A Final Report on the Integrated Socio-Ecological Research and Collaborative Learning to Promote Marsh and Community Resilience Study

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Executive Summary

The Deal Island Marsh and Community Project (DIMCP), is an ongoing collaborative effort among scientists, environmental managers, and local community members to improve resilience of the Deal Island Peninsula area communities and marsh habitats to climate change impacts and associated threats.

Between 2012-2015, DIMCP stakeholders engaged in collaborative learning activities supported by the National Oceanic and Atmospheric Administration's (NOAA) National Estuarine Research Reserve System Science Collaborative. The project developed a process for facilitating effective restoration and adaptation strategies for the Deal Island Peninsula area. An important component of this research was to learn how to integrate local experiential knowledge and scientific research in ways that foster true collaboration, and to determine how to sustain this collaboration over time through the development of a bridging organization (DIMCP) that makes communities and marshes more resilient to climate change impacts. The following is a summary of the science collaborative activities and research initiatives completed through NOAA's sponsorship of the project.

Collaborative Science:

This component of the DIMCP was conducted using collaborative learning methodology through workshops, community conversations, youth interviews, field tours, and booths at the annual Skipjack Festival. Within this framework, we established and conducted research through three Collaborative Research Projects (CRPs) covering the topics of marsh restoration, heritage, and flooding and shoreline erosion. Each CRP was guide by the following goals:

- ***Marsh Restoration CRP:*** to better understand, improve, research, and implement marsh restoration, conservation, creation, facilitated migration, and management on the marshes and the fringing uplands that may transition to marsh of the Deal Island Peninsula area.
- ***Heritage CRP:*** to expand ongoing research focused on maritime heritage (i.e., skipjacks, the sail powered oyster dredge boats, which are now very rare) to include socio-cultural traditions, practices and places (e.g., marshes) as part of the at-risk heritage in the area.

- ***Flooding and Shoreline Erosion CRP:*** to better understand impacts of periodic and infrequent severe flooding, to learn about preventative practices, and to develop community visioning for future strategic planning.

Key Findings and Next Steps:

- Development of a diverse network of community, state and federal agency, academic, and non-governmental organization stakeholders
- Creation of an open and inclusive space for stakeholder engagement
- Shared commitment to reduce vulnerability and enhance resiliency
- Established agreement on next steps: to conduct an Integrated Coastal Resilience Assessment (ICRA) of the Deal Island Peninsula area to better understand the benefits and limitations of adaptation and restoration strategies

Applied Research:

The applied science component of the project's science collaborative activities included integrated disciplinary studies in the fields of anthropology, economics, and ecology.

Anthropology:

Anthropology research was used to investigate understandings of vulnerability and resilience on the Deal Island Peninsula area, as well as to support the overall collaborative learning and science objectives of the DIMCP (see economics research below for more details). Research was guided by ethnographic methods, semi-structured interviews, pile-sorting, and prioritization analysis.

Key resiliencies and vulnerabilities identified through research include the following. The list of identified vulnerabilities also includes DIMCP stakeholders' top five ranked vulnerabilities, indicated in bolded text:

Resiliencies:

- Adaptability to change
- Can handle low flooding
- Crab fishery
- Ethic of cooperation
- Places nearby to go in storms
- Protected shorelines
- Protection provided by marsh
- Self-reliance
- Steadiness of environment
- Strong attachment to place

Vulnerabilities (& Vulnerability Rankings):

- **Changing demographics Deny vulnerability (1st/2nd tie)**
- **Distant management and governance (4th/5th tie)**
- **Erosion (3rd)**
- Isolation
- Low-lying buildings
- **Rising sea-level/rising tides (1st/2nd tie)**
- Saltwater intrusion
- **Storms (4th/5th tie)**
- Weak economics

Key findings and Next Steps:

- Vulnerability and resilience exist in both physical features and non-tangible socio-cultural features and/or conditions of the Deal Island Peninsula area.
- Attention to these different forms of vulnerability and resilience needs to be integral to the future ICRA activities.
- There are two conceptual divides that need to be addressed in future work:
    - Divergent perceptions between local community members and environmental managers on the necessity of climate change planning
    - Divergent perceptions between local and non-local stakeholders of local community vulnerabilities, leading to potential barriers to building resilience

Socio-ecological Economics:

The economics study was guided by two primary objectives: 1) to identify stakeholder values for socio-ecological services and assess priorities for sustaining or trading off benefits; and 2) to advance methodology for incorporating a broad range of socio-ecological services in decision making and economic valuation. Research was conducted using Q-methodology, a social science research method to systematically analyze diverse viewpoints on a topic, in concert with ethnographic field methods and small and large group discussions.

