

Quantifying the Value of Delaware's Tidal Wetland Ecosystem to Facilitate Protection and Acquisition

A Response to NOAA's Coastal Services Center
Announcement for a Coastal Management Fellowship

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Prepared by the Delaware Coastal Programs

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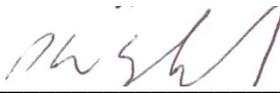
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INTRODUCTION

This document represents the Delaware Coastal Programs (DCP) response to NOAA's Coastal Services Center's (CSC) September 2013 request for project proposals for Coastal Management Fellowships. It outlines a project proposal from the DCP, which includes the Delaware Coastal Management Program and the Delaware National Estuarine Research Reserve (DNERR) that addresses the critical need to quantify the ecosystem value of tidal wetlands in the State of Delaware to aid in their protection and acquisition. This project will directly address NOAA's strategic focus area of Vibrant and Sustainable Coastal Economies. Primarily the sub-area to: *“Understand, quantify, visualize, and communicate ecosystem services of key natural areas along the coasts to inform decision-making.”* In addition the sub-areas of *“Assist coastal decision makers in conserving active and passive recreational uses and in preparing for existing and emerging coastal and ocean uses by providing socioeconomic data, information, visualizations, technical assistance, funding and tools”* and *“Build capacity of coastal states and communities to foster ecologically sustainable economic development and activities.”* Finally this project will also address the Healthy Coastal Ecosystems focus to *“Enable conservation and restoration of critical coastal ecosystem habitat by integrating priorities and interests across agencies and partner organization using geospatial applications to align interests, communicate priorities and pool resources.”*

The recently completed DCP Sea Level Rise Vulnerability Assessment for the State of Delaware showed that the State's tidal wetlands will be severely impacted by sea level rise. If wetlands cannot accrete in elevation to keep pace with accelerated sea level rise vast areas of marshes could drown and convert to open water, as already being seen at several places throughout the state including Bombay Hook National Wildlife Refuge. At the same time wetland losses from coastal erosion along the Delaware Bay shoreline has averaged 16 acres a year from 1992 to 2007. Delaware's tidal wetlands provide essential spawning, foraging, and nesting habitat for fish, birds, and other wildlife. The Delaware Bay tidal wetlands are an integral resting and foraging component of the North Atlantic waterfowl flyway and for migratory shorebirds on their travels from South America to the Arctic. They improve the water quality by filtering contaminants, nutrients, and suspended sediments, and support important fin-fisheries and shell-fisheries industries. Tidal wetlands sequester more carbon than other types of habitat in the Delaware Bay watershed and also provide a first line of defense against storm surges and coastal flooding. This resource likely provides more ecosystem services than any other habitat type in the watershed, but to leverage funds and support to protect them, the value of these services must be accurately quantified.

The Delaware Coastal Programs has just completed a year-long evaluation of the program's expertise, resources and needs of the State to direct the focus of the program for the next five years. Tidal wetlands was the highest priority identified through this effort, being fully supported not only by other programs within the Department of Natural Resources and Environmental Control (DNREC), but many outside organizations including both local National Estuary Programs (the Delaware Estuary and Inland Bays) and several local NGOs. It is widely understood that tidal wetlands are critical to the economy and are a great natural resource of the State of Delaware. Their protection and conservation is essential to sustain the many ecosystem services that they provide. To insure that Delaware continues to have viable tidal wetlands, investments in their protection and in the acquisition of adjacent lands for migration must be made. However, in the current economy, funds for tidal wetland protection and acquisition must compete with many other important issues. The ecosystem services tidal wetlands provide must be clearly shown in ways that the public and decision-makers can relate; number of jobs

provided from specific wetland activities, value of catches of wetland dependent species, the cost of providing alternative protection from storm surges as examples.

As part of the ecosystem services analysis a second level of examination must also be done to look at the quantities and qualities of the wetlands based on their unique characteristics that support the specific services; are some unique tidal wetlands limited to a small geographical area? are these unique types in imminent danger of loss? what is the critical area of certain unique wetlands needed to sustain a particular service? These are all important questions that need answers to truly understand the value of tidal wetlands. With this understanding, and knowing that the state's tidal wetlands will be severely impacted by sea level rise, which through an executive order the Governor has directed state agencies to prepare and accommodate for, DNREC and other agencies can properly target conservation and acquisition efforts to protect this valuable resource into the future.

