

Coastal Land Conservation in Maryland: Targeting Tools and Techniques for
Sea Level Rise Adaptation and Response

Submitted to:

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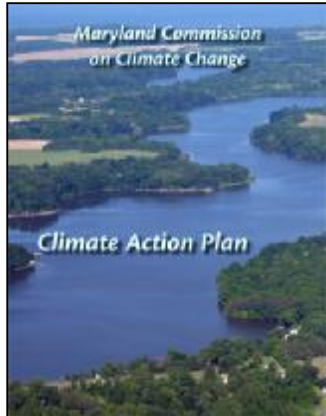
October 22, 2008



Background and Introduction

Sea level rise rates along Maryland's coastline are nearly twice those of the global average. Sea level has risen approximately one foot in the last century and is expected to rise another 2–4 feet by the year 2100¹. Sea level rise impacts coastal areas by exacerbating coastal flooding, influencing shoreline erosion, and submerging tidal wetlands and other low-lying lands. Such impacts pose a significant threat to the steep cliffs, wetlands and marshes, tidal estuaries, sandy beaches, and barrier islands that comprise Maryland's coastal environment.

By Executive Order in April, 2007, Maryland's Governor, Martin O'Malley, established the Maryland Commission on Climate Change. Through a stakeholder-based process, the Commission published Maryland's Climate Action Plan in August 2008.



Two of the priority policy recommendations identified by the Adaptation and Response Working Group of the Commission indicate a need for natural resources protection in the face of sea level rise. These recommendations are:

- Identify high priority protection areas and strategically and cost-effectively direct protection and restoration activities, and
- Develop and implement a package of appropriate regulations, financial incentives, educational, outreach, and enforcement approaches to retain and expand forests and wetlands in areas suitable for long-term survival.

In order to plan for and adapt to the effects of climate change and sea level rise in Maryland's coastal zone, the state will need to investigate how and where sea level rise inundation will affect the ability of coastal areas to continue to function effectively and what can be done to help these systems adapt.

Given the development and updates of priority land and aquatic sensitive areas identification systems, as well as the recent incorporation of climate change and sea level rise priorities into state planning and policy activities, the state is in the position to begin addressing the above recommendations. In order to begin implementing certain adaptation, restoration or protection activities, it will be essential to first identify what and where those forests, wetlands, and shoreline buffers are that are suitable for long-term adaptation and survival.

One step towards implementation of the first recommendation is already underway with the development and update of the state's blue and green infrastructures, respectively. The state's green infrastructure identifies those undeveloped lands most critical to the state's long-term ecological health. Those lands provide the natural foundation needed to support diverse plant and animal populations, and enable valuable natural processes like filtering water and cleaning the air to take place. The blue infrastructure identifies areas in Maryland's coastal near-shore zone where resources and habitat such as submerged aquatic vegetation, oyster bars, tidal wetlands, fish spawning and nursery areas, shoreline buffers, and other resource and habitat characteristics indicate priority locations for protection and restoration actions.

These coastal resources provide important wildlife habitats, have regional significance for migratory birds, protect coastal communities from storm surge and erosion, sequester large amounts of carbon, provide sediment and nutrient water quality benefits, and generate economic benefits through farming, forestry, fishing and passive recreation. As sea level rises, various future conditions are possible. As an example, tidal marshes, beaches and dune habitats have the potential to: 1) migrate landward if there are no barriers to migration, such as roads and buildings, or 2) become eliminated if the opportunity to migrate landward is blocked, or the rate of migration is exceeded by the rate of sea level rise.

A Coastal Fellow would have the opportunity to help determine where the most effective habitat migration areas are located and where the state might need to take more active management action to enhance their adaptation and migration potentials. In addition, since greenhouse gas mitigation can be achieved through terrestrial carbon sequestration, identifying those areas where habitats can be maintained through migration or adaptation will allow carbon sequestration benefits to be readily identified in conjunction with adaptive migration efforts.

Through this project, a Coastal Fellow will have the unique opportunity to define and identify what the characteristics of adaptive lands in Maryland will be. Adaptive land benefits could fall into a couple of different categories, including:

- The ability to sustain coastal ecosystem structure and function through restoration and protection activities to ensure that ecosystems can migrate and adapt; and/or
- The ability to sustain coastal ecosystem services that include maintaining healthy Bay water quality and coastal community protection such as flood control and storm-surge protection

The Fellow will then be able to develop and run a GIS-based model to assess and identify lands in Maryland's coastal zone that provide adaptive benefits from the effects of sea level rise and climate change. Finally, the Fellow will move from project design to implementation through the development of an "adaptive benefits" scorecard and coordination with land and habitat planning groups to adopt it through policy or management strategies. This fellowship project will serve as a state model for adaptive land planning as it relates to sea level rise and climate change.



