Reserve Management Needs

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Collaborative research and integrated assessment projects supported by the National Estuarine Research Reserve System (NERRS) Science Collaborative must address a management need of one or more reserves. This document is a compilation of the current management needs within NOAA's reserve system. Management needs are submitted by reserve managers and updated on an annual basis. This summary is made available to support the development of proposals in response to the 2018 NERRS Science Collaborative Request for Proposals.

Science Collaborative focus areas and reserve management needs reflect both NOAA and reserve priorities set forth in the NERRS strategic plan (climate change, water quality and habitat protection) as well as individual reserve management needs at the local level.

Science Collaborative Focus Areas:

These management needs are consistent with one or several of the Science Collaborative focus areas, which are:

- **Climate Change:** Further understanding of biophysical and socio-demographic impacts of climate change on estuarine systems, including but not limited to, sea level rise, marsh sustainability, and estimating community risk to climate change.
- **Ecosystem Service Valuation:** Supporting the utilization of ecosystem services valuation to understand the benefits and tradeoffs of preserving estuarine ecosystems.
- **Shoreline Stabilization:** Understanding the impacts and tradeoffs of shoreline stabilization and which factors communities need to consider when adopting such measures.
- **Water Quality:** Further understanding of how to mitigate the impacts of land use change and estuarine eutrophication and contamination in estuarine ecosystems.
- **Habitat Restoration:** Further understanding of how to restore estuarine habitats once it has been degraded or lost.
- **Monitoring Application:** Support the active engagement of intended end users in the development of System-Wide Monitoring Program (SWMP) and Sentinel Site data-derived information products, particularly the development of regional and national data syntheses that address coastal management needs in the NERRS and NOAA. Encourage the utilization of SWMP or Sentinel Site data as appropriate in activities that support Science Collaborative focus areas.

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Summary Table: Priority reserve management needs mapped with Science Collaborative focus areas

Click on each reserve's name to read about their specific management needs.

Reserve	Science Collaborative Focus Areas					
	Climate Change	Ecosystem Service Valuation	Shoreline Stabilization	Water Quality	Habitat Restoration	Monitoring Application
Caribbean						
Jobos Bay, Puerto Rico	x		x	x	x	x
Great Lakes						
Lake Superior, WI	x	x		x		
Old Woman Creek, OH	x		x	x	x	
Gulf						
Apalachicola, FL	x	x	x		x	
Grand Bay, MS	x	x		x	x	x
Mission-Aransas, TX	x	x	x	x	x	x
Rookery Bay, FL	x	x			x	x
Weeks Bay, AL	x	x			x	x
Mid Atlantic						
Chesapeake Bay, MD	x	x	x	x	x	x
Chesapeake Bay, VA	x	x	x	x	x	x
Delaware	x	x	x	x	x	x
Hudson River, NY	x				x	
Jacques Cousteau, NJ	x	x		x	x	x
Northeast						
Great Bay, NH	x	x	x	x	x	x
Narragansett Bay, RI	x			x	x	
Wells, ME	x	x	x	x	x	x
Waquoit Bay, MA	x	x	x	x	x	x
Southeast						
ACE Basin, SC	x	x	x	x	x	x
Guana Tolomato Matanzas, FL	x	x	x	x	x	x
North Carolina	x	x	x	x	x	x
North Inlet – Winyah Bay, SC	x			x		x
Sapelo Island, GA	x		x	x	x	x
West Coast						
Elkhorn Slough, CA	x	x		x	x	
Kachemak Bay, AK	x	x	x	x	x	x
Padilla Bay, WA	x	x	x	x	x	x
San Francisco Bay, CA	x	x	x	x	x	x
South Slough, OR	x	x	x	x	x	x
Tijuana River, CA	x		x	x	x	

Note: Reserves submitted three to five management needs. In many cases, one management need was identified with several focus areas.

Reserve Management Needs, By Region

Caribbean Region

Jobos Bay Reserve, Puerto Rico
Climate Change • Develop workshops for a climate change action plan. • There is a need to assess local issues related to CC on both, ecosystem and human settlement. Resilience for both communities is to be affected by CC. • Develop workshops for a climate change action plan. • There is a need to assess local issues related to CC on both, ecosystem and human settlement. Resilience for both communities is to be affected by CC.
Shoreline Stabilization • Workshops in community incentives for protecting watersheds and shorelines. • Our reserve needs to attend and solve many cases of encroachments in the natural habitats terrains with the collaboration of the DNER Legal Division and Law Enforcement Rangers.
Water Quality • The impacts of recreational development as a land use in coastal watersheds and measures to address those impacts. • The illegal constructions, man-made structures and rubble and debris deposited need to be removed from the mangroves and salt flats of the reserve. • There is a need to identify how LULC are specifically affecting the estuary condition such groundwater supply and runoff that may be impairing our water quality.
Habitat Restoration • Workshops on elements of conservation biology for estuaries. • All the impacted areas need to be restored to the original state.
Monitoring Application • Develop workshops to share SWMP data with coastal decision maker audiences. • Science-based strategies are the focus of management actions at the Reserve. Long term data acquired need to be depurated and use to develop products for decision makers and other stakeholders such community groups.

Great Lakes Region

Lake Superior Reserve, Wisconsin
Ecosystem Service Valuation Local partners point out a disconnect between citizens' stewardship actions and their desire to access the Rivers and Lake Superior. Understanding the critical services these systems provide and then successfully articulating their value to these citizens is a need for all Reserve Partners.
Climate Change Understanding climate change and changing land/water management in terms of climate change/resiliency; messaging for the public on these topics.
Ecosystem Service Valuation Understanding the use of ESV framework and principles in management decisions and relatedly, improving research strategies under this framework.

Water Quality
Developing model for measuring and monitoring sediment load to improve dredge material management in working port

Old Woman Creek Reserve, Ohio

Climate Change
Develop a protocol for monitoring the climate-influenced impacts of precipitation and lake level fluctuations on estuarine and coastal wetland hydrology and hydrodynamics that may be followed by other Reserves facing climatic changes in storm intensity.

Shoreline Stabilization, Habitat Restoration
Develop small-medium scale nature-based shoreline demonstrations that provide enhanced ecological services while protecting shorelines.

Water Quality
Develop a collaborative interbasin training that helps educators understand interconnected water quality issues and stewardship challenges/opportunities throughout the Great Lakes. The training will become a replicable part of the Reserve's Teachers on the Estuary curriculum portfolio.

Gulf Coast Region

Apalachicola Reserve, Florida

Climate Change, Habitat Restoration
Develop an adaptive management plan for the oyster fishery based on anthropogenic and climatic drivers or develop a broad-based Bay Management plan (for all fisheries) utilizing seafood workers as the primary stakeholders. What are their concerns? What strategies do they see as valid ways to address these concerns?

Shoreline Stabilization, Habitat Restoration
Shoreline stabilization – which factors should be considered for site selection? What are the appropriate performance measures for determining a successful project?

Ecosystem Service Valuation
Better understand the linkages between ecosystem services and our local community well-being and values (socio-economic data).

Conduct ongoing monitoring of pertinent socio-economic indicators to determine the changes over time, especially in regards to restoration projects.

