

OPALUCH, URI
DHS Coastal Resilience Center
Research Project:
Annual Project Performance Report
Covers reporting period July 1, 2016 – June 30, 2017

1. Project Title:

Overcoming Barriers to Motivate Community Action to Enhance Resilience

2. Principal Investigator / Institution:

James Opaluch; Univ. of Rhode Island

3. Other Research Participants/Partners:

Austin Becker, Marine Affairs, Univ. of Rhode Island, Dawn Kotowicz, Donald Robadue, and Pamela Rubinoff, Coastal Resources Center, Univ. of Rhode Island

4. Short Project Description (“elevator speech”):

To date there is little quantitative information on the ability of communities to adapt to the threat of coastal hazards (e.g., Corps of Engineers, 2012). This project is designed to improve our understanding of the barriers that impede community adaptation to coastal storm hazards, and designs and designs interventions that can have potential to overcome these barriers. We combine individual interviews, group decision processes, a retrospective review of public dialog and policy simulation exercises to identify key barriers and to design interventions to overcome those barriers.

5. Abstract:

This research contributes to DHS programs by helping to improve the resilience of communities that face risks from coastal storm hazards. It is widely recognized that national preparedness for hazards is not simply the responsibility of the government, but rather preparedness is a responsibility that is shared by everyone—including citizens, the private sector, and communities (e.g., Department of Homeland Security, 2014; National Academy of Sciences, 2012). Yet recent studies have shown that individual preparedness has remained largely unchanged for at least a decade (e.g., FEMA, 2014).

The goal of this research is to improve our understanding of how we can increase “whole community” preparedness for coastal storm hazards. To do so, we apply insights from social science models of behavior change to help better understand how to increase the adoption of protective actions by individuals and communities. This research embodies the September 15, 2015 Executive Order “Using Behavioral Science Insights to Better Serve the American People” which encourages agencies to conduct behavioral research to “... review elements of their

policies and programs that are designed to encourage or make it easier for Americans to take specific actions ...” (White House, 2015).

The Behavioral Science literature demonstrates that simply providing information is not generally an effective means of bringing about behavior change (e.g., Velicer et al, 1998; Stern, 2000; Scott, 2002; Moser and Ekstrom, 2010), Rather, increasing the adoption rate of behaviors to mitigate storm effects is challenging (Kesete et al. 2014; Carson et al., 2013; Moser and Ekstrom, 2010). We adopt the lessons of theories of behavior change, that recognize the need for carefully planned and well-designed interventions that are tailored to the specific needs of various groups in order to help to expedite change (e.g., Velicer et al. 1998; Moser and Ekstrom, 2014; Lindell and Perry, 2012).

A key lesson of this scientific literature is that behavior change is not an event, but rather is a process that occurs over a series of stages. The most effective behavior-change programs will identify the specific barriers that impede progress through the various stages, and will apply interventions that are tailored to overcome these specific barriers.

Our project combines the following methods for identifying these barriers and designing interventions:

- (1) Observing group decision processes,
- (2) Carrying out semi-structured interviews of stakeholders,
- (3) Carrying out a retrospective analysis of news reports and policy actions associated with storm events,
- (4) Implementing a pilot survey to carry out a preliminary test of the effectiveness of interventions.

The primary project output is a report that provides recommendations for policy actions that show potential to increase the adaptation rate for protective actions by individuals and communities. These recommendations will be targeted to specific DHS programs, and tailored to specific stages of behavior change

The project outcomes also include development and testing of policy simulation tools, such as storm impact visualizations, that can be used to help improve decision making by helping end users better understanding the consequences action (or inaction). Our current project will test the potential of these policy simulation tools to help overcome barriers to increasing the adoption rate of protective actions. Note that development of some of the policy simulation tools are part of leveraged activities led by Dr. Austin Becker, and are being tested in this project, as discussed below.

Consistent with the spirit of the DHS “Whole Community” approach, we will disseminate project-related information as widely as possible. We will also transmit information to representatives of the private sector, and to federal, state, local government officials by leveraging ongoing planning activities in which project co-PIs routinely participate. Examples of these activities for September 2015 June 2017 are reported in the Appendix A.

