESTORATION OF AN ESTUARY

Karen W. Forget*

The Lynnhaven River watershed is sixty-four square miles and located entirely within the City of Virginia Beach. The watershed is a highly developed, urban/suburban, and home to 230,000 people. Once an estuary famous for the abundance and quality of its marine life, especially the Lynnhaven Oyster, it was highly degraded by decades of unchecked development and suffered from the same problems that afflict most urban and suburban waterways in our coastal community: high bacteria levels, sediment runoff, nutrient pollution, and toxins from a variety of sources.

Lynnhaven River NOW (LRNow) was founded in 2002 with the mission of restoring and protecting the Lynnhaven River by identifying and reducing sources of pollutants, educating and engaging the community and partner organizations, and restoring critical habitat: oyster reefs, wetlands and riparian buffers. Today the organization has over 3000 members and has achieved the lowering of bacteria levels that have allowed the opening of 38% of the river to shellfish harvest. Some of these areas had been closed since the 1930's.

LRNow has used a variety of methodologies to accomplish its goals including an extensive program with the local public and private schools, an ambitious community education program, a scoop the poop campaign, the building of sixty acres of conservation oyster reef, television commercials that promote responsible use of fertilizers, training in water friendly landscaping practices for homeowners and professionals, an oyster and clam shell recycling program with local restaurants, a citizen oyster gardening program, a roundtable review of city codes and ordinances and successful partnerships with the US Army Corps of Engineers, the Virginia Institute of Marine Science and the City of Virginia Beach.

LRNow can be a model for other coastal communities.

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PREPARING FOR CLIMATE CHANGE IMPACTS TO STATE-OWNED AQUATIC LANDS: A CLIMATE CHANGE ADAPTATION STRATEGY FOR THE WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES AQUATIC RESOURCES PROGRAM

Angie Lyne Fredrickson*

This presentation will present the key elements of a Climate Change Adaptation Strategy that was prepared for the Washington State Department of Natural Resources (WDNR) Aquatic Resources Program as part of the Washington Sea Grant Marc Hershman Marine Policy Fellowship. The objective of this Strategy was to initiate the Aquatic Resources Program's climate change adaptation effort by articulating the next steps that the Program can take to begin preparing for climate change. This Strategy provided WDNR with the necessary information to transform the Aquatic Resources Program into a climate resilient institution and to increase the resiliency of the 2.6 million acres of state-owned aquatic lands under WDNR management to climate change. The presentation will include an overview of projected climate change impacts to Washington's coastal areas, and a scoping of potential impacts to Washington's state-owned aquatic lands and WDNR's management activities. WDNR's legal obligation to prepare for climate change will be discussed, as will the agency's ability to continue to meet its statutory obligations as a trustee of public lands. The presentation will conclude with a discussion of recommended next steps for WDNR to improve its resiliency to climate change by building adaptive capacity and implementing near-term and long-term adaptive actions.

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DESIGNING THE LAST POTENTIAL RETROFIT SITE – REFINING THE LID PERMIT PROCESS

Hunter C. Freeman*

Although momentum for Low Impact Development (LID) implementation within new developments has been building in recent years, the current balance of LID installations continues to lean towards retrofit projects. As stormwater regulations have evolved over the years, few communities have developed an equitable permit process which allows developers to quickly design and permit LID sites, and fewer still use the permit process as an incentive to promote LID.

While many communities and researchers have focused their attention on using LID techniques in retrofit projects, we continue to use conventional stormwater management methods in new developments. One of the first steps in promoting LID within new developments is to level the permitting playing field. All too often, antiquated ordinances focused on peak runoff rates and pollutant loads fail to properly credit the impact of LID techniques. Every community should strive to build a dynamic permitting program which appropriately reflects the integration of LID techniques within the site plan. Programs which can react to the results of ongoing research provide the groundwork for a system capable of changing as experience with LID continues to evolve. There is no excuse for letting new development continue using methods which are not adequately protecting our watersheds. Those projects are only creating more potential retrofit sites.

This presentation will use examples from recent efforts in coastal North Carolina to highlight the need for specific LID permitting platforms, explain why a new approach is needed and demonstrate how a LID permitting program might work.

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LOCAL SOLUTIONS TO LOCAL PROBLEMS: A STORMWATER EDUCATION COLLABORATIVE

Karen Fuss*

The Coastal Waccamaw Stormwater Education Consortium (CWSEC) is currently completing its fifth year of activities helping northeastern South Carolina communities meet National Pollutant Discharge Elimination System (NPDES) Phase II permit requirements for Minimum Control Measure 1, Public Education and Outreach, and Minimum Control Measure 2, Public Involvement. Coordinated by Coastal Carolina University, six regional organizations serve as core education providers to eight coastal localities including six towns and cities and two large counties. During this year, CWSEC will undergo a needs assessment to begin the process of strategizing for the second NPDES Phase II 5-year permit cycle in order to continue to develop and implement effective, results-oriented stormwater education and outreach programs to meet federal requirements and satisfy local environmental and economic needs.

The programming for the CWSEC member SMS4s (small municipal separate storm sewer systems) has greatly diversified and grown since it began in 2005. CWSEC continues to work with the regional stormwater managers and South Carolina Department of Health and Environmental Control (SCDHEC) to help the local governments meet or exceed the permit conditions required by SCDHEC. CWSEC activities include: stormwater education workshops for local officials tailored to each individual locality, in-depth training sessions on specific stormwater best management practices being utilized in the area, storm drain marking, region-wide installation of rain gardens at local schools, and marketing on television, billboard and radio.

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ASSESSMENT OF POTENTIAL CLIMATE CHANGE IMPACTS ON STATE PARK SHORELINES, WASHINGTON STATE.

Anthony O. Gabriel*, Jeremy Murray, and Ben Sainsbury

Using GIS, the potential impacts of inundation and related erosion susceptibilities for 2 and 4 foot sea-level rise scenarios were calculated for 55 Washington State coastal parks in the Puget Sound, including specific vulnerabilities and potential impacts to geomorphology, biotic systems, and infrastructure. Park shorelines were first classified according to 8 geomorphic beach form and 9 upland form types. Development of inundation scenarios at park-level scales included the use of Lidar, USGS DEM datasets and Vdatum, a free utility developed by NOAA to vertically transform geospatial data across changing tidal datums. A related multi-criteria erosion susceptibility index was constructed using geomorphic shoreline types as well as existing geospatial databases of geology, beach substrate, soil type, slope stability, drift cell direction, exposure and shoreline modification variables. Biological and land use characteristics were analyzed in relation to inundation and associated erosion vulnerability by parks and landform type, using available federal and state data sources including aerial photographs and digital databases compiled through a decision support system developed with the Washington Department of Ecology. Quantified results include the type and amount of priority habitats, natural heritage points, shorezone habitats and wetlands that would be impacted by 2 and 4 foot sea-level increases, as well as infrastructure impacts such as the number of buildings and boat launches and the areal extent of parking lots and roads. The baseline inventory of biological and cultural conditions for each park provide a framework to assess potential impacts of sea-level rise and related increases in erosion susceptibility.

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MAP THE TAC: GEOGRAPHICAL DEPICTION OF THE ECONOMIC EFFECTS OF FISHERY MANAGEMENT MEASURES

Monica Galligan*

Coastal zone and fishery managers strive to accommodate coastal communities' needs within management measures. While it's logical to incorporate a community's economic status in policy recommendations, the challenge of what data to incorporate and how to incorporate them persists. I'll present a model that depicts the economic inputs and outputs of California's Monterey County fishing communities geographically, and demonstrates the direct and indirect effects of management measures such as changes in Total Allowable Catch (TAC).

Fishery management measures are necessarily ecologically driven; such measures need to address the requirements of National Standard 8 of the Magnuson Stevens Fishery Conservation and Management Act, which mandates that conservation and management measures "minimize adverse economic impacts on [fishing] communities" to the extent practicable.

To fold economic concerns into policy recommendations, this model generates output that feeds into the value chain socioeconomic module of Ecopath with Ecosim. The GIS-based interactive model I'll present is designed to increase fishery stakeholders' engagement and support fishery managers' decisions via geographical representation in ArcGIS maps. Further, it will accept updates to the underlying data, in order to maintain its utility on an ongoing basis.

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THE INVENTORY OF US MARINE PROTECTED AREAS: BUILDING A NATIONAL SYSTEM OF MPA'S TO ENHANCE PLACE-BASED CONSERVATION

Jordan Gass,* Mimi D'Iorio, Joseph Uravitch, Charles Wahle, and Lauren Wenzel

Signed on May 24, 2000, Executive Order 13158 established the National Marine Protected Areas (MPA) Center with the goal of creating a National System of MPAs representing the nation's diverse natural and cultural heritage. To create the foundation for the national system, the MPA Center has catalogued all federal, state and territorial marine protected areas in the US. The resulting MPA Inventory contains a variety of data including conservation purpose, level of protection, fishing restrictions and boundary descriptions. All MPAs are classified using standard definitions that allow a cohesive, geographically-based story to be told about the status of protection in the waters of the United States.

Based on the Inventory data, the MPA Center officially launched the National System in April 2009 with a charter membership of 225 sites located throughout the U.S. marine and Great Lakes environments. All sites that meet the MPA definition and address additional conservation requirements described in the *Framework for the National System of Marine Protected Areas* may nominate themselves for inclusion into the System. A second round of nominations is underway, and we expect to adopt new member sites in January 2010. Through the nomination process, we collect more detailed information to describe the level of conservation of ecological and cultural marine resources present in the national system. This presentation will focus on the MPA Inventory, its ability to support the national system and its potential for enhancing decisions about place-based conservation of the coastal, marine and Great Lakes environments of the US.

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SAN FRANCISCO BAY REGIONAL SEDIMENT MANAGEMENT STRATEGY DEVELOPMENT

Brenda Goeden*

Sediment dynamics in San Francisco Bay control many estuarine processes, such as the development, sustainability, and locations of beaches, tidal flats and marshes, habitat variability, and the productivity of the Bay waters. The flux of sediments within San Francisco Bay and its nearshore environment controls areas of erosion and accretion and the creation of important Bay habitats. The San Joaquin and Sacramento Rivers of the Great Central Valley drain precipitation and sediment from forty percent of California's landmass into the San Francisco Bay-Delta. In addition, many other tributaries, such as the Napa River and Sonoma Creek in the north and the Guadalupe River, Alameda and Redwood Creek in the south, contribute both sediment and water to the Bay and the Pacific Coast. Recent studies, United States Geological Survey (USGS) scientists and others have found that the San Francisco Bay is moving towards an erosional system. This in concert with predicted sea level rise and climate change may result in widespread impacts, such as shoreline erosion and marsh degradation within the Bay and is also possibly contributing to erosion along the outer coast.

San Francisco Bay sedimentation patterns are affected by a number of human uses, such as water control structures, channel and harbor dredging, sand mining, wetland restoration, beach nourishment, flood control and watershed management. Because these uses affect the sediment transport, patterns, sources and sinks, they should be considered in one systematic management plan. The San Francisco Bay Conservation and Development Commission in concert with the partnering agencies of the Long Term Management Strategy for Placement of Dredged Sediment in the San Francisco Bay Region (LTMS) and sediment science researchers, are developing a scientific research strategy as the underpinnings of a regional sediment management strategy for San Francisco Bay that incorporates the human uses of sediment described above.

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USING CANVIS TO VISUALIZE COASTAL ISSUES

Hansje Gold-Krueck*, Chris Haynes

Resource managers of all kinds often face a challenge when speaking to stakeholders, other managers, and the public: how does the organization communicate the true importance and impact of resource change when armed with charts, graphs, and statistics? How can the speaker make these data coalesce into a visual image that will **show** the listeners—not simply **tell** them—about potential changes?

For coastal resource managers, simulated visual images—also termed visualizations—are often much more effective than charts and graphs in conveying the real impact of coastal change and development. Such visualizations can spur stakeholders to develop strategies that mitigate potential negative impacts.

However, until recently, effective visualizations such as these have been hard to come by for most coastal managers. Many lacked the specialized software, skills, or time to create visualizations.

In response to the requests of coastal professionals for easy-to-use and inexpensive visualization tools, the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center contacted the U.S. Department of Agriculture (USDA) National Agroforestry Center about CanVis.

CanVis, a free software program developed by the USDA, allows natural resource professionals to create realistic simulations with minimal computer skills. The program comes with object libraries that contain agricultural images, and these images can be supplemented with coastal objects such as docks, boats, seawalls, and aquatic vegetation (available at www.csc.noaa.gov/canvis/).

CanVis also helps the user add textures to images and modify characteristics of objects. The program has recently been used to visualize sea level rise, living shorelines, offshore wind turbines, cumulative impacts of docks, and land development options for streetscaping.

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UNDERSTANDING THE IMPLICATIONS OF AN ICE-DIMINISHED ARCTIC THROUGH COLLABORATIVE PARTNERSHIPS

Hilary Goodwin,* Leigh Zimmermann

The National Oceanographic Partnership Program (NOPP) is an innovative collaboration of federal agencies that support ocean research partnerships among academia, government, industry, and non-governmental organizations. As illustrated by the case studies below, cutting-edge science is enhanced by intersector and interagency partnerships. Working together, different sectors realize benefits through an entire spectrum of possibilities, from the simple cost benefit of leveraging to a broader situational awareness of the national implications of their goals and missions.

NOPP supported four collaborative Arctic-related research projects beginning in 2007, one of which developed predictive models on the retreat of the Arctic coastline in Alaska. By providing sophisticated estimates on coastal retreat, understanding of future navigational routes and the impact of a diminished coastline on tribal communities is improved. Another example from the suite of projects investigated the response of marine mammal occurrence on Arctic shelves to changes in ice cover, contributing to a better understanding of the changing circulation across the Arctic shelves due to variations in sea ice. Ongoing research includes data sharing between industry and NOPP researchers which has allowed for synthesized data sets from passive acoustic recorders. The value of these partnerships can be seen in results shared across the community. For example, the project on marine mammal habitats in the Beaufort Sea is committed to preparing timely response plans for the state of Alaska. This panel will explore examples of various partnership projects that have increased our understanding of implications of an ice-diminished Arctic, such as changing shorelines and coastal environments.

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MANAGING ERODING BEACHES: AN ECONOMIC-MORPHOLOGICAL APPROACH

Sathya Gopalakrishnan*, Martin Smith, Dylan E McNamara & Brad Murray

Coastal Dynamics and human interventions are strongly coupled; shoreline changes affect human shoreline stabilizations, which in turn affect shoreline dynamics. Housing markets are directly influenced by the physical processes that govern coastal systems. The value of the beach – in the form of storm protection and recreation amenities – is at least partly capitalized into property values. These beach values ultimately influence the benefit-cost analysis in support of coastal management strategy, which, in turn, influence beach width. In this paper, we address the policy implications of this circularity.

Using a unique data set, which combines real estate data on residential property with physical beach quality attributes that we collected, we estimate a hedonic model for the value of beach width, incorporating the feedback between beach nourishment and shoreline retreat when nourishment is the dominant policy. We find that beach width is a much larger portion of property value than previously thought. We use the results from the empirical model to parameterize a dynamic model of optimal beach nourishment decisions and find that the discounted value of coastal property can fall by as much as 56% in a scenario where sea level rise and cost of nourishment sand increase by a factor of three.

Finally, we model optimal beach replenishment for multiple communities, with interactions between communities through the alongshore diffusion of sand. As we begin to grapple with adapting to climate change, it is especially relevant to understand whether the socially optimal management strategy leads to emergent properties that are qualitatively different from individual communities making localized nourishment decisions.

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A PROPOSAL TO SET UP PARTICULARLY SENSITIVE SEA AREA IN TAIWAN STRAIT

Song Guan*, Haifeng Wang

The particularly sensitive sea area (PSSA), which was initiated by the IMO in 1991, has achieved great success by providing environmental protection and limiting potentially dangerous maritime activities. With the fast economic growth and frequent international trade, the pollution and environmental degradation have occurred in the territorial sea and economic exclusive zone of China. Yet, China, a country with more than 18,000 km of coastline and another 12,000 km of island coastline, has not submitted any PSSA proposals so far.

In this paper, we analyzed the necessity and possibility to set up the PSSA in Taiwan Bank, an area from Dongshan Island of Fujian Province to west of Taiwan, across Taiwan Strait. Taiwan Bank is in the south end of Taiwan Strait which is one of the busiest international straits in the world. The strong Kuroshio passes Taiwan Bank every year and impose great danger to ships passing Taiwan Bank. Taiwan Bank is also of rich finishing resources and coral reefs with high ecological value. Therefore, the ecology has been endangered by the human activity and instable weather condition.

In this paper, we evaluate the legal basis behind the PSSA and discuss how to balance the interest of marine environmental protection and the freedom of navigation under the IMO Convention and the Law of the Sea. We then calibrate the impact of the PSSA on maritime shipping industry and see the alternatives for the industry to comply with the PSSA regulation. We also compute the environmental and ecological benefit from the PSSA. By the end of this paper, we discussed the policy implications of this paper.

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THE WEST COAST ECOSYSTEM-BASED MANAGEMENT NETWORK: AN INNOVATIVE PARTNERSHIP AND THE REAL-WORLD IMPLEMENTATION OF EBM

John R. Hansen*

The West Coast Ecosystem-Based Management Network (Network) is a partnership of six community-based initiatives focused on the successful implementation of ecosystem-based management (EBM) along the coasts of Washington, Oregon and California.

The member initiatives (from north to south) are:

- San Juan Initiative (San Juan Islands, WA)
- Port Orford Ocean Resource Team (Port Orford, OR)
- Humboldt Bay Initiative (Eureka/Arcata, CA)
- Elkhorn Slough Tidal Wetland Project (near Monterey, CA)
- San Luis Obispo Science & Ecosystem Alliance (Morro Bay, CA)
- Ventura River Ecosystem Project (Ventura, CA)

Each of these six groups has begun implementing ecosystem-based approaches to management in their local area, and taken steps towards the realization of EBM for their local ecosystem. With funding from the Packard Foundation, the Network was formed in 2008 to better integrate their common efforts, exchange lessons learned, and identify opportunities to enhance their approaches to management.

Since its inception, the Network has further developed itself into a robust collaboration that has included a learning network among the groups, the pending release of an EBM Implementation Guide, and collaboration with the West Coast Governors' Agreement on Ocean Health and Joint Ocean Commission Initiative, among others.

At TCS22, the Network hopes to provide further background on its member projects, highlight its EBM Implementation Guide with real-world steps towards EBM, and illustrate the unique opportunities for innovative partnerships the Network provides.

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AN INTEGRATED APPROACH FOR EVALUATING COASTAL VULNERABILITY IN A CHANGING CLIMATE

Erica L. Harris*, Peter Ruggiero

Coastal hazards such as episodic flooding events and shoreline erosion threaten many coastal communities and ecosystems. As sea level rise accelerates and storms increase in both frequency and intensity, incorporating the impacts of climate change into coastal vulnerability assessments is becoming a necessary, yet challenging task. A range of techniques are currently available to address these issues contributing to coastal vulnerability with the most common approach relying on computing the 1% annual chance total water level, which sets guidelines for FEMA's Flood Insurance Rate Maps (FIRMs). However, long term shoreline change or the impacts posed by a changing climate are typically not incorporated, leaving many communities overly vulnerable.

We are developing an integrated technique of probabilistically incorporating the impacts of climate change and variability via a multi-scale, multi-hazard methodology. By examining the combined hazards of episodic flooding/inundation and storm event shoreline change with chronic trends under future climate change scenarios, a quantitative framework can be established to promote more science-based decision making. Our focus here is on application of our methodology in Southern Oregon near Coos Bay and Bandon.

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ENCOURAGING OFFSHORE WIND DEVELOPMENT AT THE STATE LEVEL: A CASE STUDY OF RHODE ISLAND

Megan E. Higgins, Jennifer Harris*

Offshore wind development in the State of Rhode Island is expected soon, beginning in 2012. The State established the RIWINDS program in January, 2006 to assess and promote the development of wind energy in Rhode Island with the goal of meeting 15% of the State's 1000 MW annualized average electric demand or 150MW. This requires approximately 450 MW of wind energy capacity. Simultaneously, the State authorized and provided funding for the development of the State-led Ocean Special Area Management Plan (SAMP), a regulatory framework to define use zones for Rhode Island's ocean waters through a research and planning process. The SAMP is slated for completion in summer, 2010.

Deepwater Wind, LLC was selected by the State as its preferred offshore wind developer, outcompeting six other companies. Deepwater Wind's winning RI proposal consists of two projects: Block Island Wind Farm (20-30 MW project in state waters) and the RI Sound Wind Farm (385 MW project in federal waters). Deepwater Wind utilizes proven, state-of-the-art jacket foundation technology that allows wind turbines to be cost-effectively deployed in water depths up to 150 feet. Deepwater's jacket foundation technology is the standard in the offshore oil and gas industries (up to 1,000 feet deep).

This presentation will provide general observations about permitting offshore wind projects (Federal and State requirements), discuss what Rhode Island is doing to encourage offshore wind development, and determine whether the Ocean SAMP is facilitating the permitting process.

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A COMMUNITY BASED FRAMEWORK FOR IDENTIFYING, ASSESSING, AND EVALUATING ECOSYSTEM SERVICES ASSOCIATED WITH OREGON'S MARINE RESERVES

Michael Harte,* Selina Heppell, and Gil Sylvia

Existing research on marine reserve efficacy focuses on developing sets of management indicators tied to outcomes listed in the marine reserve management plan or on the achievement of a single objective such as an increase in the size or number of female fish in a reserve. These approaches, however, fail to capture the dynamic complexity of social, cultural, economic and ecological processes and tradeoffs associated with the establishment and operation of marine reserves. Moreover, there is usually little recognition of local coastal communities and the values they hold in the evaluation of the relative benefits and costs of marine reserves. New approaches grounded in the ecosystem based management (EBM) paradigm are needed to better evaluate the efficacy of marine reserves.

