Mapping and Evaluating Zones of Dynamic Coastal Influence and Coastal Wetlands Along the Lower Peninsula of Michigan

Final Project
Narrative

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Submitted by:

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Final Project Narrative

1. **Project Title:** Mapping and Evaluating Zones of Dynamic Coastal Influence and Coastal Wetlands Along the Lower Peninsula of Michigan
2. **Grantee (Organization) Name:** University of Michigan
3. **Project Number:** 16-Climate-003
4. **Grantee Project Contact Information (for further information about approach/outcomes):**
    a. **Name:** Dr. Richard Norton
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5. **List of Coastal Counties or region affected by project:**
   All coastal counties in the Lower Peninsula of Michigan: Alcona, Allegan, Alpena, Antrim, Arenac, Bay, Benzie, Berrien, Charlevoix, Cheboygan, Emmet, Grand Traverse, Huron, Iosco, Leelanau, Macomb, Manistee, Mason, Monroe, Muskegon, Oceana, Ottawa, Presque Isle, Saginaw, Sanilac, St. Clair, Tuscola, Van Buren, Wayne.
6. **Start date and end date of project:** May 1, 2017 to July 31, 2018
7. **Final Grant amount expended ($):** $126,000
8. **Final Match amount provided ($):** $126,000
9. **"Project-at-a-Glance" Summary - Explain project outcomes and how the project advanced local coastal management efforts, in approximately 200 words or less. Include information on the "who", "what," "when," "where," and "why":**
   Given the importance of coastal wetlands to the State of Michigan, and increasing threats to their vitality, the overall goals of the *Mapping and Evaluating Zones of Dynamic Coastal Influence and Coastal Wetlands along the Lower Peninsula of Michigan* project were to:

   (1) Apply various analytical and mapping methods to generate data layers for use by local governments and others by mapping the Lower Peninsula Great Lakes shorelines for the State of Michigan.
   (2) Evaluate the implications of the data mapped for local decision-making purposes (e.g., clarifying distinctions that might be drawn between lands inundated generally and wetlands hydrologically connected through inundation), and how those data and that knowledge can best be integrated into the ongoing work with regional planning entities and local governments along the Great Lakes to improve local community planning for enhanced resilience.

   The project deliverables are designed to help inform local officials of land areas influenced by Great Lakes waters, and also to build the motivation needed to holistically address wetland management. Local government planners might use the data layers produced by this project to improve their shoreland management efforts by, for example, adopting policies that restrict development in land areas influenced by Great Lakes waters and/or inventorying coastal wetlands as part of wider economic development, recreational, or other community plans.
10. **Provide a more detailed narrative section addressing the following:**
    a. **Description of how the project promotes wise management of the cultural and natural resources of Michigan's Great Lakes coast:**
    Great Lakes coastal wetlands, some of the most biologically diverse ecosystems in Michigan, are crucial to the health of the Great Lakes basin as a whole. Great Lakes coastal wetlands serve as spawning and nesting habitat for a variety of animals, help maintain water quality, aid in preventing erosion along exposed shorelines, and offer tremendous opportunities for tourism and recreational use. Since European settlement, Michigan has lost about 50% of its coastal wetlands to human development. Michigan's remaining wetlands are at continued risk from

ongoing development pressures and, increasingly, the effects of fluctuating lake water levels combined with increased storminess from climate change. Yet many local governments in Michigan lack the tools, commitment, capacity, or political motivation required to adequately identify and protect coastal areas and coastal wetlands. The analyses and data developed through this grant are designed to help local governments improve their shoreland management efforts (and therefore the management of coastal wetlands) by facilitating and promoting data-informed municipal land management policies.