6. End users:

End users for this project include a large number of community members at varying levels, from the local to the state and national levels. This is consistent with FEMA’s “Whole Community Approach to Emergency Management” (e.g., FEMA, 2011), which “[e]mphasizes the need for

the whole community to work together in a variety of ways and make the best use of resources” (Department of Homeland Security, 2014). “Recognizing that preparedness is a shared responsibility, it calls for the involvement everyone—not just the government—in preparedness efforts. By working together, everyone can keep the nation safe from harm and resilient when struck by hazards...” (Department of Homeland Security, 2014) Similarly, Presidential Policy Directive calls for DHS to formulate a “... campaign to build and sustain national preparedness, including ... community-based and private-sector programs to enhance national resilience”. And a recent National Academy of Science report on disaster resilience concluded that “[d]isaster resilience is everyone’s business and is a shared responsibility among citizens, the private sector, and government.” (NRC, 2012)

The Table below contains a list of “Whole Community” participants in the research process, who are also included as end users for the project outputs. To date, the end users have provided critical input into the research project (see Tasks 1 and 2 in the Research Milestones below), and have been participants in planning meetings, some of which have been organized and/or facilitated by Project PIs Rubinoff and Becker. The dates, titles and purpose of these events are briefly summarized in Appendix A. These activities include both direct project-related efforts, and leveraged efforts of ongoing activities of co-PIs that the project capitalized upon (see Leveraged Activities in Table 2 below).

The meetings are designed to assist private and public officials in planning for coastal storm hazards, and for the coordination of protective actions across the various participants. Simultaneously, we used the events to (1) identify the barriers and interventions discussed above, (2) generate hypotheses to be further explored in interviews, (3) make recommendations to end users regarding actions that can be taken by stakeholder participants. We will continue interact with various officials as part of these ongoing efforts in order to obtain community perspectives on potential actions to make their community more resilient to coastal storm damages.

Individuals at the municipal level with whom the members of the research team are working include Pamela T. Nolan, Town Manager for Narragansett, City of Warwick Mayor Scott Avedisian, Warwick City Council Chair Donna Travis, Charlestown Town Council Member Virginia Lee, and Executive Director Daniel Beardsley of the Rhode Island League of Cities and Towns.

We have also identified the following end users who have been involved in the process to varying degrees:

- Tim Smail Federal Alliance for Safe Homes (FLASH)
- FEMA HQ - Individual & Community Preparedness Division.
- Michelle Burnett and Jessica Stimson, RI Emergency Management Agency
- NOAA Office of Coastal Management
- Elizabeth Stone. Office of the Director, RI Department of Environmental Management
- Board of Directors of the Rhode Island Flood Mitigation Association
- National Institute of Science and Technology
- U.S. Department of Health and Human Services

The current Phase of the project has focused primarily on a Rhode Island-specific application, but later phases of the research will extend the methods, results and outputs obtained in Rhode Island to other geographic contexts.

"Whole Community" End Users	
Private Sector Associations, Educational Institutions and Nonprofits:	
RI Realtors Association RI Builders Association Westerly Economic Development Committee RI Independent Insurers Association Save-the-Bay Homeowners Associations of Block Island & North Kingstown Salt Pond Coalition (Nonprofit Advocacy Group) RI Nursery and Landscape Association American Society of Civil Engineers Univ. of Albany	Quonset Development Corp ProvPort (Port Authority) Private firms on the waterfront FM Global (Global Insurer of Commercial & Industrial Property) Save-the-Bay CommerceRI (State of RI Business Promotion Agency) RI Marine Trades Association, Newport Maritime Association. Private Marinas. RI Sea Grant/Coastal Resources Center
Federal/State/Local Government Agencies	
RI Department of Environmental Management RI Coastal Resources Management Council RI Division of Statewide Planning RI Flood Mitigation Association RI Emergency Management Agency. South County Communities (Town Representatives) RI Green Infrastructure Project US Army Corps of Engineers	RI Coastal Resources Management Council RI Division of Planning Providence Department of Planning RI Emergency Management Agency US Marine Administration (MARAD) US Coast Guard US Army Corps of Engineers

7. Unanticipated Problems:

Year 2 funding was not made available until October 2016, which postponed progress in Year 2 of the project, particularly as co-PIs Opaluch and Becker have 9 month academic appointments, and their work on the project is concentrated in the summer months. We adjusted for this unanticipated delay by concentrating Year 2 work in May-June 2017, and by requesting a no cost extension through August 31.