We describe a preliminary framework for monitoring and evaluating the ecosystem services that are connected to the spatial management of Oregon's nearshore. This framework integrates biophysical data and state-of-the-art community-based social and economic evaluation methods. It identifies ecosystem services, ecosystem benefits and their value to evaluate the costs and benefits of changes in the use of the marine environment. We also describe the proposed application of this framework to two pilot marine reserves in Oregon state waters. The outcome of this study promises to be a groundbreaking case study of marine reserve efficacy that is widely applicable at the state, regional, national and international level.

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VERTICALLY INTEGRATED GOVERNMENT IN COASTAL MARINE SPATIAL PLANNING: WILL LOCAL-LEVEL CHANGE RESULT FROM GREATER COORDINATION IN STATE AND FEDERAL GOVERNMENTS?

Troy Hartley*

We employ four analytical frameworks from public administration studies to examine a case of coastal policy implementation in the Mid-Atlantic. By assessing the 1) institutional factors (e.g., authorities, resources and capacity, organizational cultures), 2) federalism (e.g., federal-state-local government relations, communication, and coordination), 3) procedural factors (e.g., decision-making process and constraints, information needs and requirements), and 4) street-level bureaucracy (e.g., professional norms, behavioral constraints, coping strategies), we identify the opportunities and obstacles to greater vertical integration across federal-state-local government agencies aimed at implementing a coastal policy. In particular, we will assess specific local examples of ecosystem-based approaches to management in the Chesapeake Bay, i.e., marine spatial mapping and planning, which is being funded by the Virginia Coastal Zone Management program and has been advanced by the U.S. Ocean Policy Task Force. We will conduct key informant interviews, case documentation analysis, meeting observation and data gathering, and communication network analysis through web-based and in-person surveys. Ramifications for implementing regional governance systems, including the Chesapeake Bay Program and the newly formed Mid-Atlantic Regional Council for the Oceans (MARCO), and for conducting marine spatial planning will be discussed.

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THE GLOBAL HUMAN SECURITY INDEX: CAN DISAGGREGATIONS HELP US TO FORGE PROGRESS?

David A. Hastings*

The Human Development Report of 1990 helped enhance our perception of development from raw Gross Domestic Product per-capita to a composite including education and “a long and healthy life.” The 1994 Human Development Report characterized human security, a concept that might be summarized by: “Life, Liberty, and the Pursuit of Happiness” plus “diversity-in-community.” In 2008-2009 arguably the first Human Security Index was publicly released with 200 nation-societies. Components of the HSI include (1) diversity, (2) peacefulness, (3) environment, (4) corruption control, and (5) empowerment through information. A comparison of the HSI with the Human Development Index shows considerable discrepancy between the two, with some “economies” performing quite differently than their “societies.” The HSI may help to explain how one or more “developed economies” may be seen by others as “lesser developed societies.”

When the HSI was first released, people in at least one nation began engaging with the concept as a possible vehicle for strengthening national development planning. Can this also be done regionally or thematically, such as for coastal communities and climatic-meteorological, public health or socio-economic risk? If we thus look sub-nationally (within or across national boundaries) at coastal communities, what component indicators could be used, or assembled, to benefit characterization and improvement in coastal areas? Could we thus better craft development plans, climate hazard warnings, and efforts to mitigate risk, cope with and recover from challenges? The HSI, and possible coastal applications, are discussed.

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NON-GOVERNMENTAL ORGANIZATIONS AND MULTI-SITED MARINE CONSERVATION SCIENCE: A CASE STUDY

Jesse Guite Hastings*

Non-governmental organizations (NGOs) are now major players in marine conservation. The largest now produce applied marine conservation science and work with national and international stakeholders to develop conservation solutions that work in tandem with local aspirations. However, despite the growing role of NGOs, little research has explored how NGO initiatives use collaborative means to produce marine science and transform the results of this science into constructive policy outcomes.

Using a case study approach, this study has examined the processes of a major NGO initiative that has had the goals of producing marine protected area science, building local capacity, and influencing marine policy at four sites: Belize, Brazil, Panama, and Fiji. Multi-sited ethnography has uncovered processes and outcomes unique to particular countries as well as those that are systematic. Methods have included document analysis, semi-structured interviews, direct observation, and participant observation.

Preliminary results of this study affirm two main lessons when designing and running any marine conservation science initiative: make use of ongoing in-country conservation processes and work closely with strong in-country partners. Feeding scientific projects into in-country conservation processes and working with strong in-country partners enables the use of existing governance structures, creates opportunities for extensive local capacity building, and ensures that the data will immediately be used to strengthen ongoing conservation work, thus laying the groundwork for policy successes.

Final results of this study are to be disseminated throughout the marine conservation community and used to provide lessons for future conservation science initiatives.

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CALIFORNIA OCEAN USES ATLAS: USING PARTICIPATORY TECHNOLOGY TO INCORPORATE TRADITIONAL KNOWLEDGE INTO OCEAN MANAGEMENT

Nicholas Hayden*, Charles Wahle, Lance Morgan, Mimi Diorio, Jordan Gass and John Guinotte

The California Ocean Uses Atlas Project, a partnership between NOAA and the Marine Conservation Biology Institute, has filled a critical information gap in ocean management by providing an unprecedented, comprehensive, consistent and spatially explicit picture of human uses for management agencies, policy makers and stakeholders interested in sound and equitable ocean governance. Using participatory GIS concepts and applications, the Atlas Project generated spatial data and map products illustrating patterns, intensity, and temporal changes in a wide range of human uses in three broad categories of use: (i) consumptive, (ii) non-consumptive, and (iii) industrial activities. The resulting maps depict patterns of ocean use on a broad scale appropriate for a variety of ocean planning and management needs.

Through a series of regional expert workshops, the Atlas Project gathered geospatial data related to human uses of California's ocean environment from the shoreline to the 200 nm EEZ boundary. Coupling standard GIS software, electronic whiteboard technology, and a minimal amount of existing data, this project employed interactive participatory GIS tools to enable invited workshop participants to rapidly generate reliable spatial data based primarily on their individual expertise. The workshops were held regionally across California and generated a comprehensive geospatial dataset depicting the patterns of ocean uses important for informing the marine planning process throughout the state. This presentation will focus on the workshop methodology and outputs, and the utility of Atlas data for informing marine spatial planning and other management processes.

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INVESTIGATING CHANGES IN GLOBAL TROPICAL CYCLONE STORM FREQUENCY AND INTENSITY

Paula A. Hennon*, Michael C. Kruk, David H. Levinson, Ken Knapp, Ethan J. Gibney, and Howard Diamond

Understanding fluctuations in tropical cyclone activity along United States shores and abroad becomes increasingly important as coastal managers and planners seek to save lives, mitigate damage, and plan for resilience in the face of changing storminess and sea-level rise. Tropical cyclone activity has long been of concern to coastal areas as they bring strong winds, heavy rains, and high seas. Given projections of a warming climate, current estimates suggest that not only will tropical cyclones increase in frequency, but also in intensity (maximum sustained winds and minimum central pressures). An understanding of what has happened historically is an important step in identifying potential future changes in tropical cyclone frequency and intensity. However, the ability to detect such changes depends on a consistent and reliable global tropical cyclone dataset. Until recently no central repository for historical tropical cyclone data existed. To fill this need, the International Best Track Archive for Climate Stewardship (IBTrACS) dataset was developed to collect all known global historical tropical cyclone data into a single point-source for dissemination. With this dataset, a global examination of changes and trends in tropical cyclone frequency and intensity can be performed. The presentation will use the IBTrACS dataset to show the spatial variability of tropical cyclone frequency and intensity for the world's seven ocean basins affected by tropical cyclones. Analyses will show where the strongest storms typically occur, the regions with the highest number of tropical cyclones per decade, and the locations of highest average maximum wind speeds.

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SUPPORTING REGIONAL COASTAL AND OCEAN MANAGERS: LINKING OCEAN OBSERVING TOOLS AND CAPABILITIES TO THE PRIORITY NEEDS OF MANAGERS AND USERS IN THE SOUTHEAST REGION

Debra Hernandez* and Susannah Sheldon

The ocean and coastal waters of the southeastern United States help drive the local weather and climate, support ecologically and economically significant fisheries, and provide tourism, boating, and other recreational opportunities. The oceans and coasts in the region annually provide over \$700 billion dollars worth of impact to the regional economy. Yet, monitoring such an expansive area is a difficult task. SECOORA, the Southeast Coastal Ocean Observing Regional Association, is the regional solution to integrate extensive and widely scattered information and data being collected in the area. SECOORA coordinates coastal and ocean observing activities and facilitates dialogue with the public, local, state, and federal agencies, and public and private sector interests so that the benefits from the sustained operation of a coastal and ocean observing system can be realized.

SECOORA members are working with a wide range of users in North Carolina, South Carolina, Georgia and Florida to deliver data and information to protect lives and property. This includes using high frequency radar to inform search and rescue operations, providing models and data that support harmful algae blooms and inundation forecasts, and utilizing real-time wind, wave and water level data to improve the safety of mariners throughout the region. This paper explores the capabilities of various observing platforms and makes recommendations for how these capabilities can be strengthened in the future through better connections with coastal managers and other end users.

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APPLYING HEDONIC PROPERTY MODELS IN THE PLANNING AND EVALUATION OF SHORELINE MANAGEMENT

Paul R. Hindsley*

Like much of coastal and marine resource management, successful shoreline management efforts require tools developed in both the natural and social sciences. In its simplest form, we can decompose successful management strategies into three primary stages. First, managers and planners must evaluate the existing natural and social systems to determine if management efforts are necessary and feasible. If management efforts are necessary, they must determine what management tools can be used to address existing challenges. After this planning stage, managers begin implementation efforts. Last, managers must devise methods to evaluate planning and implementation efforts. In this paper, we discuss ways in which managers can utilize hedonic property models to help guide the shoreline management process. Through the evaluation of the benefits and costs of shoreline alternatives, hedonic property models provide managers with a valuable tool for improving both the planning and evaluation of shoreline management activities. These models allow them to evaluate whether shoreline conditions and/or management efforts influence residential home buyer's purchasing decisions and the costs and benefits associated with these conditions. This paper begins with a discussion of hedonic property models and then provides a survey of the existing literature as it relates to shoreline management. Last, it discusses future avenues of research using hedonic property models which may benefit the shoreline management process.

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STORMSMART COASTS IN ACTION: TWO CASE STUDIES OF LOCAL LEVEL CLIMATE CHANGE ADAPATION

Daniella Hirschfeld*

Coastal communities are facing ever greater natural hazards challenges due to a variety of factors including, population growth, past land use decisions and accelerated sea level rise. The StormSmart Coasts program was designed to help local officials address the expected impacts of erosion, storms, floods, and sea level rise, in ways that are effective, fair, and legally defensible. In its initial phase the program gathered the best coastal management tools and developed a website for local officials. The Massachusetts' StormSmart Coasts program entered its implementation phase in September '08, and has been working on five projects with seven pilot communities.

Presented here are two case studies which are now serving as models for other communities in Massachusetts. The Town of Hull served as the study area for the development of inundation visualization models. Photorealistic 3D models of seven critical facilities were built along with five different sea inundation scenarios, all of which can be viewed in Google Earth. This visualization tool helps to communicate risk and has enabled to community to develop incentives for homeowners to freeboard their homes. A second case study shows how towns on the Cape are integrating sea level rise into their FEMA approvable, multi-hazard mitigation plans. This effort has worked on both the articulation of the increased risk in the first part of the plan development as well as on the creation of strategic next steps to address this risk. These efforts have led to enhanced guidance for local officials on creating multi-hazard mitigation plans.

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ADAPTIVE SAMPLING FOR HOPKINS MARINE LIFE OBSERVATORY IN CALIFORNIA

Kristen T. Honey*

Stanford University researchers recently launched a Marine Life Observatory (MLO) at Hopkins Marine Station in Monterey Bay, CA. This collaborative initiative, involving ecologists, biomechanists and engineers, provides long-term data on the health and functioning of nearshore marine ecosystems. One goal is to reveal how small-scale physical and biological processes affect nearshore fish assemblages and ecosystem functioning, while providing mechanistic understanding of biophysical processes within kelp forests and nearshore marine systems. Increasingly, there is growing awareness that large-scale ocean dynamics often correlate with organism distributions, suggesting that physical environments strongly influence the dynamics of populations. Small-scale biophysical processes and mechanisms, however, are little understood. Investigating scientists typically conduct "fixed" sampling procedures, where all decisions regarding design are made prior to data observation. For dynamic environments like nearshore marine ecosystems, "fixed" procedures may be suboptimal—they lack flexibility and learning occurs only at the end of an experiment. Adaptive procedures overcome such limitations. Adaptive sampling is an experimental technique that uses accrued data (*i.e.*, observations) to make adjustments to research design, while research is ongoing. It works with natural dynamic processes, which are often inherently sequential and characteristic of marine systems, to efficiently allocate limited resources without diminishing the statistical power of the procedure. Innovative adaptive designs, developed and tested at Hopkins MLO, will improve the accuracy and efficacy of data collection in marine reserve assessments and legally mandated monitoring goals. In California, this means satisfying monitoring requirements under the Marine Life Protection Act at the lowest possible cost to taxpayers.

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A GIS BATHYMETRIC MODEL FOR ANALYSIS OF *Pilayella littoralis* ALONG THE SOUTH FACING SHORE OF HARWICH, CAPE COD, MA

Helenmary M. Hotz*

For the past 20 years, implications of the proliferation of a filamentous seaweed *Pilayella littoralis* along the south facing coast of Cape Cod, MA have affected both the environmental and economic stability of the region. While noticed, it has not been the focus of a spatial investigation and little is known about the origins and conditions leading to its abundance. Without this information it is difficult to judge the risk, to develop a strategy to prevent its occurrence, or to mitigate its effects. Analysis of distributions of *Pilayella* at selected Cape Cod sites examines conditions that enable or facilitate its phenomenal success. Specifically, it investigates the coincidence of rocky coastal features, natural or human constructed, and the occurrence of *Pilayella littoralis*. A well defined physical mapping of the area was undertaken in a geographic information systems (GIS) environment. It was found that bathymetry available for the study area was not of a suitable quality. This necessitated the development of a raster application to better define coastal bathymetry for the near shore study area. This methodology generated a grid with the added value of spatial and temporal flexibility, which is necessitated by interfacing of phenomena that occur on a range of scales, spatially and temporally. The bathymetric model developed for this research allows future analysis of coastal environments for natural and man-made features against the coastal phenomena being researched, using data representing real world values defined to an appropriate scale for the research.

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INCOME, INEQUALITY, AND BIODIVERSITY AND WILDLIFE HABITAT ASSESSMENT IN THE CAMA COUNTIES

Hillary Huffer*

Socioeconomic factors have long been incorporated into environmental research to examine the effects of human dimensions on coastal natural resources. Boyce (1994) proposed that inequality is a cause of environmental degradation and Mikkelsen et al (2007) found a substantial relationship in declining biodiversity and economic inequality among countries. To further examine this relationship in the CAMA counties, the Biodiversity and Wildlife Habitat Assessment values, from the N.C. Department of Environment and Natural Resources, were utilized to yield the average score of biodiversity and wildlife habitat by county. The Biodiversity and Wildlife Habitat Assessment data is in the form of GIS layers which were mapped using ArcMap 9.2. The data was then clipped by county boundary and the average biodiversity and wildlife habitat score was obtained by averaging the score for all features within a particular county. The average biodiversity and wildlife habitat score per country was then analyzed using a multiple regression with income and income inequality, as measured by the Gini Coefficient, as explanatory variables. These results and the possible policy outcomes are addressed with particular emphasis on income redistribution and their positive effects on income disparity but their possible detrimental effects on power inequality.

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DPSIR IN COASTAL NORTH CAROLINA: APPLICATIONS AND PROBLEMS

Coley Hughes,* Elizabeth Brown, Michelle Covi, Hillary Huffer and Deanna Swain

The European Environmental Agency is increasingly using a Drivers-Pressures-States-Impacts-Responses (DPSIR) model to encourage interdisciplinary analysis and communication between scientists and managers. We sought to evaluate the applicability of the model to a coastal estuarine system through a series of case studies in eastern North Carolina. Our limited case studies focused on the areas of agriculture, fisheries, tourism, industry, and development within the study areas. We analyzed the model's utility within each area to identify the overall strengths and weaknesses of the DPSIR model as a communication tool within the current management structure.

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SOCIO-ECONOMIC VULNERABILITY OF AFRICAN AMERICANS IN THE GULF COAST COUNTIES

Tanveerul Islam,* Ariana Marshall, Elijah Johnson, and Larry Robinson

The coastal population in the United States has been increasing rapidly as more than half of the U.S. population now lives in coastal areas which account for only 17 percent of the total land area. According to the U.S. Census, the states bordering the Gulf of Mexico i.e. Texas, Louisiana, Mississippi, Alabama, and Florida are homes to the highest percentage of African-American population in the United States. These people are usually the hardest hit during a hurricane or such extreme events as evidenced by Hurricane Katrina, among others. In particular, poor and underserved communities bear the brunt of these devastations which lead to further damage and destructions in the society. In a social vulnerability study after Hurricane Katrina, it is found that most of the affected African Americans were low income, less educated, not married, older and home renters. All these factors have shown to be predictors of socio-economic vulnerability to natural disasters and hurricanes. Geographic Information Systems (GIS) is a useful tool to identify, and visualize the vulnerability and can be used to plan relief efforts and community redevelopment. Using GIS, this study maps and investigates the factors of socio-economic vulnerability e.g. age, income, poverty level, educational attainment, and marital status at the county level of African Americans living in hurricane risk areas of the Gulf coast. The spatial representation of these counties with combined hurricane risk and socioeconomic vulnerability can be used to enhance coping capacity of African Americans to hurricanes and other natural disasters in this region.

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ASSESSING TOURIST DEMAND FOR TRADITIONAL COASTAL DEPENDENT BUSINESSES ON THE SOUTH CAROLINA COAST

Laura Jodice*, William C. Norman, Carlos Carpio, Geoff Lacher, Chi-Ok Oh

The travel and tourism industry is a leading employer on the South Carolina (SC) coast. However, tourism driven development and coastal gentrification have resulted in a notable decline in waterfront-dependent businesses. In addition to waterfront access, the economic sustainability of traditional water-dependent businesses on the SC coast depends on availability of natural resources (e.g., fish, natural landscapes, sweetgrass for baskets), consumer demand, marketing capacity, competition, infrastructure costs, and coastal real estate values. Therefore, we examined the sustainability of traditional coastal-dependent businesses on the SC coast from a tourism perspective by assessing the demand for products and experiences supplied by these businesses. The research integrated focus groups and an intercept-based mail survey. Two focus groups were conducted with potential and existing coastal tourists in May 2008 to develop attributes and levels for choice modeling questions, contingent valuation questions and a comprehensive listing of common coastal-dependent activities for the follow-up coastal tourist survey. The survey was conducted from Fall 2008 through Summer 2009. Tourists (i.e., not a resident of destination county) were intercepted in the three major coastal tourism destinations, Myrtle Beach, Charleston and Beaufort/Hilton Head, in a variety of venues (e.g., beaches, visitor centers, state parks). If they agreed to receive a mail survey, tourists were asked for their mailing address. Researchers collected 1684 good addresses (1/3 per region) and received 840 survey responses (50% response rate). The presentation will report selected focus group and survey results and discuss how the findings will be incorporated into small-business training materials.

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COASTAL BARRIER ISLAND NETWORK (CBIN): MANAGEMENT STRATEGIES FOR THE FUTURE

Heather Joesting*, Amy Williams, Rusty Feagin, and William Smith

The Coastal Barrier Island Network (CBIN – <http://www.coastalbarrierisland.org/>), an interdisciplinary research group (Research Coordinated Networks, NSF), was established in 2008 to provide a forum for bio-geo-social scientists and managers to identify research questions and management strategies that will promote ecosystem sustainability, given the known transiency of barrier islands and a future with sea level rise and increased storm impacts. A recent meeting on Galveston Island, Texas, provided the opportunity to evaluate management strategies while immersed in the aftermath of Hurricane Ike (Category 4 surge). From this meeting and an earlier workshop in Biloxi, Mississippi following Hurricane Katrina, six major priorities emerged that identified critical areas for future research and science-based management decisions for the Atlantic and Gulf Coasts of the USA and Mexico. These themes included: (1) balancing natural and human processes, (2) incorporating broad spatial and temporal scales to assess ecosystem sustainability and resilience, (3) use of economic valuation tools and rapid assessment methods to generate solutions, (4) initiating multiple stakeholder communication and collaboration, (5) developing more natural restoration ideas enabling greater geomorphic stabilization, and (6) developing a comprehensive and more unified conceptual framework for managing these critical coastal ecosystems. Overall, these priorities recognize that substantial urbanization has already occurred on many barrier islands, and will most likely continue into the future. However, improved management schemes could enhance both the sustainability of the ecosystem and its critical services, as well as some degree of increased stabilization.