Grand Bay Reserve, Mississippi

Water Quality
On Grand Bay's western border there is a bankrupt fertilizer factory, a large stack of phophogypsum, and about 9 million gallons of acidic waste water that is treated and discharged daily. We know numerous spills of waste water have occurred in the past associated with storm events and berm failures. We want to know the impact of these spills on ecosystem health and groundwater and the impacts of the ongoing presence of the gypsum stack. We want to include public health impacts and provide information to the City of Pascagoula along with other local communities.

Projects that study water quality in terms of fecal coliform, including bacterial source tracking and recommendations for water quality improvements.

Projects that model water and sediment transport between Mobile Bay, MS Sound, and Grand Bay.

Projects that study nonpoint source pollution in the upper Grand Bay estuary to the Escatawpa River.

Habitat Restoration

Associated with the RESTORE act are many restoration projects occurring in the NERR and all along the MS Sound. We want to understand how those projects function and the impact on existing habitats along the MS Coast.

Projects that study different treatments on invasive species, e.g. comparing the efficacy of herbicides vs. grazing vs. prescribed burning.

Monitoring Application

Projects that synthesize monitoring information from the Grand Bay NERR and address critical coastal management questions.

Projects that aim to provide improved distribution of Grand Bay NERR (non-CDMO) datasets through a website interface at a level that is easy for the public to explore and with appropriate meta-data for scientific analysis.

Ecosystem Service Valuation

Projects that perform an ecosystem services valuation of the Reserve's habitats.

Projects that lead to a better understanding of the linkages between ecosystem services and our local community well-being and values (socio-economic data).

Projects that develop capacity at the NERRs to collect pertinent socio-economic indicators.

Projects that conduct ongoing monitoring of pertinent socio-economic indicators to determine the change over time, especially in regard to NRDA/RESTORE projects.

Projects that conduct discrete social science studies e.g., visitor/resource use and behavior, local economic impact of visitors, community relations, etc.

Climate Change

Projects that study ecological processes related to resilience to climate change such as sediment dynamics, hydrology, prescribed fire/wildfire effects, invasion by foreign species, storm frequency and intensity, vegetation response/tropicalization.

Projects that study the effectiveness of nature-based infrastructure to increase community and ecosystem resilience related to climate change.

Mission-Aransas Reserve, Texas

Habitat Restoration

Protect key habitats: Wave, current and ship wake erosion, subsidence, sea level rise, storms, and human development have changed the landscape of the reserve. We need to identify the most vulnerable habitats that are in decline (such as oyster reefs, fresh- and saltwater marsh, rookery islands, tidal flats, seagrass beds) and work to protect these areas in sustainable ways.

Link declining fish, bird, and migrating species to habitat loss/change: Within the Reserve, the populations of several species have declined over the past 50 years, including the reddish egret, the piping plover, snowy plover and all species of sea turtles. We have seen an increase in whooping crane numbers over the past 50 years, however the population is still endangered as the wild migrating population only consists of around 300 individuals. Commercial and recreationally important species populations also have many risks, and understanding

how populations change with change in habitat is critically important in how we manage future growth around the Reserve. The Reserve needs to determine the reasons behind specific species population decline and work on strategies to protect these species from further decline, including habitat protection in key spawning, nesting, or feeding locations. Finally, identification of critical pollinator habitat, invasive species priority areas, and other initiatives that have management implications is extremely important in the Mission-Aransas Reserve.

Shoreline Stabilization

Implement green infrastructure practices: The Reserve will support efforts to stabilize shorelines in sustainable ways, such as through living shorelines or green infrastructure. Nature-based solutions to resiliency and shoreline stabilization, along with the support through training or project feasibility/development assistance should continue at the Reserve.

Understand effects of hydrological alterations to hydrodynamics of estuaries: The Reserve is located next to the 6th largest port in the U.S. in terms of shipping tonnage. The channels created to allow for ship and barge traffic traverse the Reserve in multiple locations. Deepening and dredging of the channels and intracoastal waterway, and a deep stabilized channel open to the Gulf of Mexico are alterations that need to be researched to understand their impacts on larval fish recruitment and spawning grounds/activity in estuaries.

Water Quality, Habitat Restoration

Assess and manage freshwater inflows: South Texas is known for extreme droughts. Reservoir construction in the southern and northern watersheds outside of the reserve has exacerbated drought-related impacts, including reduced nutrient and sediment-transport to the bays as well as higher salinities. The Reserve needs to improve our understanding of these processes and identify key factors regulating and determining fresh water inflow to our bays, including impacts of nutrient loading and microbial transformations. We also need to asses ecological consequences of natural and anthropogenic variations in freshwater inflow that could lead to large changes in food webs and plant communities.

Improve storm water management to better water quality: The Reserve should work to assist communities develop plans and projects that improve storm water runoff and address non-point source pollution. Drainage issues in local areas due to nuisance flooding can help inform the development of these projects and help improve the water quality of storm water runoff into our bays and estuaries. Land change over time through development creates more impermeable surfaces, further exacerbating drainage and storm water-related issues. Addressing projects that help mitigate these problems will be of benefit to the Reserve.

Understanding harmful algal blooms (HABs): The Reserve has several species of HABs that pose a risk to both ecological processes and human health. Research needs to be conducted to better predict conditions causing these HABs and ways to protect human health.

Climate Change

Identify climate change impacts: The Reserve is subjected to numerous impacts from climate change, including: a relative sea level rise rate of 5.2mm per year, our location in an area where intense drought followed by heavy rains frequent, our close proximity to the 6th largest port in the United States in terms or port tonnage, and our low topography with a history of hurricanes. We currently have much open space that is prime candidate for habitat transitions, and are also home to multiple small coastal towns with an increase in developed land and population levels. The Reserve needs to identify the predicted impacts due to climate change and determine mitigation strategies to subsequently relay that information to decision makers. Some of the major research needs for climate change include ocean acidification impacts, tropicalization of the south Texas coast due to fewer hard freezes and the range extension of tropical species, especially displacement of marshes by mangroves.

Engage local communities in coastal resiliency planning: The Reserve needs to engage local communities in resiliency efforts through training and technical support of the use of resiliency indices, initiatives, or other needs as identified through engagement with each municipality. The Reserve should continue to remain responsive to

community needs to help mitigate the effects of climate change including specific support to flood- and storm-related resiliency projects.

Ecosystem Service Valuation, Monitoring Applications

Describe and communicate ecosystem services: The value (monetary or non-monetary) humans place on specific habitats, processes, and fisheries influences the direction of protection and mitigation strategies for a region. The Reserve needs to identify these values and use this information to educate local decision- and policy- makers to help protect the habitats and processes associated with the most valued or at-risk ecosystems. The Reserve also needs to determine how both human and ecologically-based valuation strategies can be used to support restoration and conservation projects, and link those values to help justify project development and implementation.

Blue carbon research: The Reserve needs to investigate the potential for incorporating Blue and Green Carbon in ecosystem services projects, and support efforts that look to engage in carbon finance options that are relevant to our local habitats.

SWMP and Sentinel Site data: The Reserve needs to utilize SWMP and sentinel site data to inform proposed research of benefit to our priority issues and initiatives and make these data relevant and accessible to resource managers.

