

NERRS Science Collaborative Progress Report for the Period 9/1/2013 through 2/28/2014

Project Title: Sustainable Shorelines along the Hudson River Estuary, Phase 2

Principal Investigator(s): Betsy Blair, Hudson River National Estuarine Research Reserve (NERR), New York State Department of Environmental Conservation (NYS DEC)

Project start date: 9/15/10

Report compiled by: Emilie Hauser and Betsy Blair

Contributing team members and their role in the project:

- Ona Ferguson, Consensus Building Institute (CBI) – project integration lead and project coordinating committee
- Stuart Findlay, Cary Institute of Ecosystem Studies (IES)-- ecological studies and project coordinating committee
- Nickitas Georgas, Stevens Institute of Technology -- physical forces assessment and project coordinating committee
- Emilie Hauser, NYS DEC Hudson River NERR -- outreach coordination and project coordinating committee
- 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
- Eric Roberts, Consensus Building Institute (CBI) – facilitation support
- Dave Strayer, Cary Institute of Ecosystem Studies -- ecological studies 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 is 1) conducting studies to test how shoreline structure affects ecological services, 2) expanding knowledge of physical forces impinging on shorelines, 3) constructing a demonstration site, and 4) and developing one or more decision support tools. The project involves and fosters collaboration with shorelines decision-makers, with the ultimate goal of providing useful products, informing decisions, and influencing outcomes. Consensus Building Institute staff continued to provide expert facilitation and project management services to advance the project.

This report focuses on Phase 2 of the project, which began in fall, 2010 and will continue through August 2014, unless extended. Phase 1 of the project was funded separately and concluded on July 31, 2012. Phase 3, also funded by a separate NSC award, began in September 2013 and will conclude in August 2014, unless extended.

During this reporting period we had several Coordinating Team calls and an in-person meeting late in this period, two in-person SHAD meetings, and seven regular project management calls

among Betsy Blair, Emilie Hauser, Ona Ferguson and Eric Roberts to keep project activities on track. On Coordinating Team calls, we reviewed work in progress, provided feedback to one or more sets of researchers, and checked in broadly on the many moving pieces of the project. We also planned next steps to advance the project and remain accountable to each other.

B. Working with Intended Users:

We had substantial contact with our intended users during the last six months, working with members of our advisory committee and other user groups, and giving presentations.

1) **Advisory Committee**

We postponed an Advisory Committee meeting that had been scheduled for fall 2013 because we felt it would be a better use of resources to convene the Advisory Committee when they could provide substantial input on project products. Instead of an informational meeting, a written project update was distributed in late February to introduce them to the Phase 3 project, update them on progress on the many facets of the project and request committee member assistance in distributing Sustainable Shorelines information and data to others who might use it. We expect to convene the Advisory Committee in the next six months, possibly for a standard meeting to get feedback on draft materials, and likely for a workshop on findings.

2) **Partnerships**

We held two meetings of the Shoreline and Habitat Adaptation Dialogue group on October 9 and February 12. These meetings provided a forum for natural resource and conservation participants to exchange information on and collectively advance shoreline and habitat adaptation to climate change. Major topics at these meetings were the Sustainable Shorelines project, restoration activities underway in the Hudson, progress on sea level rise and marsh migration modeling and GIS-based initiatives related to the river, as well as funding opportunities appropriate for collaborative work.

3) **Workshops and Webinars**

Regional Dialogue to Advance Sustainable Shorelines: With funding from the NSC, Emilie Hauser and Christina Tobitsch collaborated with Jacques Cousteau NERR and Delaware NERR staff to host a regional workshop at Rutgers University on October 4, 2013. The event enabled the sharing of living shorelines information and projects for sheltered coasts along NY, NJ, and DE and the consideration of future regional collaboration. A follow-up webinar was held on February 10, 2014 to share information with federal staff who could not attend the in-person event because of the federal shutdown. The audience for these events and products are coastal and natural resource managers in the three states. A front-end assessment, workshop proceedings and material from the two events are available at: <http://www.hrnerr.org/estuary-training/trainingtopic/regional-dialogue-nynjde/>. Shorelines team members Blair, Hauser, Rella and J. Miller presented at the workshop and Christina Tobitsch presented on the webinar.