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ECONOMICS OF CO-MANAGING WATER QUALITY AND INVASIVE SPECIES FOR CALIFORNIA AND BAJA CALIFORNIA COASTAL BOATS

Leigh T. Johnson* and Linda Fernandez

Regulatory action to protect California's coastal water quality from degradation by copper from recreational boats' antifouling paints interacts with efforts to prevent transport of invasive, hull-fouling species. A copper regulatory program is in place for a major yacht basin in northern San Diego Bay and in process for other major, California boat basins. Coastal boat traffic in California and Baja California increases invasive species transport risks. Policy makers, boating businesses and boat owners need information on costs of effective fouling control measures and supply-side capacity. Authors surveyed 30% of coastal marina, boatyard and hull-cleaning businesses in California and in Ensenada, La Paz and Cabo San Lucas of Baja California. Through summary statistical analyses and regressions, relationships were measured between factors such as fouling control options and costs, frequency of boat use, length of stay at marinas, location, awareness of nontoxic coatings *et alia*. For example, although length of stay in a marina varies greatly, approximately half of long-term marina tenants rarely take out their boats. These factors present specific issues related to toxic (copper and zinc) versus nontoxic (epoxy and slick) coatings and to invasive species control. Awareness of nontoxic boat bottom coatings has increased. Regressions indicate that awareness of nontoxic coatings was significantly associated with likelihood of choosing them.

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CLIMATE CHANGE AND THE CALIFORNIA COASTAL ACT: RISING TO THE CHALLENGE

Laurel Kellner*

Climate change is a significant challenge facing coastal communities around the world. With over 1,100 miles of open ocean coastline, California is vulnerable to sea level rise, shoreline erosion, and other effects. Political and legislative structures in the state present opportunities for state, local, and regional governments to act now to adapt to several predicted impacts of a changing climate. The California Coastal Act provides a broad framework for climate-sensitive approaches to coastal planning, addressing concepts such as hazard avoidance, low impact development, and the conservation of environmentally sensitive habitat areas.

The Coastal Act directs coastal resource planning, management, and regulatory issues on the open California coast, including, among others, public access, recreation, development, and habitat protection involving the marine environment as well as land resources. Many of the provisions of the Coastal Act involve coastal activities and resources that will undoubtedly be impacted by climate change. The goal of this work is to use current operating frameworks under the Coastal Act to inform climate change planning, including regulatory decisions and Local Coastal Program updates and amendments.

Planning and decision-making at the local and state level are central components in climate change adaptation strategies. This work illustrates key areas under the California Coastal Act where climate change planning can be addressed at the community level using the existing planning and regulatory tools including Local Coastal Programs. The research assists in the development of local-scale decision guidance, highlighting policy examples and planning efforts in California by local, state, and regional governments.

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IMPROVING REPORTING OF UNCERTAINTIES IN SEA LEVEL RISE ASSESSMENTS

Nathan P. Kettle*

Many human population centers and ecosystems along the Carolina coast are at risk to sea level rise. In response to growing concerns, numerous studies have modeled the vulnerability of various sectors, populations, and land cover to flooding using different climate change scenarios. However, the development of sea level rise vulnerability models is not always straightforward given the numerous sources and types of compounding uncertainty. These uncertainties include both climate and non-climate factors, such as the difficulty in predicting trajectories of sea level, acquiring appropriate data and methodologies to quantify impacts, and incorporating human and biological adaptations. Accurate interpretation of assessments is further compromised given that published modeled outputs seldom include discussions of how uncertainty affects the accuracy of results.

This study illustrates the compounding nature of uncertainties in sea level rise assessments in Charleston County, South Carolina. The study begins by analyzing the extent that error and uncertainty within digital elevation models affects predicted inundation under different climate change scenarios. This study then shows how uncertainty is compounded when determining populations at risk to flooding. Several other sources of uncertainty, which are known, but cannot yet be quantified, are then discussed. Sea level rise vulnerability assessments are then reviewed (n=240) in order to illustrate the inadequate reporting of these uncertainties. The study concludes by suggesting research priorities to improve our understanding and communication of uncertainties as they relate to coastal adaptation to climate change.

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THE THREE RULES FOR UNDERSTANDING COASTAL ISSUES, EXPLAINED AND ILLUSTRATED

Lauriston R. King*

It's almost a cliché' to assert that coastal issues are complex, occur at many different spatial and temporal scales, involve the land and water in ways that are elusive, and frequently the source of public conflict. Issues as diverse as the preservation of working water fronts, storm run-off and impervious surfaces, offshore wind energy, beach access, fisheries decline challenge scientific experts and citizens alike. Although these issues are associated with the coast there is no single unifying theory that guides understanding of what these share in common and what might provide a common basis for understanding. So, in the absence of the one grand theory, it may be useful to draw on the three rules to help guide understanding of coastal issues. Though they are simple and lack the elegance of formal theory, they're quite useful for understanding coastal policy and politics. They are: Rule No. 1. No people, no problem(s). Rule No.2 Money rules. Rule No.3 Politics explains everything. The paper will describe and elaborate on each of these, provide illustrations, and suggest some implications of the rules for coastal resources management and education.

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DECISION SUPPORT SYSTEMS OPTIMISING EFFLUENT RELEASE IN A SUB TROPICAL ESTUARINE ENVIRONMENT – AN AUSTRALIAN CASE STUDY

Greg Stuart, Stefan Szylkarski, Franz Thomsen, Simon Mortensen, Anna Hollingsworth, Sayed Khan, Bill Capati, Sally Kirkpatrick,* Rodger Tomlinson

Gold Coast Water is responsible for the management of the water and waste water assets of the City of the Gold Coast on Australia's east coast. Treated waste water is released at the Gold Coast Seaway on an outgoing tide in order for the plume to be dispersed before the tide changes and reenters the Broadwater estuary. Rapid population growth in the over the past decade has placed increasing demands on the receiving waters for the release of the City's effluent.

The *SmartRelease* Project is designed to optimise the release of the effluent from the City's main waste water treatment plant in order to minimise the impact of the estuarine water quality and maximise the cost efficiency of pumping. In order to do this an optimisation study that involves water quality monitoring, numerical modelling and a web based decision support system was conducted.

An intensive monitoring campaign provided information on water levels, currents, winds, waves, nutrients and bacterial levels within the Broadwater. These data were then used to calibrate and verify numerical models using the MIKE by DHI suite of software. The Decision Support System then collects continually measured data such as water levels, interacts with the WWTP SCADA system, runs the models in forecast mode and provides the optimal time window to release the required amount of effluent from the WWTP.

The City's increasing population means that the length of time available for releasing the water with minimal impact may be exceeded within 5 years. Optimising the release of the treated water through monitoring, modelling and a DSS has been an effective way of demonstrating the limited environmental impact of the expected short term increase in effluent disposal procedures.

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HISTORICAL RECONSTRUCTION REVEALS RECOVERY IN HAWAIIAN CORAL REEFS

John N. Kittinger*, Loren McClenachan, Jonathan H. Blodgett, Jennifer K. Shultz, Kepā Maly, Terry L. Hunt, Thomas S. Dye, Bruce A. Wilcox, & John M. Pandolfi

Coral reef ecosystems are among the most diverse coastal ecosystems worldwide, yet are declining rapidly due to a small set of direct human activities, or proximate impacts. Global-scale historical ecology studies have revealed regional differences in the trajectories, timing and extent of coral reef ecosystem decline, highlighting the need for in-depth regional case studies to understand what factors contribute to either ecosystem collapse or sustainability. This transdisciplinary research reconstructed coral reef ecosystem conditions over the past 1000 years in the Hawaiian Archipelago, integrating archaeological data, historical-archival information, and modern ecological data on marine species. Results indicate two different periods of reef recovery operating at different spatial scales, which are attributed to a complex set of social factors including depopulation and demographic change, shifting property rights regimes, and ecosystem protections. Analysis of social-ecological linkages through time reveals complexity that disproves myths of simplified cause-consequence relationships for coastal environmental degradation. Spatial variability in both social and ecological conditions, and the trajectories of change in both through time, suggest that a variety of conservation strategies will be required to effectively reverse degradation in areas that are still declining due to human activities. From a conservation perspective, understanding the long-term trajectory of the ecosystem under management is critical to formulating effective policy for achieving desired future ecosystem states. This transdisciplinary research seeks to bridge the ecological and social sciences, which is necessary for formulation of appropriate conservation strategies and sustainable ecosystem management.

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ANALYZING POLICY DEVELOPMENT IN EVERGLADES RESTORATION: CASE STUDY USING HABERMAS'S CRITICAL THEORY

Claire Connolly Knox*

This case study stems from my dissertation research and applies the critical theory of Jürgen Habermas to analyze public policies surrounding the Florida Everglades. Habermas argues that policymakers in advanced industrial democracies are caught between conflicting imperatives: they are expected to serve the interests of their nation as a whole, but they must prop up an economic system that benefits the wealthy at the expense of the environment. Critical theory suggests that this contradiction will be reflected in Everglades policy by communicative distortions and blockages that suppress and conceal tensions between environmental and economic priorities. In theory, policymakers will give programs misleading names; will overstate programs' environmental benefits and understate their benefits to economic special interests (farmers, ranchers, developers); and will suppress evidence and advocacy that cast doubt on policymakers' claims about program performance. The results of this case study poses a challenge to mainstream policy research, which typically avoids comprehensive theory and treats policy areas, policy concepts, and problem definitions as straightforward and unproblematic. By approaching the subject matter from a critical theory perspective, the case study demonstrates that mainstream policy research actually relies on a comprehensive set of assumptions that it fails to recognize. This set of unacknowledged premises constitutes a paradigm in need of articulation and assessment. By applying critical theory to Everglades policy and policymaking, this case study surfaces this paradigm by confronting it with competing concepts and hypotheses.

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PERCEPTIONS OF COASTAL RESOURCES AND FACTORS RELATED TO THEIR MANAGEMENT FOR SOCIAL RESILIENCE DURING DISASTER RECOVERY

Dawn M. Kotowicz*

During a recovery effort, opportunity exists to improve upon management of coastal resources by implementing policies that encourage sustainable resource use. In turn, sustainable and diverse resource use can enhance community resilience. Developing better practices requires a good understanding of residents' attitudes toward, and understanding of, coastal resource processes and their management. In addition, in a recovery scenario, associated beliefs - such as fatalism and perceptions of the future – affect rebuilding efforts and the capability to enhance resilience during recovery.

Two surveys of residents of Ranong Province in Thailand were conducted in 2005 and 2007 during their recovery following the 2004 Indian Ocean Tsunami. Perceptions of coastal resource health, management and compliance with regulations were examined at these two time periods, including relative scale pre-disaster, current and near future projections on these factors. This research assesses whether and how these beliefs have changed in response to various types of exposure and education regarding human impacts on coastal resources over the course of a livelihood rehabilitation program as part of disaster recovery efforts. The findings illustrate that overall, individuals believe coastal resources were damaged by the disaster, and the resources, as well as factors associated with their management, will return to pre-disaster states and then level off. These findings indicate that in order to improve upon pre-disaster coastal management, individuals should be educated on how their coastal resources, and related management, can be improved. Managers and residents are more likely to work toward higher expectations for enhanced coastal community resilience.

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WHAT IS COASTAL CLIMATE?

Michael C. Kruk*, David H. Levinson, Ethan J. Gibney, and Paula A. Hennon

Historical definitions of what determines whether one lives in a coastal area or not have varied over time, from using coastal watershed boundaries, shoreline-adjacent coastal counties, and even counties impacted by flooding from coastal storms. The definition one chooses can have major implications, including a simple count of coastal population and the influence of local or state coastal policies. There is, however, one aspect of defining what is “coastal” that has often been overlooked; using atmospheric long-term climate variables to define the inland extent of the coastal zone. This definition, which incorporates temperature, precipitation, wind speed, and relative humidity, is furthermore scalable and globally applicable - even in the face of shifting shorelines. The resulting definition, “coastal climate” or “climatology of the coast”, will help coastal resource managers make better-informed decisions on a wide range of climatologically-influenced issues. The presentation will outline the development of this new definition of the coastal zone, and specifics will be presented on the incorporation of each atmospheric and climatic variable using in situ weather station data. In addition, a new U.S. national map depicting the climatic definition of the coastal zone will be shown.

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COASTAL EROSION AS A NATURAL RESOURCE MANAGEMENT PROBLEM: AN ECONOMIC PERSPECTIVE

Craig E. Landry*

Natural forces render the coastal environment an evolving landscape, with the majority of coastline in the U.S. exhibiting net erosion in recent decades. Predictions suggest that 25 percent of homes within 500 feet of the coast could be lost to erosion in the next 60 years, at a potential cost of \$530 million dollars each year. Following a lengthy tradition of economic models for natural resource management, this presentation explores a dynamic capital-theoretic model for managing coastal erosion. The model conceptualized benefits of beach area as service flows accruing to nearby residential property owners, local businesses, and recreational beach users. The costs of maintaining beach area include pecuniary engineering expenditures as well as negative impacts on the coastal environment. Employing these constructs, an optimal control model is specified that provides a framework for identifying the conditions under which beach replenishment is welfare-enhancing (i.e. will “pass” a comprehensive benefit-cost analysis), and an optimal replenishment schedule (e.g. periodic frequency and requisite sand volume) can be derived. Results are scrutinized to explore ways in which geophysical shoreline processes, including stochastic variation in periodic erosion, variability in erosion in the long shore dimension, and nonlinear relationships reflecting an attempt to maintain conditions far from historical equilibriums, can be incorporated. Sea level rise is introduced as an evolving erosion rate, which provides a framework for predicting the timeline of active shoreline management (i.e. how long should we attempt to “hold the line”?) and conditions under which movement to a passive management regime might be optimal.

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FISH NURSERY FUNCTION OF OCEAN SURF-ZONE HABITAT: RESPONSE TO A HUMAN DISTURBANCE GRADIENT

Tom Lankford,* Ian Lipton, Lexi Perillo, Paula Pellerite and Rachel Dixon

The ocean surf zone provides essential habitat for a variety of coastal marine fishes. Surf zones are particularly important as juvenile nursery habitat. The nursery function of surf zone habitat may be compromised by human disturbances to adjacent beaches. Although shoreline development and sand renourishment are common practices on barrier island beaches of the southeastern U.S., their impacts on fish nursery function are poorly described. We are investigating the response of fish nursery function to beach disturbance by comparing the assemblage structure, density and nutritional condition of juvenile fishes sampled from beaches selected to represent a human disturbance gradient. Sampling sites include undisturbed (undeveloped and unnourished, n=3), moderately disturbed (developed but unnourished, n=2) and highly disturbed (developed and nourished, n=3) beaches in southeastern North Carolina. Nursery function is indexed based upon the diet and compositional analysis (tissue lipid content, ash content, somatic condition) of two surf-dependent species: Florida pompano (*Trachinotus carolinus*) and Gulf kingfish (*Menticirrhus littoralis*). Preliminary results suggest that highly-disturbed beaches differ in fish species composition compared to undisturbed sites, and that fish nursery function is compromised on highly-disturbed beaches.

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SURF-ZONE FISH ASSEMBLAGES AT WRIGHTSVILLE BEACH, NORTH CAROLINA: SHORT- AND LONG-TERM RESPONSES TO BEACH RENOURISHMENT

Tom Lankford*, Adam Branson, Trey Sherard

Wrightsville Beach, a 7km developed barrier island in southeastern North Carolina, has an extensive history of shoreline management. Efforts to combat erosion and protect shoreline structures have included periodic beach renourishment projects since 1938. Consequences of this beach management strategy for essential fish habitat are poorly understood. We describe the assemblage structure, seasonality and recruitment patterns of fishes utilizing shallow surf-zone habitat at Wrightsville Beach, North Carolina, and the response of fish communities to beach renourishment. Year-round sampling initiated in May 2004 is conducted biweekly (May-September) or monthly (October-April) using a 30 x 2 meter seine. To date, 543 seine hauls have yielded 118,464 individuals representing 71 species and 29 families of fishes. Numerically-dominant species include *Membras martinica* (35% of total individuals), *Anchoa hepsetus* (28%), *Trachinotus carolinus* (10%), and *Menticirrhus littoralis* (6.0%). Fish utilization (density, species richness and species diversity) is positively correlated with water temperature, peaking during summer/early fall and declining during late winter. Surf sites appear to function as nurseries for several commercially-important species, including *T. carolinus*, *M. littoralis* which recruit as small juveniles during May/June and remain until December. Beach renourishment during April 2006 involved the placement of 560,000 cubic yards of inlet-dredged sand along 2.5km of Wrightsville Beach, resulting in high turbidities, reduced sediment grain sizes, altered beach slope and reduced invertebrate abundance. The short- and long-term responses of surf-zone fish assemblages to these disturbances will be presented.

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SOUTH ATLANTIC REGIONAL RESEARCH PLAN: A REGIONAL RESEARCH FRAMEWORK

Christine Laporte,* Merryl Alber

The South Atlantic Regional Research Project (SARRP) is developing a coastal regional research framework for the southeast. The project, undertaken by the Sea Grant Programs of the South Atlantic (NC, SC, GA, and FL) and coordinated by the Georgia Coastal Research Council, is part of a mosaic of similar efforts by Sea Grant programs throughout the US. SARRP's goal is to identify "demand-driven" regional research priorities (natural and social science) for ocean and coastal resource management. The plan is a "living document" that incorporates priorities identified by SARRP's Strategy Team and the results of an extensive needs assessment and stakeholder survey. Priorities are also aligned with the Ocean Research Priorities Plan and the Priority Themes of the South Atlantic Alliance, a cooperative coastal agreement recently signed by the governors of NC, SC, GA and FL.

This project provides a case study in regional cooperation, engaging federal, regional and state agencies, academics and other stakeholders. We will present an overview of the SARRP process and results, highlighting its dynamic partnerships, relevance and high value for addressing critical scientific needs in coastal management issues. Through alignment with our partners, SARRP's aims can significantly advance our region's progress towards meeting our nation's coastal and ocean stewardship needs, especially in times of dwindling resources. Additionally, SARRP is an excellent example of the regional approach highlighted in the evolving National Ocean Policy.

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MOVING PAST THE STATEMENT “LOCAL GOVERNMENT SHOULD DO THE RIGHT THING”- WHAT’S LOCAL GOVERNMENT’S ROLE IN CLIMATE CHANGE AND SEA LEVEL RISE?

Lewis L. Lawrence*

Recognizing and understanding that local governments (Dillon Rule State) exist as an administrative arm of the parent state government, created for the express purpose of attending to the administrative affairs of the state. These affairs set the stage for understanding how and why local governments operate. Local governments exist to secure and promote public health, safety, and general welfare of its inhabitants.

To frame climate change and sea level rise around public health, safety, and general welfare is a challenge, especially absent a Federal or State mandate to plan or address climate change. To complicate matters further at the local level, some in the community believe that sea level rise is a “concept based on spurious data” and one should “not discourage someone from building a nice home on the water” and that one should be “aware of the concept of sea level rise, but don’t use a hammer to discourage some from coming in and building”.

This session focuses on the anthropogenic impacts related to seal level rise, impacts that equate to votes in the local election. We will identify and discuss issues and public policy implications in regards to flooding of secondary roads and small bridge elevation issues, flooding of septic tank and drinking well concerns, flooding of public infrastructure, relocation of residential structures, as well as the loss of the community tax base and other revenue considerations. These are issue that elected officials will hear about from constituents.

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AQUACULTURE AND WORKING WATERFRONT INFRASTRUCTURE: A LOCAL PUBLIC POLICY DIALOG FOR A TIDEWATER VIRGINIA LOCALITY

Lewis L. Lawrence*

Aquaculture and related working waterfront infrastructure is a complex economic, environmental, land and water resource and use conflict issue. As many coastal localities struggle with becoming less rural and more suburban, balancing growth, preserving coastal character, coastal culture and the delivery of public services forms the basis for a local public policy conundrum: to what extent will our future economic fabric rely on the opportunities presented from a coastal environment and what public policies will govern such opportunities?

To keep pace, new local public policy must be developed. As with most public policy questions, elected officials struggle with the concept of “progress”: balancing environmental protection with economic prosperity. Aquaculture as a potentially new and/or expanding economic engine for many Chesapeake Bay coastal local governments begins to blur the line between the need for enhanced local environmental management and economic prosperity.

This presentation will report on the approach and results of placing the question of public policy need for aquaculture-working waterfront sustainability in front of local elected officials and to explore other economic tradeoffs and/or competing economic interest of existing local public policy. If local government is to develop new public policy to support and sustain aquaculture-working waterfront infrastructure, tradeoffs will have to be made. Additionally, the presentation will discuss various approaches and new local public policy options under consideration to strengthen aquaculture-working waterfront infrastructure to enhance sustainability within a Tidewater Virginia locality.

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COASTAL MANAGEMENT MEASURES FOR THE LOWER MAUMEE WATERSHED, LAKE ERIE

Patrick L. Lawrence*

In January 2006 the Maumee Remedial Action Plan (RAP) Committee submitted a State II Watershed Restoration Plan for the Maumee River Great Lakes Area of Concern (AOC) area located in NW Ohio to the State of Ohio for review and endorsement (www.partnersforleanstreams.org). The plan was created in order to fulfill the requirements, needs and/or use of five water quality programs including: Ohio DNR Watershed Coordinator Program; Ohio EPA Great Lakes RAP Program; Ohio DNR Coastal Non-point Source Pollution Control Program; Ohio EPA Total Maximum Daily Load Program; and US F&WS Natural Resources Damage Program. The plan is intended to serve as a comprehensive regional management approach for all jurisdictions, agencies, organizations, and individuals who are working to restore the watershed, waterways and associated coastal zone. The plan includes: background information and mapping regarding hydrology, geology, ecoregions, and land use, and identifies key causes and sources for water quality concerns within the six 11-digit hydrological units (HUCs), and one large river unit that comprise the Maumee AOC. Tables were also prepared that contains detailed project lists for each major watershed and was organized to facilitate the prioritization of research and planning efforts. Also key to the plan and project tables is a reference to the Ohio DNR Coastal Management Measures that may benefit from the implementation of an identified project. This paper will examine the linkage between watershed planning and coastal zone management efforts in the Maumee AOC and how the coastal management measures were integrated into the watershed plan.