Rookery Bay Reserve, Florida

Habitat Restoration

Effects of watershed inflows to wetlands and estuarine habitats: The Rookery Bay reserve watershed has been impacted by canals, ditching, and water control structures which alter freshwater inflows into wetlands and estuarine areas. These alterations in freshwater flows have impacted the function and structure of these habitats, particularly the interface between freshwater and estuarine habitats. Several projects are being proposed or implemented to restore natural sheetflow into the Reserve as well as contiguous conservation lands and estuaries. These impacts and restoration projects, within the context of sea-level rise will determine future trajectories of habitat change, salinity regimes, and associated floral and faunal communities. An understanding of how this restoration outcome will impact habitat and community structure will inform reserve management decisions and guide monitoring efforts.

Monitoring Application, Climate Change

Connecting remote sensing with vegetation monitoring: Within the Reserve, natural ecosystem function and structure have been impacted by historic land alterations within the system (e.g., restricted tidal regimes due to road construction). Indicators of system-wide stressors include mangrove die-off and reduced production, and fragmentation of seagrass habitat. Rookery Bay NERR has conducted extensive vegetation and benthic habitat mapping. We are looking for techniques to incorporate remote sensing and aerial imagery to link habitat surveys, ecosystem structure and function, and ecosystem resilience. The objective is to understand and predict watershed-scale management activities on ecosystem resilience under the context of climate change.

Habitat Restoration; Climate Change

Coastal sediment transport, erosion, and barrier island change in response to sea-level rise: The barrier islands in and adjacent to the reserve have changed significantly with impacts from episodic storms, sea-level rise, and coastal zone management practices. Erosion, accretion, and longshore sediment transport has altered natural habitats and shifted associated use by shorebirds, beach-nesting birds and sea turtles. These shifts in sediment are also responsible for changes in natural habitats such as pocket beaches, seagrass, and emergent shoals. There also may be a link between these sediment changes and turbidity levels within the reserve which may affect light levels reaching submerged aquatic vegetation. Understanding overall sediment budgets, erosional, accretional, and habitats shifts in response to natural and anthropogenic drivers will guide management decisions to protect and restore critical habitats for avian communities and nesting sea turtles.

Ecosystem Service Valuation

Perform an ecosystem services valuation of the Reserve's habitats: Better understand the linkages between ecosystems services and our local community well-being and values (socio-economic data). Develop capacity at the NERRs to collect pertinent socio-economic indicators Conduct ongoing monitoring of pertinent socio-economic indicators to determine the change over time, especially in regards to NRDA/RESTORE projects Conduct discrete social science studies e.g., visitor/resource use and behavior, local economic impact of visitors, community relations, etc.

Weeks Bay Reserve, Alabama

Climate Change, Ecosystem Service Valuation, Habitat Restoration

Carbon Cycle Research: The Reserve needs investigation of potential for incorporating Carbon in ecosystem services projects, and support efforts that look to engage in carbon finance options that are relevant to our local habitats. An effort to better understand Weeks Bay and local restoration projects in terms of Carbon processes would be of benefit including development of carbon cycling models to inform coastal flatwoods and marsh restoration and management (i.e. carbon sequestration/release resulting from canopy reduction and prescribed fire). Attendees of carbon workshops have stated their need for additional research on both blue and green carbon topics and valuation of small-scale projects. More details relating to issues of concern at the Reserve can be found at WBNERR Management Plan - Research and Monitoring p. 127.

Ecosystem Service Valuation, Habitat Restoration

Development of a hydrological cycling model to inform coastal flatwoods restoration practices (i.e. prediction of change in transpiration/residence time resulting from canopy reduction and fire). More details relating to issues of concern at the Reserve can be found at WBNERR Management Plan - Research and Monitoring p. 127.

Monitoring Application

The Reserve needs to utilize SWMP and sentinel site data to inform proposed research of the benefit to our priority issues and initiatives and make these data relevant and accessible to resource managers. More details relating to issues of concern at the Reserve can be found at WBNERR Management Plan - Research and Monitoring p. 127.

Habitat Restoration, Climate Change

Research is needed to assist in understanding the impacts of land use change with a focus on mitigation and restoring wetland, shoreline and estuarine habitats. In looking at impacts and land use change, focus areas could include:

- Ecology of manmade impoundments in coastal flatwoods/pine savannah;
- Development of a decision support tool to determine a restoration cost/benefit analysis;
- Understanding impacts of shoreline stabilization and cost/benefits to coastal ecology; and
- Boundary effects of shoreline stabilization to adjacent properties in residential scale projects.

More details relating to issues of concern at the Reserve can be found at WBNERR Management Plan - Research and Monitoring p. 127.

Ecosystem Service Valuation, Monitoring Applications

Describe and communicate ecosystem services: The value (monetary or non-monetary) humans place on specific habitats, processes, and fisheries influences the direction of protection and mitigation strategies for a region. The Reserve needs to identify these values and use this information to educate local decision- and policy- makers to help protect the habitats and processes associated with the most valued or at-risk ecosystems. A Visitor Use Study for the Reserve would tell us more about who is coming, what they are doing, and what economic value visiting the Reserve brings to them or the community. The Reserve also needs to determine how both human and ecologically-based valuation strategies can be used to support restoration and conservation projects, and link those values to help justify project development and implementation. More details relating to issues of concern at the Reserve can be found at WBNERR Management Plan - Research and Monitoring p. 127.

Under the Ecosystem Services Valuation there are specific items of interest that include:

- Perform an ecosystem services valuation of the Reserve's habitats;
- Better understand the linkages between ecosystems services and our local community well-being and values (socio-economic data);
- Develop capacity at the NERRs to collect pertinent socio-economic indicators;
- Conduct ongoing monitoring of pertinent socio-economic indicators to determine the change over time, especially in regards to NRDA/RESTORE projects;
- Conduct discrete social science studies e.g., visitor/resource use and behavior, local economic impact of visitors, community relations, etc.; and
- A needs assessment for decision-makers exploring use of data in planning and in integration into ordinance writing.

Mid-Atlantic Region

Chesapeake Bay Reserve, Maryland

Ecosystem Service Valuation, Shoreline Stabilization, Water Quality, Habitat Restoration, Monitoring Application

Abundant Life: Poor water quality and harvest pressure challenge the health of species across the region, while our increasing need for land and resources has fragmented and degraded the habitats they depend on. Supporting sustainable fish and shellfish populations and restoring habitat for native and migratory species will support a strong economy and a balanced ecosystem.

Reserve priorities: Understand the cost & benefit of habitat restoration and invasive species management

Ecosystem Service Valuation, Shoreline Stabilization, Water Quality, Monitoring Application

Clean Water: Excess nutrients, sediment and toxic contaminants degrade our waterways, harm fish and wildlife and pose risks to human health. Reducing these pollutants is critical to creating safe, healthy waters for animals and people alike.

Reserve priorities: Use ecosystem service valuation to understand the understand the benefits and tradeoffs of land use and management

Climate Change, Ecosystem Service Valuation, Shoreline Stabilization, Water Quality, Habitat Restoration, Monitoring Application

Climate Change: Storms, floods and sea level rise will have big impacts across the watershed. Monitoring, assessing and adapting to these changing environmental conditions will help our living resources, habitats, public infrastructure and communities withstand the adverse effects of climate change.

