ACCELERATING COLLECTIVE LEARNING AND ACTION FOR ENHANCED CLIMATE RESILIENCE

NERRS Science Collaborative

Kachemak Bay Reserve, AK ⑨

San Fransisco Bay Reserve, CA ⑦

Tijuana River Reserve, CA ③ ④

⑤ ⑧ Wells Reserve, ME
Great Bay Reserve, NH

Waquoit Bay Reserve, MA
Narragansett Bay Reserve, RI

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Hudson River Reserve, NY

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Jacques Cousteau Reserve, NJ

Delaware Reserve, DE

Chesapeake Bay Reserve, MD

North Inlet-Winyah Bay Reserve, SC

NOAA Office for Coastal Management

Mississippi-Alabama Sea Grant Consortium, MS   Weeks Bay Reserve, AL

This graphic illustrates how collective learning and accelerated action for enhanced climate resilience is facilitated by the interconnectedness of the Reserve system. These nine projects, supported by the Science Collaborative between 2015 and 2018, are a just a sub-set of the resilience and adaptation work being led by the reserves. How to read this map: Numbered dots indicate the location of the lead reserve for each project. Color-coded lines indicate an exchange of information, tools, or activities between reserves and partners.
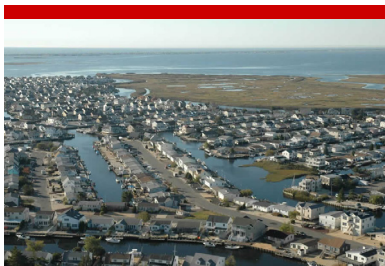
1 Coastal hazards risk communication: A technical assistance transfer project within the NERRS
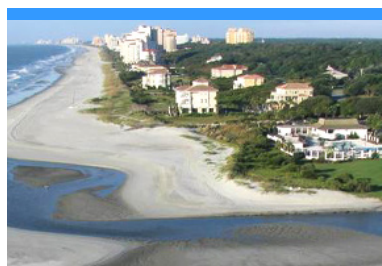

2 Enhancing coastal resilience decision-support tools to reflect the latest local applied science

3 Tools, techniques, and tactics for advancing successful climate adaptation

4 Carrying out climate scenario planning for the Kenai Peninsula, Alaska
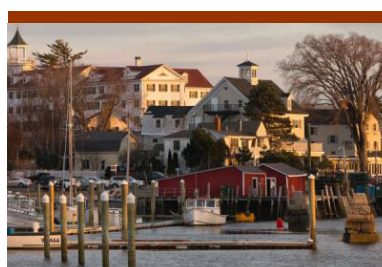

5 From NECAP to GCAP: Transferring climate adaptation knowledge and tools from New England to Georgetown, South Carolina
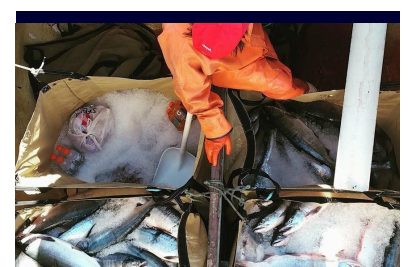

6 Assessing the effects of storm surge barriers on the Hudson River estuary

7 A collaborative process to develop solutions for tidal road flooding in China Camp State Park

8 Decreasing vulnerability for Maine's beach-based business community

9 Promoting coastal community resilience through Alaska fisheries business self-assessments

ACCELERATING COLLECTIVE LEARNING AND ACTION FOR ENHANCED CLIMATE RESILIENCE

Awareness of climate change is growing, and many groups are addressing the issue and sharing lessons learned in order to help communities prepare in the face of uncertainty; however, the pace of learning must also accelerate to keep up with the increasing rate at which climate change impacts natural and built environments. To meet this need, the National Estuarine Research Reserve System (NERRS) and partners are exploring a range of approaches to enhance climate resilience and are finding ways to transfer methods and lessons learned. This management brief highlights the work of nine project teams, supported in part by the NERRS Science Collaborative, that have been working to enhance coastal resilience across the country. These projects illustrate a few of the ways in which the reserves and their partners are advancing climate adaptation and resilience.