8. Project Impact:

As discussed above, this project identifies barriers to creating more resilient coastal communities, and policy interventions that can help overcome these barriers. This information is of direct relevance to FEMA programs such as the Science and Technology Directorate Flood Apex Program, FEMA’s National Preparedness Directorate, and the Community Rating System, among others. The work is of particular relevance to the Individual and Community Preparedness Division and FEMA’s National Flood Decision Support Toolbox.

The information on barriers and interventions helps to answer questions asked by FEMA programs, including the Flood Apex program, which asks:

- “Why do property owners and renters not buy and hold flood insurance, especially when it is a mandatory requirement of a mortgage?”
- “How can developers, real estate companies and lenders contribute to decreasing flood risk and promoting insurance?”
- How can FEMA better foster and promote products made by other public and private sources?” (FEMA, 2017)

Specific project impacts to date include the following:

PI James Opaluch participated in the Rhode Island State Legislative Commission on Economic Impacts of Sea Level Rise and Coastal Flooding. The Number 1 recommendation of the report was for the State of Rhode Island to develop a process for providing storm vulnerability audits, and to seek funding to implement such a process (State of Rhode Island, 2016). The results of the audit would be given to the property owner with “...an evaluation detailing overall risk and flood preparedness along with specific resiliency measures available.” The property owner “... could be eligible for certain financing measures to reduce costs in exchange for implementing these resiliency measures. This recommendation has led to the introduction of a bill in the Rhode Island Legislature to create a system of storm vulnerability audits. We see a system of storm vulnerability audits, with associated incentives to adopt recommended actions, as an effective tool increasing the adoption rate of protective actions.

This project leverages ongoing efforts by co-PI Pamela Rubinoff, who has participated in planning process for coastal resilience for several Rhode Island communities, and who has played a major role in development of Rhode Island Shoreline Change Special Area Management Plan (Beach SAMP). The Beach SAMP is a guidance document and a set of tools to help state and local decision makers prepare for, and adapt to the impacts of coastal storms, erosion, and sea level rise. The Beach SAMP develops official planning documents for the Rhode Island Coastal Resources Management Council. Consistent with the “Whole Community” philosophy, the intended audience for the documents include the Rhode Island Coastal Resource Management Council, as well as decision makers, planners, boards and commissions in Rhode Island’s 21 coastal communities who are the main individuals responsible for coping with the impacts of storms, coastal erosion, and sea level rise. The Beach SAMP is also intended for other state and federal agencies with the responsibility of planning for coastal resources, assets and property in Rhode Island. (<http://www.beachsamp.org/wp-content/uploads/2015/12/Beach-SAMP-Introduction.pdf>). This project leverages activities of the Rhode Island Coastal Resources Management Council, and activities funded by Rhode Island Sea Grant and others by capitalizing on these planning processes.

Project co-PI Dr. Austin. Becker gave a Congressional Briefing hosted by Congressman Alan Lowenthal on June 12, 2017. The Briefing focused on planning coastal development and resilience to extreme events in order to enhance the quality of life and economic strength of coastal areas.

9. Research Activity and Milestone Progress:

Research Activities and Milestones: Progress to Date

Reporting Period 7/1/2016 – 6/30/2017			
Research Activity	Proposed Completion Date	% Complete	Explanation of why activity / milestone was not reached, and when completion is expected
Task 1. Literature Review		100%	<p>We have developed an annotated bibliography of several hundred publications and reports. We will continue to update the literature review throughout the project as we identify additional literature.</p> <p>We have also compiled an electronically searchable dataset of nearly 1,200 reports on coastal hazard issues.</p>
Task 2. Group Decision Processes		100%	<p>We have facilitated, observed and participated in a total of 35 group decision processes listed in the Appendix. We will continue to participate in this activity as opportunities arise through the project in order to obtain additional insights, to maintain 2-way communications and to deliver products to the various stakeholders.</p>
Task 3. Individual Semi-Structured Interviews	12/31/17	75%	<p>We have completed roughly 30 interviews of various stakeholder to follow up on hypotheses generated as part of Task 2, discussed above. Those interviews include private citizens, as well as local and state officials. We have also carried out a pilot survey on perceptions of storm risks and protective actions by private citizens to reduce storm vulnerability.</p> <p>Our initial task for semi-structured interviews is complete.. But we have extended our plan for semi-structured interviews to follow up on the timeline of actions (See the discussion of the timeline, below). This part of the task is scheduled for completion in Dec 2017.</p>

