NERRS Science Collaborative Progress Report for the Period 3/1/13 through 8/31/2013
Project Title: Sustainable Shorelines along the Hudson River Estuary, Phase 2
Principal Investigator(s): Betsy Blair, Hudson River NERR, NYSDEC
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 -- 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.

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

During this reporting period we had six Coordinating Team calls or in-person meetings, and ten 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 made plans for next steps to be sure we are keeping everything moving forward and that we are all accountable to each other. During this period we applied for and received funding from the NSC to fund Phase 3 and have had four meetings to plan for Phase 3 project implementation activities.

B. Working with Intended Users:

We had substantial contact with our intended users during the last six months, working with our advisory committee and other user groups, as well as conducting workshops and giving talks. We also sought and received funding to support the transfer of findings to intended users.

1) ***Advisory Committee***

We sent our Advisory Committee written project updates on April 5, 2013 and June 12, 2013 to announce the addition of new online resources from the project, and to request committee member assistance in distributing the announcement to others who might use the new information and data. The new online information included several shoreline demonstration network case studies added to the project website, and estuary-wide spatial data about ice climatology and the estuary's physical environment that were added to the New York State GIS Clearinghouse.

2) ***Partnerships***

Hauser continued to work with NOAA and Army Corps of Engineers (ACOE) staff to support their initiative to catalogue living shorelines in the NY- NJ district. We held two meetings of the informal shoreline and habitat adaptation dialogue (SHAD) group on March 19 and June 23, a forum to exchange information on and collectively advance shoreline and habitat adaptation to climate change.

3) ***Workshops***

Enhancing Habitat and Planning for Resilience: Climate Change and Contaminated Sites on the Hudson Estuary
On March 21st, the first of two workshops for NYSDEC Division of Environmental Remediation staff was held, both in person and via video conference at 12 sites around the state. This event covered climate change policy and reports relevant to New York State staff, projections of climate change scaled to regions of New York State, expected vulnerabilities to heat, increased intensity of storms and sea level rise. Modeled sea level rise maps were presented. Case studies of remediated sites and the risks associated with sea level rise were presented and discussed with the 192 participants.

Enhancing Shoreline Habitats and Protecting Contaminated Sites from Erosion along the Hudson River Estuary and Beyond
This workshop on *5/7/2013* for NYSDEC Division of Environmental Remediation staff was presented both in person and via webinar at several sites around the state. Seventy-five participants became aware of Hudson River habitats in general and learned about the habitat value of shorelines and coastal hazard areas. They learned about the types of shoreline protection techniques that enhance habitats, special considerations for remediation sites, and site designs. Andrew Rella, Jon Miller, Betsy Blair, Emilie Hauser and Sven Hoeger (Advisory Committee member) spoke and Emilie Hauser helped plan the event.

Hauser and others received an NSC transfer grant to create and deliver a workshop for Delaware and New Jersey NERRs and regional shoreline decision makers. Hauser also served on a team which began planning a series of webinars on living shorelines for the NERRS and coastal zone managers.

4) ***Presentations***

Jon Miller and Andrew Rella presented the findings of our project at an event sponsored by NY Sea Grant, "The Living Shorelines for Coastal Erosion Protection in a Changing World" on May 15, 2013 in Hauppauge, NY to an audience of government officials, coastal mangers and planners, shoreline property owners, marine contractors and consultants and others interested in coastal erosion management.

Betsy Blair presented an overview of the Sustainable Shorelines project and decision support tools to the NYSDEC Division of Environmental Permits central office and regional staff, and discussed policy implications of various recommendations.

In the next 6 months we plan to:

- Convene a meeting on September 20, 2013 with the newly formed Sustainable Shorelines Technical Panel (engineers/product end users) to launch Phase 3: "What made shorelines resilient? A forensic analysis of shoreline structures on the Hudson River Estuary following three historic storms."
- Convene a day-long Advisory Committee meeting on October 31, 2013.
- Hold Coordinating Team conference calls every 4-5 weeks.
- Reconvene the regulator and permit staff that we met with early in the project and gather updated input on the most useful way to communicate project results to that particular group of users.
- Continue to explore opportunities to contribute project recommendations to state or other programs, and to inform policies that affect shorelines, for example, 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 three community sea-level rise task forces, which three coordinating team members are involved in leading. These task forces will begin to meet this fall.
- Using other NSC funding, transfer findings to Reserves in Delaware and New Jersey during a workshop scheduled for October 4, 2013.
- Develop more communication products that will fill gaps in decision support process and enhance our website.
- Begin planning a training workshop for consulting engineers and regulatory and permit agency staff.
- Convene 1-2 meetings of the shoreline and habitat adaptation dialogue (SHAD) group.