An aerial view of communities impacted by flooding in New Jersey. Photo credit: Jacques Cousteau Research Reserve

SUPPORTING DIALOGUE WITH TOOLS AND TRAINING

Embedded within their communities, reserves are well-positioned to identify specific needs, and can fill knowledge gaps with training and tools. As the two examples below illustrate, tools such as maps and conceptual frameworks can enhance the work of reserves and their partners, improving how we talk about climate change, how we assess vulnerabilities, and how we determine appropriate adaptation strategies.

1 The Jacques Cousteau reserve in New Jersey became especially attuned to the need for better risk communication in the months following Superstorm Sandy, which devastated the region but opened up opportunities for talking about future risks. Reserve staff saw an opportunity to incorporate their own observations and

National Estuarine
Research Reserve System
Science Collaborative

lessons learned into standard **risk communication training materials** to make them more real and locally relevant.

To transfer this work, a project team - made up of specialists from the Jacques Cousteau, Chesapeake Bay-Maryland, Narragansett Bay, and Weeks Bay Reserves, the National Estuarine Research Reserve Association, and the NOAA Office for Coastal Management - created a unique two-day training program, which combines risk communication training with an opportunity to apply the principles to local projects and programs in a workshop setting. The program has been used in five states to help decision makers learn the skills needed to communicate about risks better and improve the effectiveness of their resilience planning and hazard management initiatives.

What's more, thanks to the propensity of reserves to transfer knowledge and tools across sites and with partners, project participants didn't need to create their own tools to assess or communicate risk; instead, they learned from their colleagues' work and applied lessons within their local context.

2 There are also tools that help to assess risk, such as the **NJFloodMapper** recently updated by Jacques Cousteau reserve and Rutgers University, which will provide a statewide coastal resilience assessment and planning framework for New Jersey. With the stated goal of operationalizing the total water level concept - i.e., the combination of tides, surge, and wave runup used to estimate where the ocean will meet the coast - the framework: a) steps users through key decision points; b) relates water levels to geographically relevant historic events; and c) allows users to visualize total water level. Through enhanced mapping and decision-support tools, the project team aims to increase the capacity of New Jersey's coastal decision makers to assess and plan for potential risks to people and property from future storms and related flooding.

The project team engaged experts with extensive experience in state and local planning for climate-related hazards throughout the development process; this enabled them to incorporate feedback on content and design into the final tool. Early versions of the mapper have been well received, with end users indicating they will use it to update local master plans and hazard mitigation plans, and in resilience planning efforts at local, regional, and state levels.

3 Building on these and other initiatives to foster productive dialogues around climate change planning, Susi Moser - a member of the Science Collaborative team - has been working with reserves and their partners to be more specific about what **adaptation success** could look like in their region and how progress could be measured and tracked over time.

Flooding and storm surge pose major threats to infrastructure in many coastal communities, as shown in this photo of a 2015 flood in South Carolina.
Photo credit: National Guard

HOW RESERVES ENRICH RESILIENCE EFFORTS

The National Estuarine Research Reserves are positioned to monitor key metrics that provide insights into how climate change is impacting water quality and coastal habitats, which has important implications for adjacent towns and cities.

Reserve staff bring expertise in coastal ecology to discussions about coastal infrastructure and land use planning and can help communities recognize and maximize the natural buffering and protective services provided by wetlands. By design, reserves are place-based; their training and education specialists are highly attuned to the communities around them, and can identify and reach out to groups that may not yet be involved in resilience planning.

Due to their unique funding and management structures, reserves can readily work across sectors to leverage the resources of the federal government while connecting with local entities; but reserves also benefit from participation in a national network of 29 member locations that can readily facilitate transfer and learning about climate resilience strategies.

To date, five reserves have piloted efforts to develop locally appropriate metrics and indicators to help evaluate climate adaptation success. This group of reserves is now integrating their diverse experiences and developing resources to help other reserves facilitate dialogues and advance efforts around successful adaptation. A range of resources, including facilitation tools, example indicators, case studies and related reports will soon be available through a new online toolkit.

GETTING TO ACTION THROUGH SCENARIO DEVELOPMENT AND PLANNING

Successful community adaptation efforts require collective and coordinated actions involving a broad suite of stakeholder groups. To address this need, reserves and their partners are applying a variety of customized community planning approaches to bring diverse voices together and make climate adaptation strategies more tangible, local, and actionable.

