

NERRS Science Collaborative Progress Report for the Period 9/1/11 through 2/28/12

Project Title: Sustainable Shorelines along the Hudson River Estuary

Principal Investigator(s): Betsy Blair, Hudson River NERR, NYS DEC

Project start date: 9/15/10

Report compiled by: Betsy Blair

Contributing team members and their role in the project:

- Emilie Hauser, NYS DEC Hudson River NERR -- outreach coordination and project coordinating committee
- Ona Ferguson, Consensus Building Institute (CBI) – project integration lead and project coordinating committee
- Stuart Findlay, Cary Institute of Ecosystem Studies -- ecological studies and project coordinating committee
- Nickitas Georgas, Stevens Institute of Technology -- physical forces assessment
- Kristin Marcell, NYS DEC Hudson River Estuary Program and Cornell University -- project coordinating committee and climate change program liaison
- Dan Miller, NYS DEC Hudson River Estuary Program -- demonstration project development, ecological studies, and project coordinating committee
- Jon Miller, Stevens Institute of Technology -- physical forces assessment, demonstration project, and project coordinating committee
- Dave Strayer, Cary Institute of Ecosystem Studies -- ecological studies and project coordinating committee
- Kathie Weathers, Cary Institute of Ecosystem Studies – project integration and project coordinating committee

A. Progress Overview:

The purpose of the Hudson River Sustainable Shorelines Project is to provide science-based information about the best shoreline management options for preserving important natural functions of the Hudson River Estuary's shore zone, especially as sea level rise accelerates and storms increase in intensity. With the ongoing input of decision-makers and intended users of project results, the project team is generating new information about engineering performance, ecological tradeoffs, economic costs, projected river conditions, legal and regulatory opportunities, and the needs and priorities of key audiences. With NERRS Science Collaborative funding, the shorelines project team will conduct studies to 1) test how shoreline structure affects ecological services, 2) expand knowledge of physical forces impinging on shorelines, 3) construct a demonstration site, and 4) and develop a decision support tool. The project will involve and foster collaboration with shorelines decision-makers, with the ultimate goal of providing useful products, informing decisions, and influencing outcomes.

During this reporting period, we continued to advance demonstration site development, planned for spring/summer 2012 field research, continued our review of decision support tool options, and obtained valuable input from our advisory team and other intended users on ways to insert project findings into policy.

B. Working with Intended Users:

Progress:

We held an in person all-day Coordinating Team meeting on September 27, 2011 plus monthly Coordinating Team calls to steer the project. We also had ongoing project management calls among Betsy Blair, Emilie Hauser, Betsy Fierman and Ona Ferguson to keep project activities on track. We worked closely with our TIDES intern Zack Steele to explore options for the

Decision Support Tool that we're planning to produce, with a small working group from our advisory teams. We convened the larger Shorelines Project Team on November 14, 2011, focusing on decision support tools, engineering work, the legal and regulatory findings, demonstration sites, and overall lessons learned. Members also provided quick updates on other project elements. On December 9, 2011, we convened the Shorelines Advisory Team to provide a project update, and to seek member input on demonstration site priorities and opportunities to enhance shoreline practices in New York State. We also held two meetings of the informal shoreline and habitat adaptation dialogue group (September 23, 2011 and February 15, 2012). Consensus Building Institute staff continued to provide expert facilitation and project management services to advance the project.

In the next 6 months we plan to:

- Combine the Project Team and Advisory Committee to streamline efforts and because we think we can effectively engage both the more and less technical participants over the course of the day if we manage the agenda carefully.
- Hold a day-long Advisory Committee meeting in September 2012.
- Do planning for the outreach and education efforts for this project, including designing a website to hold final products and discussion about trainings and good approaches for sharing lessons learned.
- Hold focus groups on (a) modeling/physical forces work and (b) opportunities to contribute recommendation to state or other programs and policies that affect shorelines.

Lessons Learned:

- The challenge of identifying standard terminology for use within this project across the many different areas of expertise that will work in specific products (technical for engineers, scientific journals for ecologists, and communication documents for outreach). We have worked to clarify our terms and have decided to use "ecologically enhanced" shorelines instead of "soft" shorelines as the topic of our attention, since we're looking at ways to improve hardened shorelines along the Hudson as well as ways to encourage softer approaches.
- In our demonstration site work, we've learned that landowners along the Hudson want help getting permits for shoreline activity, and that if there's a way to streamline that process while improving the likely ecological performance of a site, land owners will be open to these ideas.
- It takes a lot of work for researchers in a particular field to engage with each other and end users in order to share their approach early on and to translate key findings at the end of a project. This requirement is almost an additional 20% of work which needs to be planned for with researchers, letting them know they'll be expected to share drafts and revise documents based on feedback from colleagues and end users so that the final product will be useful. This includes vetting responses with knowledgeable people and doing high level synthesis of the importance of what was found and the opportunities identified by the work. Doing in depth research and producing a 50-page dense document is not success in this project without the additional synthesis and translation.
- Complex research and collaborative efforts like this need clear objectives, or it is tempting for participants to be always suggestion additional outward expansion of the questions being answered. While having the ecological and community end vision as a goal, the aspects of that vision to be undertaken in the project must be clear and selective or some people will be confused and frustrated. The more structure and

guidance and boundaries around the project, while having some flexibility to incorporate key lessons and make adjustments, the better.