Hauser also served on a team which produced a webinar series called *Living Shorelines: Bringing Together Science, Restoration and Management on our Nation's Coasts* for NERRs staff and coastal zone managers for which Findlay, Rella and Miller presented project findings.

4) **Presentations**

Jon Miller and Andrew Rella presented findings related to the engineering analyses conducted through the Sustainable Shorelines Project at several conferences and workshops. Betsy Blair gave presentations about the project and findings at a conference and a workshop.

- In September, 2013 results from the Sustainable Shorelines Project were used as the basis of a 2-day training provided by Miller and Rella to the NJ Department of Environmental Protection (DEP) on living shorelines. The audience consisted of both regulatory and construction division personnel. NJ DEP organized the training and requested Sustainable Shorelines participation in anticipation of the acceleration of the living shoreline program in NJ.
- In September, 2013 Blair gave a talk on the shorelines project and the role of shorelines in building coastal resiliency at the New York State Business Council's fall Environment workshop.
- In October, 2013 the results of the engineering analysis were shared at the Regional Dialogue to Advance Sustainable Shorelines, described above.
- In November, 2013 Jon Miller was invited to participate in a workshop organized by the U.S. Army Corps of Engineers (ACOE) as a part of the North Atlantic Comprehensive Study authorized by Congress in the wake of Hurricane Sandy. The objective of the workshop was to review innovative practices being applied in the North Atlantic and to help inform an ACOE report on "natural and nature-based alternatives" for stabilizing shorelines. Dr. Miller presented information about shoreline sites in NY and NJ, including several in the Sustainable Shorelines Demonstration Site Network.
- In November, 2013 Blair presented on the shorelines project at the NERRS Annual Workshop.
- In December, 2013 Dr. Miller was invited by the organizers of the Mid-Atlantic Living Shorelines Summit to sit on a panel with other living shorelines practitioners. One of the objectives of the panel was to facilitate the discussion of projects in NY and NJ that incorporate living shorelines principles while not taking the traditional marsh sill form typically associated with living shorelines projects.
- In January, 2014 Dr. Miller gave a talk at the annual meeting of the NJ Chapter of the American Society of Landscape Architects. Dr. Miller's presentation focused on some of the non-traditional shoreline stabilization approaches identified in the literature review completed during Phase 1 of the Sustainable Shorelines Project.

In the next 6 months we plan to:

- Hold Coordinating Team conference calls every 4-5 weeks.
- Shepherd our various sub-projects towards completion and creation of synthesis or summary documents that can help target audiences and our intended users utilize the project's products.
- Work individually with members of the Advisory Committee as needed, including permit staff.
- Continue to explore opportunities to contribute project recommendations to state or other programs, and to inform policies that affect shorelines, for example, Climate Smart Communities Certification, New York Rising and sharing more in depth aspects of our work with interested staff in environmental remediation and habitat at NYSDEC,
- Contribute work from this project to an ongoing Hudson River Estuary Restoration Planning initiative that involves NYSDEC, NYS DOS, ACOE and a suite of partner non-profits.

- Incorporate information about shoreline management options into the work of two community sea-level rise task forces,
- Convene 1-2 meetings of the Shoreline and Habitat Adaptation Dialogue group.
- Convene the Advisory Committee
- Continue to communicate the results of the Sustainable Shorelines Project as opportunities arise.

Lessons Learned: It is important define our terminology. We continue explain to our users that erosion protection and stabilization can use natural features to enhance habitat and that these techniques can extend beyond traditional marsh sill form typically associated with living shorelines projects.

C. Progress on project objectives for this reporting period:

1) ***Shoreline structure effects on ecological services***

In 2012, Stuart Findlay and Dave Strayer (Cary Institute) and Dan Miller (DEC Hudson River Estuary Program) collected data on the physical structure and fish communities of 20 built shorelines (timber cribbing, sheetpile bulkheads, and rip-rapped revetments). The data were very noisy, but suggested that shores that are more physically complex may support more fish (especially small fish) and more diverse fish communities than physically simpler shorelines. The group decided not to sample again in 2013. The study will not be published, however an internal report was written. This work is completed.