4 In Alaska, for example, a cross-reserve project team - consisting of coastal training staff at the Tijuana River and Kachemak Bay Reserves - leveraged findings from an initiative at Tijuana River Reserve in California to help design and facilitate climate change dialogues in Alaska's Kachemak Bay region.

The project team conducted one-on-one interviews with local leaders and researchers and facilitated workshop discussions that informed the development of planning scenario narratives. Each scenario narrative is an alternative description of how the future may unfold, outlining a different plausible trajectory for the system that helps community leaders make sense of climate information and planning options.

Thanks to the efforts of workshop participants, not only have cities and boroughs been factoring anticipated local climate trends into their planning processes, but they've garnered community attention and support for climate adaptation via creative media and outreach strategies such as art programs and children's stories.

A vital stretch of road in China Camp State Park, California is frequently impassable or damaged due to storms and tidal flooding.
Photo credit: Stuart Siegel, San Francisco Bay Research Reserve

5 In South Carolina, a project team - made up of specialists from the University of South Carolina, Coastal Carolina University, the Consensus Building Institute, and North Inlet-Winyah Bay Reserve - is developing and implementing a novel approach to climate adaptation planning that uses role playing and case studies to immerse community members in the planning process. The project, called the Georgetown Climate Adaptation Project, applies lessons learned from the New England Climate Adaptation Project and has created a locally relevant set of **case study materials** around coastal flooding issues.

Structured in a workshop setting, participants receive background information describing a fictional county in the southeastern United States - typically with a striking resemblance to their own - and must assume a fictional role in which they work collaboratively to prioritize actions that help the community manage flooding risks.

Beach-based businesses are inherently vulnerable to storms and flooding, but represent a major component of many coastal economies.
Photo credit: Susan Downing.

Role-playing workshops have been held in four communities, and participants have included two mayors and other municipal officials and a range of other community members. Participants report that the overall experience has helped demystify the role of government in adaptation planning and allowed them to more clearly see the tradeoffs in making adaptation decisions. For community leaders, the role-playing exercises offered a chance to experiment with collaborative decision-making and stakeholder engagement, which led to a series of recommendations for establishing community task forces to support comprehensive planning.

IDENTIFYING ADAPTATION SOLUTIONS THROUGH DATA SYNTHESIS AND ENGAGEMENT

Community visioning and planning exercises can uncover specific vulnerabilities in coastal infrastructure that need in-depth, integrated assessments in order to evaluate and select appropriate engineering options. The two projects described here combined targeted data collection and synthesis with robust collaborative processes to help clarify adaptation options and catalyze next steps. By integrating ecological, engineering, and collaborative expertise, the projects are helping decision makers evaluate options around particularly sensitive infrastructure decisions.

Port cities are considering a range of options to protect valuable coastal infrastructure from coastal storms and sea level rise, but there are always tradeoffs and a range of views on what's appropriate for a particular place. For example, the US Army Corps of Engineers is assessing the feasibility of building a system of gated storm surge barriers that could be closed when a storm is expected to push a surge of water toward the coast and flood the New York/New Jersey Harbor region.

6 In parallel with this work, researchers from the Stevens Institute of Technology are working closely with the Hudson River Reserve to broaden research about the effects of prospective surge barriers and analyze how they would change and impact the physical conditions, wetlands, migrating organisms, and the ecology of the estuary.

With facilitation support from the Consensus Building Institute, the team has conducted interviews with individual decision makers and is convening a series of workshops to identify areas of emerging consensus among the broader scientific community, as well as short- and long-term research needs, potential research partnerships, and funding strategies to pursue. State and federal participants have responded positively to initial findings and one state agency has already offered to fund additional modeling work, demonstrating the power of the project team's complementary collaborative and technical expertise.

7 Although the damage caused by coastal flooding can be especially costly in large seaports, sea level rise threatens shoreline infrastructure in nearly every coastal town, and there are no easy solutions. In California, a project team led by the San Francisco Bay Reserve is seeking creative solutions for dealing with transportation infrastructure that is repeatedly damaged or impassable due to storms and tidal flooding - specifically, a vital stretch of shoreline road that bisects the San Francisco Bay Reserve's China Camp State Park.

Resilience specialists at the reserve thoughtfully mapped out and engaged key players, including the California Department of Parks and Recreation, Marin County Board of Supervisors, and Marin County Department of Public Works. Through three formal workshops and many individual consultations, they've engaged homeowners' associations, tribal groups and the many organizations involved in recreation and management of the park and surrounding watershed.