While there have been studies in the past of the ecosystem values of wetlands, including three recent Delaware Bay based reports, they have all lacked the specificity to truly quantify the value of specific tidal wetlands services. These reports have either not separated tidal from non-tidal wetlands, estimated services on a watershed scale, ignored many of the hard to quantify social ecosystem services or used limited information from other areas of the country to estimate local values. To compete for funding or legislative initiatives the value of the ecosystem services must be specific to tidal wetlands, based on local information, include non-market valuations and must be defensible.

Through this fellowship project and ongoing efforts of the DCP, informed decisions will be able to be made on investments for tidal wetlands. There will always be limited resources so it is of upmost importance that sufficient funds and efforts be allocated to tidal wetland protection and that these activities are targeted where most needed. The key to accomplishing this is irrefutable numbers on the economic value of the wetland services and the related impacts on the economy from the loss of these services.

GOALS & OBJECTIVES

The goal of this project is to quantify the economic value of Delaware's tidal wetlands and their importance to the region and identify areas of specific wetland characteristics based on the ecosystem service they provide, in order to effectively campaign for wetland protection and acquisition through defensible data that show any cost of investment is overshadowed by the potential impacts to the State's economy from the loss of these services.

The main objectives of the project will be to:

- Review and compile existing information on specific tidal wetland ecosystem services.
- Identify ecosystem services not adequately captured for Delaware in existing studies.
- Quantify the ecosystem services value of wetland regions not adequately understood.
- Determine the impact of individual and cumulative tidal wetland services on the region's economy.
- Locate specific wetland areas in the state that provide unique and/or highly valuable services to the region which are critically important and need upmost protection.
- Develop outreach material and methods to effectively communicate the importance of the tidal wetlands.
- Identify research opportunities to augment existing data.

MILESTONES & OUTCOMES

The following milestones and outcomes have been developed to provide a general timeline and schedule for the project tasks and coastal fellow responsibilities. The Fellow's responsibilities are divided into five (5) major tasks, each of which are considered a significant milestone and have a product or anticipated outcome. The Fellow will lead on several tasks, and serve as part of the support team on others. The project team has a broad range of expertise that provides some level of flexibility to tailor the Fellow's work plan to maximize their individual strengths and expertise. The tasks and deliverables are described in more detail in the project description section of this proposal.

Overview of the Project:

Task 1 – Review, compile and augment existing information on specific tidal wetland ecosystem services.

Deliverables:

- A detailed list and review of existing ecosystem studies in the region or applicable to the state.
- Identification of areas where the existing data is non-existent, lacking specificity, or not defensible.
- Literature review of existing research and information of services identified as lacking or not defensible.
- Development of a process to quantify ecosystem services values using existing models, methods or variations of each.

Task 2 – Determination of ecosystem services values of tidal wetlands and the impact on the economy of individual and cumulative tidal wetland ecosystem services

Deliverables:

- Compilation of information and data gathered from regional experts and stakeholders needed implement process identified in Task 1.
- Determination of ecosystem services value with detailed outline of methods and process used to determine the value.
- An interim report that details the descriptions of specific ecosystem services and their value.

Task 3 – Determine locations and areas of tidal wetlands that have unique characteristics for specific ecosystem services and acreages needed to sustain the service.

Deliverables:

- GIS layers showing locations of tidal wetlands that are associated with particular services.
- Determination of minimum areas (aggregate and/or individual) to sustain particular ecosystem services.

Task 4 - Identify research opportunities to augment existing datasets and identify target areas for tidal wetland protection/acquisition.

Deliverables:

- GIS layers identifying tidal wetlands that are critical for protection and potential acquisition areas to allow for tidal wetland migration; and
- A report documenting where additional research is required to fill identified gaps in or to further bolster ecosystem service values.

Task 5 – Final report and development of outreach material and methods to effectively communicate the importance of the tidal wetlands.

Deliverables:

- Final report on tidal wetland ecosystem services for Delaware including economic impact and/or value of individual and cumulative ecosystem services.
- Information brochures (2-8 pages) for public, legislative and stakeholder groups.
- Presentations to stakeholder and decision makers.

Timeline:

	Year 1				Year 2			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q
Task 1								
Task 2								
Task 3								
Task 4								
Task 5								

PROJECT DESCRIPTION

Task 1 – Review, compile and augment existing information on specific tidal wetland ecosystem services.

Task 1 will entail the review of existing tidal wetland ecosystem services information for the region and nationally. Particular scrutiny will be given to three existing local reports and the weaknesses of each, including their generalizations, non-tidal wetland specific assumptions and lack of examining all services. An intense literature review of other existing applicable research will take place to examine methods used in other studies and data needed to quantify the ecosystem service. A matrix will be developed to indicate services, data requirements, data availability, and if values currently exist. Finally, results of this review and matrix will be used to develop procedures to be used for Delaware based on the ecosystem service being examined.