Lessons Learned: This 6-month period has been primarily devoted to finalizing several products and finding ways to clearly articulate project outputs to stakeholder groups in an easily digestible format. We also spent significant time assessing how the products can be used together or complement resources produced by other organizations.

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 riprapped 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 considered whether to take additional samples at these 20 sites in 2013, but decided not to do so. In 2012, the ecology group analyzed data and drafted a report about plant communities and physical attributes along 21 riprapped revetments.

Stuart Findlay and Christina Tobitsch, an intern at the Hudson River NERR, revised 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. The revisions were made based on lessons learned having Stevens Institute students pilot use of the protocol in 2012. This summer, Tobitsch and Findlay trained a new set of Stevens Institute students via webinar about use of the protocol. These students carried out rapid assessments of shoreline ecology at sites where they were also making wake observations. Although these data have not been analyzed yet, the reporting sheets are more complete than last year.

In the next 6 months we plan to:

- Complete a publishable manuscript on the results of the surveys of shoreline vegetation.
- Analyze the results of additional rapid assessments of shorelines.
- Make progress on a shorelines decision support tool with Hudson River Foundation funding.

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*
Previously all ice records since 2005 were analyzed and incorporated into a new Hudson River ice climatology dataset. Nickitas Georgas completed the metadata during this period and coordinated with NYSDEC staff and the NYS GIS Clearinghouse to post the ice layer and metadata there. He worked with Christina Tobitsch and Emilie Hauser on a summary of the ice work and findings which is used to direct users through the Sustainable Shorelines website to the data at the NYS GIS Clearinghouse. http://www.hrnerr.org/hudson-river-sustainable-shorelines/shorelines-engineering/ice-conditions/

c. *Creation and analysis of NYHOPS data and assessment of NYHOPS predictions*
Previously the NYHOPS model's forcing was created and the sECOM model was run for a year to produce hydrodynamic predictions for water levels, currents, and waves along the Hudson's

coastlines. The model refinement work included: generating and mapping wind and other meteorological variables on the grid's surface, hydrological inputs from the distributed network of Hudson tributaries, streams, and wastewater treatment plant outfalls on the grid's sides, and tidal and other ocean-generated forces on the grid's open boundary at the Battery. The new model's predictions were assessed while the model was running. The model output time series at each of over 50,000 locations were extracted.

During this reporting period the statistical analyses of model results for currents, water levels, and surface wind waves were completed. Nickitas created GIS layers displaying and quantifying the statistical analysis, along with metadata, and worked with NYSDEC staff and the NYS GIS Clearinghouse to post the layers there. He worked with Christina Tobitsch and Emilie Hauser on a description of the statistics for water levels, currents, vertical current stresses and mixing, and surface wind waves which is used to direct users through the Sustainable Shorelines website to the data at the NYS GIS Clearinghouse. http://www.hrnerr.org/hudson-river-sustainable-shorelines/shorelines-engineering/physical-forces-statistics/.

d. *Analysis of wake data and development of analytical wake model*
Stevens Institute students under the supervision of Jon Miller collected a second set of wake data on June 30 and July 1, adding to the first set of wake data collected in summer 2012. The data were collected at the same sites as in 2012 so that a larger sample could be analyzed. All data were entered into Excel and histograms were created for vessel type, size, speed, distance from shore, and wake height. Data are currently being formatted for entry into GIS. Relationships between the various parameters are being investigated for input into the analytical model.

In the next 6 months we plan to:

- Finalize the analytical model for wakes.
- Reformat the wake data for use in a GIS environment.
- Create a wake-study GIS layer
- Work on a 5-page summary of the full physical forces work.
- Begin Phase 3: "What made shorelines resilient? A forensic analysis of shoreline structures on the Hudson River Estuary following three historic storms."