- There is a huge amount of management time and attention required to coordinate numerous research endeavors simultaneously, and it can be tricky to figure out how to answer questions that are outside of the technical knowledge of the leadership team (in this case, the Coordinating Team). For example, in this project, we've had over the years real challenges figuring out what both how social science can contribute to the project (and the many ways it is already doing so) and what was a reasonable approach to take for incorporating economic information into the project, given the realities of the project scope and timeline.

C. Progress on project objectives for this reporting period:

1) *Shoreline structure effects on ecological services*

During this period, Stuart Findlay, Dan Miller, David Strayer identified study sites and began preparation for field study beginning spring 2012. Planning for development of the rapid assessment protocol also occurred during this reporting period. Field study was scheduled to begin September 2011. However, persistent high flows and turbidity following Tropical Storms Irene and Lee led to a decision to delay field sampling until spring 2012.

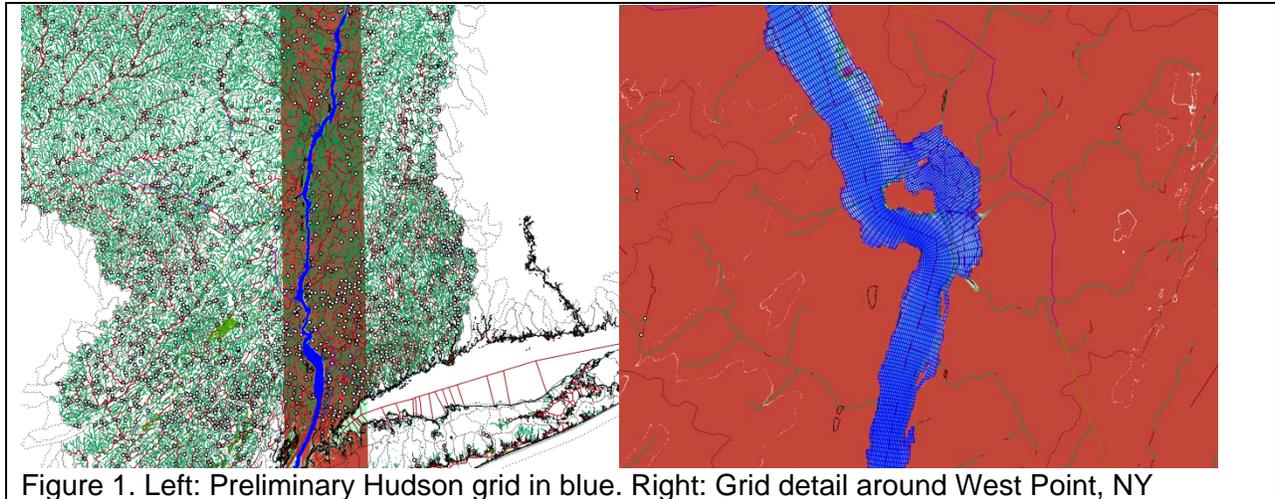
In the next 6 months, the group will begin to collect data at 20 sites on physical structure of the study sites, fish communities, and plant communities; this is projected to occur in April and May 2012. This field sampling is being done on a range of built shorelines to explore how their physical structure affects ecological function.

2) *Physical forces on shorelines*

The overall goal of the engineering and modeling analysis is to characterize the physical forces acting on the shorelines of the Hudson River Estuary (HRE) using a combination of modeling and observational approaches. The scope of work was broken down into 9 specific tasks as described below.

a. Refine NYHOPS model

The new modeling computer was selected and purchased. Software for gridding was acquired and installed. Work has begun on generating the refined ultra-high resolution grid on which the Hudson River simulations will be run. Recent Digital Elevation Models (DEM) and Hydrographic surveys have been identified with assistance from John Ladd, NYSDEC, and imported into ArcGIS. Areas within and adjacent to the Hudson lying below +5m NAVD88 have been identified and mapped. A preliminary, but highly refined, orthogonal curvilinear grid containing the Hudson from the Battery to the Troy Dam, including these areas that may become inundated in extreme future events has been created (Figure 1).