The Fellow will consult on this task with staff from the Wetlands Assessment Section of DNREC, the Research Director for the Partnership for the Delaware Estuary, and the Delaware Water Resources Agency, the groups responsible for the three aforementioned studies. The Fellow will be encouraged to contact other researchers familiar with the data and methods. Staff from the Delaware Coastal program will assist in the process and provide access to University of Delaware Library and Journal collections.

Task 2 – Determination of ecosystem services values of tidal wetlands and the impact on the economy of individual and cumulative tidal wetland ecosystem services.

Task 2 will involve meetings and workshop(s) with local and regional stakeholders to insure all services are captured and the Task 1 matrix is complete. Part of these or subsequent meetings and workshops will be the collection of data to be used in determining the values of the services and any specific traits that geographically narrow the locations of these services. Based on the methods and procedures developed in Task 1, values of the ecosystem service will be determined. The services will also be examined to determine if there are and cumulative impacts of the services (i.e. will a change in one service increase or decrease the value of another service) Qualitative descriptions and background information will be written up for each ecosystem service to be used in outreach materials and other reports.

The DCP has vast experience in holding these types of workshops and meetings and will provide the logistics and facilitation support for the information collection phase of the project. When necessary the Fellow can draw on the knowledge of other DNREC personnel in their areas of expertise. DCP will also assist in identifying contacts outside the Department at local to federal government levels, local universities, NGO's and individual stakeholders.

The DCP has secured the commitment of Dr. George Parsons, University of Delaware Professor specializing in environmental economics to advise the fellow for economic analysis portions of the proposal. Dr. Parsons has performed similar ecosystem services valuations and understands the importance of this project to Delaware.

Task 3 - Determine locations and areas of tidal wetlands that have unique characteristics for specific ecosystem services and acreages needed to sustain the service.

Task 3 will coincide with most of the data collection and characterizations in Task 2. GIS maps will be created locating specific tidal wetlands based on the ecosystem service they provide. It is assumed that some of the services will be based on specific traits (ex, salinity, vegetation, etc.). Minimum size of areas needed to sustain the service (ex. minimum non-fragmented acres required to support bird habitat needed for tourism) will also be examined.

The State of Delaware has an extensive GIS data portfolio available to the Fellow which will contain much of the base information needed. The Fellow will also work with wildlife managers and other biologist in determining critical habitat acreages. Several DCP staff are highly trained in GIS and will assist in analysis of the existing data and/or supplementing the data sets to develop new GIS layers that are applicable to this project. Depending on project progression, Fellow workload and GIS expertise, DCP staff may take the lead on developing the maps based on the Fellow's criteria.

Task 4 - Identify research opportunities to augment existing datasets and identify target areas for tidal wetland protection/acquisition.

Task 4 will be ongoing for the project once the initial literature review is completed. As knowledge of a specific ecosystem service are discovered to be not existent, or in need of additional information, methods to obtain the information will be developed. This may involve in-house research projects or contracting with others to obtain the information. In addition through the process, especially while working with the geospatial data, tidal wetlands of critical importance, due to their unique characteristics or danger of loss will be identified and mapped. Areas of potential acquisition to allow for migration and/or upland protection will also be identified. These will be catalogued based on services provided, danger of loss, and potential for successful acquisition. Guidelines will also be developed to be used in site selection for land acquisition to protect tidal wetlands.

The Fellow will work with the DNERR Research Coordinator in identifying potential research projects, and if desired, assisting in design and implementation of some of these projects. DCP staff will assume the lead in analyzing the geo-spatial data as needed to develop the protection and acquisition maps with assistance from the Fellow. The Fellow will work with DCP planning staff to develop the guidelines.

Task 5 - Final ecosystems service value report and development of outreach material and methods to effectively communicate the importance of the tidal wetlands.

Task 5 will be the in-depth economic impact analysis of the ecosystem services on the state's economy. Each service will be examined individually to quantify the value of the service based on the area of specific tidal wetland with the required characteristics. The consequences of incremental wetland loss on the ecosystem service and the repercussions on the state's economy will be examined. The final report will combine the information of the interim report on individual ecosystem value coupled with the areas of the wetlands that provide the service and the impacts on the economy. The report should be easily separated into key sections to be used to address target audiences or individual ecosystem services. Finally, the report should include cost benefit analyses of potential investment/protection scenarios.