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 drafted a scope of work for the engineers designing and constructing shoreline improvements at the Quiet Cove county park. The scope is for services to design and fabricate a post-installation enhancement of a section of vertical sheet pile bulkhead at the site. This enhancement would increase habitat value by increasing structural complexity and possibly adding plantings. Project engineers will work with research members of the Sustainable Shorelines team on the design concept, seeking to develop one that could be replicated and installed throughout the estuary, provided an ecological benefit can be demonstrated. The scope of work is currently being reviewed by Dutchess County Department of Public Works staff and their project engineers.

c. *Dockside* (Putnam County) *Demonstration Site*
A request for proposals for the design of a demonstration site at the Dockside property in Cold Spring, NY was drafted and approved and sent out this summer. Proposals were received on August 22, 2013. It is anticipated that a contractor will be selected and work will begin by mid to late September. The NYSDEC Hudson River Estuary Program is funding the Dockside shoreline design.

d. Nyack Beach State Park (Rockland County) Demonstration Site
A request for proposals for the design of a demonstration site at the Nyack Beach State Park in Upper Nyack, NY was drafted and circulated to project partners for comment. The RFP is currently being reviewed by agency staff. The NYSDEC Hudson River Estuary Program is funding the Dockside shoreline design.

e. *Demonstration Site Network*
Emilie Hauser and Christina Tobitsch continued to advance documentation of innovative shoreline projects. Christina Tobitsch worked with the site designers, property owners, and funders to complete four case studies (Esopus Meadows, Habirshaw Tidal Marsh, Foundry Dock Park, and Athens 4th Street Kayak Launch). Final case studies are posted to http://www.hrnerr.org/hudson-river-sustainable-shorelines/demonstration-site-network/. A professional designer created a standard sign to be placed at every site in the Network. The sign acknowledges the ecological enhancement of the shoreline. Christina is actively working with property owners at every site to arrange the desired location and protocol for installing the signs.

In the next 6 months we plan to:

- Manage the design work projects at the Quiet Cove, Dockside and Nyack.
- Install the network recognition signs and Coxsackie interpretive 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 demonstration site network on-line directory.

4) ***Decision support tool***

In August, Coordinating Team members participated in a simulated decision making process to evaluate how people would use existing Sustainable Shorelines products and tools to assess shoreline conditions and determine management options. The process allowed us to step through how we envision a decision maker would use each of the products and helped to highlight what types of additional tools or products could help end users make informed management decisions. Team members proposed communication products to fill identified gaps.

We continue to engage regulators and experts 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.

Dave Strayer sought and received private foundation funding to develop additional tools to help various stakeholders make better decisions about shore zone infrastructure to be built or managed along the Hudson River. These tools include (1) a simple, attractive brochure; (2) an expert-systems key that identifies and describes appropriate shore zone infrastructure for

different environmental settings and applications; and (3) a series of fact sheets that describe and critically assess different kinds of shore zone infrastructure that might be built along the Hudson. These different decision-support tools are targeted at different groups of people who make decisions about building and managing shore zone infrastructure along the Hudson, and should result in better, more fully informed decisions about managing the Hudson's shore zones.

In the next 6 months we plan to:

- Develop outreach products to support decision making.
- Add these products to the web site.

D. Benefit to NERRS and NOAA:

Jon Miller and Andrew Rella presented the findings of our project at an event sponsored by NY Sea Grant, “The Living Shorelines for Coastal Erosion Protection in a Changing World” on May 15, 2013 in Hauppauge, NY to an audience of government officials, coastal managers, planners, shoreline property owners, marine contractors and consultants and others interested in coastal erosion management.

The following activities are underway to present or make available the findings of the Hudson River Sustainable Shoreline project to NERRS and NOAA audiences:

- The transfer of findings to Reserves in Delaware and New Jersey with other NSC funding, workshop scheduled for October 4, 2013.
- Demonstration network sites will be included in the NOAA and Army Corps of Engineers directory of living shorelines in New York and New Jersey.
- Emilie Hauser is 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. Stuart Findlay, and Jon Miller and Andrew Rella have accepted invitations to speak in the October and January webinars, respectively.

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) ***Outside Funding****:*

David Strayer received a grant from the Hudson River Foundation: "Decision-support tools to improve shore zone management", 2013-2014 for $35,711, with work starting September 1, 2013.

David Strayer has a proposal under review at New York Sea Grant: “Evaluating the ecological value of green walls as shoreline defenses in the Hudson River, 2014-2016.

Stevens Institute, in partnership with Arcadis, Inc., has submitted a proposal for a NEIWPCC, 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.”

NYSDEC Hudson River Estuary Program is providing funding for the design of sustainable shorelines demonstration project at the Nyack Beach State Park and Dockside in Cold Spring for approximately $75,000 each.

2) ***Activities:***

Kingston, NY (Ulster County) Flooding Task

Several coordinating team members facilitated the 9-month, community-based Kingston Flooding Task Force process. Between December 2012 and August 2013, 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.