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CLIMATE CHANGE IMPLICATIONS FOR NORTH CAROLINA: THE ROLE OF COASTAL AND ESTUARINE OBSERVING SYSTEMS

Lynn Leonard,* Jennifer Dorton, Rick Luettich, Harvey Seim, and Doug Gamble

North Carolina's coastal environments are highly vulnerable to climate change. In North Carolina (NC), sea level rise will result in increased coastal flooding, loss of freshwater swamps, saltwater intrusion into surface and subsurface water supplies, and coastal erosion. Additionally, anticipated changes in climate, including temperature and precipitation changes, and storm frequently and/or intensity, have the potential to significantly impact the state's coastal ecosystems and the resources they support. Determining climate change impacts is difficult due to the fact that existing models provide predictions at coarse scales and are unable to create accurate predictions for specific locations. One strategy to develop reliable predictions for eastern NC is the development of a coastal monitoring network that can provide the baseline information required to adequately describe current conditions. This information will support current and future research and modeling efforts and provide the data and scientific background required to better manage our coasts and estuarine ecosystems in the face of climate change. While a number of university-based efforts to monitor and describe climate change exist in NC, the goals of these discrete research projects have been tied to specific funding opportunities and are not well coordinated. To ensure the most cost-effective delivery of data, products, and climate change information to NC citizens, a systematic and integrated coastal and estuarine observing system is required. This system should address sea-level rise and its effects on coastal environments and human populations, mitigation strategies related to climate-related hazards, and monitoring/identifying climate-related indicators and changes in marine ecosystems.

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INTEGRATING CLIMATE CHANGE IMPACTS TO IMPROVE UNDERSTANDING OF COASTAL CLIMATE CHANGE: HEAVY RAINS, STRONG WINDS, AND HIGH SEAS IN COASTAL HAWAI'I, ALASKA AND THE PACIFIC NORTHWEST

David H. Levinson,* Michael C. Kruk, John Marra, and Ethan J. Gibney

Understanding the long-term variability and trends in coastal climate has grown in public awareness given the potentially severe impacts related to sea level rise coupled with changes in storminess. Previous research and operational products have typically focused on whether monthly, seasonal or annual averages of temperature and precipitation have varied over time, and whether there is a discernible trend in these quantities. In order to better address the observed trend in coastal impacts related to climate change, the Pacific Region Integrated Climatology and Information Products (PRICIP) Program has been developing analyses of heavy rains, strong winds, and high seas to better identify the observed long-term variability and trends related to these climate impact parameters. This presentation will specifically address the development and application of climate indices across coastal Hawai'i, Alaska, and the Pacific Northwest. Specific focus is on those observed changes and trends in the most extreme events using a suite of climate indices, and how these climate indices can aid in understanding variations and trends in extreme events over time.

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COASTAL COMMUNITY HAZARD MITIGATION AND COMMUNITY RATING SYSTEM OF NFIP

Jingyuan Li*, Craig E. Landry

In September, 2008, floodwaters were surging into Galveston Island while the center of Hurricane Ike was still more than 200 miles from landfall. Storm force flooding continues to be a major concern in the hurricane season and causes considerable loss to the coastal communities. National Flood Insurance Program (NFIP) provides recovery resources for the flood disaster and dissuades uneconomic uses from locating in flood hazard area. In order to motivate flood insurance purchase and promote increased flood hazard mitigation, the Community Rating System (CRS) that is a part of NFIP, credits 18 community floodplain management activities. Under the program, communities are scored on the basis of their activities that mitigate flood risk. Flood insurance policy holders in CRS communities receive flood insurance discounts ranging from 5% to 45%. However, CRS has been marked by a lack of active participation since its inception limiting its potential effectiveness. As of January 2008, 1080 communities, representing only 5% of all the NFIP communities have enrolled in CRS. Little empirical evidence exists to shed light on what factors influence the establishment of local hazard mitigation projects. To fill this gap, we propose to analyze flood hazard mitigation projects in 107 NFIP communities of 20 North Carolina coastal counties between 2002 and 2009. Specifically, we will examine the influence of physical, risk, and socioeconomic factors on coastal community hazard mitigation decisions as reflected in the CRS score. Ultimately, our project will forge a better understanding of community decision making, as related to natural hazards.

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ELICITING AND USING STAKEHOLDER VALUES AND PREFERENCES TO GUIDE COASTAL RESTORATION DECISIONMAKING

Rachel Lipsky*

The goal of the Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) is to improve system-wide functionality of nearshore ecosystem processes. To achieve that goal, PSNERP plans to strategically restore coastal sites throughout Puget Sound. PSNERP scientists are currently assessing changes to nearshore ecosystem structures and functions and will recommend an ecologically strategic restoration portfolio. Yet, PSNERP also needs stakeholder input to design a socially strategic portfolio.

This research investigates the values and preferences of stakeholders in the Whidbey Sub-Basin of Puget Sound to help PSNERP be both socially and ecologically strategic there. Similar research may be repeated in the six other Puget Sound Sub-Basins. The results will inform future stakeholder involvement activities.

This study examines four areas of stakeholder values and preferences:

1. Beliefs about the causes and severity of coastal problems
2. Priorities for coastal features, shoreforms and developments
3. Thoughts about ecosystem services and trade-offs among them.
4. Visions of a future, restored Puget Sound nearshore.

The study is framed by two hypotheses from the Advocacy Coalition Framework (ACF), which suggests that groups form around “policy core beliefs.” Yet, some studies indicate that while these beliefs are most important for groups organized around shared ideology, self-interest is most important for groups organized around shared economic interests. The ACF also suggests that individuals within a group will show substantial consensus on policy core beliefs (values), but less alignment on secondary beliefs (preferences). Results of this research will be used to inform adaptive governance of PSNERP.

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OCEANS AND HUMAN HEALTH: SENTINEL HABITATS AND SENTINEL SPECIES

Susan Lovelace*, Denise Sanger, Anne Blair, Thomas Greig, Lori Schwacke

Sentinels are indicators of change in the health of marine animals and ecosystems that can provide public health and resource managers the opportunity to prepare for challenges to human health and well-being.

Tidal creeks are the interface between stormwater runoff and estuaries. Levels of microbial and chemical contamination here are often an order of magnitude greater than reported in adjacent open-water environments. Studies completed within the Southeast and Gulf NERRS indicate that these ecosystems have the potential to serve as sentinel habitats for assessing the impact of development and climate change on ecosystem and public health. Hydrologic and economic studies contribute to our understanding of how these changes may impact people.

The grass shrimp, *Palaemonetes pugio*, is a common inhabitant of estuaries along the Atlantic and Gulf coasts. Occurring in high densities, it is an obligate food source for many tidal creek species and an important component of the coastal ecosystem. Given their ecological proximity to terrestrial influences grass shrimp are excellent models for assessing sub lethal toxicant effects.

Dolphins are top-level predators exposed chemical contaminants that biomagnify through the food chain. One study is looking at the health and movement of dolphins along the coast of Georgia to determine potential sources of measured high contaminant concentrations and to determine potential impacts on the population. Complementary studies are being conducted to examine the contaminants in fish, sediments, and humans. Collectively, the research will help to understand the movement of contaminants through the marine foodweb and implications for human health.

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ADDRESSING AND ADAPTING TO CONTEMPORARY ISSUES IN THE CENTRAL PHILIPPINES

Ethan Y. Lucas*, Kathryn Schleit, Chelsea Combest-Friedman, Cirse Gonzalez, and Turner Pittkin

Integrated coastal management (ICM) efforts have been underway in the Philippines for over 30 years. Substantial progress has been made towards creating comprehensive and integrated solutions to the problems faced by coastal communities and resource managers. This session will address five case studies that portray how contemporary challenges and opportunities in integrated coastal management are being addressed and adapted to in the Central Philippines: 1. Adapting to Climate Change requires an understanding of social vulnerability. The study statistically analyzes perceived vulnerability of fishermen and business people to distinct coastal climate impacts. 2. Ecosystem-Based Management Applicability: The prospective expansion of management and conservation efforts on a rare reef formation depends upon current biophysical data, knowledge of local resource patterns and the formulation of acceptable management frameworks. 3. Financial Sustainability: The willingness of the dive tourism industry to support management and conservation efforts provides an opportunity for the financial sustainability, and thus, future success, of marine protected areas. 4. Social Networks are a forum for the diffusion of information surrounding MPAs. The social network of a successful MPA was analyzed to gain valuable insight into community dynamics. 5. Marine Protected Area Networks preserve marine resources through ecological, social and institutional linkages. The current and future challenges to the community-based management process of one MPA Network are assessed. Implications for coastal managers are stated while recommendations for all five areas are provided.

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DEVELOPING A SEA LEVEL RISE ADAPTATION PLAN AND MARSH VULNERABILITY INDEX FOR THE STATE OF DELAWARE

Gabrielle C. Lyons,* Bartholomew Wilson, David Carter, Drexel Siok

Several studies using possible greenhouse gas emissions scenarios have predicted substantial increases in global sea level rise (SLR) over the next century. Incorporating accelerated ice sheet melting could increase these projections even further. The broad spectrum of coastal impacts introduced by ongoing SLR and uncertainty presented by scientific projections of these changes in SLR have made planning for and adapting to this natural hazard quite challenging.

SLR effects and storm inundation could have catastrophic effects on the coastal infrastructure and resources of Delaware. The State's extensive impounded marshes are important habitat for migratory waterfowl and aquatic biota, but are sediment starved. The Delaware Bay and its wetlands support multiple fisheries, while serving as one of the major marine transportation centers for the East Coast. Inadequately preparing and planning for the impacts of inundation can be detrimental to Delaware, thus the need to design solutions to the problem with minimum environmental impacts and cost-effectiveness. An adaptation plan will serve to provide stability and control of the effects of SLR on coastal processes.

One key aspect of SLR adaptation planning currently underway at DCMP, is an initiative to develop a Marsh Vulnerability Index (MVI) to assess the health and sustainability of *Spartina alterniflora* wetlands. This serves to monitor marshes' response to SLR, while promoting conservation and restoration. This also classifies healthy and degrading short-form *Spartina alterniflora* marshes based on a correlation between degrading marshes and low elevations. With success, the MVI can be used in Mid-Atlantic States for regional comparison and planning.

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URBAN RUNOFF AND SEPTIC LEACHATE CAUSE WATER POLLUTION IN A NEARBY COASTAL NATIONAL PARK

Michael A. Mallin* and Matthew R. McIver

Cape Hatteras National Seashore is a large coastal park that lies adjacent to several communities. On South Bodie Island an arm of a municipality extends south along the seashore next to park property for several km. Sewage in this area is treated by septic systems; however this area has a high water table coupled with sandy, porous soils. Water sampling was conducted in nine brackish water bodies located within and near the park. Deep drainage ditches flowing westward from the urban area through the park displayed low dissolved oxygen, high ammonium and phosphate, algal blooms, elevated BOD, and high fecal *Enterococcus* bacteria counts. A large roadside ditch draining the developed area and entering public beach waters had particularly high *Enterococcus* counts. Counts were strongly correlated to rainfall that fell on day of sampling, but not on previous days, indicating surface urban stormwater runoff pollution. *Enterococcus* counts in the deep westward-flowing drainage ditches were correlated with rainfall only after a 24-48 hour delay, indicating septic contamination of shallow groundwater forced by rain infiltration. Ammonium and phosphate concentrations showed strong seasonality with highest concentrations in mid-summer; these concentrations were strongly correlated with human water use in the nearby municipality. Sewage-derived nutrients cause algal blooms, which are significantly correlated to BOD in these water bodies, which promotes hypoxia, an ecosystem-level problem. Development of barriers, hammocks and other islands throughout the U.S. southeast continues to increase; thus, to prevent human health problems and ecosystem impairment, alternatives to standard septic systems must be required in these sensitive areas.

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PANEL DISCUSSION: US EPA USING MODELING AND ECOSYSTEM SERVICES TO ENHANCE COASTAL DECISION MAKING

Deborah Mangis,* Rochelle Araujo, Betsy Smith, Marc Russell, Lisa Wainger, Susan Lovelace

This panel will highlight current EPA research that is focused on communicating changes in ecosystem services in coastal areas as they are affected by alternative decisions made in response to problems posed by increasing population, changes in land use and management, climate change, etc. The session will illustrate the processes used in the different geographic areas of Tampa Bay, Chesapeake Bay and the Coastal Carolinas, ranging from initial problem characterization with stakeholders, to alternative future scenario development, quantification of ecosystem service benefits, development of integrated modeling systems, and communication of trade-offs associated with potential decision choices. These studies are intended to provide a broader and more comprehensive approach to policy- and decision-making affecting coastal ecosystems as well as provide an accounting of valued services that have heretofore been largely unrecognized. Interim research products, including updated and integrated spatial data, models and model frameworks, and interactive decision support systems will be demonstrated to engage potential users and to elicit feedback. It is anticipated that the near-term impact of the projects will be to increase the awareness by coastal communities and coastal managers of the implications of their actions and to foster partnerships for ecosystem services research and applications.

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APPLYING PLANNING THEORY TO COASTAL RESOURCE MANAGEMENT

Daniel J. Marcucci, James D. Brinkley, Lauren M. Jordan

In recent years coastal resource management has begun to stand as its own discipline. Its multidisciplinary nature gives it access to theory situated in each of the diverse fields which it encompasses, yet management practices understandably revert to the primary field of the manager. There is a lack of a common set of “coastal” theory from which managers can draw. Issues with which coastal planners and managers must contend include: coastal habitat conservation, traditional maritime communities and economies, strong development and use pressures, sea level rise and climate change, landscape sustainability and resilience, coastal hazards, and emerging energy technologies. The complexity and range of human and environmental interactions at the coast suggests a strong need for a common set of coastal management theory which managers would do well to understand generally.

Planning theory, which itself is a synthesis of concepts from multiple fields, contains ideas generally valuable to planners and managers of coastal resources. In particular we discuss five concepts in the planning theory discourse and present their utility for coastal resource managers. These include “wicked” problems, roles of the planner/manager, collaborative planning, ecological planning, and the epistemology of knowledge communities. While these theories are known and familiar to some professionals working at the coast, we argue that there is a need for broader understanding amongst the various specialists working in the increasingly identifiable field of coastal resource management.

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ADAPTATION THROUGH COASTAL LAND USE MANAGEMENT: THE CONTEXT OF ENVIRONMENTAL JUSTICE

Ariana J. Marshall,* Larry Robinson, Ph.D.

The Environmental Justice research community has been centered on land-use decision-making in low income and communities of color (UCC 1987). Several of these communities have been coastal, exemplified by the magnification of the public health impacts of Hurricane Katrina (Bullard and Wright 2009). Climate change impacts are projected to disproportionately affect these already pressured coastal communities (Hoerner and Robinson 2008). Furthermore, these communities will be impacted by the land-use decisions made to both mitigate and adapt to climate change impacts. Land use decision-making specifically influences the societal impact of climate change in relation to increased intensity of hurricanes and coastal inundation due to sea-level rise. Also, with the implementation of mitigation solutions such as renewable energy technologies, coastal land-use decision making requires the consideration of the principles of climate justice (EJLFCC 2009). By 2050, the population proportionality of ethnic minorities will shift to more than 50% (Pollard and Mather 2008). Shifting geographical and social vulnerability must be considered in land-use planning to avoid the exacerbation of these disproportionate impacts of climate change (Cutter and Emrich 2006)

Panel discussion questions: How can the disproportionality of climate change impacts on socio-economically vulnerable coastal communities be addressed by coastal managers? Can climate/environmental justice principles be utilized by coastal managers to address the disproportionate climate change impacts? What policy windows exist to ensure that coastal land use decisions consider the cultural value of historical coastal land uses and their communities? How can these underserved communities be further engaged in the coastal land-use decision-making process?

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CREATING SUSTAINABLE COMMUNITIES

Scott Bradshaw, Lori Brinn, Marilyn Marsh-Robinson,* Brian Roth, Mikki Sager

The Albemarle Pamlico watershed, which has some of the poorest counties in the state and has lost much income from traditional industries such as manufacturing, fishing and farming, faces many social and ecological concerns. The Albemarle and Pamlico Sounds region has been identified as the third most impacted area by sea level rise in the country. Impacts from climate change is a huge concern and present both threats and opportunity.

Discussions are happening at the community, local government and state level. We will share information on impacts and solutions from residents regarding sea level rise and population trends. Survey results conducted by the state given to local governments as well as results from a state interagency process on climate change will be presented. Mayor Brian Roth of Plymouth will reflect on issues faced by small towns, including protection of infrastructure from rising seas with limited economic means.

Communities are also embracing opportunities. Some new prospects replace vanishing income, such as ecotourism and recreational outlets. Habitat and wetland restoration efforts are also being implemented. For example, Elizabeth City received funds to create an ecopark that will not only restore wetlands but also educate citizens. It will include training area community college students and these efforts can be duplicated in nearby areas needing similar defense against rising seas. Weatherization efforts have increased to address energy efficiency needs. Also, land management and conservation incentives are being used for both environmental and economic benefits.

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CONSTRUCTING OREGON'S DIKED LANDS VULNERABILITY INVENTORY TO SUPPORT STRATEGIC PLANNING FOR THE IMPACTS OF SEA LEVEL RISE

Laura E. Mattison*

Now is not the first time that Oregon's coast line has undergone great change. The pioneering spirit of the late 1800s and early 20th century led many farmers to alter estuaries to their own agricultural advantage. Many tidally influenced wetlands surrounding the estuaries were thus drained, diked, and filled so as to be used as flatlands, mainly for cattle grazing. Dikes and tidegates were built to prevent tidal inundation and ditches were dug to drain these diked areas. While this created ideal conditions for Oregon's dairy farming businesses, more than 68% of Oregon's estuarine habitat was lost. Lost with these habitats were vital estuarine functions and tidal volume.

Today, interest in dikes and diked lands does not just have to do with reclaiming these estuarine habitats, but also has to do with new changes in Oregon's coast due to climate change. The effects of climate change are likely to include a rise in tidal elevations as well as increased flooding and storms. Knowing where Oregon's dikes are located, what condition they are in, and who is responsible for them is therefore critical in decision-making about where dikes should be breached in order to restore tidal wetlands and where they need to be maintained in order to protect private and public infrastructure.

The primary objectives of the project are to 1) create a GIS-based product that includes an inventory of hydromodification structures in Oregon's estuaries, along with their associated attributes such as property ownership and structure vulnerability, and; 2) distribute this tool, along with other methods, to both increase awareness of sea level rise issues in tidal areas and to support improved planning on the use and maintenance of structures and lands susceptible to tidal influence amongst local planners and stakeholders.

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THE EFFECTS OF RESIDENTIAL DEVELOPMENT AND WATER POLLUTION ON FISH COMMUNITY STRUCTURE AND NURSERY FUNCTION OF SALT MARSH TIDAL CREEKS IN SOUTHEASTERN NORTH CAROLINA

Janie A. McAuliffe* and Thomas E. Lankford, Jr.

Coastal zones are pressured increasingly by the development of salt marsh tidal creek watersheds. In Southeastern North Carolina, deterioration of tidal creek water quality associated with residential development has been documented. Resulting effects on estuarine fish community structure and nursery function are unknown. We test the hypotheses that 1) fish community structure will be more complex and diverse in less-impacted creeks compared to impacted creeks and 2) residential development and associated anthropogenic stresses negatively affect fish nursery function. Our study area consists of four tidal creeks in Southeastern North Carolina which are designated as “primary nursery areas” by the North Carolina Division of Marine Fisheries. Two of the creeks (Bradley and Hewletts) display degraded water quality resulting from residential development, while the other creeks (Pages and Futch) are considered the most pristine salt marsh tidal creeks in New Hanover County. Field sampling was conducted monthly during the fish nursery period (May-September 2008/2009) using a 15m haul seine to collect fishes from multiple sites (n=6-2008; n=3-2009) within each tidal creek. Fish community structure was described for each creek based on species diversity, abundance and density. Nursery habitat function was examined in four indicator species (*Lagodon rhomboides*, *Leiostomus xanthurus*, *Brevoortia tyrannus*, and *Fundulus heteroclitus*) using nutritional condition indices (somatic condition factor, fish weight, viscera weight, tissue lipid content, and organic content) as proxies for feeding success and growth. Community structure and nursery function estimates will be compared among creeks to evaluate whether residential development compromises fish nursery function of tidal creek habitats.

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SHORELINE CHANGE AND BEACHFRONT MANAGEMENT IN NORTHEAST SOUTH CAROLINA: 20+ YEARS AFTER THE BEACHFRONT MANAGEMENT ACT

C.A. McCoy*

In the late 1980s, South Carolina developed the Beachfront Management Act which was amended and strengthened from the Coastal Zone Management Act of 1977. Concerns about impacts to the public beach and tourism led a ban on new erosion control structures and consequently, beach nourishment has become the primary method to combat erosion at a cost of approximately \$250 million over the past 25 years.

The coastline of northeast South Carolina is composed of a mix of barrier islands and mainland attached beaches that hosts over 13 million visitors annually with an economic impact of \$5.8 billion. Erosion rates are generally low at mainland attached beaches and greater on barrier islands with limited sources of beach compatible sediment in the nearshore environment. Even with minor erosion rates, two major nourishment projects have been conducted on mainland attached beaches and several projects have been conducted on barrier islands. Population growth in combination with sea level rise provides increasing pressure for sound scientific information and effective management of these coastal regions. This presentation will highlight erosion rates based on beach profile data collected annually since 1989, document the effectiveness of nourishment projects and impacts to sediment borrow sites, and discuss the feasibility of maintaining the current shoreline location over the next 20+ years.