Key Findings and Next Steps:

- The Q methodology identified three distinct perspectives that represented roughly a spectrum from high scores on the least tangible benefits of marshes (*Ecological sustainability emphasis*) to high scores on the most direct benefits (*Community livelihood emphasis*). In between these two end-member perspectives was a group that balanced tangible and intangible benefits (*Balanced*). Stakeholder groups (residents, academic/NGO researchers, and government officials) were distributed broadly on this spectrum. Across all perspectives stakeholders were remarkably consistent in ranking long-term marsh system vitality at or near the top. Further, The Q methodology revealed that the collaborative learning process caused the goals of stakeholders to align to some extent, in large part due to researchers raising their scores on services of most concern to local residents.
- *DIMCP Policy and Management Implications:* The Q-methodology was useful for exploring values, while still retaining the variety of individual perspectives needed to design resilience strategies acceptable to diverse stakeholders.
- *Research Implications:* We found the primary advantage of using Q methodology was the ability to provide a quantitative interpretation of qualitative preference information in a time efficient manner. Further, Q-Methodology helped strengthen Ecosystem Service Valuation in three ways:
    - Using stakeholder input to develop statements for Q-methodology ranking makes statements more understandable and resonant for respondents.
    - Identifying and comparing distinct social perspectives gives economic researchers a better understanding of key differences and commonalities to incorporate in survey design.

- Findings will be published in a forthcoming manuscript on methodological insights and lessons learned that will promote ongoing learning from the DIMCP. Insights from research are also being applied to a new stakeholder effort examining oyster restoration and harvest policy in the Little Choptank area of the Bay.

Ecological Research:

Ecological research focused on the hydrological restoration of ditch-drained marshes. Marsh ditching on the Deal Island Peninsula area began in the 1930s as a way to mitigate mosquitoes and facilitate salt hay harvesting. However, a subset of stakeholders believed that these ditches may be harming the marsh and that the restoration of natural hydrology through ditch-plugging could improve the habitat quality of these systems and make them more resilient to sea-level rise.

Fieldwork was conducted at seven sites (five on Deal Island, MD and two at E.A. Vaughn Wildlife Management Area), which include three pairs of ditched and unditched marshes, and a reference unditched marsh. Data were collected on six key variables: Vegetation (species variability and cover); Mosquito and nekton (mosquito larval presence, density, and species counts; nekton count); Soil (horizonation; dry bulk density; organic carbon and nitrogen content; rubbed fiber content); Hydrology (water levels; water pressure; sedimentation); Elevation change dynamics; and Methane gas emissions.

Key Findings and Next Steps:

- We found overall low rates of mosquito production in marsh habitats, likely due to high fish predation, indicating that effects of ditch-drained marsh restoration on mosquito production are likely to be small relative to production rates in adjacent forested ecosystems.
- Researchers will collect a second year of post-restoration data with funding received from the University of Maryland in 2015 to determine whether plugging has any positive or negative effectives on the marsh system.
- CBNERR- MD will be using the outcome from the restoration monitoring to determine if ditch plugging is a viable best management practice for returning the marshes to a more natural state. If it proves to be viable, other sites on the Peninsula will be considered for restoration with input from DIMCP stakeholders. If plugging shows to have a negative effect, researchers will recommend plug removal.
- CBNERR-MD will monitor elevation change over the long-term to see if the marshes are able to build peat fast enough to keep pace with sea-level rise.

Retrospective:

- We faced challenging management issues because the project differed from past projects conducted by various stakeholder groups, forcing everyone to simultaneously adapt their standard habits to fit the project. Through these challenges we learned that the resilience of a project itself is a challenging goal,

and establishing and increasing its resilience should be a key component of project activities.

- One skill set that was missing was expertise in social network analysis to better assess the impact of project network development. This is an gap that the DIMCP will fill in future work on the ICRA by having Dr. Christina Prell, a sociologist who specializes in social network analysis, join our project team.
- For future work, additional resources will help support local community member engagement, many who have unique skills, such as detailed knowledge of the history of the area and in-depth understanding of local cultural beliefs, value and religion.
- We succeeded at our goal of establishing a collaborative network of stakeholders, but we did not appreciate at the beginning of the project that this network would present us with a new set of research questions about how to undertake collaborative science and learning to advance understanding of socio-ecological resilience to climate change and serve as a platform for intervention activities.
- An additional lesson learned was that some of strongest collaborative learning occurred during the planning and writing of funding proposals, even though we hadn't planned on this as a key project activity.
- The Collaborative Research Projects (CRPs) were an important innovation in our project, but in hindsight we could have increased their funding and administrative support so that their activities could have produced more substantive findings. It may also have been better if the CRPs replaced some of the discipline-based research the project undertook. As the project move forward, we may consider having the CRPs as the principal research vehicle for the project.