b.   Description of how the project further advanced a CZM Program focus area(s):
The research team has been working with the CZM Program to advance its Great Lakes coastal wetlands management strategy by field testing site conditions against currently available data on nearshore elevations, bathymetry, LiDAR, wetlands, and related natural resources. It has also been working to develop protocols for measuring on a county-by-county basis lake water level fluctuations and total storm surge (i.e., data more precise and tailored than currently available lake-wide data, generated for selected counties). Through that work, the research team developed methods specifically for mapping: (1) zones of dynamic coastal influence (ZDCIs); and (2) land areas (including wetlands) that are hydrologically connected to—because they are periodically inundated by—Great Lakes waters during periods of average, high, and surge standing lake water levels. The work for this grant built upon these previously developed methods to map the Great Lakes shorelines for the State of Michigan, including generating county-by-county lake water level and total surge estimates for shorelines not yet evaluated (primarily large bays like Saginaw Bay). In addition, the project team generated data layers showing wetlands hydrologically connected by inundation to Great Lakes waters during average, high, and surge-water periods, as well as other ZDCIs. These data layers are now incorporated into the Great Lakes Aquatic Habitat Framework (GLAHF) website, and the data are available to the public as downloadable GIS files and through an on-line visualization tool.

c.   Description of the benefits of the project:
This project is beneficial by providing improved information on where wetlands in Michigan's Lower Peninsula are hydrologically connected to Great Lakes waters. It is also beneficial for assessing the various land areas in Michigan's Lower Peninsula that are periodically inundated by Great Lakes water. These data and knowledge augment ongoing coastal management efforts in a number of ways. As one example, the produced data layers can be used by local governments and others for local decision-making purposes (e.g., to clarify distinctions between lands inundated generally and wetlands hydrologically connected through inundation).

d.   Description of successful challenges; lessons learned:
As can be anticipated, coordinating project efforts and final report documents across the various academic institutions and fields was at times challenging. In order to produce the final project outcomes, the project team spent considerable time thinking through the various research, analytical, and community engagement lenses involved, and in that process iteratively evaluating how the work we were conducting could help address our larger research questions. We learned that it is vitally important to clearly communicate methodologies, to develop data-sharing standards (and to share data frequently), and to regularly update others on progress made.

Some of the sub-team challenges included: (1) requiring several iterations of analyses within the complex large bays in order to achieve reasonable, expected, and extreme water elevation predictions; (2) overcoming DEM data limitations by developing an automated algorithm to modify DEM data sets to account for bridges and culverts, where hydrologic connectivity continues despite infrastructure development; and (3) developing an on-line

visualization tool (i.e., the Coastal Wetlands Explorer) that displays our generated data layers in an accessible and helpful way to local officials and others.

e.   **Description of the next steps and/or recommendations stemming from the project:**
The data layers and maps created by this project will immediately be used in ongoing work with regional planning entities and local governments along the Great Lakes to improve local community planning for enhanced resilience. This use will test the accessibility and applicability of the Coastal Wetlands Explorer for local planners, and provide valuable feedback on ways to improve the visualization tool.

In addition, further verification of predicted extreme elevation values (500-year storm) could be verified along both the open coastlines as well as throughout the large bays of Michigan's shorelines. Throughout our continued efforts in developing resilient coastal communities, we will take every available opportunity to acquire this comparison data.

Other potential next steps include comparing predictions of hydrologic connectivity with historical measurements from other researchers in order to evaluate our hydrologic connectivity predictions with field observations. The team will evaluate the potential to make these comparisons in the future.

Lastly, pending funding availability, the team stands ready to apply the connectivity modeling algorithm to Michigan's Upper Peninsula and other regions of the Great Lakes.

11. **Required logos and view disclaimer as provided in footer below (update to reflect "grantee" name):**
The required logos and disclaimer are provided on the cover page for this project narrative.

12. **Quote from the Grantee Perspective (or local project partner) regarding how project enhances local coastal zone management for potential use in outreach publication (e.g., CZM Coastal Note):**
Coastal wetlands are of special concern because they offer many valuable ecosystem services. Our data layers and maps will help local officials understand where coastal wetlands are located and when they are directly connected to Great Lakes waters under varying lake water levels and storminess conditions. Local governments might use these data layers and maps to improve their shoreland management efforts by, for example, adopting policies that direct development away from wetland areas influenced by Great Lakes waters, or inventorying coastal wetlands as part of wider economic development, recreational, or other community plans.

13. **If available, include your organization's logo:**