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CLIMATE ADAPTATION AND THE FIFTH AMENDMENT OF THE UNITED STATES CONSTITUTION: HOW DOES ADAPTATION STRATEGIES IMPACT REGULATORY TAKINGS CLAIMS?

Chad J. McGuire*

As the impacts and potential of climate change are realized at the governance level, states are moving towards adaptation strategies that include greater regulatory restrictions on development within coastal zones. The purpose of this paper is to outline the impacts of existing and planned regulatory mechanisms on the Fifth Amendment to the United States Constitution, which states in relevant part, “nor shall private property be taken for public use, without just compensation.” *U.S. Constitution, amendment V*. A short history of regulatory takings will be explained, and the potential legal issues surrounding mitigation and adaptation measures for coastal communities will be discussed. The goal is to gain an understanding of the legal issues that must be resolved by governments to effectively deal with regulatory takings claims as coastal mitigation and adaptation plans are implemented.

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DEVELOPING EFFECTIVE TMDLS AND TMDL RESTORATION PLANS TO TACKLE THE WIDESPREAD IMPAIRMENT OF COASTAL SWIMMING AND SHELLFISHING WATERS

Todd Miller*

The North Carolina Coastal Federation and partners propose a full conference session on how to restore impaired coastal waters using Total Maximum Daily Load (TMDL) and TMDL Watershed Restoration Plan mechanisms. This session will focus on advancing the science and technology of TMDLs and TMDL implementation plans for coastal swimming and shellfishing waters that are impaired by bacterial pollution. There is widespread impairment of such surface waters throughout the nation. Federal, state and local governments are attempting a variety of strategies for addressing the mandate in the Clean Water Act to clean up these polluted waters. This full session will feature regulators, scientists, consultants and NGOs that are applying various approaches to restoring these impaired waters, helping to develop a national dialogue on how to most effectively and efficiently address one of the most widespread and chronic water pollution issues facing our nation today. The goal of the session is to advance the scientific understanding of the challenges associated with these types of waters, and provide a model for easy technology transfer, and the enhancement of TMDL production efficiencies.

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RESOURCE MANAGEMENT OF DYNAMIC COASTAL ENVIRONMENTS USING SYNOPTIC MEASUREMENTS FROM REMOTE SENSING

Richard L. Miller* and Chris J. Buonassissi

Coastal environments are vital national resources that provide areas of habitation and recreation, support recreational and commercial fisheries, provide major corridors of transportation and commerce, and are essential to our nation's security and defense. Coastal environments are also highly dynamic, complex systems that are frequently subjected to significant natural and human-induced events that occur over a broad spectrum of time and space scales. This dynamic nature makes it difficult to effectively monitor and manage important coastal resources. Many global societal issues are centered on coastal environments. These issues include the mobilization and transport of pollutants and contaminants from coastal landscapes to coastal waters resulting from specific land use practices; the impact of recreational and commercial use on shallow water benthic communities; and the effect of increasing human population growth and development on the geomorphology of coastal land forms and beaches.

Remotely sensed images obtained from airborne and satellite platforms provide a unique vantage point from which to examine dynamic coastal systems. These images provide a synoptic view of coastal processes at both spatial and temporal scales unavailable using traditional field measurements. The UNC Coastal Studies Institute is developing the capability to acquire, process, and analyze remotely sensed data from several remote sensing instruments to address regional-to-international coastal issues. Using several examples from coastal North Carolina, we present the fundamental aspects of remote sensing in the context of examining dynamic coastal environments to derive information that supports efficient and effective management of coastal resources.

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PROTECTING A THREATENED COASTAL FISH SPECIES THROUGH COLLABORATIVE REGIONAL RESEARCH AND PLANNING

Katherine Mills*, Claire Enterline, and Brad Chase

Rainbow smelt populations have declined throughout their range, and southern populations between Chesapeake Bay and Long Island appear to have been extirpated in recent years. As a result, rainbow smelt was listed as a species of concern by the National Marine Fisheries Service in 2004. Since 2007, the states of Maine, New Hampshire, and Massachusetts have been working together regionally to document the status of smelt spawning populations, understand factors affecting them, and develop an integrated conservation plan to protect them.

This presentation provides an overview of this collaborative project, highlighting key biological monitoring and threat assessment results from throughout the Gulf of Maine. Findings show biological differences in the structure of spawning runs along the regional north-south gradient. In addition, analyses suggest that watershed land use, nutrient loading, and other water quality conditions affect the strength of smelt spawning runs. These results suggest that conservation strategies focused on improving water quality and spawning habitat conditions will be important elements of protecting and restoring rainbow smelt along the Gulf of Maine coast.

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MARINE PROTECTED AREAS IN WASHINGTON STATE: RECOMMENDATIONS FOR FUTURE PLANNING

Jamie Erin Mooney*, Chelsea Combest-Friedman, Bridget Emmet, Jennifer Reitz

Washington State Marine Protected Area (MPA) sites fall under various titles, such as Aquatic Reserves, Marine Preserves, Conservation Areas and Underwater Parks, collectively known as State Marine Managed Areas (MMAs). Various levels of government are involved in the planning and management of these areas including federal, state, local and tribal stakeholders. Among these levels of governance, the Department of Natural Resources and the Department of Fish and Wildlife play a prominent role in the planning, implementation, and management of Washington State MMAs. Agencies such as the Army Corps of Engineers and the Puget Sound Partnership also influence the planning and management processes. This paper addresses the strengths and weaknesses of institutional coordination amongst the various management and regulatory agencies, with a focus on the planning process of aquatic reserves: Maury Island, Cypress Island, Fidalgo Bay, and Cherry Point. The paper concludes with recommendations for how future Marine Protected Area planning can be improved in the State of Washington including paths to increase efficiency and coordination between the various involved institutions.

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MEDIA AND MESSAGES: SORTING SIGNALS AND SHARING STORIES

Moderator: Katie Mosher, North Carolina Sea Grant

Panelists: Roy Kron, Louisiana Sea Grant, Sea Grant National Communications Network

Laura Leslie, WUNC, CapitolBeat Association of Capitol Reporters & Editors

Gareth McGrath, *Wilmington Star-News*

Billy Warden, Billy Warden Communications and Imagination Group

Jamie Krauk, NOAA Office of Communications, External Affairs

The communications landscape is changing as a new decade opens. Traditional print and broadcast media are cutting back. Online opportunities are surging. How are general and targeted media using Facebook, Twitter, YouTube, etc., to learn about and report on topics including climate change? How can anyone sort news from noise on various online feeds? Can complicated science and resulting policy fit into limited character counts? Is “social media” relevant for government agencies and nonprofits? If so, are there boundaries?

Speakers from outside TCS will bring personal perspective on various communications tools. Introductory remarks will highlight how each panelist and his or her respective colleagues receive and share news and information today — in general and on particular coastal science/policy topics. At least 30 minutes of the 90-minute session will be a dialog. We will invite the audience to submit questions in advance regarding specific communications challenges. Thus TCS members can leave with new ideas to focus limited staff time and resources on achieving specific communications goals. The session even may be the topic of tweets to share information with those who cannot attend in person.

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COASTAL DEVELOPMENT PERMITTING IN THE ERA OF CLIMATE CHANGE

Timothy M. Mulvaney*

When government agencies deny coastal development permit applications outright, they are subject only to a deferential standard of judicial review when the landowner challenges that denial. However, instead of issuing outright denials, agencies can grant permits with conditions aimed at offsetting any burdens new development might impose on the public, such as increased strain on infrastructure, loss of natural shore protection features, or degradation to coastal species habitat. However, the standard of review of conditional permits is different from that of permit denials: when granting conditional approval, the judiciary is called to review such action with a much keener eye, resulting in a greater likelihood that the agency action will be declared unconstitutional than had the agency simply denied the permit. The differences between these standards of review are leading to strange, ineffective results for both landowners and government agencies along U.S. coasts, even despite recent judicial efforts to clarify this area of law. To demonstrate the interplay between these differing standards, the author will present a hypothetical coastal wetlands permitting scenario, based loosely upon both cases the author worked on at the N.J. Attorney General's Office and cases from state courts around the country in 2009. The author and conference attendees can use this hypothetical to analyze and respond to the difficulties associated with a heightened standard of review that applies only to coastal permit conditions and not denials in the face of a need for adaptation to modern environmental challenges associated with sea-level rise and increased storm intensities.

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WETLANDS AND COASTAL WATER QUALITY: SHOULD WETLAND SIZE MATTER?

Monique R. Myers,* Richard F. Ambrose, Trish Holden, Bram Sercu, and Stephen Estes

In Southern California over 90% of our coastal wetlands have been destroyed. The paradigm that wetlands act as filters for urban runoff, removing contaminants before they enter the ocean, was challenged when researchers found a small southern California wetland increased fecal indicator bacteria (FIB) populations. We investigated FIB in a medium-sized, 93 ha, Southern California wetland. Bacteria populations were measured during dry and wet weather at all inlet sites, where water entered the wetland, and at the one outlet site, where water drained into the ocean. We also measured water FIB concentrations at different distances along tidal creeks. This natural wetland attenuated FIB during all but the largest rain events of the year. Bacterial populations were reduced as they traveled along naturally shaped, sinuous tidal creek channels. Furthermore, we used human *Bacteroides* markers to determine whether bacterial contaminants from human sources were attenuated similarly to FIB. Insight is provided into the relationship between FIB and human specific markers. Our work demonstrates the important water quality services provided by a large southern California wetland. The question is raised: should there be size requirements for coastal wetland restoration projects?

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REFORMING MARINE AND COASTAL SPATIAL MANAGEMENT IN KOREA: INTRODUCTION OF ZONING MECHANISM AND TARGET-BASED NATURAL SHORELINE MANAGEMENT PROGRAM

Jungho Nam*, Daeseok Kang, Jongdeog Kim, Hee-Jung Choi, Keun-Hyung Yook and Jiho Jung

Integrated coastal management (ICM) in Korea has evolved showing the three-phase development pattern. ICM implementation of Korea has been, to large extent, strengthened by national policy for marine environmental protection strategy, and consequently much progress has been made during the second ICM phase of the late 1990s to 2005.

In terms of comprehensive spatial management, however, ICM mechanism of Korea worked in a limited manner. The National ICM plan for the spatial management deals mainly with policy directions on the modification or cancellation of reclamation projects on coastal waters, and the designation of marine protected areas. Local ICM plans also achieved limited success even though the plans adopt zoning mechanism because the mechanism for local planning is based on non-legal binding guidelines.

For effective implementation of the national plan, and strengthening integrated spatial management, the Korean government adopted the Presidential Executive Order on the introduction of zoning mechanism and target-based shoreline management program in 2005. Accordingly, the amendment of Coastal Management Act was approved by the National Assembly in 2009, and will enter into force from March of 2010.

The zoning mechanism would classify the entire coastal waters under jurisdiction of the Act into four zones: general use zone, special management zone, reserve zone, and conservation zone. The amendment stipulates that every zone save the reserve zone could have “its own function districts” for effectively addressing ‘rigidity issue’ of the zoning mechanism, and accommodating present/future demands on coastal use in a sustainable manner. Jurisdictional purview of the zoning mechanism does not cover coastal land area, however. Target-based natural shoreline management program (hereinafter ‘the shoreline program’) is expected to overcome the limits of the zoning mechanism. The shoreline program defines target of quantified protection for natural shoreline at national and local levels.

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IMPLEMENTING THE ISLAND OF KAUAI'S PROGRESSIVE SHORELINE SETBACK AND COASTAL PROTECTION ORDINANCE

James F. O'Connell*

In 2008, the County of Kauai, Hawaii, passed a progressive Shoreline Setback Ordinance. Following 2 years of experience by the Planning Department implementing the Ordinance, the County Council recently (November 2009) passed amendments which some hail as significant improvements, while others although stating the 'core setback legislation is still strong' follow-on stating they wished the amendments had been 'thrown in the trash'.

In Hawaii, the public has rights of use of all Island beaches and adjacent landward areas, including private property, up to the 'shoreline' defined as 'the upper reaches of the wash of the waves, other than storm or seismic waves, at high tide during the season of the year in which the highest wash of the waves occurs, usually evidenced by the edge of vegetation growth or the upper limits of debris left by the wash of the waves'. In addition, the coastal construction setback distance is measured landward from the (Certified) Shoreline'. This results in the specific location of the '*shoreline*' being vitally important for both the public and the shoreline property owner.

Much of the controversy to the recent amendments stems from allowing the Planning Department Director discretion on whether to require, or not, a state Certified Shoreline for public improvements and facilities, and repairs to lawfully existing private structures *within* the shoreline setback area.

Using case examples, the specifics of Kauai's Shoreline Setback Ordinance, including recent amendments, and the art and science of delineating a Certified Shoreline and calculating the setback distance will be described.

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COMPARISON OF RESIDENT AND TOURIST PREFERENCES FOR PUBLIC BEACH ACCESS

Chi-Ok Oh*, Jason Draper, Anthony W. Dixon

As coastal destinations continue to grow, due to tourism and residential expansion, the demand for public beach access and related amenities will also increase. The issue confronting management agencies responsible for providing and maintaining public beach access and related amenities is the varying needs and preferences of both residents and tourists of coastal destinations. The purpose of this study is to provide comprehensive information about coastal recreational needs of residents and tourists with regards to public beach access and associated amenities using the stated preference choice method. Overall, the results indicate tourists were more interested in additional public beach access points and commercial development, while residents supported beach rules and regulations but opposed high levels of crowding and noise. Implications of these results for management agencies include the utilization of parking fees to subsidize additional public beach access points, identifying appropriate types and levels of commercial development that moderates the use of coastal resources by tourists and day-trip users, and implementing beach rules and regulations that reduce the potential for conflict between user groups. Providing management agencies with comprehensive information of the preferences of different beach user groups can assist in the development of more effective policies and management programs.

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CREATING SYSTEMS FOR IMPROVED ECOSYSTEM MANAGEMENT: INFORMATION SHARING, KNOWLEDGE ACQUISITION & LEARNING IN THE CORAL TRIANGLE INITIATIVE

L. Katrina ole-MoiYoi*, Patrick Christie, Helen Leitch

Recent years have seen a global surge in efforts to create large networks of marine protected areas (MPAs) in order to improve fisheries management and protect marine biodiversity. The six Southeast Asian countries of the Coral Triangle Region¹ have embraced this concept, and are working to establish a region-wide MPA system in order to jointly manage the world's most biologically diverse marine environment. Though the program is in its early stages, implementers are currently facing one of the fundamental challenges of ecosystem management: how should information and knowledge be gathered, consolidated, analyzed and disseminated across wide geographic scales, in a manner that promotes learning and leads to improved management?

This study hypothesizes that the success of the ongoing \$450 million Coral Triangle Initiative hinges upon effective information sharing between stakeholders, and asks the questions: what are the barriers to, and the opportunities for improved information exchange? What are the connections between information exchange, knowledge acquisition and improved management? Data is gathered through formative evaluation techniques in Malaysia, Indonesia and the Philippines, and online surveys in Timor-Leste, the Solomon Islands and Papua New Guinea. Findings will be used to (1) Provide CTI implementers with recommendations to improve existing approaches, and (2) Create generalizable knowledge applicable to ecosystem-based management programs elsewhere in the world.

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SHIFTING TIDES: THE EBB AND FLOW OF TIDAL ENERGY IN PUGET SOUND

Rebekah R. Padgett*, Olivia H. Romano

Puget Sound, the second largest estuary in the United States, has been the proposed home to nine tidal energy projects over the past three years. Today, there are three sites being considered, with only two of these under active discussion with agencies and tribes for potential permitting. Both are located in Admiralty Inlet, a narrow channel in north Puget Sound.

Snohomish County Public Utility District No. 1 (Snohomish) is pursuing a 10-year pilot project with potential for future build-out, while the U.S. Navy is planning to conduct a 1-year demonstration project to learn more about an American-made technology for potential use at remote installations around the world. While similar, these projects are also divergent: proceeding under separate regulatory frameworks, utilizing two types of turbines, obtaining funding from different sources, and planning for distinct purposes.

As this energy gold rush of the Puget Sound shifts with the tide, the proponents and those that regulate them need to flex from the usual approach. Together we face new challenges as a new energy source is discovered and mined, while being protective of the unique, sensitive environment of Puget Sound. This paper examines the progress of tidal energy projects, as well as changes that have occurred while proponents come and go and individual projects mature.

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COASTAL LAND CONSERVATION IN MARYLAND: TARGETING TOOLS AND TECHNIQUES FOR SEA LEVEL RISE ADAPTATION AND RESPONSE

Chelsie Papiez*

In the Chesapeake Bay relative sea level rise is impacting coastal lands at twice the global average rate. Over the last century relative sea level has risen a foot in the Bay causing the loss of 13 barrier islands and continual shoreline retreat. Maryland must have a strategy for coastal land conservation in order to preserve distinct habitat, facilitate shoreline migration, and to reduce and abate storm surge events that cause erosion and salt water intrusion. Developing new criteria to target land acquisitions and conservation easements is critical. A case study was done in Dorchester County in order to begin developing appropriate adaptive criteria. Three different sea level rise scenarios have been modeled for the Chesapeake Bay; 0-2, 2-5, and 5-10 feet. In Dorchester County the 2-5 foot rise scenario would result in the conversion of working agricultural lands to waterfront. The case study found that under sea level rise scenarios upland conservation is the most important feature for land conservation. The uplands provide opportunity to facilitate inland migration of wetlands, the practice of wetland restoration ecology, carbon sequestration, all of which can help buffer against storm surge events, erosion, and salt water intrusion, and provide new habitat values for those lost. The criteria developed for the case study provide data layers for GIS targeting that will be expanded to incorporate Maryland's entire coastline. Additional criteria will be developed and applied to Maryland's coastline as the project continues to find adaptive benefits of land conservation under sea level rise scenarios.

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RESPONDING TO MARINE DEBRIS FROM CLIMATE-INDUCED EVENTS: ARE COASTAL COMMUNITIES PREPARED?

Neal B. Parry*, Nir Barnea, Holly.A. Bamford

Increasing development and population growth in coastal areas exposes communities to many different impacts of a changing climate, notably coastal storms. The Intergovernmental Panel on Climate Change (IPCC) reports that tropical storms and hurricanes are likely to become more intense due to warming sea surface temperatures that can energize these storms. The combination of increased storm intensity with coastal development can lead to the increased generation of debris that impacts human health and safety, the coastal environment, and natural resources.

Debris removal activities account for 27 percent of disaster recovery costs according to the Federal Emergency Management Agency. The National Oceanic and Atmospheric Administration Marine Debris Program (MDP) responded to debris concerns in the Gulf of Mexico following Hurricanes Katrina and Rita in 2005, surveying over 1,500 square nautical miles and mapping over 7,000 debris targets to aid in removal efforts, increase navigational safety, and restore economic livelihoods to the coastal community.

To improve pre- and post-storm planning to respond to coastal hazards, the MDP has developed an Emergency Response Plan to mitigate the impacts of marine debris. This plan was developed for the Gulf of Mexico region, with the purpose of helping other coastal communities develop pertinent plans of their own to respond to the impacts of a changing climate. Improving strategies in this way to respond to marine debris following coastal storm events can lead to a reduction in deleterious impacts coastal communities will face. This poster presentation should ignite dialogue on how to develop debris management plans.

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HEADWATERS TO EEZ: IS ECOSYSTEM BASED MANAGEMENT POSSIBLE?

Mike Orbach, Robbin Peach*

This illuminating and entertaining panel will create, through role playing, a discussion where nontraditional allies identify issues and explore a potential framework for integrating science, management, and policy that addresses true *ecosystem* based management – from watersheds to the coast and the coast to the EEZ limit.

The concept of ecosystem-based planning involves identifying specific biophysical, human and institutional systems and treating them as a ‘holistic’ entity for the purposes of policy and planning, both public and private sector. This discussion would be role played among the people and organizations who live or work in or are otherwise concerned with an area and the local, state, regional and federal agencies with public trust authority or responsibility in this area. Our primary purpose would be to bring together people, organizations, sectors and agencies that do not normally deal closely with one another, but whose authorities, responsibilities and activities are inter-related and whose actions affect one another.

In particular, we hope to demonstrate the value of interdisciplinary, collaborative discussion and decisionmaking and explore how to apply a broad array of social science disciplines to both assess and improve coastal and marine resources. The selection of a mock site and types of “sectors” and people involved will be determined after President Obama’s Task Force on Ocean Policy makes its recommendations for a framework on regional ocean governance.

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HUMAN USE DATA FOR MARINE SPATIAL PLANNING: WHAT DO WE NEED, WHEN DO WE NEED IT?

Session Co-Chairs: Linwood Pendleton* and Tricia Ryan (NOAA, CSC)

Marine spatial planning is primarily a social undertaking in which human uses of the ocean and coast are managed to achieve social, economic, and ecological goals. Collecting, analyzing, and communicating the appropriate data on human uses of these areas is a challenge that faces all marine spatial planning endeavors. Many questions remain about what data are needed, what data are available, and what data must be collected for scientifically sound MSP. Similarly, planners must grapple with questions about the appropriate geographical and temporal scale of the data, the sectoral and sub-sectoral specificity of the data (e.g. recreational fishing or recreational fishing for bottom fish), and the degree to which we need to model future human uses. Given the current evolving state of human use data for oceans and coasts, planners need to identify a phased approach for using data on human uses – one where we move from the practical to the optimal.

In this panel, we provide a semi-structured discussion of the minimum needs for human use data, the challenges of getting these data, and opportunities for leveraging currently available data.