Goals and Objectives

This project has three overarching goals. They are defined as follows by the overall goal and their supporting objectives:

Goal 1: Identify characteristics of and map coastal lands that provide adaptive benefits from the effects of sea level rise and/or co-benefits for carbon sequestration.

Objective: Review and analyze literature regarding adaptation (in the context of coastal environments), sea level rise, climate change and coastal habitats and resources in Maryland. Review and compare similar actions, plans, or research in other regions related to coastal adaptation.

Objective: Organize a workgroup to identify and develop project application goals and modeling parameters to identify lands that provide adaptive benefits.

Objective: Compile blue infrastructure, green infrastructure, sea level rise, coastal habitat, land use and other related data into a GIS project file.

Objective: Complete and run a GIS model to identify those coastal lands that may provide adaptive benefits from sea level rise and/or carbon sequestration co-benefits.

Objective: Write a supporting report documenting model requirements and development.

Goal 2: Enhance Maryland's ability to prioritize and target protection and restoration activities based on the identification of adaptive land benefits.

Objective: Analyze the actions being taken or plans being made by other states, regions, or entities in response to landward migration of coastlines.

Objective: Work with land planners and land acquisition groups in Maryland to develop a scorecard to rate lands for their adaptive benefits for shoreline change as a result of sea level rise based on the model completed during the first phase of the project.

Objective: Develop recommendations for prioritizing planning, protection or restoration activities to ensure that adaptive benefits of coastal environments are maintained or improved.

Goal 3: Improve adoption and coordination of specific actions that can be taken through which programs can consider the adaptive benefits of lands and their carbon sequestration co-benefit values at the parcel and/or landscape level.

Objective: Participate in meetings or planning sessions and provide technical feedback to individual or inter-agency groups charged with incorporating sea level rise and climate change into strategic land or resource planning activities.

Objective: Work with land planners, land acquisition, and habitat/wildlife groups in Maryland to adopt recommendations related to adaptive benefits and habitat changes.

Objective: Evaluate relevant local, state and federal programs that could implement or fund projects that support adaptive land management.



Milestones and Outcomes

The following milestones and outcomes have been developed to provide a general timeline and outcome schedule for the coastal fellow project. Based on the fellow's skill set, training needs and meetings with their core advisory group, the milestones, outcomes and anticipated completion dates may be modified as the project develops.

Certain activities such as participating in meetings and planning sessions and providing technical feedback to groups charged with incorporating sea level rise and climate change into strategic land or resource planning activities will occur throughout the fellowship. Because these types of activities will occur throughout the fellowship, the Fellow will have the opportunity to develop long-term working relationships with a wide array of groups and industry professionals.

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| August – September | 2009 | Begin Fellowship. Orientation at the Department of Natural Resources. Subject area background research and review. |
| September – December | 2009 | Identify and meet with advisory group members to define adaptive benefit land characteristics. |
| January – February | 2010 | Compile relevant data for project. Synthesize model requirements and develop parameters for a GIS model. Work with stakeholders and advisory group to refine model characteristics. Meeting #1 with core advisory group - January. |
| March – October | 2010 | Run, test, and refine GIS model to target areas for coastal habitat adaptive potential. Work with advisory group and stakeholders to establish feedback loop for the model outputs. Meeting #2 with core advisory group – May. |

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| October – December | 2010 | <p>Prepare and submit poster or oral presentation abstract for Coastal Zone 2011, if desired. Work with land planners and land acquisition groups in Maryland to identify the needs for an “adaptive benefit” scorecard.</p> <p>Completion of Goal 1. Meeting #3 with core advisory group – October.</p> |
| January – April | 2010 | <p>Research and analyze mechanisms through which adaptive benefit land planning scorecard could be adopted by stakeholders. Draft, revise, and finalize the scorecard to meet desired targeting outcomes.</p> <p>Completion of Goal 2. Meeting #4 with core advisory group – February.</p> |
| March – July | 2010 | <p>Formulate recommendations for inclusion in final adaptive benefits land and habitat plan. Work with stakeholders to incorporate the scorecard and recommendations into management practices and existing implementation programs. Make recommendations for any new projects or programs that should be developed.</p> <p>Completion of Goal 3. Meeting #5 with core advisory group – June.</p> |
| July | 2011 | <p>Present at Coastal Zone 2011, if desired. Give a brown bag presentation to MD DNR during a noon seminar. Complete final report.</p> <p>End of Fellowship.</p> |

Project Description

Implementing the comprehensive set of recommendations set forth by the Maryland Commission on Climate Change’s Adaptation and Response Working Group for how Maryland should plan for and reduce its vulnerability to the effects of sea level rise and climate change is a challenging undertaking. Recognizing the magnitude and breadth of the policies, people and stakeholders that will need to be implemented and involved in addressing this global issue for Maryland, this fellowship provides the opportunity for the development of targeting tools and identification of strategy recommendations for adoption into state-level planning.