Reserve priorities: Understanding climate driven impacts such as, but not limited to, precipitation & temperature changes, marsh functionality, nutrient loading, and invasive species

Climate Change, Ecosystem Service Valuation, Shoreline Stabilization, Water Quality, Habitat Restoration, Monitoring Application

Engaged Communities: The long-term success of the Chesapeake Bay restoration effort depends on the work of individuals and communities living throughout the watershed. Connecting with current environmental stewards and encouraging future local leaders helps build the network that will keep our work moving forward.

Reserve priorities: An informed and engaged citizenry is an overarching theme for all CBNERR-MD's work. This management need should be a component of all proposals.

Chesapeake Bay Reserve, Virginia

Climate Change, Monitoring Application

Several critical York River estuary ecosystems (i.e., emergent tidal wetlands and associated upland ecotones, underwater grass beds) are sensitive to and vulnerable to climate change factors; most often cited stressors include relative sea level rise (of which local land subsidence is significant), salt water intrusion, increasing temperatures, enhanced storm damage and spread of invasive species. These stressors and associated impacts on ecosystems (and key species) need to be better described/quantified and integrated into ecosystem vulnerability assessments and forecasting models so as to support effective communication and the development of appropriate long-term planning and management actions.

Climate Change, Water Quality, Monitoring Application

The York River estuary continues to suffer from chronic water quality issues driven by excessive loads of sediment, nutrients (N, P) and to varying degrees oxygen consuming material (e.g., organic matter). Evidence of such aquatic stressors includes routine low DO, harmful algal blooms and reduced water clarity that impact finfish, shellfish and underwater grass habitats. Watershed and bay source estimates of primary contaminants need to be refined along with the development of updated watershed and point source management strategies (that include relevant climate change and water withdrawal/injection scenarios) to mitigate the effects of excessive contaminant loadings.

Climate Change, Ecosystem Service Valuation, Shoreline Stabilization, Water Quality, Habitat Restoration, Monitoring Application

Increased issue awareness and access to relevant information products/tools will support the development and implementation of planning and management plans designed to protect and restore York River water quality and coastal ecosystems. Utilizing information derived from the SWMP, the Sentinel Site Initiative and other research efforts, the Education and Coastal Training Program can assess user/stakeholder needs and develop curriculum, outdoor experiences, labs and workshops, demonstration sites and other information/tools products to support resource management and restoration efforts.

Delaware Reserve, Delaware

Habitat Restoration, Climate Change, Ecosystem Services Valuation

The Delaware Reserve and surrounding land management agencies are looking for improved strategies for wetland management and restoration, including (but not limited to) research aimed at understanding future climate impacts to wetland habitat and function and to better understand the trade-offs of removing, containing, or leaving invasive Phragmites. Research questions could include habitat function and biodiversity changes for key species, the role Phragmites plays in soil stabilization, and carbon fluxes specific to this invasive.

Climate Change, Habitat Restoration, Ecosystem Service Valuation

The Delaware Reserve is looking to improve understanding of blue carbon fluxes in coastal wetlands, and promote possible use of a blue carbon value system for estuaries. This could include evaluating the long-term carbon storage potential specific to different tidal wetland systems ranging from high salinity salt marshes to tidal freshwater wetlands.

Climate Change, Ecosystem Service Valuation, Shoreline Stabilization, Water Quality, Habitat Restoration, Monitoring Application

The Delaware Reserve is looking to increase the resiliency of our coastal ecosystems and communities in Delaware by connecting users/stakeholders to science-based strategies and our monitoring work, such as the System Wide Monitoring Program, Sentinel Site Initiative, and other research efforts. This depends upon increased awareness and access to science-based information, products, and tools to support resource management and community planning.

Water Quality, Monitoring Application

The Delaware Reserve is looking to better understand the source and concentration of contaminants in Delaware's tidal systems. This could include an assessment of dissolved persistent bioaccumulative toxins resulting from both

legacy and emerging contaminants (such as chlorinated pesticides and pharmaceuticals) and/or natural products (including harmful algal toxins).

Hudson River Reserve, New York

Habitat Restoration

There is widespread concern about the population status of American eels, in part due to restrictions on their historic access to tributary streams and the watersheds where they grow to adulthood. The Reserve has invested resources for over a decade in citizen science eel projects in Hudson River tributaries, where volunteers capture juvenile American eels and move them over the first barriers to their passage. Some baseline data were collected about the upstream eel populations prior to the eel passage projects. Managers need to know whether eel passage is resulting in a more robust upstream eel population and contributing to American eel recovery, and particularly whether existing baseline data are sufficient to answer this question. This information would inform management decisions on the installation of permanent passage devices, removal of barriers, and continuation of citizen science efforts throughout the region.

Managers are exploring options for improving aquatic connections from tidal wetlands to headwaters. We seek information about how the four Hudson River NERR sites are connected to their tributary watersheds, especially where artificial barriers, such as dams and culverts, impair aquatic connectivity. Once barrier assessments are completed, managers also need to understand options for prioritizing potential connectivity restoration projects, and to see how Reserve watershed barriers would be prioritized under different scenarios.

The protection, recovery, and restoration of submerged aquatic vegetation (SAV) is a significant management concern in the Hudson River estuary, especially with dramatic population decline following hurricanes Irene and Lee. At the same time, as marinas throughout the estuary have silted in, SAV beds have formed. There is increasing pressure on state regulators to permit the dredging of shallow areas within marinas, often where SAV beds have formed. Managers need information about the potential for SAV mitigation to be successful in the estuary. A collaborative team could be assembled to develop a scope of work to pilot SAV mitigation, drawing on existing data about where SAV has previously existed, where SAV is not yet recovering, where these areas are adjacent to marinas, and the characteristics of the adjacent shoreline.

Climate Change, Habitat Restoration

In response to recent major storms and rising sea level, New York City and federal agencies are considering storm surge barriers in various configurations. There is an urgent management need to develop a scope of work for approaching the environmental assessment of this large-scale project. A collaborative team would be assembled to formulate an approach to an environmental impact assessment and to identify existing knowledge to assess long term impacts. The potential impacts that would affect the 152 miles of the Hudson River estuary include disruptions to physical processes, changes in sediment transport, and disturbances to the life cycles of many biota. This issue could have an impact on a variety of Hudson River habitats and is a high priority management need.

Jacques Cousteau Reserve, New Jersey
Ecosystem Service Valuation, Habitat Restoration Understand the processes governing connectivity of habitats and communities from the watershed to the ocean. Communities and resource managers in our watershed need this information to inform decisions on development, restoration and habitat preservation.
Water Quality, Monitoring Application Understand the response of the ecosystem to habitat change and alteration to inform coastal decision-making. Communities and resource managers need science-based information to guide preparation of master plans including how best to preserve ecosystem services.
Climate Change, Water Quality, Habitat Restoration Increase the resilience of coastal ecosystems and communities to anthropogenic and natural drivers of environmental change. Communities and resource managers need science-based strategies for reducing their vulnerability to coastal storms, inundation and sea level rise.

