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CLIMATE READY ESTUARIES: AN ADAPTATION TOOLKIT TO GET READY FOR A CHANGING CLIMATE

John W. Wilson, U.S. EPA

In the face of uncertain impacts from a changing climate, one thing is certain - coastal communities can expect to experience some of the most drastic repercussions including more severe coastal storms, habitat losses (coastal wetland inundation), and changes in water quality, salt-water intrusion, and ecosystem structure and function. Believing that it is critical to move forward in the face of these uncertainties, EPA's Climate Ready Estuaries (CRE) program has selected and deployed six estuary "pilots" to start planning and adapting for sea level rise and other impacts of climate change in their estuaries. The difficulties inherent in identifying vulnerabilities including socio-economic vulnerabilities, priority habitats of concern, or species that are likely to be impacted, and in turn, actions to adapt to those changes, can limit a community's willingness and ability to develop and implement a climate adaptation plan. However, the development and implementation of a robust climate adaptation plan can be guided by tools that include vulnerability studies, adaptation planning and implementation guidance, and natural capital valuation approaches. Working with these pilots, the EPA's CRE program is identifying and refining some of the critical tools necessary to develop and implement an adaptation plan. Using these tools, the CRE pilots are able to move beyond limitations resulting from existing uncertainties towards on-the-ground implementation. In this session, the pilot estuaries will share their experiences in identifying options, prioritizing actions, and going through the adaptation planning process – assessing vulnerability, understanding the value of what is at risk, and planning for change. Vulnerability studies from the pilots will be highlighted and innovative and applicable approaches for addressing a changing coastline and future will be described and garnered through audience participation to continue to define the right tools to do the job – to get our coasts Ready for climate change.

Moderator:
John W. Wilson
Climate Ready Estuaries, Co-lead
Coastal Management Branch
Office of Wetlands, Oceans and Watersheds (4504-T)
USEPA 1200 Pennsylvania Avenue, NW
Washington, DC 20460
wilson.john@epa.gov

Speaker #1 (This abstract was submitted and accepted separately)

CLIMATE CHANGE ADAPTATION IN A COASTAL NEW HAMPSHIRE WATERSHED: IMPROVING CULVERT INFRASTRUCTURE FOR INCREASED STORM FREQUENCY AND INTENSITY

Derek C. Sowers
Piscataqua Region Estuaries Partnership

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University of New Hampshire
131 Main Street
Durham, NH 03824
derek.sowers@unh.edu

Extreme precipitation events have increased in frequency and magnitude over the past two decades across the Northeastern United States. Global climate change models predict that this trend will continue over the next fifty to one hundred years regardless of future reductions in global greenhouse gas emissions. In addition, due to ongoing development, watersheds throughout the coastal zone are becoming increasingly altered by impervious surfaces (roads, roofs, parking lots, etc.). The combination of these changes means that many of the region's road-stream crossings will experience stormwater flows that they have not been designed to safely convey. Failures of culverts during peak flow events can lead to extensive damage to road infrastructure and property, severe degradation of aquatic habitat, and sometimes even loss of human life.

The Piscataqua Region Estuaries Partnership (PREP) is one of twenty-eight programs included in the U.S. Environmental Protection Agency (EPA) National Estuary Program. The EPA is developing climate change adaptation strategies through its "Climate Ready Estuaries" initiative. As part of this initiative, PREP convened a technical team to conduct a climate adaptation pilot project in the Oyster River watershed in southeastern New Hampshire. The project identified specific road/stream crossing culverts that are threatened with failure as a result of impacts from increasingly extreme storm events due to climate change, as well as from future hydrologic modifications due to watershed development. The intent of the project was to develop a practical adaptation strategy to proactively reduce negative climate change impacts on stream habitat and road infrastructure.

The study approach utilized geographic information system (GIS) watershed modeling techniques to examine the hydrologic impact of several climate change and land use scenarios on existing culvert infrastructure. Through the efforts of local project partners, all the major culverts in the watershed (110 culverts) were assessed and mapped with a standardized protocol. Data on culvert capacity, vegetation cover, slope, soils, permeability, roads, and land use were used to create a nested GIS model that calculates runoff volumes for the 24-hour, 25-year precipitation event for current and projected future precipitation patterns. For the model of future conditions, two build-out analyses were developed for the study watershed based on current zoning ordinance regulations: one that assumes full build-out based on existing patterns of development, and one that incorporates available Low Impact Development (LID) techniques. The Geophysical Fluid Dynamics Laboratory CM-2.1 climate model output was used as the basis to estimate mid-21st century storm event magnitudes and return intervals for the A1B and A1Fi global greenhouse gas emission scenarios developed by the Intergovernmental Panel on Climate Change.

Utilizing the model results, the project team is developing recommendations for culvert improvements based on risk, cost, and infrastructure lifespan considerations. Project results provide a specific climate adaptation plan strategy to local communities, evaluate the contribution of LID techniques in mitigating development impacts at the watershed scale, and provide a repeatable methodology for application to other coastal watersheds.

Speaker #2

ESTIMATING THE COSTS TO REPLACE LOST ECOLOGICAL SERVICES DUE TO SEA LEVEL RISE IN THE DELAWARE ESTUARY

Ann Shellenbarger Jones, Ph.D.
Senior Associate
Industrial Economics, Inc.
2067 Massachusetts Avenue
Cambridge, MA 02140
ajones@indecon.com

Coastal wetlands are potentially at risk from accelerated rates of sea-level rise, which could result in significant losses in ecological services in areas where migration or accretion are not sufficient to maintain current habitats. For several counties in the Delaware Estuary, we combine a marsh migration model (SLAMM), which uses elevation data and other local parameters to evaluate wetland impacts, with habitat equivalency analysis (HEA), which enables the comparison of habitat types based on relative ecological values and allows for the use of discounting to appropriately value future losses. We will present model results from both phases: habitat change on a decadal scale using SLAMM and estimated costs to replace lost ecological services using HEA. The results will be used to inform adaptation planning efforts in the estuary.

Ann Shellenbarger Jones is a Senior Associate at Industrial Economics in Cambridge, where she concentrates on natural resource damage assessment and restoration and valuation of ecological services in various habitats. For the Climate Change Science Program Synthesis and Assessment Product 4.1 (Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region), Dr. Shellenbarger Jones served as lead author for Chapter 5 (Vulnerable Species) and lead or supporting author for various appendices and supporting documents describing key habitats and potential impacts of sea level rise.

Speaker #3

RESPONDING TO RISING TIDES: VULNERABILITY ASSESSMENT AND POLICY RESPONSE TO SEA LEVEL RISE IN SAN FRANCISCO BAY

Steve Goldbeck, Deputy Director
Climate Change & Legislation
San Francisco Bay Conservation & Development Commission
50 California Street, Suite 2600
San Francisco, California 94111

steveg@bcdc.ca.gov

Global climate change will result in intensification of sea level rise. The low-lying and highly urbanized San Francisco Bay Area is highly vulnerable to sea level rise. The San Francisco Bay Conservation and Development Commission (BCDC) has used a scenario approach to evaluate the vulnerability of the region to sea level rise and determined that hundreds of acres and billions of dollars of development will be subject to flooding and inundation. The remaining wetlands, hemmed in by upland development and hampered by dwindling sediment supplies, face potential drowning. BCDC has prepared amendments to its Bay Plan policies, which guide its planning and regulatory program for the Bay, to address the emerging threat to the Bay's natural and developed shoreline.