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USING INTERNET SURVEYS TO ASSESS AND MONITOR PRIVATE COASTAL USES

Linwood Pendleton* and Chris LaFranchi

According to the National Survey on Recreation and the Environment (NSRE 2000), roughly half of all Americans visit the coast each year for recreation. Coastal recreation contributes to coastal businesses and also contributes directly to the economic wellbeing of coastal visitors. Many types of coastal management require information about who uses the coast, what they do, and what are the economic contributions of different types of uses.

Despite the substantial economic value of coastal recreation, we know very little about the spatial details of these visits. There has been little effort invested in collecting rigorous, consistent, spatially explicit and time series data on private, shore-based coastal recreational users, the activities they undertake, their spending patterns, and their demographics. Telephone surveys and on-site intercept surveys have proven costly to use given the large number of possible coastal access points. Mailback surveys suffer from low response rates.

To collect spatially-arrayed, quantitative data on coastal visitors, for very large stretches of coast, we developed a tool that leverages the internet and Google Earth/maps technology to randomly sample California internet users about their visits to the California coast. Our survey tool collects quantitative data on annual visitation and last trip to the coast that allows us to: a) develop a quantitative baseline of shore-based visitation to coastal sites and regions (including annual coastal “trips,” the activities people undertake when they visit the coast, and demographic information about visitors), and b) estimate the economic impacts (expenditures) associated with these visits.

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INNOVATIVE APPROACHES FOR EFFECTIVE CLIMATE CHANGE ADAPTATION IN COASTAL COMMUNITIES: STAKEHOLDER ENGAGEMENT STRATEGIES AND ESTIMATING ECONOMIC IMPACTS

Tristan Peter-Contesse*, Jeremy Martinich, Amanda Babson, Lisa Beaver

Projected impacts of climate change on U.S. coastal populations are severe and unprecedented. With the prospect of rising seas, damaging storms, and loss of ecosystems, planners and decision-makers often encounter public resistance both to the reality of climate change and the necessity of adaptation. To build support and engage affected constituencies, contextual and frequent stakeholder engagement is an important component of adaptation planning for climate change. Along with – and in support of – public engagement, modeling approaches that incorporate an understanding of rates of sea level rise (SLR), the vulnerability of the physical landscape, options for responding, and corresponding economic implications are urgently needed for effective planning that decision makers can stand behind, and that impacted communities can rely upon.

In this panel session, representatives of EPA’s Climate Ready Estuaries program will present innovative approaches for engaging stakeholders in the process of adaptation planning, as well as demonstrate new analytical frameworks for estimating the economic impacts of sea level rise on coastal communities. In Charlotte Harbor, Florida, a series of creatively-designed workshops engaged community members in the identification and prioritization of significant climate change-related vulnerabilities, while elicitation-type workshops for Massachusetts Bays and San Francisco brought together local experts for the same purpose. Finally, in the Delaware Estuary scientists are utilizing innovative modeling techniques to demonstrate the economic and ecological impacts of SLR on coastal resources, including higher-profile habitats and developed properties. Taken together, these approaches can serve as effective models for other coastal communities beginning to develop their own adaptation strategies.

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“DO WE STAY AND FIGHT OR DO WE RELOCATE?” LOSS OF PLACE AND LOSS OF FUTURE ON THE CHANGING COAST OF LOUISIANA

Kristina Peterson*, Shirley Laska*, Al Naquin, Rosina Philippe

In the aftermath of the environmental devastation caused by hurricanes Katrina, Rita, Gustav, and Ike, issues of environmental destruction and relocation have become real and pressing problems in communities of the Southeastern Louisiana wetlands. Traditional and historic coastal communities are seeking and discerning necessary action to protect their life world while also protecting their lives. Some communities choose to stay while others are seeking methods of relocation. One community, the Biloxi-Chitimacha Band of Isle de Jean Charles, has determined -- after six successive floods in five years -- that relocation is inevitable. They would like to move as a community in order to preserve their culture and social ties, but in the absence of established models for planning and execution, they must proceed on educated guesses, trial and error. Members of the Grand Bayou community are staying in place utilizing ‘soft’ mitigation measures to lessen their risks. The community continues to use and share their traditional knowledge in the ever increasing struggle to preserve what remains of the wetlands and of the eco-systems they support. This paper and presentation will explore the complexities of cultural continuity as it is rooted to place as life world. The question of staying or leaving is difficult and complex. It has implications to the knowledge base that can be utilized in the changing of the coast.

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USING SCIENCE TO INFORM A POLITICALLY SENSITIVE ISSUE: THE CASE OF OFFSHORE OIL AND GAS PLATFORM DECOMMISSIONING IN CALIFORNIA

Diana M. Pietri* and Amber Mace

The potential decommissioning of California's 27 oil and gas platforms is a scientifically complex, politically sensitive issue that elicits heated public reactions and sparks polarized debates. Under the current regulatory framework, leases require complete removal of the facility upon decommissioning. However, due to high removal costs and potential environmental impacts, federal and state agencies and oil companies have investigated feasible alternatives, such as converting decommissioned platforms into artificial reefs. In a renewed attempt to analyze options and provide a sound scientific basis for policy decisions, the California Natural Resources Agency coordinated with the California Ocean Science Trust (OST) – a nonprofit whose mission is connect science to management – to commission a multidisciplinary study evaluating decommissioning alternatives. The purpose of this study is to examine and synthesize scientific information that will frame future state policy discussions. The OST has coordinated all aspects of this effort in order to ensure that the study is unbiased and credible, based on the best available science, incorporates a broad range of expertise, and can be effectively translated to management actions. To support these objectives, the OST appointed an Expert Advisory Committee, a multidisciplinary body that has played a pivotal role in guaranteeing that the state receives authoritative and robust advice on this important issue. This presentation will highlight results from the study and focus on the comprehensive approach that OST has used to insulate this process from the associated political controversy and ensure that the results of the study can be used to effectively inform policy.

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PREDICTING THE EFFECTS OF CLIMATE CHANGE ON SEA TURTLE NESTING HABITAT IN FLORIDA

Matthew D. Poti*

Climate change poses a significant threat to species that are sensitive to temperature. Sea turtles exhibit temperature-dependent sexual determination and seasonal migration patterns and it has been hypothesized that predicted climatic changes could influence nesting behavior. I evaluated the impact of changing climate conditions over the next fifty years on sea turtle nesting habitat availability in Florida given predicted changes in temperature and precipitation. Environmental and climate variables likely to affect nesting habitat, including elevation, solar exposure, temperature, and precipitation, were built into a maximum entropy (Maxent) model to predict the distribution of sea turtle nesting habitat under current conditions. The model results closely matched current nesting distributions, slightly overpredicting potential nesting habitat. The model was then projected using a future climate scenario to predict the potential distribution of sea turtle nesting habitat under climate change. Initial projection model results were surprising and led me to explore which of the environmental and climatic variables are driving the predicted reduction in suitable nesting habitat, particularly since inundation has not yet been included in the model. While sea turtles are resilient and may adapt to use other locations for nesting, it is possible that climate change will devastate sea turtle populations through reduced nesting potential. Therefore, scientists must closely observe nesting sea turtle populations, in Florida and worldwide, as nest distribution may change significantly in the next few decades. Also, knowledge of factors that influence nesting habitat suitability may inform coastal managers who seek to restore/create beaches to provide suitable nesting habitat.

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RESTORING LINKED HABITATS: AN OPPORTUNITY ON PALOS VERDES

Lia Protopapadakis*, Shelley Luce

The National Estuary Program has been doing ecosystem-based management long before it was called that. The estuary programs work to improve water quality and protect natural resources from the upper reaches of the watershed out into the ocean in which it empties. Abalone used to thrive in the rocky reefs of the southern California bight. Changes upstream and along the shoreline have brought about changes in the marine ecosystem, such as sedimentation, water pollution, and disease that, in concert with overfishing, have put the two species of abalone in the region on either the threatened or endangered species list.

We at the Santa Monica Bay Restoration Commission have been trying to figure out how to restore this important component of the rocky reef ecosystem and have concluded that it will be impossible unless we also address the changes occurring both upstream and offshore. We are developing a plan to link the restoration of abalone, kelp forests, intertidal communities, and coastal dunes and bluffs in one area. We believe that the plan being developed to create a marine protected area in Palos Verdes would be an obvious location to do this because it would afford the intertidal species and abalone additional protection. This presentation will discuss the rationale for restoring all these habitats in one area will make the restoration of each of these complimentary habitats more successful.

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REACHING THE SHORE: PROVIDING SHORELINE PUBLIC ACCESS INFORMATION THROUGH THE WASHINGTON COASTAL ATLAS

Deborah Purce*, Kathy Taylor, Jessica Bennett, Jessica Archer, Darby Veeck and Liz O'Dea

Washington State's 3000 miles of coastal shoreline are increasingly subject to uses and ownership that restrict public access. Fortunately, legislation passed in the early 70's and embodied in the federal Coastal Zone Management Act and Washington's Shoreline Management Act makes the creation and protection of shoreline public access a management priority.

Since inception of the CZMA almost 40 years ago, a variety of resources have been produced at the local, county and state level cataloging shoreline public access sites and features. Such documents provide information on shoreline access to coastal managers, but also serve to increase public awareness and appreciation of Washington's coastal ecosystems. However, it has been almost 25 years since Washington's shoreline public access sites have been comprehensively inventoried and up-to-date information made available to planners and the public.

"Reaching the Shore" is a one-year-old project being lead by Ecology's current NOAA Coastal Zone Management Fellow. The goals of the project are to develop a public access GIS layer and an interactive public access search tool, both of which will be featured on the Washington Coastal Atlas. Washington's Coastal Atlas is an open access, online resource available to all sectors, and therefore, an excellent clearinghouse for public access information.

Methods for achieving project goals include: compilation of public access resources and information, identification of new public access sites, development of a public access GIS database, ground-truthing of GIS data, collection of supporting information about public access sites (photos, amenities, activities, safety information, etc.), web tool design, data quality control and internal/external evaluation of final products.

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ENCOURAGING SUSTAINABLE DEVELOPMENT IN A COASTAL COMMUNITY: NEW HANOVER COUNTY, NORTH CAROLINA'S EXCEPTIONAL DESIGN ZONING DISTRICT

Shawn Ralston*

While New Hanover County is the second smallest county in North Carolina, it is also the second most densely populated with approximately 850 people per square mile. Nestled between the Cape Fear River and Atlantic Ocean with surrounding barrier island beach communities, the County's geographic location provides a prime vacation destination as well as an ideal location for residents who wish to live at the water's edge. Wilmington is the largest city in the County with a population just under 200,000. Most of the Wilmington metropolitan area is developed, creating intense development pressures for the remaining undeveloped land in the unincorporated County. In order to provide development opportunities for mixed use or high density projects within unincorporated New Hanover County where appropriate urban features are in place to support such projects without the negative effects of urban sprawl, County Planning Staff recently developed an Exceptional Design Zoning District (EDZD). Largely based on the LEED for Neighborhood Development program, the EDZD standards were scaled to fit the unique conditions of the County with the goal of encouraging sustainable development while providing density incentives to entice the use of the voluntary district. Through the conservation of water bodies, wetlands, floodplains and open spaces and the use of LID techniques, it is intended that the district will prevent the degradation of water quality and provide design flexibility to achieve public and private spaces that advance a sense of community in a well-integrated service area that diminishes the need for vehicular traffic.

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AN INITIAL ASSESSMENT OF COASTAL HAZARDS AS A RESULT OF SEA LEVEL RISE ALONG THE CALIFORNIA COAST

David L. Revell* and Bob Battalio

As a result of climate change, sea level rise is expected to substantially increase the extent of coastal hazards including both flooding and erosion along California. As a result of Governor Arnold Schwarzenegger's executive order, California state agencies are evaluating potential climate change impacts from a 1.4 m sea level rise. This study examined potential erosion impacts along California for two sea level rise scenarios and a range of planning horizons.

Previous studies of sea level rise have relied on simplistic assumptions of physical processes and coastal landforms primarily based on the East Coast experience. To more accurately account for the range of geology and geomorphology on the tectonically active US West Coast, we developed and applied a methodology using inputs from a downscaled regional climate model. Building on the best currently available geospatial information on topography, erosion rates, and failure mechanisms, future changes were estimated across the range of backshore types and geologic units. Erosion impacts were predicted based on increases in the total water levels attacking the base of the backshore.

This erosion study provided the technical basis for a vulnerability assessment along the California coast. This study comes at a critical junction, as California prepares for climate change and developing an adaptation plan to enhance human and ecosystem resiliency.

As an initial assessment of this important problem, recommendations for improvements, management changes, as well as a discussion of a variety of various adaptation strategies and case study examples to highlight both successes in climate change planning.

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AN EVALUATION OF COASTAL EROSION MITIGATION ALTERNATIVES: PROTECTING A BEACH FOR FUTURE GENERATIONS

David Revell, PhD. *, Bob Battalio, P.E., Brad Damitz, Phil King and Meg Caldwell

As sea level rises, coastal erosion will accelerate threatening more and more private property and public infrastructure. Within the range of potential management responses, the traditional coastal engineering solutions that may protect the property have predictable and known consequences, which negatively impact the recreation and ecosystem along our beaches – our public trust lands. In this study we evaluate a range of potential coastal erosion mitigation alternatives for Southern Monterey Bay to address critical erosion hotspots that rank as some of the highest in California. Building on the findings of one of the first Regional Sediment Management Plans in California, we examine a series of land use planning tools, specific opportunities to reduce the causative mechanisms of erosion, and then regional “soft” coastal engineering solutions. Some of these evaluated tools include: managed retreat, rolling easements, artificial reefs and beach dewatering. Each of these alternatives is evaluated using a variety of criteria important to regional planning entities – focused on balancing ecosystem and recreation with erosion mitigation. The cost benefit analysis includes a more robust accounting of recreational and ecological services at four different planning horizons which illustrate the long term benefits of some approaches. Results of this project are relevant to both the local entities addressing erosion hotspots in Monterey Bay, but also coastal managers across the country facing similar issues of flooding and erosion.

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HOW CAN WE HELP DEVELOPING COASTAL COUNTRIES IMPROVE THE CHANCES FOR SUCCESS IN ADAPTING TO CLIMATE CHANGE?

Donald D. Robadue, Jr.,* Pamela Rubinoff, James Tobey, Glenn Ricci

The Coastal Resources Center's (CRC) climate change program provides governments, businesses and communities with the knowledge and tools they need to make good decisions about adapting to the impacts of climate change through training, technical support and a decision and learning framework that aids in selecting measures appropriate to specific coastal contexts around the world. In 2009 CRC prepared "Adapting to Coastal Climate Change: A Guidebook for Development Planners" which describes where to start (strategy), what to do (policy) and how to do it (implementation). It helps its target audience of environment and coastal planning professionals:

- understand how climate change is impacting their environment and their lives
- make choices for adapting to these accelerating changes in light of the biophysical and human features of their coastline and its existing governance system
- implement actions that build on existing policies, plans, and programs
- enhance capacity through short term training, exchanges and certification programs
- document and share the learning among practitioners and improve the practice

Both during and after preparation of the guidebook CRC has carried out a number of practical exercises and training in a wide range of settings including our home state of Rhode Island, national level research, training for marine and coastal professionals in Asia, Latin America and Africa. This paper provides a variety of examples of choosing promising starting points making the connection between plans and actions in order to mainstream adaptation thinking into public policy.

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CONCERTED ACTION FOR SUCCESSFUL COASTAL COMMUNITIES IN TANZANIA: PERSPECTIVES AND LESSONS FROM THE TANZANIA COASTAL MANAGEMENT PARTNERSHIP, 2006-2009

Donald Robadue, Jr.,* Elin Torell, Jeremiah Daffa, James Tobey, Brian Crawford

This paper captures the achievements, explains the challenges and draws insights from the most recent phase of work of the Tanzania Coastal Management Partnership as it helped to implement the National Integrated Coastal Environmental Management Strategy (NICEMS) in Tanzania's coastal landscapes and seascapes. The overarching goal of Sustainable Coastal Communities and Ecosystems in Tanzania (SUCCESS Tanzania) funded by USAID Tanzania and other partners is to conserve coastal and marine biodiversity while improving the well being of coastal residents. It focuses on three key results:

- Policies and Laws that Integrate Conservation and Development Applied
- Participatory Landscape Scale Conservation Practiced
- Conservation Enterprises Generate Increased and Equitable Benefits from Sustainable Use

The TCMP collaborates with partners such as the Marine and Coastal Environmental Management Project (MACEMP), which has invested in scaling up district level action planning and implementation for the entire coast. The TCMP provided substantial support to helping the Wami-Ruvu Basin Water Office make strides in obtaining the information and insight and institutional capacity to make good water allocation decisions, as well as communicating information to local and national stakeholders. It incorporated funds for HIV/AIDS prevention from through its partner UZIKWAZA in coastal communities, along with USAID's SUCCESS project which focused on improving income earnings through mariculture and promoting improved resource management and conservation through community-based management approaches. The aim of program activities is best understood in light of the craft of encouraging and assisting District and local actors to effectively govern how they utilize the rich biodiversity of coastal areas.

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GAUGING COMMUNITY VIEWS ABOUT OCEAN AND COASTAL ISSUES IN DOWNEAST MAINE

Thomas G. Safford*

Like other many coastal areas of the United States, Maine's coastal communities are experiencing dramatic social and environmental changes. Fishing is in decline and tourism is rapidly becoming the principle economic driver. Second home development is among the highest in the U.S., and shifting demographics are rapidly altering the cultural character of many coastal villages. The threat of pollution also continues to affect communities across coastal Maine, and governmental entities are grappling with how to address these myriad social and environmental concerns.

A team of social scientists at the University of New Hampshire is working to better understand these changes and provide policy-relevant data to support local management efforts. This research focused on the two easternmost "Downeast" coastal counties in Maine, Hancock and Washington. In August 2009, a random digit dial phone survey of approximately 1,400 residents was conducted to gauge local concern about both ocean and coastal management issues. Survey results show marked differences in the views of respondents based on their socio-economic status, political party affiliation, and employment in different natural resource activities. Residents were most concerned about the loss of jobs in the fishing sector and pollution of beaches and clam beds. There was also strong support for the development of aquaculture as an alternative economic venture. However, residents appeared to have a limited confidence in governmental authorities' ability to address environmental problems or promote sustainable development. These results highlight both challenges and opportunities for encouraging more collaborative coastal management in Downeast Maine.

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LONG BAY HYPOXIA STUDY: A COLLABORATIVE AND MULTIDISCIPLINARY APPROACH

Denise Sanger*, Rick DeVoe, and Debra Hernandez

Long Bay, the coastal ocean from Cape Fear, NC to Winyah Bay, SC, experienced a hypoxic event in the summer of 2004. A Long Bay Working Group of state and federal agency and academic partners (managers and scientists) have been working together since then in an attempt to understand the event, and obtain funding to conduct research. More recently (2009), Long Bay experienced another prolonged hypoxic event. The working group, as well as some new partners, quickly responded to this event with a variety of research efforts. This multi-state and multi-agency collaboration has led to a wide range of research and monitoring efforts, including: real-time monitoring of water quality, numerical modeling, spatial water quality assessments, process-oriented studies of pelagic respiration and microbial metabolism, and groundwater inputs. Several factors or themes were found to be important as a result of this collaborative effort: (1) there is genuine interest by scientists and managers to collaboratively work across disciplines; (2) there is a strong commitment by agency leadership, decision-makers, and researchers to creating a successful communication process; (3) there is an improved understanding of how science and management are performed; (4) decision-maker input in development of research projects has been enhanced; (5) networking among researchers and managers has been fostered; and (6) resources for facilitation have been committed to ensure that the researchers and decision-makers are communicating effectively. Development of an ecosystem-based management approach is warranted considering worldwide coastal hypoxia has been increasing in frequency, duration, and extent over the last 3 decades.

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ESTABLISHING THE NERRS AS SENTINEL SITES FOR COASTAL ECOSYSTEM RESPONSE TO A CHANGING CLIMATE

Whitley Saumweber,* Marie Bundy, Nina Garfield

The National Estuarine Research Reserve System (NERRS) is a network of 27 coastal marine protected areas maintained through a Federal-State partnership as authorized by the Coastal Zone Management Act. As part of its mission to better inform coastal decision makers through improved scientific understanding, the NERRS is working to establish itself as a network of sentinel sites for assessing the impacts of climate change on coastal ecosystems. Initial work has focused on developing the infrastructure and capacity to assess the impact of sea level change on the diverse set of coastal vegetative habitats represented in the NERRS, but future efforts will build upon these capabilities to include the responses of other ecosystem elements and to address additional climate-driven factors such as changes in precipitation rates and temperature. Syntheses of NERRS system-wide monitoring data, along with data related to sea-level change impacts will be used to inform both local management and stewardship actions, as well as to support development of local and regional models on the ecosystem impacts of sea level change. We report here on the status of program implementation in three regions: the Gulf of Mexico, Southeast, and Pacific Northwest.

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INTEGRATING CLIMATE CHANGE ADAPTATION PLANNING INTO EXISTING LOCAL PLANNING EFFORTS

Courtney E. Scarborough*

The San Francisco Bay Conservation and Development Commission (BCDC) is a California State Agency that functions at a regional level to ensure the protection, enhancement, and responsible use of the San Francisco Bay and its resources. In this capacity, BCDC has begun to develop strategies to reduce the region's vulnerability to climate change and to help the Bay Area adapt to a changing Bay shoreline. While the Bay Area has made significant strides towards mitigating greenhouse gas emissions, efforts towards adapting to inevitable climate change related impacts have received less consideration. One way to support adaptation planning in the Bay Area is to focus on the planning efforts underway at the local level. BCDC along with our regional and national partners has begun developing an Adaptation Assistance Program to provide local jurisdictions with the necessary information, tools, and resources to undertake these adaptation planning challenges. In September 2009 we organized climate change adaptation planning workshops aimed at outreach to local planners. The feedback from these workshops indicated that planners would like more guidance on how to integrate climate change adaptation planning into the planning projects that are already being carried out at the local level. This poster addresses specific mechanisms that local governments can use to integrate adaptation planning into existing planning efforts. The primary focus of this analysis is to identify how win-win climate change adaptation solutions can dovetail with existing local planning efforts to more seamlessly and efficiently forge a path towards regional climate change adaptation.