Northeast Region

Great Bay Reserve, New Hampshire
Climate Change, Ecosystem Service Valuation, Shoreline Stabilization, Water Quality, Habitat Restoration Many management strategies are currently focused on reducing nitrogen to the Great Bay system, and look at eelgrass as the indicator of health. As this pollutant continues to be addressed, how can we identify and embrace management solutions that also address other current stressors and mitigate future stressors. What are the tradeoffs of different management options? What are some more holistic approaches to monitoring ecosystem health that help link water quality to living resource impacts?
Climate Change The towns around GB and the natural resources in and around Great Bay will be influenced by tidal SLR and storm surge AND increased precipitation in the seven rivers that flow into the bay. Understanding and communicating total water level is critical to adaptation plans.
Climate Change, Shoreline Stabilization, Water Quality, Habitat Restoration, Prioritizing restoration and protection projects is critical, and the criteria for success need to be rooted in the best available science AND on informed predictions about how ecosystem function will shift or change in the future. In particular, thinking about the fate of salt marshes in NH and what realistic and desirable management goals for the future might be.
Climate Change, Water Quality Shoreline management options that maximize ecological and human benefit in an integrated and planned way to ensure a holistic approach rather than site by site and reactive practices. Larger scale planning and site based decisions must consider restoration or habitat improvement and be supported by science that advances the likelihood of their success.
Climate Change, Ecosystem Service Valuation, Shoreline Stabilization, Water Quality, Habitat Restoration, Monitoring Application What influences how individuals and organizations in our region act when making decisions that impact Great Bay? Where are the points of influence that could help organizations like GBNERR direct messaging and resources in the most productive paths to stewardship?

Narragansett Bay Reserve, Rhode Island

Climate Change

Sea level rise is negatively impacting Rhode Island's coastal marshes. The reserve and the entire Narragansett Bay region need enhanced tools and strategies for mitigating the effects of sea level rise and other stressors on coastal salt marshes.

There is a need across a variety of habitats (upland to subtidal) to better understand habitat vulnerability in the face of various stressors resulting from climate change such as variation in precipitation, temperature, competition among species, phenology etc.

Water Quality

Storm water management continues to be a key issue throughout the watershed. Increased storm intensity due to climate change, coupled with continued development are driving the need for additional tools to help mitigate the negative consequences that storm water brings to coastal habitats.

Develop user-based information from the SWMP monitoring and sentinel sites programs. The reserve has been at the forefront in establishing salt marsh sentinel monitoring and national metrics and products based on this work. However the need to further enhance, refine and develop these products is needed.

Habitat Restoration

Ongoing restoration and management work within the reserve in estuarine and upland habitats and throughout the Narragansett Bay region is challenging due to climate change. New information, data, methods as well as monitoring and reporting metrics are needed.

Wells Reserve, Maine

Climate Change

Climate change is reshaping ecosystems in ways that affect resources and ecosystem services. We are interested in the impacts of climate change on estuarine and coastal ecosystems and their related implications. To this end, our goals are to assess climate change as it pertains to:

a) Alterations to the spatial distribution of both marine animals and plants in addition to the timing (phenology) of ecological events (e.g., changes in the abundance, diversity, and composition of larval fish in the Webhannet River Estuary over time).
b) Impacts of invasive species and range extensions of others on the biophysical features of estuaries and coastal ecosystems.
c) Evaluation of the implications of sea level rise on salt marsh ecology.
d) Evaluation of climate change risk to coastal communities and assessment of adaptation strategies
e) A better understanding of the impacts of climate change on finfish and shellfish species, including commercially-important species (e.g., shellfish) as well as those species that are considered 'data-poor' (e.g., Jonah crab, larval fishes).
f) Ocean acidification (elevated CO2) and its implications on shellfish physiology, behavior, and ecosystem stability and functionality.
g) Deviations in local mesoscale oceanographic features (currents, tides, freshwater input) that may act to change hydrographic features in estuarine and coastal waterways.

Monitoring Application, Water Quality

The overall goal is to identify and track short-term variability and long-term changes in the integrity and biodiversity of estuarine ecosystems (e.g., sea level rise, CO_2 inputs, water quality), through the evolution of new monitoring efforts as well as examining existing and archival data sets. To that end, we intend to work with local, state, federal, and academic institutions to encourage:

a) The design and development of a monitoring system for ocean acidification, enabling us to measure trends in pH, alkalinity, and calcite over a long-term time series.
b) Improved measurements to sea level rise through existing instrumentation (SSM-1) and the development of new methods, tools, and gauges to assess these data with better accuracy and precision.

c) The design and development of a monitoring system for ocean acidification, enabling us to measure trends in pH, alkalinity, and calcite over a long-term time series.
d) Improved measurements to sea level rise through existing instrumentation (SSM-1) and the development of new methods, tools, and gauges to assess these data with better accuracy and precision.
e) Supporting the use of large SWMP datasets to synthesize water quality parameters (temperature, chlorophyll, salinity, among others) and query the relationship of these data to long-term changes in ecological communities such as larval fish assemblages from our larval fish monitoring project.
f) Advancing our current monitoring of 'Fish Species of Greatest Conservation Need' by employing new methodologies (e.g., eDNA) and tools for obtaining the best data for future management decision-making.
g) Incorporate an assessment of end user needs for data and the format of that data as part of each of the above focus areas.

Ecosystem Service Valuation

An analysis of potential ecosystem service values associated with river and marsh conservation and restoration under current and anticipated sea level rise, extreme precipitation and development scenarios could help determine where resources should be focused for long term benefit. Our reserve and collaborating partners in academia and at the local, state, federal, and NGO level need improved strategies for using ecosystem service valuation methods in decision-making. Tools that contribute to evaluating policies and tradeoffs related to land use and climate change impacts on ecosystem services such as juvenile fish habitat provision, flood attenuation, and contaminant removal are needed. Food web relationships and data visualization approaches that make ecosystem service values more available to decision makers are integral to achieve this objective.

Habitat Restoration

Land use change in southern Maine caused by increased impervious cover, loss of buffers and hardening of headwater streams and wetlands results in increased delivery of sediment and contaminants to estuaries and near shore waters. Green infrastructure approaches to land use have the potential to mitigate pollution inputs to the estuary as well as increasing the resilience of natural landscapes and local communities. The benefits of green infrastructure approaches can be economical, efficient, and accepted by land owners and the business community. The reserve and our collaborating partners in at the local, state, federal and NGO level need strategies for developing, modeling and diffusing green infrastructure strategies to support landscape and community resilience. Goals of exemplary projects include anadromous fish passage restoration, conservation for marsh migration, and biological connectivity that allows for species migration.

Shoreline Stabilization

Beach and dune systems in southern Maine provide ecological and economic benefits to local communities and the state. These systems are increasingly vulnerable to sea level rise and development pressure. Living shoreline approaches and beach replenishment are among the strategies that local communities are evaluating.

Waquoit Bay Reserve, Massachusetts

Climate Change

Research is needed on the biophysical and socio-demographic impacts of climate change on estuarine systems, including but not limited to, water quality, ecosystem service provision, marsh sustainability, species response, and estimating community risk to climate change. Changes in freshwater inputs and other meteorological factors (temperature, wind speed and direction) and their effects on salinity and flow regimes are important for understanding restoration remediation options within the watershed and Bay. Research is also needed to further understand blue carbon in coastal wetlands and strategies for applying blue carbon to support coastal restoration and habitat protection.

Enhance Coastal Resilience Planning – Research should focus on developing decision-support tools and resources to better enable coastal communities to engage in effective resilience planning that involves different sectors of society and protects people, infrastructure and natural resources.