Task 4. Initial Draft Policy Simulation Tools	12/31/17	50%	This Task is on schedule to be completed by Dec 31, 2017. We have carried out preliminary tests of some Policy Simulation Tools within the context of a pilot survey listed as part of Task 3, above.
Timeline of Storm Events and Protective Actions	12/31/17	75%	<p>This Task searches for news items, reports and documentation of policy actions to develop a timeline for (1) barriers to resilience, (2) protective actions and (3) the temporal connections with major events (e.g. hurricanes).</p> <p>This task augments Tasks 1 and 2 by providing a longer-term perspective. We hypothesize that opportunities for change vary over time, so there may exist “windows of opportunity” when real change is more likely to occur.</p> <p>This task studies the dialog in news media and various reports to see whether we can identify particular times when barriers appear to be lowest, and when interventions become more feasible from political, economic and social perspectives.</p> <p>We also intend to follow up on this timeline with interviews to get the perspective of key participants with a long history of engagement in the public policy process on coastal hazards.</p> <p>This activity is on schedule to be completed by December 31, 2017</p>
Research Milestone			
Plan for Coordination with Davidson Research Team	12/31/2016	100%	We held periodic conference calls with the Davidson team during 2016. This activity is now complete.

Updated Literature Review	3/1/2016	100%	<p>As indicated above, we have compiled an annotated bibliography of several hundred publications, reports and other documents. However, this activity will continue throughout the project as addition literature is identified.</p> <p>As indicated above, we have also compiled a set of nearly 1,200 reports and policy documents that are in digital searchable form. This database is being used to develop a retrospective analysis and timeline of events and protective actions, as discussed above.</p>
Facilitate, Observe and Participate in Group Decision Processes		100%	<p>The goals of this activity were accomplished in Year 1 of the project. However, we have continued to participate in this activity as opportunities arise through Year 2 of the project in order to obtain additional insights, to maintain 2-way communications with end users, and to test and deliver project outputs to end users.</p> <p>We have facilitated, observed and participated in a total of 35 meetings involving group decision processes, listed in Appendix A (Note: Some activities in Appendix A involved more than one meeting).</p>
Preliminary list of barriers and interventions	12/31/2016	66%	<p>We have developed an initial list of barriers to adoption of protective actions and interventions to overcome those barriers using the results of Group Decision Processes and semi-structured interviews. We have carried out a preliminary test of some interventions using a pilot survey.</p> <p>We are preparing a report that links each barrier and intervention to specific DHS programs and reports, as well as to state and local programs.</p>

Complete One-on-One Interviews	12/31/2016	75%	<p>As indicated above, we have completed roughly 30 interviews of various stakeholder to follow up on hypotheses generated as part of the Group Decision Processes, discussed above. Those interviews include private citizens, as well as local and state officials.</p> <p>Additional interviews will be carried out to follow up on hypothesis based on the retrospective timeline.</p> <p>We have also completed an on-line survey that involved roughly 110 respondents regarding likelihood of a major storm event in the area, their storm vulnerability and actions that have been taken to reduce risks. This survey was also used to provide a pilot test of the effectiveness of storm visualizations.</p>
Timeline of News Reports and policy documents	12/31/2017	75%	This work is to be completed in Year 3 of the Project, no later than June 2019, assuming the promised no-cost extension
Content Analysis of Interviews	12/31/2017	0%	Content analysis of interviews is set to begin once interviews are finished. Content analysis is on schedule to be completed in Dec 31, 2017.

10. Transition Activity and Milestone Progress:

Transition Activities and Milestones: Progress to Date

Reporting Period 7/1/2016 – 6/30/2017			
Transition Activity	Proposed Completion Date	% Complete	Explanation of why activity / milestone was not reached, and when completion is expected
Workshops on Coastal Resilience	12/31/2017	25%	We had proposed to organize and carry out one or more workshops to showcase tools developed by the various Rhode Island projects to end users. This activity is on schedule to