New monitoring and analysis of water levels have allowed the team to illustrate the severity and pattern of flooding on the road for participants. Workshop discussions have generated specific planning goals, feasibility criteria, alternative road configurations, and a set of weighting factors to evaluate road options.

In addition to clarifying options and spelling out the regulatory considerations for advancing any of the road reconfiguration plans, the team is also documenting their process for others to adopt for their own adaptation challenges. The project team is hopeful that their proactive, participatory, bottom-up approach will help minimize conflict and expedite agency decision making about the road.

ENGAGING BUSINESSES IN CLIMATE PLANNING

Climate change will affect all sectors of the economy but some are likely to be especially vulnerable because, for example, they lack the resources and information needed to plan for potential impacts or to rebuild after a disaster. Reserves are well-positioned to examine their region, and to identify and reach out to potentially vulnerable groups not currently engaged in climate planning.

RESERVES IN ACTION

MISSION-ARANSAS RESERVE

As the Mission-Aransas reserve recovers from 2017 Hurricane Harvey, they are rebuilding facilities to new standards that include hurricane windows, elevated structures where possible, and non-rock roofs. These new building codes provide additional resistance against storm damage, and serve as a regional example for tougher built structures.

Reserve staff are also working with their community through the Coastal Training Program, holding events about climate change and helping develop floodplain management plans where needed.

They continue to monitor sea level rise, water quality, vegetation changes, and sediment accretion and erosion rates within the estuary in hopes of measuring the long-term changes occurring due to climate change.

The two projects outlined here participated in broader community planning exercises that led them to identify a need to engage local businesses better in conversations about climate change and resilience. Both teams found that customizing existing self-assessments created a powerful tool for engaging industry partners, identifying specific vulnerabilities and action items, and potentially tracking adaptation progress over time.

8 In Maine, beach-based businesses, such as hotels, restaurants, and stores, are a vital component of the economy, and lessons learned from previous disasters underscore the importance of business recovery to a region's overall economic recovery. Staff at the Wells Reserve partnered with the Town of Kennebunkport and the regional Chamber of Commerce to better understand the business community network and their potential vulnerabilities.

The team worked collaboratively to adapt the Tourism Resilience Index, which was originally developed for the Gulf Coast by Mississippi-Alabama Sea Grant. Through introduction by the Chamber, reserve staff interviewed businesses in Kennebunk and Kennebunkport to help them assess their ability to sustain operations during and after a natural disaster. The index produced a cross-section of resilience scores for businesses in the region and highlighted the challenges small business face planning beyond their operating season. The project team's approach and results from their experience are available on the Wells Reserve website.

9 In Alaska, a project team drew lessons from the aforementioned work in Maine, applying an adapted version of the same resilience index to their local fisheries, which are collectively an economic linchpin for many coastal communities and are also threatened by the shifting oceanographic conditions brought on by a changing climate.

The project team - consisting of personnel from Kachemak Bay reserve, Alaska Marine Conservation Council, Alaska Sea Grant, and University of Alaska - has been working with commercial fishermen to assess the resilience of Alaska's fisheries businesses.

The team tailored the Gulf Coast Fisheries Resilience Index by convening focus groups made up of a network of partners - including fishery industry leaders, resource managers, business owners, and resilience experts - to identify primary indicators and metrics to include in the self-assessment. The team will use the updated Alaska Fisheries Resilience Index and companion training materials to hold business resilience workshops across Alaska.

Additionally, the assessment results will be used to inform future climate resilience and research efforts at the reserve and strengthen partnerships with fishing stakeholders in Kachemak Bay.

CRITICAL NEXT STEPS FOR ACCELERATE COLLECTIVE LEARNING AND ACTION

On September 9, 2019, the Science Collaborative hosted a panel webinar during which representatives from four projects featured in this brief discussed lessons learned from their climate resilience work. Here we list some panelist conclusions and participant ideas that emerged from the Q&A and exit webinar survey. We offer this list to help spark new ideas for future collaborations:

Engage New Players

In many cases, new players need to be engaged in order to advance climate resilience. Engaging new audiences, such as funders, additional government agencies, businesses and underrepresented communities will require creative new approaches. Specific ideas include:

- Educate funders to ensure they feel informed and can be supportive through all phases of an initiative;

- Improve communication and collaboration among government agencies, researchers and stakeholders to expand the science and viewpoints considered for adaptation decisions;

- Engage new stakeholders by going to them at their spaces and events, rather than hosting a new workshop; and

- Try to offer childcare and food so that working parents and low-income individuals can attend workshops and events without added hardship.