Water Quality

Many coastal communities in Massachusetts are challenged to address water quality impairment in various forms.

Pollution from excess nutrients and contaminants of emerging concern – Research is needed to help communities make decisions on different strategies that can be used to reduce nitrogen loading. Specifically, research about the performance and efficacy of non-traditional methods of remediating excess nitrogen (e.g. use of shellfish aquaculture, constructed wetlands, permeable reactive barriers, alternative septic systems, etc) that have been prioritized by water managers and other decision-makers as desirable options is needed. Additionally, social science research is needed to determine the social and economic barriers and factors that affect public acceptance of these non-traditional approaches.

Acidification – The effects of coastal acidification on shellfish aquaculture and sediment processes, such as denitrification rates, are unknown. As the major drivers of coastal and ocean acidification are somewhat distinct, further research into the exchanges of nearshore with oceanic waters will elucidate the major contributors to acidification related threats for coastal ecosystems.

Harmful Algal Blooms - Pseudo-nitzschia and other Harmful Algal Blooms (HABs) are important water quality indicators and potential food safety hazards. Research is needed to understand the link between nutrient pollution, warmer temperatures and increased risk of potentially lethal HABs.

Ecosystem Service Valuation

Research is needed to determine the best ways to account for and value ecosystem services in coastal wetlands and to assess how these services could change under different environmental conditions (e.g. nitrogen loading) and climate change scenarios (coastal acidification, increasing temperature and water levels). Studies are also needed to test processes and develop tools to help incorporate these ecosystem service values into policy and management decisions and frameworks.

Habitat Restoration

Cape Cod's shallow embayments have undergone dramatic physical changes due to decades of eutrophication and changing climactic regimes. Even with restoration of water quality there are many questions about recovery of eelgrass beds, associated fish and shellfish densities, as well as increased abundance of harmful or invasive species such as the clinging jelly, *Gonionemus vertens*). Wetlands degraded by climate change and other anthropogenic factors should be examined for their suitability for various restoration options such as hydrological modifications and sediment augmentation.

Shoreline Stabilization
Research is needed to evaluate use of green infrastructure and nature-based approaches for enhancing shoreline stabilization and coastal resilience. Investigate factors such as site selection, performance, local relevance and effectiveness as well as ways to help communities better understand and implement these techniques.

Monitoring Application
To enable mangers and community groups to better understand and track trends in water quality and local climate change impacts, analyze, synthesize and communicate system wide monitoring program (SWMP) data including information from salt marshes and complementary monitoring programs. Support opportunities to combine SWMP water quality, meteorological, habitat mapping and salt marsh data with other regional datasets for larger scale trends analysis.

Southeast Region

ACE Basin Reserve, South Carolina

Shoreline Stabilization, Water Quality, Habitat Restoration
Develop information, tools and techniques to support and promote habitat conservation within the ACE Basin.

Water Quality and Monitoring Application
Understand and communicate factors impacting water quality with focus improving water quality.

Climate Change
Improve capacity of human communities to co-exist with nature.

Ecosystem Service Valuation
Develop tools and information that guide a robust Reserve plans for public access while ensuring the health of natural resources.

Guana Tolomato Matanzas Reserve, Florida

Water Quality, Habitat Restoration
GTMNERR is centered in a region of both high percentage of conservation lands and even higher growth rates of urban population. Our landscape changes on a weekly basis as more and more people move into the region with a desire to live close to the coast. Our need to understand techniques to mitigate these land use changes and their effects on the estuary are important to protecting the resource.

Most of the waters within the GTMNERR are listed as “Impaired” for fecal coliforms by the state of Florida and high bacteria levels have caused closures of shellfish harvesting areas. Studies are needed to 1) synthesize available water quality and biological data; 2) investigate indicators of ecological condition; 3) determine if bacteria are from human sources, and if so, how to restore water quality, and 4) estimate sustainability of shellfish populations in harvest and non-harvest areas.

Climate Change, Ecosystem Service Valuation, Shoreline Stabilization, Habitat Restoration, Monitoring Application
GTMNERR is a bar-built estuary with a dynamic coastline and an increasing population. Our region is in need of habitat mapping, sediment transport, hydrodynamic, and ecosystem valuation studies to investigate 1) the impacts of climate, dredging, shoreline armoring, and sand placement on nearshore and estuarine structure and function, and 2) the ecosystem benefits and tradeoffs of different management options including living shorelines.

Climate Change, Ecosystem Service Valuation, Habitat Restoration, Monitoring Application
GTMNERR marshes are threatened by sea level rise due to a lack of riverine sediment delivery and increasing

coastal development. Our reserve needs estimates of marsh sustainability (e.g., using Marsh Equilibrium Models which require detailed hydrodynamic and elevation data) and associated impacts to ecosystem services so that land acquisition and restoration projects can be prioritized.

The major tributary of the southern component of the GTMNERR, Pellicer Creek, has a watershed that is approximately 90% undeveloped and these natural lands represent important marsh migration and wildlife corridors. Projected population growth and water supply needs, however, threaten the watershed and the region is in need of a collaborative plan for development that considers the impact of sea level rise and synthesizes available data from SWMP, SSAM-1, and SLAMM efforts in the region.

North Carolina Reserve, North Carolina

Climate Change, Ecosystem Service Valuation, Shoreline Stabilization

Coastal and estuarine ecosystems face several threats including sea level rise, invasive species, and coastal development. NCNERR seeks research partnerships to provide ecosystem service valuation of Reserve and surrounding estuarine ecosystems and how these services are altered by the threats identified above.

Climate Change, Shoreline Stabilization

The natural geography and topography of North Carolina's coastline make it vulnerable to coastal hazards, such as flooding, coastal storms, shoreline erosion, and sea level rise. NCNERR seeks projects that consider vulnerability and provide information, tools, and strategies that improve the resilience of natural and human communities to coastal hazards.

Water Quality, Monitoring Application

NCNERR and coastal decision makers need an improved understanding of how management practices impact water quality, as well as statistical models and syntheses of System-wide Monitoring Program (SWMP) data that provide useful decision support tools.

Ecosystem Service Valuation, Shoreline Stabilization, Habitat Restoration

An estuarine shoreline stabilization approach that minimizes ecological impacts and maximize resilience of human communities is a coastal management priority in North Carolina. NCNERR seeks research that 1) develops clearly defined standards for monitoring performance of shoreline stabilization options, 2) evaluates performance of alternative living shoreline materials in a variety of environmental settings, 3) develops tools to quantify biophysical drivers critical to the success of living shorelines, and 4) identifies optimum conditions for various living shoreline options.

Habitat Restoration, Ecosystem Service Valuation

Over the last three decades, many habitat restoration projects have occurred within NCNERR and surrounding estuarine ecosystems. NCNERR seeks analyses and syntheses of these projects to improve understanding of 1) the biophysical factors underpinning restoration success or failure, 2) the ecological functions restored habitats provide and how these functions change over time or based on their setting within the landscape, and 3) the research and monitoring gaps needed to address the questions identified above. Ultimately, NCNERR would like restoration-based research and monitoring to move towards a more holistic, ecosystem-services based approach to restoration.