			<p>be completed by Dec 31, 2017, as initially planned. See discussion below for current status.</p> <p>As noted in previous project reports, this project has no money budgeted for this activity, but we continue to seek to leverage events and other activities funded elsewhere. See the discussion on Transition Milestones, below.</p>
Report on Barriers to Adaptation and Interventions to overcome barriers	12/31/2017	75%	<p>We have compiled a preliminary list of barriers and interventions, and are developing a report to be released to end users. The report will also include specific programs of FEMA and other end users for which this information is of direct relevance.</p> <p>This work is on schedule to be completed in Dec 2017. Extensions and refinements may be carried out during the anticipated period of no-cost extension through June 30, 2018.</p>
Transition Milestone			
FEMA Course on Coastal Resilience	12/31/2017	25%	<p>We will participate in a FEMA course on coastal resilience held June 19-22 involving numerous Rhode Island state and town officials. This course will demonstrate several products being developed by the URI projects, including draft policy simulation tools.</p> <p>Following this event, we will determine whether there is a need for a follow up workshop showcasing more completed project tools, assuming adequate funds can be identified.</p>
Presentation at Congressional Briefing	6/12/2017	100%	Dr. Austin Becker was a presenter at a Congressional Briefing on Coastal Resilience that was hosted by Congressman Alan Lowenthal

11. Interactions with education projects:

We have funded Courtney Hill from Tougaloo College to serve as a summer intern for our project. The goal of the internship is to expose Courtney to rich and varied educational experience centered on adaptation to coastal hazards. The primary project-related activity is participating in our retrospective review and timeline of community response to storm events by analyzing the content of various types of reports, data bases, interviews and news coverage of coastal hazards. This activity will develop a timeline of coastal storms and associate community response to provide a longer terms perspective on barriers to adaptation and potential interventions. This review will utilize state agency permit data; reports of state and local policy responses; content analysis of newspaper coverage of post-storm events; and identification of patterns of decision making. The findings will be reported in the form of a timeline of events and associated responses. The student intern will participate in team meetings, and have the opportunity to engage in other coastal resilience meetings and activities of the URI-CRC project.

We have also carried out a separate set of educational activities on coastal storm hazards. In the spring 2017 semester we ran a Capstone Class with 27 students in the Department of Environmental and Natural Resource Economics. The Capstone is a senior-level class, in which students carry out a detailed case study of direct policy significance applying the methods that they learned throughout their undergraduate careers.

This year's Capstone focused on the issue of improving storm resilience in coastal communities, with a case study of Misquamicut, Rhode Island. Misquamicut is an excellent case study, as it is coastal beach community that is extremely vulnerable to inundation by coastal storms, and as has a repeated history of hurricane devastation including the Great New England Hurricane of 1938, Hurricanes Carol in 1954, Gloria in 1985, Bob in 1991, Irene in 2011 and most recently Sandy in 2012.

The Capstone project was coordinated with Capstone classes in the Ocean Engineering Department and the Landscape Architecture Department to create an interdisciplinary collaboration that focused on increasing the resilience of Misquamicut to coastal storm hazards. The students in the three Capstone classes met periodically throughout the semester, and shared research plans, project data and research findings. At the end of the semester the students from the three Capstone classes hosted an event with public presentations of their findings to a set of "whole community" end users.

The Ocean Engineering Capstone project analyzed potential physical damages to properties in Misquamicut for scenarios of varying hurricane intensity and sea level rise. Landscape Architecture students created different designs for communities to improve storm resilience. Environmental Economics students in our Capstone carried out three sets of analyses:

- (1) A cost-benefit analysis of alternative structural solutions, including shoreline armoring, beach renourishment, elevating structures and retreat from hazard zones;
- (2) A housing value assessment to see whether coastal storm threats are reflected in housing prices;
- (3) A survey of the local public on risk attitudes and willingness to take protective actions.

The survey was used as a pilot test of the effectiveness of storm visualizations. Roughly 110 respondents were assigned to two groups: a treatment group that was shown visuals of storm

impacts and a control group that was not shown visuals. Aggregate survey responses were compared across the control and treatment group to test the hypothesis that visualizations of storm impacts affected the respondents’ perceived risk of coastal storms, and to compare stated intentions to take protective actions with vs without storm visualizations. We found that the visualizations show promise in preparing communities to adapt to storm hazards, both in terms of an increased perception of storm risks, and in terms of a stated willingness to take protective actions. Details of the findings will be included in the Biennial Review.