Findlay and Strayer sampled plant communities and physical attributes along 21 rippapped revetments. These data are being analyzed and a publishable manuscript and a summary piece will be drafted in the coming months.

Findlay and Strayer attempted to test small-scale manipulations (wrack catchers) to improve ecological function of shore zones. This study was hampered by the near-absence of submerged aquatic vegetation (SAV) in the Hudson in 2012 and 2013¹, but some pilot studies were conducted in fall 2013. As SAV is the main source of wrack in the Hudson River, this experiment could not be completed. A short report will be prepared for use by the Coordinating Team only.

Stuart Findlay analyzed the data collected by Stevens Institute students in 2012 and 2013 using the Shorelines Rapid Assessment Protocol, which is designed to enable people without ecological expertise to evaluate the ecological components of a shoreline in an hour or two. A report of lessons learned and the meaning of the results will be completed in the upcoming months. The coordinating team will be discussing whether and how to proceed with the use of the assessment on a broader scale.

In the next 6 months we plan to:

- Complete a publishable manuscript and summary piece on the results of the surveys of shoreline vegetation.
- Complete a report on the Rapid Assessment Protocol.
- Write a small report on fish surveys and wrack catchers that can be used by the coordinating team.

¹ SAV declined 80-90% from historic numbers (Cary Institute of Ecosystem Studies SAV Volunteer Monitoring Project 2012 & 2013)

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. Jon Miller and Nickitas Georgas (Stevens Institute) made progress on multiple fronts, and most tasks are either completed or nearing completion.

a. Refinement of NYHOPS model

Nickitas Georgas completed this work previously.

b. Analysis of ice historical record and production and distribution of ice GIS map layers

Nickitas Georgas completed this work previously. A summary of the ice work and findings is available at: <http://www.hrner.org/hudson-river-sustainable-shorelines/shorelines-engineering/ice-conditions/>

c. Creation and analysis of NYHOPS data and assessment of NYHOPS predictions

Nickitas Georgas completed this work previously. A summary of the physical forces work and a link to the statistical analysis on the NYS GIS Clearinghouse is available at: <http://www.hrner.org/hudson-river-sustainable-shorelines/shorelines-engineering/physical-forces-statistics/>.

d. Analysis of wake data and development of analytical wake model

Data from the summers of 2011 and 2012 were collated and organized for display in GIS. Histograms based on the data were created to illustrate the distributions of vessel type, size, speed, distance from shore, and wake height at each measurement location. Data are summarized on an annual basis as well as overall for each site and the river as a whole. The data are currently stored locally in GIS format pending completion of the metadata.

e. Communications Products

A literature review was conducted to identify methods for transforming the statistical properties of the physical parameters created under task 2c into a categorical (low, medium, high) representation of the forces along the shoreline. The literature review is in draft form.

In the next 6 months we plan to:

- Create the metadata for the wake data set.
- Work on a summary of the wake analysis for display on the website (similar to what was done for the ice and physical forces work).
- Complete a 5-page synthesis of the full physical forces work.
- Finish the categorical (low, medium, high) representation of the forces along the shoreline.

3) **Demonstration sites and demonstration network**

a. Coxsackie Boat Launch (Greene County) Demonstration Site

Dan Miller monitored vegetation and overall stability of the Coxsackie Boat Launch demonstration site. We worked with NYS Parks to design an interpretive sign about the site.

b. Quiet Cove (Dutchess County) Demonstration Site

Dan Miller worked with Dutchess County Public Works staff to advance a scope of work to develop an 'ecological enhancement' system for existing sheet pile bulkheads to be tested at

Quiet Cove Park. We intended for the project to be implemented after completion of a site rehabilitation project. Unfortunately, the contractor working for the county was unable to complete the work. Therefore the ecological enhancement project at the site has been delayed indefinitely. Resources intended to support the bulkhead enhancement at this site have been redirected to a similar effort to be implemented by the Sustainable Shorelines Team at a location to be determined (see Bulkhead Enhancement Demonstration Project below).