North Inlet – Winyah Bay Reserve, South Carolina

Water Quality

Stormwater management continues to be an issue of interest to the NI-WB NERR and the communities we serve. Additional research is needed to determine the ecological effectiveness and cumulative impacts of existing and emerging stormwater best management practices for the north coastal region of South Carolina.

A socio-economic analysis of incentives and trade-offs of low impact development approaches and stormwater BMP choices that is specific to our region is needed to encourage the adoption of best practices locally.

Climate Change

Little is known on how climate change might compound or reduce existing stressors such as eutrophication and biological and chemical contaminants. There is a need to examine the synergistic effects of climate change and existing natural and anthropogenic stressors on coastal habitats and ecosystem functioning and to use this information to help managers assess how management practices may exacerbate or mitigate future threats.

There is also a need to gain a better understanding of carbon cycling and carbon sequestration services provided by our local coastal marshes, spanning a range of salinities from high salinity salt marshes to tidal freshwater swamps.

Climate Change, Monitoring Application

One of the reserve' primary goals is to gain a better understanding of the impacts of naturally occurring short-term, stochastic and long-term, large-scale climate events on coastal ecosystems and human communities. We seek collaborators interested in data syntheses to address this goal locally and regionally utilizing the reserve's foundation of over 20 years of weather and water quality monitoring data, 8 years of salt marsh emergent vegetation monitoring, and/or other biological data sets spanning more than 30 years.

Sapelo Island Reserve, Georgia

Shoreline Stabilization, Habitat Restoration

The few living shorelines built to date in Georgia all employ oyster shell (bagged) as hardened substrate, because of Georgia's significant tidal range and currents. We need to measure and evaluate the long-term efficacy, stability, habitat value and cost-effectiveness of this approach, versus traditional "hard" stabilization methods.

Climate Change, Shoreline Stabilization

We need additional research into potential sea level rise impacts to Georgia tidal marshes and adjacent uplands, as well as additional research into how sea level rise may exacerbate or alter ongoing shoreline erosion and barrier island migration patterns and dynamics.

Climate Change, Water Quality

The private residential community on Sapelo Island affects water quality, habitat integrity and ecosystem functions within the Reserve, as well as programmatic activities the Reserve conducts on the island. In turn, the community has been affected by major land use/land cover changes in the past, continues to be affected by ongoing socio-demographic and socio-economic changes, and will become increasingly vulnerable to sea level rise and nuisance flooding in the future. We need to better understand these complex, interacting factors in order to help enhance the resilience of the local community and to improve the State's ability to manage the Reserve and Sapelo Island.

Monitoring Application

Patterns in our long-term SWMP data (including nutrient data), as well as long-term data on local tides and relative sea level rise need to be assessed in the context of land use and other changes on Sapelo Island and along the nearby Georgia coast in the last 15 years.

Climate Change

We need additional research into potential impacts of shifting local and regional temperature and precipitation patterns (esp., flooding, drought) on coastal and estuarine natural habitats and processes.

West Coast Region

Elkhorn Slough Reserve, California
Climate Change, Habitat Restoration Understanding factors that enhance marsh resilience and restoration in the face of sea level drive, and linking marsh resilience to blue carbon and other ecosystem functions
Habitat Restoration Hydrologic system service responses to ecosystem restoration
Climate Change, Ecosystem Service Valuation Bringing together stakeholders affected by levee management in the estuary, for joint-fact-finding and exploration of best alternatives for different shoreline stabilization or retreat options in the face of SLR
Water Quality, Habitat Restoration Exploring collaborative estuarine management to improve water quality in tidally restricted wetlands while protecting infrastructure

Kachemak Bay Reserve, Alaska
Climate Change, Ecosystem Services Valuation, Shoreline Stabilization, Water Quality, Habitat Restoration, Monitoring Application *Habitat Change Assessments.* Assessments should establish current baselines, identify where change is happening most rapidly, and provide direction for the Reserve program. Assessments should include landowners and decision makers and evaluate socio-economic, biological and ecological parameters to quantify changes that have occurred within Reserve boundaries since KBNERR's designation in 1999, and other time periods, when appropriate.
Climate Change, Ecosystem Services Valuation, Water Quality *Groundwater hydrology:* Groundwater is a key contributor to maintaining watershed functions for healthy salmon streams in Kachemak Bay as well as a driver of change in supplying human water needs. The Reserve should lead efforts to classify and map groundwater discharge and recharge areas so that these resources can be included in valuation strategies of ecosystem services and climate change adaption and scenario planning efforts. *Blue carbon research:* Investigate the potential for incorporating Blue and Green carbon for the purpose of the ecosystem services valuation. Use carbon flow models to inform decision and policy-makers about habitat protection and assist communities with identifying regional management needs and priorities related to ecosystem services.
Climate Change, Ecosystem Services Valuation *Communicating climate change:* Identify biophysical and sociodemographic impacts of climate change on watersheds, nearshore and ocean processes. Integrate available climate trends data and identify research gaps. Develop climate scenarios using collaborative learning methods involving researchers, planners, and policy makers. Provide skills training and workshops on collaboration and communication on climate change issues. Disseminate information through community adaptation and resilience engagement opportunities, and to K-12 and public audiences.
Ecosystem Services Valuation, Water Quality *Quantify and communicate coastal ecosystem services:* Identify values (monetary and non-monetary) of watershed habitats, from headwaters to estuaries, and use this information to educate decision and policy makers and help communities make informed watershed-based management strategies, specifically to protect the habitats and processes associated with the most valued and/or at risk ecosystems. Investigate the potential for incorporating Blue and Green carbon for the purpose of ecosystem services valuation. Use carbon flow models to inform conservation decisions, habitat protection and to assist communities with identifying regional management needs and priorities related to ecosystem services.

Climate Change, Ecosystem Services Valuation, Shoreline Stabilization, Habitat Restoration, Monitoring
Living Shoreline Restoration: Work with land-owners and stakeholders to develop and realize a vision for restoration projects in Kachemak Bay and surrounding areas. Mud Bay, an impacted shoreline located directly adjacent to the new KBNERR headquarters, is an ideal location for a K-12 stewardship project through the restoration and monitoring of currently degraded wetlands. It can also serve as an outdoor visitor center proximal to our port for visiting tourists, and as a sentinel site for impacts of climate change including storm surges and sea level rise. This site historically supported healthy clam populations and eel grass beds and contributes to the overall productivity of Kachemak Bay. It is the only sheltered cove on the north side of Kachemak Bay.

Work with land-owners and stakeholders to mitigate impacts to vegetation at Fox River Flats, the largest salt marsh in Kachemak Bay. The Flats haves been changing due to impacts from heavy use, including cattle grazing, ATV use, and vehicle traffic, as well as the effects of relative sea level change. Improved management of this State Critical Habitat Area could benefit a wide range of species, from juvenile salmon and other fish, to nesting waterfowl, and brown bears.

Situational assessments of emerging resource issues: Explore hatchery impacts on wild salmon fisheries (Hatcheries failing to mark otoliths, straying of hatchery fish) and the impacts of unregulated peat extraction from wetlands (Material site regulations and wetland ecosystem services).

Climate Change, Ecosystem Services Valuation, Water Quality, Habitat Restoration, Monitoring
Holistic watershed management of anadromous fish: The nature of juvenile anadromous salmon requires an integrated approach to the management and habitat conservation of estuaries, and by extension, salt marshes, and headwater streams. By integrating and outreaching current scientific data in a useful format to landowners we can work collaboratively to conserve landscapes and maintain the health of salmon populations.