12. Publications:

Becker, Austin, Pamela Matson, Martin Fischer, and Michael D. Mastrandrea, Forthcoming. “Towards Seaport Resilience for Climate Change Adaptation: Stakeholder Perceptions of Hurricane Impacts in Gulfport (MS) and Providence (RI)” *Progress in Planning*. Status: Accepted for Publication. Anticipated Publication Date November 2017.

Zhang, H., Ng, A., Becker, A. (In Press), “Institutional Barriers in Adaptation to Climate Change at Ports, Regions, and Supply Chains.” North American Symposium on Climate Adaptation, New York, New York. Aug. 16-18, 2016. (Refereed Conference Paper)

Touzinsky, K, Rosati, J., Fox-Lent, C., Becker, A., Luscher, A., 2016. “Advancing Coastal Systems Resilience Research: Improving Quantification Tools through Community Feedback” *Shore and Beach* Vol. 84 No. 4 · November 2016.

13. Tables

Table 1: Documenting CRC Research Project Product Delivery

<u>Product Name</u>	<u>Product Type</u>	<u>Approx. Delivery Date</u>	<u>Recipient or Anticipated End Users</u>
Coastal Storm Planning Tools	Visualizations and other information tools	Testing in June 2017, Revisions in Dec 2017	Products will be tested at a June 2017 FEMA course on Integrated Emergency Management for hurricane preparedness.
Barriers and Interventions to Adaptation	Report with guidance and program-specific recommendations	Dec 2017	FEMA, Individual and Community Individual and Community Preparedness Division; FEMA National Flood Decision Support Toolbox; RI Coastal Resources Management Council; RI Coastal Communities

Table 2: Documenting External Funding and Leveraged Support

<u>External Funding</u>			
<u>Title</u>	<u>PI</u>	<u>Total Amount</u>	<u>Source</u>
Measuring Climate Risk to Inform Resilience: Pilot Study for North Atlantic Medium and High-Use Seaports	Dr. Austin Becker	\$280,000	US Army Corps of Engineers
Climate Change Community Resilience ¹	co-PI Pamela Rubinoff	\$47,625	RI Sea Grant
<u>Leveraged Support</u>			
<u>Description</u>			<u>Estimated Annual Value</u>
Returned Indirect Cost			\$4,328
Project Management and Coordination			\$1,500

¹ Our DHS project leverages ongoing efforts by co-PI Pamela Rubinoff and colleagues at the URI Coastal Resource Center to increase resilience of coastal communities in the face of climate change. Many of the group decision processes listed in the Appendix are organized by, or otherwise associated with this Sea Grant funded project. We add value to that effort by applying formal a social science based framework of behavior change, identifying barriers to adaptation and interventions to overcome those barriers.

14. Metrics:

<u>Metric</u>	<u>Year 1</u> (1/1/16 – 6/30/16)	<u>Year 2</u> (7/1/16 – 6/30/17)
HS-related internships (number)		
Undergraduates provided tuition/fee support (number)		
Undergraduate students provided stipends (number)		
Graduate students provided tuition/fee support (number)		
Graduate students provided stipends (number)		1
Undergraduates who received HS-related degrees (number)		
Graduate students who received HS-related degrees (number)		
Graduates who obtained HS-related employment (number)		
SUMREX program students hosted (number)		1
Lectures/presentations/seminars at Center partners (number)	2	3
DHS MSI Summer Research Teams hosted (number)		
Journal articles submitted (number)	2	9
Journal articles published (number)		3
Conference presentations made (number)	13	18
Other presentations, interviews, etc. (number)	5	4
Patent applications filed (number)		
Patents awarded (number)		
Trademarks/copyrights filed (number)		
Requests for assistance/advice from DHS agencies (number)	2	
Requests for assistance/advice from other agencies or governments (number)	5	
Total milestones for reporting period (number)	6	7
Accomplished fully (number)	4	5
Accomplished partially (number)		2
Not accomplished (number)		0

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Appendix A. Summary of Group Decision Meetings²