The Fellow’s activities will be centered around the following three project goals previously

described:

- Identify characteristics of and map coastal lands that provide adaptive benefits from the effects of sea level rise and/or co-benefits for carbon sequestration.
- Enhance Maryland's ability to prioritize and target protection and restoration activities based on the identification of adaptive land benefits.
- Improve adoption and coordination of specific actions that can be taken through which programs can consider the adaptive benefits of lands and their carbon sequestration co-benefit values at the parcel and/or landscape level.

The first phase of this project will allow a fellow to design and develop a methodology to characterize, identify, and target coastal lands that provide adaptive benefits from sea level rise and co-benefits for carbon sequestration. The second and third phases of this project then provide the unique opportunity for the fellow to develop recommendations to enhance the state's ability to prioritize and target lands for their adaptive benefit and work to incorporate the recommendations into management strategies. These final two phases will be based on the tool developed in the first phase of the Fellow's work.

A number of project deliverables are expected to result from this fellowship. They include:

- Adaptive lands and/or habitat migration land benefits data layer, associated metadata, and a report detailing the model's characteristics and goals;
- Parcel-level evaluation of lands for adaptive benefit;
- An adaptive benefits checklist for land parcels; and
- A policy; management strategies; and program or incentive recommendations report detailing how to ensure that adaptive benefits of coastal environments can be maintained or improved throughout Maryland.

The Fellow will advance comprehensive evaluation and planning through the identification and analysis of adaptive benefit characteristics of coastal lands and habitat. The development of potential management strategies and an "adaptive benefits scorecard" for evaluating and scoring lands on these characteristics will permit coordinated and informed coastal land planning for adaptation in response to climate change and the effects of sea level rise.

A key mechanism through which strategic land protection efforts currently occur in Maryland is through DNR's Program Open Space (POS). Established under DNR in 1969, POS symbolizes Maryland's long term commitment to conserving natural resources while providing outdoor recreation opportunities. POS currently uses a scorecard that considers green infrastructure and other natural resource values to evaluate lands on their benefits to natural resource protection. To date, support for this program has resulted in the acquisition of more than 254,429 acres of open space for state parks and natural resource areas and more than 37,512 acres of local park land. The development of this new "adaptive benefits scorecard" would be a complementary product that many groups throughout the state, including POS, could incorporate into management and acquisition decisions.

From this project, the fellow will gain a number of technical- and policy-related skills that include GIS model building and development, advisory and stakeholder group development, policy and management strategy recommendation development, problem solving, and coastal land prioritization skills. The fellowship will provide an opportunity to network with numerous state stakeholders such as state agency stakeholders and non-governmental organizations.

The ideal fellow candidate will possess prior GIS modeling experience and have an interest in

working through a stakeholder-based process to identify, develop and implement a GIS model and adaptive strategies to maintain or improve coastal environments and habitats in Maryland. While the Fellow will have the primary responsibility to address the goals outlined in this project, they will work closely and collectively with their supervising mentor, two members of the Office for a Sustainable Future and various others on a “core advisory group” to ensure that adequate support and feedback is provided. A number of meetings with the Fellows’ core advisory group have been identified in the milestones and outcomes section at points in the project where major decisions or deliverables are anticipated.

DNR and the Maryland Department of the Environment (MDE) are already undertaking efforts or implementing programs to address natural resource protection as it relates to sea level rise. By the time the coastal fellow would start, the lead agencies will have made significant progress towards developing a comprehensive plan to integrate various models, identify data gaps and evaluate sea level rise and marsh migration models. From this work, a fellow would be afforded a strong base of information and research from which to begin immediately working on evaluating adaptive benefits and/or carbon sequestration values of lands in Maryland.

By serving as the project lead for development of the GIS model and the recommendations, the Fellow will work closely with staff whose specialties range from scientists to planners and modelers – providing the Fellow an opportunity to consider the impacts of climate change and sea level rise on coastal habitat and lands from a diversity of perspectives. The fellow will benefit from being in the unique position to act as a bridge providing important communication between all those perspectives.



Fellow Mentoring

The Fellow will be a member of the MD DNR Chesapeake & Coastal Program (CCP). Staff within this Program have a variety of expertise related to coastal management and can offer support and advice based on several years of experience in the field. CCP staff are currently engaged in a number of activities in three thematic areas including healthy coastal waters, coast smart communities (coastal hazards-related issues) and coastal habitat that will provide numerous opportunities for professional development.