During the next 6 months the grid's bathymetry and topography will be finalized, and meteorological and astronomical forcing functions will be interpolated on the grid, and the sECOM hydrodynamic model will be run to generate current and wave data along the Hudson River's coastline.

b. Analyze ice historical record

Ice data was originally obtained from the U.S. Coast guard for the past 4 years. This data was digitized and converted into quantitative records of ice thickness and extent. An undergraduate student worked with this information to create a series of non-georeferenced images relating to ice cover. The information on ice cover was utilized to reanalyze tidal anomalies observed in the HRE during icy winters. The resulting information was used to refine the NYHOPS model physics and resulted in a publication in the Journal of Physical Oceanography (to be published on the February 2012 issue: <http://journals.ametsoc.org/doi/abs/10.1175/JPO-D-11-063.1>). These results have significant implications beyond the scope of the project and will likely be investigated further pending the availability of additional funding from outside sources.

The USCG ice record has now been enlarged to all years since 2005 based on an online databank from Moran Engineering. In addition, this year's ice cover information is updated each day – although this year has been a particularly warm winter, ice reports are still produced and downloaded from USCG.

During the next 6 months, all records since 2005 will be analyzed and incorporated into the existing dataset. The Hudson River pilots have shown great interest in this information, as it pertains to the navigable conditions of the Hudson both in terms of the ice itself but also in terms of its impacts to water level and current predictions affecting cargo volume and times of transit.

c. Create and analyze NYHOPS data

The majority of the effort during this reporting period focused on generating the high resolution grid to be used for the project.

During the next 6 months the 3D grid generation will be finalized and the NYHOPS model development and refinement will begin. That involves generating and mapping wind and other meteorological variables on the grid's surface, hydrological inputs from the distributed network of Hudson tributaries, streams, and plants on the grid's sides, and tidal and other ocean-generated forces on the grid's open boundary at the Battery. Based on this applied forcing, the sECOM model will then be run for a year to produce hydrodynamic predictions for currents and waves along the Hudson's coastlines. The model results will then be statistically analyzed and geo-referenced.

d. Collect field data on wake energy

Summer students evaluated the video wake measurement technique at a site in Pt. Pleasant, New Jersey. The experiment consisted of deploying a graduated rod (PVC) 10 feet from the bank in a muddy substrate, then observing and recording the wakes generated by a series of recreational vessels transiting the adjacent channel. The experiment demonstrated the viability of the technique.

During the next 6 months the data sampling plan will be finalized and the equipment will be purchased for the field work to be conducted during the summer of 2012. Presently an externally funded undergraduate student is conducting an experiment comparing various techniques for collecting wake data. The results will be used to inform the field work to be done during the summer. Another student is exploring possible locations for conducting wake measurements.

e. Analyze wake energy data

To supplement the observed data, an analytical approach was adopted to predict the maximum expected wake in the channel based on vessel dimensions. This approach will be used to supplement the observations made in the HRE during the summer of 2012.

During the next 6 months an externally funded undergraduate research student is refining our approach for calculating theoretical wakes. In addition the student is conducting an exercise whereby he will break the HRE into zones based on geometry and/or ship traffic for the analysis. Analysis of the wake data collected during the summer of 2012 will likely commence in July/August.

f. Assess NYHOPS prediction

No work was performed on this task. During the next 6 months, the NYHOPS predictions will be assessed as a part of refining the model under Task 5.

g. Produce and distribute GIS map layers

An undergraduate research student created a series of images intended to help visualize the extent and thickness of ice cover in the HRE based on the Coast Guard reports. Due to time/effort constraints the images are non-georeferenced and were created as a visual aid only. As the ice record has been expanded, we have worked on the base GIS layer which the derived ice statistics will populate. During the next 6 months, the focus will be on generating the data which will eventually populate the layers.

h. Dissemination of findings

No work was performed on this task. During the next 6 months the concentration will be on generating the findings.

i. Participation in Sustainable Shorelines Coordinating Team and Project Team

The PI participated in coordinating team meetings as well as project team meetings and teleconferences. During the next 6 months, the PIs will continue to participate in monthly project team meetings/calls, and will attend the next coordinating team meeting assuming it is held within the 6 month time frame.

In addition to the above referenced specific tasks, PI's helped frame the NYSERDA modeling workshop held in January 2012 at the Hudson River Foundation. Nickitas Georgas presented in the forum and his presentation is available online at http://hrnerr.org/public/training/Modeling/Modeling_index.html.

3) *Demonstration site*

During this reporting period, a DEC permit was issued to the NYS Office of Parks Recreation and Historic Preservation (OPRHP) for construction of a shoreline stabilization treatment at Cocksackie Boat Launch. The design includes a series of steps protected by lines of stone and planted with vegetation, as well as an offshore sill. On February 6th, the steps and sill were installed. The Sustainable Shorelines Project contributed funding and technical assistance to this project. In the next six months, the demonstration site will be planted and monitored. A HRNERR staff intern will develop information for on-site interpretive signage identifying the site as a Sustainable Shorelines demonstration project.