Meetings to Date

1. Rhode Island Legislative Commission on Economic Impacts of Sea Level Rise and Coastal Flooding. (September 24, 2015) Legislative Hearings on economic threats of sea level rise and coastal flooding.
2. Rhode Island Legislative Commission on Economic Impacts of Sea Level Rise and Coastal Flooding. (Oct 15, 2015) Legislative Hearings on economic threats of sea level rise and coastal flooding.
3. Municipal Adaptation Work Session, New Shoreham. (Oct 22, 2015). Purpose: Assist communities to understand exposure to coastal storm hazards, plan for action to reduce risk and implement plans. Increase awareness of tools, planning requirements and adaptation strategies.
4. Municipal Adaptation Work Session, Westerly. (Oct 29, 2015) Purpose: Assist communities to understand exposure to coastal storm hazards, plan for action to reduce risk and implement plans. Purpose: Assist communities to understand exposure to coastal storm hazards, plan for action to reduce risk and implement plans. Increase awareness of tools, planning requirements and adaptation strategies.
5. Municipal Adaptation Work Session, Charlestown. (Oct 29, 2015) Purpose: Assist communities to understand exposure to coastal storm hazards, plan for action to reduce risk and implement plans. Purpose: Assist communities to understand exposure to coastal storm hazards, plan for action to reduce risk and implement plans. Increase awareness of tools, planning requirements and adaptation strategies.
6. Municipal Adaptation Work Session, North Kingstown. (Nov 11, 2015) Purpose: Assist communities to understand exposure to coastal storm hazards, plan for action to reduce risk and implement plans. Purpose: Assist communities to understand exposure to coastal storm hazards, plan for action to reduce risk and implement plans. Increase awareness of tools, planning requirements and adaptation strategies.
7. Rhode Island Legislative Commission on Economic Impacts of Sea Level Rise and Coastal Flooding (Nov 19, 2015) Legislative Hearings on economic threats of sea level rise and coastal flooding.
8. Rhode Island Legislative Commission on Economic Impacts of Sea Level Rise and Coastal Flooding. (December 17, 2015) Legislative Hearings on economic threats of sea level rise and coastal flooding.
9. Town of South Kingstown, Municipal Adaptation Work Session. (January 20 2015) Purpose: Assist communities to understand exposure to coastal storm hazards, plan for action to reduce risk and implement plans. Increase awareness of tools, planning requirements and adaptation strategies.
10. Rhode Island Legislative Commission on Economic Impacts of Sea Level Rise and Coastal Flooding. (January 21, 2016) Legislative Hearings on economic threats of sea level rise and coastal flooding.
11. #ResilientPVD Community Workshop. A team of experts from around the country come to Providence for three days of charrettes, workshops, and community meetings to explore how Providence's infrastructure, buildings, and neighborhoods can prepare for the impacts climate change. (February 1- 3, 2016)
12. Beach SAMP meeting, Meeting of State and Town leaders to discuss adaptation to sea level rise and coastal flooding threats. (February 4, 2016)

² Note that some of these meetings are periodic events that involve attending multiple meetings.

13. Meeting of Community Leaders to Discuss historic and potential future impacts of coastal flooding, and actions to mitigate impacts. (February 16, 2016)
14. Rhode Island Legislative Commission on Economic Impacts of Sea Level Rise and Coastal Flooding. Legislative Hearings on economic threats of sea level rise and coastal flooding. (February 25 2016)
11. BeachSAMP meeting. Meeting of State and Town leaders to discuss adaptation to sea level rise and coastal flooding threats. (April 6, 2016)
12. ANNUAL RIFMA CONFERENCE - "Incentivizing Actionable Resilience to Flooding" - Join floodplain management and hazard mitigation professionals as we explore implementation tools and techniques, and share experiences and lessons learned from the past to improve resiliency in the present and future. (April 7, 2016)
13. Keeping History Above Water Conference, Newport, RI. One of the first national conversations to focus on the increasing and varied risks posed by sea level rise to historic coastal communities and their built environments. This is not a conference about climate change, but about what preservationists, engineers, city planners, legislators, insurers, historic home owners and other decision makers need to know about climate change—sea level rise in particular—and what can be done to protect historic buildings, landscapes and neighborhoods from the increasing threat of inundation. (April 10-13, 2016)
14. RI Silver Jackets (RIEMA, Cranston) - Meeting of Interagency coalition to reduce flood risk. State-led teams, implementation of USACE National Flood Risk Program (April 14, 2016)
15. DC DHS Presentation and discussion with DHS HQ and others on how to link with their efforts. (April 14, 2016)
15. RI Coastal Erosion Control Workshop (April 21, 2016)
http://www.crmc.ri.gov/news/pdf/2016_0421_Workshop_Flyer.pdf
16. Meeting with and presentation by Chris Landsea, NOAA's Joint Hurricane Testbed Director/Science and Operations Officer at the National Hurricane Center. Discussion of all three URI projects funded by DHS, and lecture "Inside the Eye: Improving Hurricane Forecasts". (May 3, 2016)
17. BEACHSAMP Stakeholder Meeting with presentation from Michael Oppenheimer, speaking about climate change and the IPCC. (May 3, 2016)
18. Estuarine and Coastal Modeling Conference (ECM14) at URI - Rick Luettich (UNC lead) will be a keynote, Meeting with Rick Luttich with our team and other key users, including Coast Guard, and possibly other DHS leaders. (June 12-15, 2016)
19. New England Climate Adaptation, Preparedness, and Resilience seminar - Organized by DHS Infrastructure Protection, EPA, FEMA, NOAA, NH Department of Safety. First in a series of New England seminars. (May 24 – 25, 2016)
20. Preparedness Conference (CCRI) - Series of presentations, trainings, and exhibits.
<http://www.riema.ri.gov/resources/government/prepare/preparednessconference/index.php> (August 10-11, 2016)
21. RI Shoreline Change Special Area Management Plan Meeting, (August 25, 2016)
22. Presentations on Misquamicut Storm Vulnerability. Presentations by Rhode Island Officials to Capstone Classes. (Feb 3, 2017)
23. Coastal Storm Vulnerability Case Study. Misquamicut beach storm vulnerability site visit to led by RI Coastal Resources Management Council. (Feb 3, 2017).