The mentor for the Fellow will be CCP’s coastal habitat planner, Catherine McCall. However, the goals and objectives set forth for this effort will require that a team-based approach is taken to guide and provide feedback to the Fellow on this project. Therefore, from the time work begins through the project implementation phase, the Fellow will work in a networked manner. In addition to the CCP coastal habitat planner, the Fellow will also work closely with staff in DNR’s Office for a Sustainable Future (OSF) and Watershed Services Unit. Within OSF specifically, the Fellow will network with Zoë Johnson (a previous NOAA Coastal Fellow) and Christine Conn who work on state-level Climate Change, Sea Level Rise and Strategic Land Planning issues.

The Fellow will be encouraged to attend relevant meetings, conferences and workshops, including but not limited to: Maryland Commission on Climate Change meetings, blue infrastructure meetings, interagency task force meetings, coastal citizen advisory group meetings, CCP staff meetings, the coastal program managers meetings sponsored by NOAA, Coastal Zone 2011, and the Coastal Society Meeting. This will allow the Fellow to gain a broad understanding of how coastal management is implemented at the state level, while focusing on the specific coastal management issues of sea level rise, climate change and coastal habitat adaptation. The Fellow may become

involved in activities which would further the professional development of the Fellow (e.g. special short-term coastal projects) depending on his/her desire and the progress of the project.

In addition to regular interaction and meetings with the primary mentor and other project advisors, the Fellow will have the opportunity to hold regular project development meetings with a core advisory group. These meetings will serve as the avenue through which the Fellow can update the group on milestones and project development stages. At these meetings, the work plan may be adjusted as needed.



Project Partners

Through this project, the Fellow will have the opportunity to develop professional working relationships with a variety of groups and individuals currently engaged in land-use, climate change and sensitive coastal habitat issues in Maryland. In addition to CCP and OSF staff, the fellow will have the opportunity to work with other DNR groups including the Land Acquisition and Planning (LAP) group and the Wildlife and Heritage group (specifically as the project relates to State Wildlife Action Plans). Other non-profit groups, such as The Nature Conservancy (TNC), have also expressed interest in working with DNR on this project.

The Fellow will also have access to staff at the Department of Natural Resources and other federal, state, and local agencies who are working on issues relevant to the Fellow's project. More specifically, there will also be the opportunity to work with staff at the Maryland Department of the Environment (MDE) as this agency has been involved in developing or implementing programs addressing the recommendations of the Commission.



Cost Share

The Maryland Chesapeake and Coastal Program will provide the Fellow with an office complete with a personal computer with Microsoft Office and ArcGIS software and a telephone. The Fellow will be set up with a State ID to gain access to parking facilities and state buildings, a State e-mail account, and access to network data drives. The Fellow will also have access to a shared printer, office supplies, mailing, secretarial support, necessary training and pool resources that include a CCP laptop and projector, State vehicles for travel to meetings, and other specialty software for presentation and document design needs.

The Watershed Services Unit (within which CCP is located) and the Office for a Sustainable Future will equally cost share the total 2-year \$15,000 non-federal fellowship match.

Thematic Areas

The proposed project would address three of the seven thematic areas developed by NOAA for the Coastal Fellowship. The three thematic areas that would be addressed are:

- (4) Projects that increase information about or develop visualization tools related to coastal inundation and sea level rise;
- (5) Projects that provide economic, social science, and spatial data and tools, or support collaborative efforts to support climate change adaptation; and
- (7) Projects that exemplify, provide access to, allow for understanding of, or explicitly incorporate the principles of ecosystem-based management strategies.

Directly related to the fourth thematic area, this fellowship project addresses the development of a visualization tool that will identify the locations of coastal lands that provide adaptive benefits related to sea level rise, climate change, and co-benefits of carbon sequestration. Through the identification of these lands, the visualization tool/data layer will provide information about how shoreline change related to sea level rise will result in changes in the location of coastal buffers such as tidal wetlands or forests.

Second, the visualization tool and data developed by the Fellow will lend itself to efforts that are either underway or anticipated to begin that support climate change adaptation actions. Specifically, the Fellow will work to develop an “adaptive benefits scorecard” for lands that have characteristics that will assist in the retention or expansion of forests and wetlands in areas that are suitable for long-term survival. This scorecard will assist in strategic conservation planning and alternative land use planning efforts being undertaken either by state or local governments or non-governmental organizations.

Finally, this project builds toward the seventh thematic area of creating a project that allows for the understanding of incorporation of ecosystem-based management strategies, formulating policies that take into account ecosystem structure and demonstrating stakeholder engagement. By incorporating a vast array of coastal environment and situation data in the model portion of this project, the resulting management strategy and policy recommendations will begin to build a link between ecosystem characteristics, climate change and land planning at a regional scale. In addition, Maryland’s Climate Action Plan was developed through a stakeholder-based process. By taking a recommendation from the adaptation and response section of the report for implementation development, this project will extend the broad stakeholder engagement and collaborative decision-making process to a real-world and tangible application.

¹ MCCC Climate Action Plan, 2008