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COASTAL WIND: ENERGY FOR NORTH CAROLINA’S FUTURE

Lisa Schiavinato,* Harvey Seim, Charles “Pete” Peterson, Spencer Hanes, David Miller

In 2008, the North Carolina General Assembly commissioned a study of the feasibility of wind energy production off the state’s coast. A team comprised of experts from UNC-Chapel Hill, NC State University, East Carolina University and consulting firms undertook the study. The team prepared a report entitled “Coastal Wind: Energy for North Carolina’s Future” that identifies and analyzes the wind power resource, potential ecological impacts, geological foundation constraints, power transmission issues and legal and regulatory barriers associated with wind energy production off North Carolina’s coast. The report identifies key areas along North Carolina’s coast most feasible for wind energy projects that do not significantly conflict with military airspace or natural and cultural resources. The report was submitted to the General Assembly in July 2009. Based on the study’s results, the legislature appropriated funds to continue the research. In addition, the legislature authorized up to three turbines in Pamlico Sound to serve as a demonstration project. UNC-Chapel Hill has partnered with Duke Energy for the demonstration project, the goals of which are to determine the viability of offshore wind as a scalable renewable energy resource, to optimize measuring and predicting the wind as an energy source, quantify ecological impacts and demonstrate turbine performance and survivability in severe tropical storm conditions. The panel will include members of both the academic study team and the UNC-Duke Energy project team and will present the findings contained in the study report and provide an update on the progress of the demonstration project.

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BUILDING COAST-SMART COMMUNITIES: AN INTERACTIVE AND COLLABORATIVE SUMMIT TARGETING SEA LEVEL RISE AND STORM SURGE ADAPTATION MEASURES

Gwen Shaughnessy^{*}, Joe Abe, David Plumb, Larry Susskind, Nathan Lemphers, and Evan Thomas Paul

In April, 2009, Maryland's Chesapeake & Coastal Program (CCP) hosted the "Building *Coast-Smart* Communities" interactive summit, the centerpiece of which was an innovative role-play that demonstrated the key challenges and policy options coastal communities face in addressing the impacts of climate change. Over 170 community leaders came together to discuss and work through sea level rise and coastal hazard adaptation measures. This exercise was designed to create a network of energized community leaders who can replicate the process in their own community, and to mobilize Maryland's coastal communities into action.

Through a unique partnership between the Maryland CCP, MIT-USGS Science Impact Collaborative, and the Consensus Building Institute, a role-play was developed based on a hypothetical decision-making situation informed by real-world information and recommendations put forth in the Maryland *Climate Action Plan* (2008). Professional facilitators mediated negotiations of a series of actions that coastal communities can take to protect their people, infrastructure, and investments from future risk, and used a scorecard to rank them based on effectiveness and cost. The *Coast-Smart* Communities Scorecard provided a mechanism for participants to learn about key choices communities face; how to anticipate risks and opportunities; and how to factor differing interests into building readiness, adaptability and resilience. The scorecard is now being expanded and developed into a self-assessment tool for coastal communities in Maryland to determine the current status of policies and programs in place, as well as providing guidance on how these decision-making processes can be strengthened to reduce vulnerability and build resilience.

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THE STORMSMART COASTS NETWORK: CONNECTING COASTAL DECISION MAKERS TO RESOURCES AND EACH OTHER

Wesley Shaw*, Heidi Recksiek, Tina Sanchez, Tracie Sempier, Chrissa Stroh

Today's coastal decision makers have more information than ever before on the risks they face from climate and weather hazards, as well as how they can most effectively protect their communities from harm. Unfortunately, the sheer bulk of the material is often overwhelming—seemingly each week a relevant new report, study, or website is released. This can be especially challenging for people working at the local level who are often not allocated specific time to stay abreast of the constantly changing technology.

The StormSmart Coasts Network is a dedicated resource to help decision makers in coastal communities address the challenges of storms, flooding, erosion, sea-level rise and climate change. Through its websites, newsletters, and news streams (including RSS and Twitter), the StormSmart Coasts Network provides a continually-updated place to find and share the best resilience-related resources and tools available. State-level websites provide information on steps communities can take before, during, and after storms (including a growing catalog of funding options). The Network also includes collaborative tools for its users, including forums, dedicated pages for participating communities (and other groups addressing coastal climate and weather challenges), events calendars, and other user-generated content.

This project, which began in the Massachusetts Office of Coastal Zone Management, is supported by The Gulf of Mexico Alliance, the Northeast Regional Oceans Council, the NOAA Coastal Services Center, Edward A. Thomas Esq., Michael Baker Jr. Inc., and others. Its current scope includes the states of the Gulf of Mexico, and the five coastal states of New England, and is actively seeking to expand to the remaining coastal states.

The site may be visited at: StormSmartCoasts.org

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CHALLENGES IN USING SCIENCE-BASED SHORELINE SETBACKS: EXAMPLES FROM SOUTH CAROLINA

Matthew J. Slagel* and Braxton C. Davis

Beachfront jurisdictional lines were established by the SC Beachfront Management Act in 1988 to regulate the new construction, repair, or reconstruction of buildings and erosion control structures along the state's ocean shorelines. Building within the state's beachfront "setback area" is allowed, but is subject to special regulations. For "standard beaches" (those not influenced by tidal inlets or associated shoals), a baseline is established at the crest of the primary oceanfront sand dune; for "unstabilized inlet zones," the baseline is drawn at the most landward point of erosion during the past forty years. The parallel setback line is then established landward of the baseline a distance of forty times the long-term average annual erosion rate (not less than twenty feet from the baseline). The positions of the baseline and setback line are updated every 8-10 years using the best available scientific and historical data, including aerial imagery, LiDAR, historical shorelines, beach profiles, and long-term erosion rates.

While there are clear benefits in using science-based setbacks, significant challenges are becoming increasingly apparent. For example, science-based setbacks rely on historical and current data, but do not consider future scenarios or projections of accelerated sea level rise. Also, in some very dynamic regions (e.g. unstabilized inlet zones), the long-term average erosion rates used to establish the setback distance can be far lower than the short-term rates of change. Recent experiences with revising the beachfront jurisdictional baselines and setback lines in South Carolina have shown that these and other concerns will need to be addressed.

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THE POLITICS OF PARTICIPATION: EVALUATING STAKEHOLDER EQUITY IN CO-MANAGEMENT REGIMES

Sarah Lindley Smith*

In recent years, the concept of co-management of natural resources, in which management responsibilities are shared between the government and stakeholders, has become increasingly popular, both in the academic literature and in practice. However, while co-management has significant potential as a management tool, the issue of equity in co-management has rarely been addressed. It is necessary to understand the differential impacts on stakeholders of co-management processes and the degree to which diverse stakeholders are represented within co-management. Understanding the interests of various stakeholders can be a way to more effectively address the distributional and social impacts of coastal policies, which can in turn increase compliance with management measures and lead to more sustainable resource management regimes.

This paper analyzes stakeholder participation at six different co-managed marine reserves in the Caribbean, comparing the frequency and extent of participation in management activities amongst various stakeholder groups and between communities and marine reserves. At each site, community members were surveyed about their participation in marine reserve management activities, and about their knowledge of the individuals responsible for making decisions about the marine reserve. Responses were analyzed to determine the influence of community-level factors such as size, homogeneity, and management structure, as well as individual-level factors including gender and occupation on participation. Each co-management arrangement is evaluated with respect to the nature and extent of community participation, as well as the degree to which the co-management arrangement equitably accounts for various stakeholder groups. Recommendations are made to improve participation and equity in co-management regimes.

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MARINE SPATIAL PLANNING APPROACHES AT THE STATE LEVEL: SIMILARITIES AND DIFFERENCES BETWEEN MSP EFFORTS ACROSS THE COUNTRY

Brian Smith (moderator), Bob Bailey, Scott Geiss, John Webber, Kathy Cunningham-Ballard

Competing uses, overlapping jurisdictions, and numerous laws and policies all come into play when deciding how ocean resources will be used. Organizations are turning to marine spatial planning to manage this situation. Marine spatial planning is a comprehensive, ecosystem-based process through which compatible human uses are objectively and transparently allocated to appropriate ocean areas to sustain critical ecological, economic and cultural services for future generations. This session will include panelists offering perspectives on marine spatial planning efforts being carried out in multiple regions. Panelists representing the West Coast, South East, North East, and Great Lakes will be on hand to frame a discussion around the similarities and differences of their efforts. The approach to marine spatial planning in each state will be discussed with specific attention given to issues such as what is driving the effort, data availability, maturity of the effort, and level of resources devoted to marine spatial planning. Highlighting the similarities and differences of the efforts will shed light on the state and region specific challenges faced by each effort, and the approaches being taken to meet those challenges.

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MARINE SPATIAL PLANNING IN RHODE ISLAND: THE RI OCEAN SPECIAL AREA MANAGEMENT PLAN

Tiffany Smythe*

The Rhode Island Coastal Resources Management Council (CRMC) is currently leading the development of a special area management plan (SAMP) for Rhode Island's offshore waters. The Ocean SAMP is an ecosystem-based marine spatial plan that will define use zones for a 1,547 square mile area of RI's offshore state and federal waters through a research and planning process that integrates the best available science with open public input and involvement. Through the SAMP, Rhode Island will refine the zoning of its offshore waters for diverse activities including renewable energy development. The SAMP will also protect current uses and resources including commercial fishing; critical habitats for fish, marine mammals, and birds; marine transportation; and recreational boating. The Ocean SAMP is being developed through a two-year process, concluding in July 2010, that includes scientific research on the natural resources and human uses of the SAMP area and extensive stakeholder input from user groups and concerned citizens. It will result in a SAMP document to be approved by the CRMC, a refined zoning map, and regulatory standards to guide the future uses of RI's offshore waters.

This presentation will comprise an overview and update of the Ocean SAMP with an emphasis on the process through which Rhode Island is developing this interdisciplinary, ecosystem-based marine spatial plan. The presentation will include discussion of the Ocean SAMP research agenda; the stakeholder process; and the process of integrating scientific research and public input into the Ocean SAMP document. Specific issue areas to be highlighted in this presentation include working with fisheries stakeholders; mapping human uses; and the public review process.

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THE PROBLEM OF ECOSYSTEM-BASED MANAGEMENT IN THE COASTAL CONTEXT: COLLABORATION, COMMUNICATION NETWORKS, AND MENTAL MODELS IN THE GREENWICH BAY SPECIAL AREA MANAGEMENT PLAN

Tiffany Smythe*

Ecosystem-based management is touted as the preferred approach to coastal management, though coastal management decisions largely occur through a fragmented system of governance through which practitioners act somewhat autonomously to make land- and water-use decisions that can have tremendous impacts on entire ecosystems. To effectively implement an ecosystem-based management plan, practitioners must collaborate across both jurisdictions and disciplines in order to fully consider coastal management decisions within an ecosystem context. This study analyzes the capacity of practitioners to implement an ecosystem-based management approach by collaborating across jurisdictions and disciplines through a case study analysis of the Greenwich Bay Special Area Management Plan in Rhode Island. Mental models and social network analysis methodologies are used to analyze how practitioners conceptualize coastal ecosystem-based management, whether and how practitioners collaborate across both jurisdictions and disciplines, and whether collaboration enhances practitioners' capacity to implement an ecosystem approach. This study will conclude with recommendations for enhancing practitioners' capacity to implement coastal ecosystem-based management plans. This presentation will highlight research methods and preliminary findings of this study, which represents one part of the author's doctoral dissertation research.

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NON-CONSUMPTIVE OCEAN RECREATION IN OREGON: DATA TO SUPPORT TERRITORIAL SEA PLANNING

Pete Stauffer,* Surfrider Foundation
Chris LaFranchi, NaturalEquity
Charles Steinback, Ecotrust

The Surfrider Foundation, NaturalEquity, and Ecotrust are partnering with Oregon state agencies on a study of non-consumptive recreational use of the Oregon coast. The study will provide spatially explicit information on activities such as water sports, boating, beach-going, and wildlife viewing in Oregon's Territorial Sea. This data will then be used to inform the development of a comprehensive plan that identifies potential locations for renewable ocean energy projects in state waters.

The objectives of the study are to: 1) identify and if possible estimate the size of the Oregon non-consumptive recreational ocean user community; 2) collect spatially explicit information on current non-consumptive recreational use including activity, extent, and demographics; 3) estimate the economic impacts and describe the sociocultural significance of non-consumptive ocean recreation to Oregon's communities; and 4) integrate baseline data into Oregon's Coastal Atlas (GIS) to inform Oregon's Territorial Sea Plan (TSP) update and other relevant decision-making.

The survey instrument utilizes Ecotrust's Open OceanMap, a web-based and desktop data collection tool used to effectively collect local expert knowledge in support of marine spatial planning, to gather data both on-line ("opt-in") and desktop (in-person intercept). Each survey administered via Open OceanMap follows a shared protocol to capture spatially explicit information that will illustrate the type of non-consumptive activities they undertook and where, they last time they recreated at the coast, then again over the last 12 months.

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COLLISION AT THE END OF THE LINE: SHIPWRECKS AND COMMERCIAL FISHING

Joyce Steinmetz*

This study examines the site formation processes of commercial trawling and dredging impacts on mid-Atlantic deepwater shipwrecks. Exploring this human-related interaction requires multi-disciplinary sources, including historical research, maritime archaeologists, and fisheries and sanctuary management. Non-traditional sources include interviews with fishermen, who experience damage and loss of gear, and recreational divers, who observe damage to shipwrecks. Gear impacts accelerate structural deterioration and filter and scramble contents. From depths of 75 to 235 ft., statistical analysis shows 70% of 50 mid-Atlantic shipwrecks have 1 to 5 abandoned nets or dredges on-site. Specific cases include a) the 1847 side wheel paddle steamer *Admiral DuPont*, b) the Civil War and early 20th century U.S. Navy tugs *Nina* and *Cherokee*, c) the 1920 U.S. submarine *S-5*, and d) the WWII patrol boat *St. Augustine*. Collision prevention proposals seek to provide economic benefits for fishermen, conserve essential fish habitat, preserve recreational tourism, and safeguard non-renewable underwater cultural resources.

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COASTAL RESOURCE PLANNING SYSTEM: INTEGRATING EVALUATION OF ECOLOGICAL INTEGRITY AND ECOSYSTEM SERVICES VALUATION

Harry J. Stone*, Leslie-Ann S. McGee

In 2009, the widely-used “Battelle Method” (1972), *Environmental Evaluation System for Water Resource Planning*, was modernized to reflect the state of knowledge of ecology and ecological economics. The updated environmental evaluation system established a conceptual framework linking human stressors (or natural drivers) to resilience of ecosystem functioning, preservation of intrinsic value, and changes in ecosystem services – collectively, environmental quality. The coastal resource planning adaptation of the system is introduced as an approach to screen the likely impact of alternative scenarios on ecosystem integrity and ecosystem services values. The output from the environmental evaluation system can provide an environmental quality baseline, be used to evaluate temporal changes in environmental quality compared to the baseline, and can be used to anticipate likely changes in environmental quality resulting from changing drivers and human activities. The methodology supports estimation of the impact of stressors and drivers (natural or human) at various levels of data intensity from a screening level, supported by heuristics derived from empirical data, to incorporation of rigorous modeling. The output of the standardized environmental evaluation system provides individual outcomes for scientifically-sound ecological integrity measures and human-valued ecological services, as well as an integrated overall evaluation of environmental quality. The ability to model and value management decisions in the coastal environment is necessary to planning in an ecosystem-context.

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LONG-TERM PLANNING FOR COASTAL PASQUOTANK COUNTY-ELIZABETH CITY, NORTH CAROLINA

Deanna F. Swain,* Daniel J. Marcucci

North Carolina has been credited with being progressive in its policy response to the Coastal Zone Management Act. As one part of its Coastal Area Management Act (CAMA), North Carolina requires municipalities in the twenty coastal counties to have land use plans drafted in accordance with CAMA requirements and approved at the state level. These plans, ostensibly updated every five years, must address community goals, infrastructure capacity for future growth, as well as contain an analysis of significant existing and emerging conditions that may impact the planning jurisdiction. The plan calls for population, economic, and environmental planning to be based on sound facts and analysis of the best available data and mapping sources. The plan must map and identify vulnerable coastal areas as well as consider projected population growth out to twenty years.

While the CAMA plans represent the state of the practice for coastal planning in North Carolina, we will use the draft joint land use plan for Pasquotank County/Elizabeth City to examine how the state of the practice fails to address changing coastal concerns like sea level rise, climate change, and exurban development. We argue that these are long-term issues. While CAMA calls for twenty-year planning, we critique the plan not on conventional standards but with a framework based on planning for fifty or one hundred years into the future. A long-term perspective infuses both different issues and processes into comprehensive planning.

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CAN BUILDING CODES KEEP PACE WITH CLIMATE CHANGE? FINDING WAYS TO SPEED UP MITIGATION AND ADAPTATION

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The materials and techniques that are used to build or renovate structures are instrumental in determining the amount of damage a structure will suffer during a severe coastal storm. Because building codes dictate what materials and techniques are used for construction and renovations, they are critical tools for creating disaster resilient communities. Yet a time lag exists between the updating of a code and the meaningful incorporation of new materials or techniques into buildings. Typically, homeowners incorporate better techniques or materials when replacing part of a building, but only that part of the building is brought up to code. Normally, the entire structure only needs to be brought up to code when the cost of renovations exceeds fifty-percent of the market value or replacement cost of the structure. Thus, creating resilient communities might be quite slow. This paper reports on a GIS decision tool that was developed for Charlestown, RI. It covers areas that are subject to flooding, erosion, and wind damage and predicts the rate at which new building standards that are intended to mitigate storm damage will be incorporated into this area's buildings. The building improvements in the model were selected by a panel of experts from government, the insurance industry, and research institutions. The paper also reports on factors that are slowing the pace at which buildings are improved. The paper closes by discussing what federal, state, or local government might do to quicken the pace at which these mitigation measures are incorporated into buildings.

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COASTAL PLANT GROWTH AND CO₂ ENRICHMENT: CAN THE PRODUCTIVITY OF *Juncus roemerianus* KEEP PACE WITH SEA LEVEL RISE?

Brant W. Touchette*, Mariana M. R. Poole, Mica D. McCullough, Gracen A. Smith and Emily C. Adams

Due to anthropogenic contributions to climate change, the rate of sea level rise is expected to increase from 0.04 cm per year to as much as 0.25 cm per year. Perhaps more disconcerting, some areas, such as the northeastern coast of North Carolina, may experience a rise in sea level by as much as 0.8 cm per year, through a combination of global warming and coastal subsidence. Changes in coastal elevations have been attributed wetland decline, especially in areas where the mean surface elevations were the lowest. Interestingly, less vulnerable wetlands are able to increase elevation (through depositional accretions of peat) at rates comparable to the rising sea. The ability of wetlands to accumulate peat is largely dependent on plant productivity, with higher productivities resulting in higher accretions. Studies considering the effects of higher atmospheric CO₂ on natural vegetation often revealed enhanced plant productivities. This elevated growth may be short lived or long-term depending on prevailing environmental conditions, with soil nutrients as a primary factor limiting sustained elevated growth. Nevertheless, coastal wetlands can maintain comparatively high soil nutrients and sustained accelerated growth could be expected. Therefore, the purpose of this study was to evaluate the effects of CO₂ enrichment (800 ppm CO₂) on the growth and productivity of the coastal wetland plant, *Juncus roemerianus*. Our results indicate that, under optimal growing conditions, elevated CO₂ will significantly increase *J. roemerianus* productivity. This enhanced growth, however, does not appear to be sufficient enough to allow for peat accretions that would equal or exceed the projected rise in sea level.

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SHOAL MANIPULATION AS AN EFFECTIVE SOLUTION TO LOCALIZED BEACH EROSION NEAR INLETS: EXAMPLES FROM THREE SOUTH CAROLINA BEACHES

Steven B. Traynum*, Timothy W. Kana

Soft engineering solutions, such as beach nourishment and temporary erosion control devices, have replaced groins and seawalls as the preferred methods to protect public and private beach areas. One solution which may be underutilized in certain areas is shoal manipulation. Beaches along mixed energy coasts, such as portions of Florida's Gulf Coast, South Carolina, and New England, are highly influenced by tidal inlets. A key process that controls the sediment supply near tidal inlets is shoal bypassing. Shoal bypass events typically occur when sand is released on the downdrift side of an inlet delta, and worked by waves into an isolated shoal. The shoal migrates onshore due to wave action, and in the process causes major fluctuations in the shoreline, including zones of significant localized accretion and erosion. While the erosion may be temporary and localized, it often threatens structures or negatively affects the surrounding area. Individual shoal bypass events in South Carolina have been estimated to add 500,000 cy of sand or more to the beach.

Shoal manipulation can take the form of any artificial movement of sand from the shoal or the beach being fed, and transferring sand to adjacent eroding areas. The goal of manipulations should be to accelerate movement of new sand to the beach and redistribute it to adjacent areas. Manipulation of migrating shoals has the potential to be a cost effective and environmentally sensitive way to manage areas which otherwise have an adequate sand supply. Shoal manipulation should only be considered in areas where there is an adequate sand supply, as it acts only to rearrange sediment already in the system, and not add to the sediment budget like an offshore nourishment project. The authors present examples from three South Carolina islands where shoal management was either used as a management technique, or has the potential to be used to provide a better alternative for coastal communities.