- 24.** Rhode Island Association of Emergency Managers (RIAEM) - Monthly meetings of local emergency managers, Red Cross, RIEMA, and Dept of Health. Identify tangible and useable products. Obtain feedback on prototypes of hazard management tools.
- 25.** RI Annual Conference on Building Flood Resilience, (April 6, 2017)
- 26.** Improving Resilience to Coastal Storms: Misquamicut Capstone Presentations, Reporting of findings of Capstone Classes to Stakeholder Groups. (May 5, 2017).
- 27.** RI Executive Climate Change Coordinating Council Meeting, Council created by RI Legislation to coordinate planning for climate change impacts into the duties of all state agencies. (June 14, 2017)
- 28.** FEMA Integrated Emergency Management Course/Community Specific Public officials and other leaders are placed in a realistic simulation of a hurricane disaster scenario to enhance storm preparedness. (June 19–22, 2017).

Appendix B. Policy Simulation Laboratory Facilities

Policy Simulation Laboratory. The URI Department of Environmental and Natural Resource Economics (ENRE) manages the Policy Simulation Laboratory (Sim Lab) and associated facilities. Dr. James Opaluch, project PI, is the Department Chair of ENRE, and is the Founder and Director of the SimLab. This will be the venue for social science-based laboratory experiments to be done in support of this project. The SimLab and associated facilities is a group of electronically networked rooms that capitalize on emerging technologies to help citizens, policy makers and other interested parties better understand the consequences of actions.

What makes this facility unique is the close integration of the various system components to create a flexible, coordinated facility for studying decision making, and for helping communities or stakeholders to visualize the consequences of policy actions. All of the rooms are linked through the use of computer networks, so we can harness the power of modern technology to help communities make better decisions.

The facilities include the SimLab, two Group Decision Rooms, a Presentation Hall and a Large Conference room. The SimLab is a computer lab with 26 computer workstations and advanced audio-visual capabilities. The Group Decision Rooms are small conference rooms that seat up to 12 people who make decisions while interacting face-to-face. The Presentation Hall is a 125-seat auditorium with advanced audio-visual aids and in-seat voting capabilities.

3-D data-drive visualizations will be used to present storm scenarios to participants in policy simulations. Some preliminary examples of 3-D visualizations are presented below. As currently envisioned, hurricane simulation modeling work by other CRC projects is used to forecast storm effects for different storm scenarios, including wind speed and inundation. These data are used to identify likely storm impacts to structures. Maps are used to depict model forecasts for inundation and/or wind speeds from a given storm scenario. By clicking on locations on the map, 3-D visualizations representing those impacts are presented to participants in policy simulations to help them better understand likely vulnerability across the landscape.



Policy Simulation Laboratory

Appendix C. Example Policy Simulation Tools



Clicking on Map Locations Brings Up 3-D Visualizations of Representative Impacts to



Static Visualization (not 3D Model)