c. Dockside (Putnam County) Demonstration Site

The engineering firm Milone & MacBroom Inc. was selected to design a Sustainable Shorelines Demonstration Project at the Dockside property in Cold Spring, NY, using guidance and data produced by the Sustainable Shorelines project, with funding from the NYSDEC Hudson River Estuary Program. The consultant conducted a site assessment and held a public information meeting in the Village to gather community input on perceptions of and intended uses of the shoreline. Dan Miller and Betsy Blair partnered with the New England Interstate Water Pollution Control Commission to submit a grant proposal to the National Fish and Wildlife Foundation to support construction of the site once design is completed at the end of 2014.

d. Nyack Beach State Park (Rockland County) Demonstration Site The engineering firm Princeton Hydro was selected to design a Sustainable Shorelines Demonstration Project at the Nyack Beach State Park in Upper Nyack, NY, also based on Sustainable Shorelines findings and with NYSDEC Hudson River Estuary Program funding. Dan Miller began initial coordination with the project team in anticipation of beginning work in early spring. Dan Miller and Betsy Blair partnered with the New England Interstate Water Pollution Control Commission to submit a grant proposal to the National Fish and Wildlife Foundation to support construction of the site once design is completed at the end of 2014.

e. Bulkhead Enhancement

Dan Miller is leading a sub group to design and install ecologically enhanced bulkheads as an alternative to the Quiet Cove project. Staff from Stevens Institute, Cary IES and Hudson River NERR have researched the current state of knowledge, identified possible sites, developed a list of characteristics to prioritize sites, outlined a monitoring plan, researched equipment for fish monitoring and are investigating use of metal and concrete alternatives for the enhancement of bulkhead ecosystem services. The group will likely apply for funding support for installing habitat-friendly concrete panels made by SeArc.

f. Demonstration Site Network

Emilie Hauser and SCA interns, Christina Tobitsch and Ben Ganon, continued to advance recognition of innovative shoreline projects. Network site managers have installed the standard sign acknowledging the ecological enhancement of the shoreline at all sites except Habirshaw and Foundry Dock.

In the next 6 months we plan to:

- Manage the design work projects at the Dockside and Nyack.
- Install the remaining network recognition signs and complete the Coxsackie sign.
- Monitor success rate of demonstration network sites, including the annual growth of vegetation and stability at the Coxsackie boat launch site.
- Add to the network on-line directory.
- Advance the implementation of a bulkhead enhancement project

g. Lessons Learned

Even after agreeing on sign design, some network partners asked for modifications to a standard generic sign. A possible solution is to add a space for the logo of site owner.

4) Decision support tools and communication products

We continue to engage users as necessary to familiarize them with existing products and tools, and seek their guidance on best ways to package and refine the large body of technical information available to them. We are basing our approach in part on the results of the Coordinating Team's decision-making process exercise in August 2013, where we reviewed past input from the Advisory Committee and other intended users, and identified additional tools and products that would meet identified needs. The team began to design and create several new products to more easily convey the findings of Sustainable Shorelines research or fill information gaps between the existing products. The following were identified:

- a. Sustainable Shorelines bookmark – The bookmark was designed to direct end users to the Sustainable Shorelines website and products.
- b. Categorical mapping of the Hudson River shoreline (described above) – the categorical mapping communication tool will synthesize many components of the physical forces products and identify locations along the Hudson River that may be suitable for sustainable shoreline projects given the site characteristics and dynamics.
- c. Shoreline erosion identification brochure and/or web content – The erosion identification brochure will help landowners, property managers, and municipal government officials identify problematic erosion and guide them towards information about management options.
- d. Guide to shoreline ecological improvements – This 15-30 page guide will build upon the Managing Shore Zones for Ecological Benefits brochure by providing two or three concrete actions that could be implemented for each of the 10 recommendations in the Managing Shore Zones brochure.
- e. Digital expert systems key and related tools – Dave Strayer, in coordination with the Sustainable Shorelines project, was awarded Hudson River Foundation funding to develop decision-support tools to improve shore zone management, including a digital expert systems key, fact sheets, a dichotomous key and brochure.
- f. Workshops for users – These workshops are designed to introduce engineers, permit staff and others to the HRSSP findings and raise participant capacity to design and permit ecologically enhanced shoreline protection.