Foster Communities of Practice

Learning across regions could be accelerated through the creation of new avenues to share knowledge, experiences, and pitfalls among coastal resilience practitioners. Some existing groups include:

- National Adaptation Forum and Regional Adaptation Forums;

- EcoAdapt's Climate Adaptation Knowledge Exchange;

- American Society of Adaptation Professionals; and

- Urban Sustainability Directors Network.

Communities of practices and communication platforms could be used to:

- Share ideas across regions about how to best tackle climate adaptation;

- Create venues for showcasing successful collaborations, fostering connections and greater awareness of each other's work;

- Foster connections across disciplines engaged in climate adaptation topics;

- Share strategies for different approaches, such as community visioning, long-term adaptation planning, and techniques to sustain relationships and trust; and

- Explore different processes and lessons learned, including offering facilitation and collaborative problem solving tools.

Improve Communication with Key Stakeholders

There is also a need to improve communication with communities and stakeholders by being thoughtful about the flow of information, the framing and tone used, and how risks are communicated. Specific ideas include:

- Bring new partners, such as community groups, into grant proposals and the early phases of project planning;

- Start building trustful relationships now so that when funding opportunities arise, you have already made key connections, identified shared values and agreed on goals;

- Build excitement for new initiatives while being clear about how long a process might take; and

- Create working groups for people working with similar stakeholder communities, within similar geographies, or tackling specific climate impacts, but ensure there is also cross- working group exchange and coordination.

TABLE OF REFERENCED PROJECTS, IN ORDER OF APPEARANCE IN THE BRIEF

	PROJECT TITLE	PROJECT CONTACT	RESERVE(S), STATE
1	**Coastal hazards risk communication: A technical assistance transfer project within the NERRS**	Lisa Auermuller, Jacques Cousteau NERR (auermull@marine.rutgers.edu)	Jacques Cousteau, NJ Chesapeake Bay, MD Delaware, DE Narragansett Bay, RI Weeks Bay, AL
2	**Enhancing coastal resilience decision-support tools to reflect the latest local applied science**	Lisa Auermuller, Jacques Cousteau NERR (auermull@marine.rutgers.edu)	Jacques Cousteau, NJ
3	**Tools, techniques, and tactics for advancing successful climate adaptation**	Kristen Goodrich, Tijuana River NERR (kgoodrich@trnerr.org)	Jacques Cousteau, NJ Kachemak Bay, AK Tijuana River, CA Wells, ME Hudson River, NY
4	**Carrying out climate scenario planning for the Kenai Peninsula, Alaska**	Syverine Bentz, Kachemak Bay NERR (syverine@alaska.edu)	Kachemak Bay, AK Tijuana River, CA
5	**From NECAP to GCAP: Transferring climate adaptation knowledge and tools from New England to Georgetown, South Carolina**	Jennifer Plunket, North Inlet-Winyah Bay NERR (jen@belle.baruch.sc.edu)	North Inlet-Winyah Bay, SC **NECAP:** Waquoit Bay, MA Narragansett Bay, RI Wells, ME Great Bay, NH
6	**Assessing the effects of storm surge barriers on the Hudson River estuary**	Philip Orton, Stevens Institute of Technology (philip.orton@stevens.edu)	Hudson River, NY
7	**A collaborative process to develop solutions for tidal road flooding in China Camp State Park**	Stuart Siegel, San Francisco Bay NERR (siegel@sfsu.edu)	San Francisco Bay, CA
8	**Decreasing vulnerability for Maine's beach-based business community**	Annie Cox, Wells NERR (acox@wellsnerr.org)	Wells, ME Mississippi-Alabama Sea Grant Consortium
9	**Promoting coastal community resilience through Alaska fisheries business self-assessments**	Syverine Bentz, Kachemak Bay NERR (syverine@alaska.edu)	Kachemak Bay, AK

A fleet of commercial fishing vessels in Cook Inlet, Alaska.
Photo credit: Jamie McKellar