The Fellow will have substantial support from DCP staff as needed to complete this task; however the Fellow should have a strong economic background to understand the implications of the ecosystem services on Delaware's economy.

Task 5 will also involve the creation of various types of outreach material to be used to inform stakeholders and decision makers of the results of the project. These materials will be individually designed for the particular audience. They will range from 2-8 page handouts to complete peer-reviewed documents. In addition presentations will be developed to relay the information for audiences ranging from the general public to scientific forums.

The Fellow will work closely with the DNERR Coastal Training Program Coordinator to develop outreach materials and events. Some of these events will include the University of Delaware Sea Grant "Coast Day" event, the DNREC Wetlands Conference and the Partnership for the Delaware Estuary's Bi-annual Science and Research Symposium. The most important outreach material the Fellow will compile is the final report.

FELLOW MENTORING

This is a multi-year project with challenging tasks that cannot be met by an individual effort. It will require a team of individuals with varying management and technical backgrounds. From joining the project to completion of the Fellowship term, the Fellow will be fully integrated into this project as part of the leadership team. The DCP team for this project has extensive experience to carry out each phase of this project, providing the Fellow an opportunity to work very closely with professionals with various types of specialized expertise. The Fellow will be one of the individuals that is crucial to the successful completion of the project. The Fellow will take on a lead role and increasing project responsibility as they gain experience and confidence through the peer to peer mentoring activities with the project team.

The Fellow will be under the primary supervision of the Delaware Coastal Programs' Environmental Program Manager II, but will work very closely with staff from both the DCP and the DNERR. The Fellow will be mentored by Bonnie Arvay, an Environmental Scientist in the DCP and a former CSC Fellow. The Fellow will be located in the DCP offices, and have access to facilities available at the DNERR. The Project Team and percent of their staff time dedicated to this project is outlined below:

- Coastal Management Fellow (100%)
- Robert W. Scarborough, Ph.D., DCP Environmental Program Manager II (25%)
- Bonnie Arvay, Environmental Scientist (50%)
- Lyndie Hice-Dunton, DNERR Research Coordinator (25%)
- Kelly Valencik, Coastal Training Program Coordinator (25%)
- Christina Pinkerton., Environmental Scientist (25%)
- Drexel Siok, Environmental Scientist (25%)
- Carl Yetter, Environmental Engineer, (25%)
- Tricia Arndt, Environmental Scientist, (10%)

The Fellow will be an integral part of this team of coastal management and technical professionals, and will never be left without the guidance, assistance, and leadership of a team member. This team integration approach will ensure that the Fellow receives the maximum concentration of educational and professional development opportunity possible while gaining valuable experience on the varying aspects of coastal management.

PROJECT PARTNERS

The project partners listed below each have communicated interest and support in this tidal wetlands ecosystems services project. They also have a vested interest in the high quality data that this project will provide. All have agreed to participate in the project and provide the data and technical support to make the project a success.

- Delaware Department of Natural Resources and Environmental Control
 - Office of the Secretary
 - Delaware Coastal Programs
 - Delaware Coastal Management Programs
 - Delaware National Estuarine Research Reserve
 - Division of Watershed Stewardship
 - Watershed Assessment
 - Division of Fish and Wildlife
 - Division of Water
 - Wetlands and Sub-aqueous Lands
- Partnership for the Delaware Estuary
- University of Delaware
 - College of Earth, Ocean , and the Environment
 - School of Marine Science and Policy
 - Water Resources Agency

COST SHARE

The Delaware Coastal Management Program will provide a furnished office along with the core group of DCP staff assigned to the project. This will also include a personal computer with office software (Microsoft Office), ArcGIS Software, and other software as needed. The Fellow will also have full State e-mail and internet e-mail capabilities, access to all DNREC and DCP network data drives, and will have access to a shared laptop. The Fellow will also be provided any economic modeling software programs deemed necessary for completion of the project. The DCP will provide boats for field surveys and site inspections and other project equipment as needed. All work transportation will be provided and state vehicles will be available for all project work activities as needed.

In addition, the DCP will provide funds and materials for all workshops & symposiums required for the project, funding for any necessary training, as well as printing, photocopying, mailing, and incidental costs for project interim products. Funds are also available for travel to professional conferences or meetings in which the project aspects are presented and for project related training. Other funds will also be available for the dataset acquisition and other supplemental research that may be part of this project.

The DCP will provide the \$15,000 Fellowship match through State funds. This will be paid in \$7,500 per year installments.