In the next 6 months we plan to:

- Develop and finalize these outreach products to support decision making.
- Add these products to the web site.
- Utilize the products while presenting the workshops to intended user groups.
- Update the website so that it is more user-friendly and includes new products.

Lessons Learned: We continued to refine several products to more clearly articulate project outputs to stakeholder groups in an easily digestible format. We also continued to assess how

the products can be used together or complement resources produced by other organizations. We began to create several additional communication products to address information gaps.

D. Benefit to NERRS and NOAA:

This project has resulted in new information and tools that enable NOAA and partners to promote more sustainable and resilient shorelines, a contribution to achieving NOAA's mission "To conserve and manage coastal and marine ecosystems and resources" and realizing NOAA's vision of "**Healthy ecosystems, communities, and economies that are resilient in the face of change**". Project findings have been solicited by resource managers in several other states. Within the NERRS, this project has contributed to both national and regional conversations about shoreline management policy and best practices, especially through the following:

- The transfer of findings to Reserves in Delaware and New Jersey with other NSC funding, Regional Dialogue to Advance Sustainable Shorelines, described above, which was attended by representatives of NY and NJ Sea Grant.
- The inclusion of Hudson River Sustainable Shorelines Demonstration Network sites in the NOAA and Army Corps of Engineers SAGE (Systems Approach to Geomorphic Engineering) directory of living shorelines in New York and New Jersey.
- Emilie Hauser's work on the planning team of the Living Shorelines Webinar Series organized by NOAA's Office of Ocean and Coastal Resource Management, the NOAA Restoration Center, and the National Estuarine Research Reserve System. This series, intended for NERRS and state coastal management program staff, took place between September 2013 and February 2014. Stuart Findlay, Jon Miller and Andrew Rella presented at the January and February webinars, respectively. The Hudson River NERR hosts the archived recordings of the webinars on its website (www.hrner.org) so that NOAA and NERRS staff can view them.

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

1) **Leveraging:**

Several team members have continued to seek funding or award funding to expand upon this project's findings, as described below.

- David Strayer and others submitted a proposal rejected to NOAA COCA in November 2013 for evaluating the ecological value of green walls as shoreline defenses in the Hudson River, 2014-2016. In the next few months he expects to hear whether this project was funded.
- Stevens Institute, in partnership with Arcadis, Inc., received funding for a NEIWPC, NYSDEC Hudson River Estuary Program and New York City Department of City Planning project: "To Develop a Research Plan to Advance the Understanding of Potential Coastal "Green" Shoreline Infrastructure Strategies In New York City."

- Kristin Marcell, Dan Miller and Betsy Blair successfully advocated for NYS DEC Hudson River Estuary Program funding to design additional innovative and sustainable shorelines.
- Dan Miller and Betsy Blair partnered with the New England Interstate Water Pollution Control Commission to submit a grant proposal to the National Fish and Wildlife Foundation to support construction of the demonstration projects at the Nyack Beach State Park and Dockside in Cold Spring design.
- Stevens Institute, in partnership with the Barnegat Bay Partnership and the Partnership for the Delaware Estuary submitted a proposal to the National Fish and Wildlife Foundation through the Hurricane Sandy Coastal Resiliency Competitive Grants Program.
- Stevens Institute in partnership with the Nature Conservancy received funding for the development of the NJ Coastal Resilience Network which will look to advance the concept of living shorelines in the State of NJ.

2) ***Community Resilience Planning Activities:***

Kingston, NY (Ulster County) Flooding Task

In related work, several coordinating team members facilitated a community-based Kingston Flooding Task Force process. Between December 2012 and January 2014, the process allowed city officials, businesses, churches, community groups, residents, and other interested parties to collaborate on potential adaptation strategies for the Kingston's flood-prone waterfront and create a series of recommendations to plan for sea level rise, including utilizing ecologically enhanced approaches for shoreline erosion protection. Similar planning processes are now underway in Catskill and Piermont, and Sustainable Shorelines findings are a part of the recommendations.