Dan Miller reviewed and commented on a draft Request for Quotes (RFQ) and project description for the Quiet Cove Shoreline in Poughkeepsie, NY produced by the Dutchess County Public Works Department. The RFQ contained recommendations for project design made by Dan and Betsy Blair during a site visit earlier in 2011, and provisions for involvement of Sustainable Shorelines team members as early as possible in future design efforts for the site. In the next six months Dan will continue to track progress of construction of the Cocksackie boat launch demonstration site and pursue involvement in the Quiet Cove shoreline. He will also seek additional opportunities to develop demonstration sites in other regions of the estuary.

As an outgrowth of the Sustainable Shorelines Project, a work group was formed to explore development of a demonstration site network in the Hudson River Estuary and New York Harbor. The purpose of the network is to show engineers and other experts how to design a shoreline treatment, and to show regulatory agencies and municipalities how ecologically enhanced shorelines look and perform. In the future we anticipate that the network can be used to raise regional capacity for ecological design, and possibly as a vehicle for recognizing design and construction professionals who are designing and building ecologically enhanced shoreline projects using Sustainable Shoreline Project principles and products. The workgroup is composed of members of the Sustainable Shoreline advisory groups and other shoreline advocates.

The workgroup met three times during the last six months and drafted an evaluation rubric to apply to existing and prospective shoreline projects to determine if they meet ecological, sustainability criteria and human use needs. The evaluation will be used to 'grade' individual

shoreline projects according to principles identified in the document “Managing Shore Zones for Ecological Benefits”, produced by Sustainable Shorelines project partners at the Cary Institute for Ecological Studies. It will also be used to promote desired design features in new projects that may become demonstration sites. A Student Conservation Association intern began work at the end of January 2012 and will be assisting the work group. In the next 6 months, the work group will continue to meet need

In the next six months, the work group will refine the evaluation rubric, and apply it to network has not been finalized. The network will showcase existing sites, initially as an on-line resource that could be expanded to a trail of sites with educational signage.

4) *Decision support tool*

During this reporting period, Zack Steele, TIDES intern, researched decision support tools, developed decision-making logic models and a conceptual model, and made recommendations of the most useful decision support tools to our project and advisory teams. One of these, development of a decision tree, will be advanced by team members in the next 6-12 months. Zack made important contributions to our project and was a valued member of our teams.

D. Benefit to NERRS and NOAA:

Emilie Hauser and Dolores Leonard presented a poster at the NERRS annual meeting that won best poster of the session! Hudson River NERR and NSC staff Dolores Leonard and Cory Riley continued to explore ideas for extending this work to NERRS and NOAA audiences. Betsy Blair was video-taped by NSC staff discussing the project and the value of collaborative learning. It appears that Betsy will be invited to present a webinar for NERRS staff on the project in the next 6 months.

E. Describe any activities, products, accomplishments, or obstacles not addressed in other sections of this report that you feel are important for the Science Collaborative to know

Contributing team members of the project also worked on the following outreach activities to other potential users during this reporting period.

Revitalizing Riverfronts Community Forums: Kristin Marcell presented information about sustainable shorelines considerations and initial best management practices at two Revitalizing Riverfronts community forums. These meetings were organized by Scenic Hudson, the Hudson River Estuary Program, and the Research Reserve to promote community dialog on climate adaptation. The first meeting was held in Beacon, NY on November 9th, and was attended by about 50 community leaders from at least three Hudson River municipalities. The second meeting was held in Kingston, NY, and drew nearly 100 community leaders from at least 3 communities.

Green Harbor and Aqueduct Task Force Meeting: Jon Miller and Betsy Blair attended the December 1, 2011 meeting in New York City and Betsy provided a brief overview of the Hudson River Sustainable Shorelines Project to about 50 attendees, a diverse group of stakeholders from the New York/New Jersey Harbor area. As a result of this outreach, we identified one potential demonstration site, distributed our guidance *Managing Shore Zones for Ecological Benefits* to a diverse group of stakeholders, and made a number of connections to organizations working on shoreline management issues in the harbor area.

Webinar on Shorelines Project: The Connecticut chapter of The Nature Conservancy hosted Betsy Blair in a 1-hour webinar on the Shorelines Project on February 6, 2012. As a result of this webinar, we identified several potential users of the information.

Seminars on Shorelines Project: Dave Strayer gave a project overview and details about his ecological findings to two groups: the Hudson River Foundation in fall, 2011 and to the Hudson Valley Watershed Alliance in February, 2012.