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THE DEVELOPMENT OF THE SOUTH CAROLINA COASTAL INFORMATION NETWORK AND PORTAL SITE: BRINGING TRAINING OPPORTUNITIES AND EDUCATIONAL RESOURCES TO COASTAL COMMUNITY OFFICIALS AND THE PUBLIC

April L. Turner* and Samantha M. Bruce

The South Carolina Coastal Information Network (SCCIN) emerged as a result of a number of coastal outreach institutions working in partnership to enhance coordination of the coastal community outreach efforts in South Carolina. This organized effort led by the S.C. Sea Grant Extension Program, includes partners from federal and state agencies, regional government agencies, and private organizations seeking to coordinate and/or jointly deliver outreach programs that target coastal community constituents. The Network was officially formed in 2006 with the original intention of fostering inter-agency communication, coordination, and cooperation. The overall goal is to maximize the efficient delivery of quality training and educational material to coastal decision-makers, community planners, local officials, and the public. This collaboration was an attempt to avoid duplicative efforts and to minimize the number of meetings/workshops that community leaders and staff are asked to attend, while maximizing program benefits and expected outcomes and leveraging scarce resources.

A SCCIN Web site with a searchable calendar of outreach events and a resource portal was launched in 2008 to provide S.C. coastal communities with a streamlined search process for coastal resource-related training and educational opportunities and publications. The SCCIN prototype has generated interest from other state and federal agencies that want to develop a similar network based on the South Carolina model. This presentation will demonstrate the SCCIN Web site functions, give the audience an understanding of how it was created, and identify the challenges and recommendations associated with developing and managing a Network and Web site like the SCCIN.

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A NEW APPROACH TO TMDLS: REDUCING THE FLOW OF STORMWATER TO RESTORE THE LOWER WHITE OAK RIVER IN NORTH CAROLINA

Frank Tursi*

More than two-thirds of the White Oak River along the central N.C. coast is closed permanently to shellfishing or closes temporarily after moderate rains because of bacterial pollution. Stormwater runoff is the identified source. The river has long been on North Carolina's list of impaired waters.

Using money from an EPA Section 319 grant, the author led a team that consisted of Cedar Point, a small town that borders the river; the N.C. Department of Transportation; and the N.C. Division of Water Quality on a two-year investigation of bacterial sources in four watersheds along the lower portions of the river. The goal was to produce a TMDLs and watershed plans for each of the study sites.

TMDLs have historically focused on source reduction as a remedy to the contamination. The study team quickly realized that such an approach was unrealistic because the bacteria were ubiquitous and the sources primarily natural (wildlife and pets). They focused instead on reducing the amount of stormwater entering the watersheds. Cutting the flow of runoff that was carrying the bacteria to the river offered a realistic remedy for improving water quality.

The watershed plans that accompanied the TMDL offered more than 40 recommendations on reducing the flow of stormwater. Most rely on low-cost techniques that attempt to mimic natural drainage patterns.

The TMDLs and watershed plans were approved by EPA and the state, and Cedar Point has received another 319 grant to implement some of the recommendations contained in the plans.

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FORAGING ECOLOGY OF HUMPBACK WHALES *Megaptera novaengliae* IN THE WESTERN ANTARCTIC PENNINSULA

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Reduction in the extent and duration of winter sea ice has caused a decrease in the abundance of Antarctic krill (*Euphausia superba*) around the Western Antarctic Peninsula (WAP). To examine how this decrease in prey may affect the spatial distribution and behavior of humpback whales (*Megaptera novaengliae*), we conducted a multi-scale, integrative study in the austral fall of 2009. We conducted visual surveys using standard line transect, distance sampling protocols in several coves along the WAP to estimate density of whales during the study period. We measured the density and distribution of prey concurrently at both fine (< 1km) and broad scales (1-25km) using a 38 and 120 kHz SIMRAD EK-60 and RDI narrow-beam 150 kHz ADCP, respectively. We confirmed the identity of acoustic targets with MOCNESS tows. We tagged humpback whales with digital acoustic recording tags (Dtags) to measure dive patterns and record underwater behavior. The distributions of humpback whales closely tracked their primary prey. In Piccard Cove we encountered 502 humpbacks foraging on a massive aggregation of krill, with an approximate biomass of 7.65E+05 tons. In adjacent Anvord Bay 295 whales were foraging on a smaller, patchy aggregation of approximately 3.82E+04 tons of krill. Further reductions in krill biomass mediated by changes in the duration and extent of sea ice will likely affect the distribution and behavior of humpback whales and other top predators in the WAP, although the exact nature of these changes cannot yet be predicted.

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DYNAMIC LIVING SHORELINE DESIGN ON THE CORSICA RIVER

Keith R. Underwood*, Matthew Miller, Bhaskaran Subramanian, Kevin M. Smith, and Kathryn L. Shinkiewicz

Recently, there has been a great deal of focus on shoreline stabilization approaches referred to as “Living Shorelines”. The majority of approaches are over-armored designs that do not allow for the diverse ecosystem and important function of a true shoreline. Biological diversity is a critical factor in the sea-land interface, planting a monoculture of *Spartina* grasses severely limits the ecosystem function. Dimensional diversity is also important to these systems including lagoons, shallow aquatic beds, tidal marsh, beach strand pools, and non-tidal wetlands and forests instead of just a sea-land barrier. Valuable Living Shoreline designs mimic natural shorelines by creating shoreline area that integrates the tidal with the non-tidal ecosystem providing unique habitat and dissipating tidal energies.

Natural shoreline ecosystems are stable only in a dynamic sense, shifting as the shoreline adapts to the energies delivered. Under the sponsorship of the Ecosystem Restoration Center of the Maryland Department of Natural Resources, Underwood & Associates was retained to design and install a shoreline stabilization in accordance with the aforementioned design principles, in order to establish a rhythm of accretion and biodiversity along a shoreline on the Corsica River in Queen Anne’s County, Maryland. In this paper a novel approach to shoreline stabilization using sand, cobble, and plants in lieu of rip-rap boulders is used to set up a rhythm of accretion at the Windy Hill restoration project. Through ecological engineering, a dynamic, three dimensional, natural, biologically diverse, self-sustaining shoreline is integrated in to the adjacent landscape maximizing riparian habitat.

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VISITOR ATTITUDES AND PREFERENCES TOWARD FERAL HORSE MANAGEMENT AT THE RACHEL CARSON NATIONAL ESTUARINE RESEARCH RESERVE

Hans Vogelsong

One growing problem facing resource managers is protecting fragile resources from exotic or feral animals. These animals may cause damage to vegetation, displace native species, and pose threats to the livestock health. This problem can become intensified when the species in question attracts tourists and is supported by the local population.

Feral horse populations have been growing on the islands of the Rachel Carson NERR on the NC coast, and have resulted in altering the eco-system of the islands. Additional problems exist when horses become injured, die, or are orphaned. These naturally occurring incidents are often disturbing to island visitors and result in pressure to reserve staff to deal with horse related problems that they do not have the resources or expertise to solve. Furthermore, efforts to humanely control the population of feral horses on the islands have been met by resistance from local residents who believe that the horses are a valuable tourism attraction and are more important than other native wildlife species.

The purpose of this study was to determine visitor attitudes toward feral horses on the reserve and preferences for management alternatives. Visitors to the reserve were surveyed and responded to items concerning how they felt about feral horses and wildlife in general. Respondents were also asked to provide preferences for various management strategies based on several scenarios concerning feral horses.

Discussion focuses on analysis of feral horse attitude responses, as well as on the relationships between feral horse management preferences, attitudes toward wildlife, and visitor characteristics.

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SMART GROWTH AT THE WATER'S EDGE: WATERFRONT & COASTAL COMMUNITY SMART GROWTH

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Living near the water has historically been, and is expected to remain desirable. The water, beaches, and other natural features attract people and spur development. A 2005 report released by NOAA estimated that coastal counties cover less than 17 percent of the U.S. land area, but are home to 53 percent of the population. Within 10 years, that population is expected to grow by 12 million people—or by 3,600 people per day—reaching a total population of 165 million by 2015.

The unique amenities that draw people to the coast also require special consideration when addressing growth and development. These include protecting sensitive coastal ecosystems, revitalizing waterfronts, preserving water dependent uses, providing public access, and planning for hazard resiliency and the impacts of climate change.

Many coastal and waterfront communities have found traditional development patterns threaten the assets they treasure most. Smart growth approaches—guided by a set of principles that help communities grow in ways that expand economic opportunity and protect public health and the environment, can help communities accommodate development while protecting their traditional sense of place. Some of these approaches can also help communities be more resilient to hazards and the impacts of climate change.

Smart Growth at the water's edge requires a tailored approach that recognizes the unique opportunities and challenges of waterfront and coastal development. This proposed panel will overview NOAA and EPA's waterfront and coastal smart growth elements (Walker & Desautels); and highlight state and local implementation of coastal and waterfront smart growth approaches.

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IDENTIFYING COASTAL HABITATS FOR CONSERVATION UNDER SEA LEVEL RISE SCENARIOS

Bethney Ward*, Craig Sasser, Danielle Bamford, Chrissa Stroh

Long-range habitat planning in a rapidly changing coastal environment is a critical management challenge for the National Wildlife Refuge System. For example, at the Waccamaw National Wildlife Refuge in South Carolina, the manager and researchers are currently identifying and evaluating habitat, both within and adjacent to the refuge, for the swallow-tailed kite (which requires large acreages of coastal hardwoods for nesting and foraging) and other species. Understanding the spatial habitat conditions and needs of key species will help habitat planning efforts address current and future habitat losses from storms, drought, sea level rise, and coastal development.

This presentation will focus on how the Habitat Priority Planner was used to identify coastal habitats for conservation as a long-term adaptation strategy for rising sea levels in and around the Waccamaw National Wildlife Refuge. The Habitat Priority Planner is a GIS-based tool developed by the National Oceanic and Atmospheric Administration (NOAA) for guiding decisions related to conservation, restoration, and land use and which is ideal for engaging multiple stakeholders. The Habitat Priority Planner was used to examine spatial habitat conditions (e.g., fragmentation) before and after predicted sea level rise scenarios (generated from the Sea Level Affecting Marshes Model with high-resolution elevation data and local parameters).

The Habitat Priority Planner is playing an important role in helping the refuge and the local conservation community identify current habitat areas that are not protected, but which are most suitable—based on predicted changes—for meeting long-term conservation goals of the refuge and other stakeholders.

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TO PAVE OR NOT TO PAVE: A SOCIAL LANDSCAPE ANALYSIS OF LAND USE DECISION MAKING IN THE TOWNS OF THE LAMPREY RIVER WATERSHED

Erika Washburn

Population pressure in coastal New Hampshire challenges land use decision-making and threatens the ecological health and functioning of Great Bay, an estuary designated as both a NOAA National Estuarine Research Reserve and an EPA National Estuary Program site. Regional population in the seacoast has quadrupled in four decades resulting in sprawl, increased impervious surface cover and larger lot rural development. All of Great Bay's contributing watersheds face these challenges, resulting in calls for strategies addressing growth, development and land use planning. The communities within the Lamprey River watershed comprise this case study. Do these towns communicate upstream and downstream when making land use decisions? Are cumulative effects considered while debating development? Do town land use groups consider the Bay or the coasts in their decision-making? This presentation will discuss a novel social science approach to analyze and understand the social landscape of land use decision making in the towns of the Lamprey River watershed. The methods include semi-structured interviews with GIS based maps in a grounded theory analytical strategy. Discussion will include key findings, opportunities and challenges in moving towards a watershed approach for land use planning. This presentation reviews the results of this case study and the developed methodology, which can be used in watersheds elsewhere to map out the potential for moving towns towards EBM and watershed-scaled, land use planning.

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WATERSHED MONITORING AND TMDL MODELING TECHNIQUES TO ASSESS BACTERIAL LOADING IN ESTUARINE ENVIRONMENTS APPLIED TO IMPROVE SHELLFISH RESOURCE MANAGEMENT PROGRAMS

Nancy M. White* and Daniel E. Line

Bacterial loading rates from three watersheds with suburban, farm and wooded land cover were compared. Two methods for identifying the sources of the bacteria: DNA ribotyping and antibiotic resistance analysis were used. The primary goals were to quantify load, identify sources and then review and recommend management strategies to reduce shellfish closures. Fecal indicator bacterial loading rates routinely exceeded state and federal standards. The rates were sufficiently high to conclude that compliance was practically beyond the reach of any current management strategy available to North Carolina government agencies. This situation is particularly troubling given that the development densities were low (less than 15% total watershed imperviousness), but this study found that bacterial levels cannot be solely described using density. High levels of bacterial loading can be derived from low density watershed where urban wildlife are highly concentrated in small areas of habitat, usually near water, providing a significant store of bacterial material. The source tracking results also insinuated that septic tanks may have some influence on bacterial levels in the urban study area, but the techniques evaluated in this study can not quantify the load specifically attributable to source. One of the causes however is the increased volume of runoff. The results of this study show that to improve coastal waters, we will need to utilize methods that both significantly reduce the total volume of stormwater runoff but also provide better treatment of bacteria.

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USING CLIMATE EXTENSION TO ASSIST COASTAL DECISION-MAKERS WITH CLIMATE ADAPTATION: THE SEA GRANT EXPERIENCE

Jessica C. Whitehead*, Robert H. Bacon, John F. Thigpen, Greg Carbone, Kirstin Dow, and Daniel Tufford

Coastal managers are becoming aware of the need to adapt to climate change. However, managers may not be familiar with climate science and methods for determining the impacts climate change could have on natural resources, communities, and economies. While tools to help them scope out vulnerabilities and risks are becoming more common, there are few tools available to support more specific decision-making needs. Coastal managers need accessible, trusted resources to help them interpret climate information, identify vulnerabilities, and apply climate information to decisions about adaptation on regional and local levels.

Sea Grant works to bridge the gap between information and adaptation by using extension methodologies. This presentation will discuss climate extension methodologies and Sea Grant's capacities for climate outreach and extension on regional and national levels. One regional climate extension initiative is a partnership between the South Carolina Sea Grant Consortium, North Carolina Sea Grant, and the Carolinas Integrated Sciences and Assessment Center (CISA) at the University of South Carolina. The Carolinas Regional Climate Extension Specialist informs and educates users about climate variability and climate change and provides tailored, decision-relevant coastal climate information to users. Current research-outreach projects in the Carolinas include research on adaptation priorities and decision support tools. Nationally, the Sea Grant Climate Network is expanding Sea Grant's capacity to provide climate extension, communication, and educational resources to the nation's coasts. By working to develop and improve climate extension approaches, Sea Grant is able to assist coastal users with understanding and applying climate information to adaptation decisions.

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DECIDING TO EVACUATE: GATHERING THE INFORMATION TO MAKE THIS IMPORTANT DECISION

Kenneth Wilson, Catherine Smith, Donna Kain and Amanda Drozdowski

When hazardous storms threaten coastal communities, people need information to decide how to respond to this potential emergency. NOAA and NC Sea Grant are funding a two-year project to learn how residents, government officials, businesses and other organizations are informed and use information regarding hurricane and tropical storms. One part of this project seeks to better understand the process through which residents gather this important information. To this end, we interviewed 1079 randomly selected residents in 20 coastal and coastal-area counties using a mixed mode (telephone and web) survey. Most respondents (59.8%) reported that their initial response to a threatening hurricane is to gather information to decide if they should evacuate or ride out the storm. A factor analysis of nine possible sources of information (TV, Radio, newspapers, NOAA weather Radio, Internet website, social networks, Alert services, local officials or state/national officials) examines which information source tend to be used together. The factor analysis identified two multi-item factors: Alert (Alert Service, TV and Radio) and Network (Social Network, Local officials and State/national officials). The other three sources (NOAA, Internet and Newspapers) are analyzed as individual items. Finally, the demographic groups (Mobile Home, Married, Gender, Education, Age, Children, Race and Income) that are most likely to use the various information sources are identified.

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STAKEHOLDER ENGAGEMENT STRATEGIES FOR EFFECTIVE CLIMATE CHANGE ADAPTATION PLANNING IN COASTAL COMMUNITIES

John W. Wilson*, Lisa Beever, Curtis Bohlen, Bill Crowell

Projected impacts of climate change on U.S. coastal populations are severe and unprecedented. With the prospect of rising seas, damaging storms, and loss of ecosystems, planners and decision-makers often encounter public resistance both to the reality of climate change and the necessity of adaptation. To build support and engage affected constituencies, contextual and frequent stakeholder engagement is an important component of adaptation planning for climate change. Unfortunately, it is easily overlooked in favor of technical, scientific, and other more easily quantified aspects of developing an effective adaptation plan.

In its first two years of existence, the Environmental Protection Agency's Climate Ready Estuaries (CRE) program has supported several projects that have emphasized public engagement as an important precursor to vulnerability assessment and adaptation planning. In this panel session, we will present the results of these projects and draw out lessons for other coastal communities as they begin to plan for climate change. Albemarle-Pamlico National Estuary Program, Casco Bay Estuary Partnership, and Charlotte Harbor National Estuary Program will serve as case studies demonstrating successful instances of engaging the public and decision-makers in adaptation planning. Listening sessions, targeted meetings with public officials, and workshops drawing on local knowledge have all proven effective as first steps of an adaptation strategy. An overview of the three geographically and demographically diverse projects will provide important lessons learned moving forward with public support and informed decision makers for coastal climate change adaptation.

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A COASTAL VULNERABILITY INDEX FOR THE DELAWARE BAY: A PILOT STUDY FOR NEW JERSEY COASTAL COMMUNITIES

Ida Leigh Wood*, John D'Agostino, Dorina Frizzera

Nearly 9 million people live within the coastal counties of New Jersey, making up approximately 99 percent of the most densely populated state in the nation. The shore promotes tourism, which accounts for over 16 billion dollars of yearly revenue, in addition to revenues derived from the maritime and commercial fishing industries. Global climate change threatens to negatively impact the vitality of coastal communities, industry, and the natural environment with the onset of increased rates of coastal erosion, sea level rise, and frequency of severe coastal storms. Unfortunately, few coastal communities are aware of the potential impacts of existing coastal hazards on their economy, infrastructure, and natural environment, let alone, the projected impacts of accelerated sea level rise. Defining risk and vulnerability serve as the initial steps to improve the resilience of coastal communities.

In an effort to promote resiliency and engage coastal communities to develop and plan for coastal hazards and accelerated sea level rise, the New Jersey Coastal Management Office (NJ-CMO) has developed a protocol to define current and projected geographic areas at risk. This protocol is being tested on the tidal portion of the Delaware Bay, utilizing a raster overlay analysis and the Sea Level Affecting Marshes Model (SLAMM). By defining areas of geographic risk, the NJ-CMO will have the ability to identify vulnerable populations, infrastructure, and natural resources. Such information will provide the NJ-CMO the knowledge to develop local decision-support tools that will promote sustainable coastal development practices. Ultimately, it will have the ability to shape future planning on the federal, state, and local level and serve as a guide for the location of future infrastructure, conservation, and hazard mitigation efforts.

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RECOMMENDED DECISION-MAKING STRATEGIES FOR SAN FRANCISCO'S OCEANSIDE WAVE ENERGY PROJECT

Carmen Yeung*

The City and County of San Francisco (CCSF) employs a number of efficient and renewable energy technologies to achieve a series of ambitious goals: 1) generate 50 MW of in-city renewable energy, 2) reduce greenhouse gas emissions to 20% below 1990 levels by 2012, and 3) become carbon neutral by 2030. Guided by the goal to gradually displace existing fossil fuel generation with renewable energy technologies, CCSF is pursuing wave energy as a substantial portion of its energy portfolio and to prove whether wave energy is a viable option for an urban environment.

With stakeholder input and scientific information coming in, the city will need to employ a meaningful tool that will produce scenarios regarding how various stakeholders will be impacted depending on the location of the wave farm. By identifying potential conflicts in an early and orderly fashion, CCSF will be able to develop equitable solutions, with the assistance of an appropriate tool, and maintain public support of the wave energy project. My role is to evaluate and identify a tool that formalizes the stakeholder process and feedback. Furthermore to move this project forward, CCSF needs a Minerals Management Service lease and Federal Energy Regulatory Commission preliminary permit. I will also examine how CCSF can better prepare itself to obtain the necessary documentation.

This poster presents a case study on methods being used by and suggested solutions to CCSF's developing wave energy project; it addresses how CCSF can integrate science, stakeholder input, and management constraints, and overcome policy challenges.

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BERYLLIUM-7 ATMOSPHERIC DEPOSITION AND SEDIMENT INVENTORIES IN THE NEPONSET RIVER ESTUARY, MASSACHUSETTS, USA

Jun Zhu* and Curtis R. Olsen

Measured monthly atmospheric depositional fluxes of cosmogenically produced ^7Be ranged from 1 to 67 mBq/cm^2 in Boston, Massachusetts between September 2000 and August 2007. These fluxes exhibited seasonality and supported a decay-corrected ^7Be atmospheric depositional running inventory that ranged from 36 to 144 mBq/cm^2 . Annual ^7Be deposition exhibited an increasing trend that may reflect a general decrease in solar activity and a general increase in precipitation over the 7-year sampling period. To investigate short-term sediment dynamics and accumulation patterns in the Neponset River estuary, we collected six sediment cores in July 2006 and measured ^7Be sediment inventories ranging from 48 to 546 mBq/cm^2 . Comparisons of these sediment inventories with the ^7Be running inventory from atmospheric deposition (101 mBq/cm^2) at the time of core collection indicated a large degree of spatial heterogeneity in sediment accumulation patterns and its potential use as a tool for assessing the impacts of environmental restoration activities in estuarine environments.

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