Climate Change, Ecosystem Services Valuation, Water Quality, Monitoring
Larval transport for harvestable species: Work with area oceanographers and researchers to synthesize data, identify data gaps, and develop a population dynamics model for early life stage survival and settlement patterns of harvestable clams and crab species in Kachemak Bay and lower Cook Inlet. Vet and outreach this model to inform the decision-making processes of shellfish producers, researchers and subsistence users.

Marine Biotoxins: Develop long-term monitoring strategies for understanding the triggers, causes and ecological effects of marine biotoxins on upper trophic levels in Kachemak Bay. Utilize existing long-term monitoring data of bloom times for primary producers and evolving knowledge of coastal circulation patterns to identify trends in phytoplankton transport. Utilize this data to better understand population trends in marine birds and mammals.

Ecosystem Services Valuation, Water Quality, Habitat Restoration, Monitoring Application:
Bivalve Restoration: Review history and current habitat data for known bivalve populations in Kachemak Bay. Assess the potential for the recovery of native bivalve populations and work with communities and shellfish hatcheries to develop and implement out planting methods and monitor reintroduced native bivalves in suitable habitats.

Climate Change, Water Quality, Monitoring
Ocean acidification (OA): Develop a sampling methodology and algorithm for near shore OA monitoring in the glacially influenced waters of Kachemak Bay and south central Alaska. Use this sampling method to inform the structure and efficacy of long-term monitoring programs for ocean pH; effects of OA on the ecosystem; and potential effects of OA on food security in coastal Alaska.

Climate Change, Ecosystem Services Valuation, Shoreline Stabilization, Monitoring
Sediment transport dynamics. Support holistic coastal management decisions about marine infrastructure and estuarine habitats by acquiring new data to document and map how glacial melt and silt load, tidal action, watershed hydrology, coastal erosion and storm surges influence sediment transport dynamics in Kachemak Bay.

Climate Change, Water Quality, Habitat Restoration, Monitoring Application

Food web dynamics: Holistic research of marine invertebrate community structure and habitat is needed prior to natural and anthropogenic disturbances (such as from point source pollution or marine invasive species) in order to develop trophic models and increase our understanding of benthic and pelagic drivers in the estuary.

Climate Change, Ecosystem Services Valuation, Monitoring

Pilot Research Projects: Invest in SWMP pilot projects (Mud Bay vegetation monitoring, SWMP synthesis projects, connecting SWMP Data to End Users).

Padilla Bay Reserve, Washington

Climate Change, Ecosystem Service Valuation, Shoreline Stabilization, Water Quality, Habitat Restoration, Monitoring Application

Sea-level rise is evident in Padilla Bay and threatens saltmarsh, SAV and other intertidal organisms and habitats. Our reserve needs to establish more precise, reliable mechanisms (e.g. sentinel site protocols) to document local sea-level rise, estimate extent of saltmarsh and SAV habitat loss/change, and identify and implement strategies to protect and expand these habitats as sea-level increases.

Climate Change, Ecosystem Service Valuation, Water Quality, Habitat Restoration, Monitoring Application

Restoration of eelgrass habitat has been identified as a top regional priority in the Puget Sound/Salish Sea, with the goal of increasing eelgrass coverage by 20% by the year 2020 (from a 2000-2008 baseline). As one of the largest contiguous eelgrass beds in North America, Padilla Bay NERR has a scientific and resource management responsibility to work with regional stakeholders to preserve existing eelgrass habitat, contribute to restoration science, identify means of restoring degraded habitats, and identify strategies for facilitating the expansion of eelgrass into new areas. The Reserve needs to continue existing research and monitoring regarding the basic ecology of eelgrass, as well as explore environmental factors (e.g. eutrophication, extreme weather events, sea level rise) that promote or inhibit success of eelgrass communities.

Climate Change, Ecosystem Service Valuation, Habitat Restoration, Monitoring Application

The effects of ocean acidification are particularly pronounced in the waters of the Pacific Northwest, where seasonal upwelling brings corrosive, low pH water into the Puget Sound/Salish Sea and impacts calcifying organisms and the regional shellfish industry. There is increasing evidence that eelgrass can serve as a sink for atmospheric and ocean CO2 and locally mitigate decreases in ocean pH. However, the capacity for eelgrass to serve as a long-term carbon sink (i.e. blue carbon) remains loosely quantified. The Reserve needs to help quantify the role that eelgrass has in long-term sequestration of atmospheric/ocean carbon and the potential for eelgrass habitats to provide refuge for marine organisms (juvenile fish, crabs, calcifying organisms) potentially affected by fluctuating ocean pH.

Water Quality, Habitat Restoration, Monitoring Application

Fecal coliform contamination is a recurring problem in Padilla Bay, leading to the closure of local shellfish beds to harvest. The Padilla Bay watershed includes livestock, hobby farms, and a range of septic systems - many of which are failing. The Reserve needs to identify sources of fecal coliform contamination and assist local stakeholders and management agencies, including our partner agency - Dept of Ecology, to reduce the inputs so waters of Padilla Bay and the associated watershed can be "fishable, swimmable and drinkable".

Habitat Restoration

Padilla Bay has a wide range of non-native species found throughout the Reserve, many of which are invasive and pose a threat to the local ecosystems and habitats. Predictions suggest that the number and incidence of invasive species will only increase. The Reserve needs to continue efforts to monitor and eradicate existing invasive species, as well as monitor for potential threats, and identify management strategies to reduce the occurrence of invasive species within Reserve boundaries and prevent further degradation of local estuarine and upland habitats.

San Francisco Bay Reserve, California
Climate Change, Shoreline Stabilization, Habitat Restoration, Monitoring Application Translate sentinel site data into communication materials to help inform future decision-making at NERRS sites, within regions, and at a national scale
Climate Change, Shoreline Stabilization, Water Quality, Habitat Restoration Assess scientific, implementation, and policy options for living shoreline projects in the San Francisco Estuary to provide guidance for land owners, funders, practitioners and regulators to facilitate sustainable protection of the bay shoreline
Climate Change, Ecosystem Service Valuation, Shoreline Stabilization, Water Quality, Habitat Restoration, Promote landscape connectivity between watersheds, flood plains, marsh plains, and sub-tidal habitats to support a full range of ecosystem processes and services in conjunction with a viable local economy
Climate Change, Shoreline Stabilization, Water Quality, Habitat Restoration, Monitoring Application Design and implement a regionally-scaled tidal wetland monitoring program that integrates sentinel sites to help calibrate remote sensing approaches to ecological forecasting products that inform coastal decision-making, planning, and education

South Slough Reserve, Oregon
Climate Change Increase our understanding and communication of locally- and regionally-relevant issues related to climate change and carbon dynamics (e.g. sea level rise, ocean/estuarine acidification, and the increased frequency of harmful algal bloom events and biological invasions).
Ecosystem Service Evaluation, Climate Change Increase our understanding and use of existing data on ecosystem services (e.g. carbon sequestration) of estuarine habitats in the Pacific Northwest coastal region, including tidal marshes and seagrass beds, and identify local and regional management needs/priorities related to ecosystem services.
Water Quality, Climate Change, Shoreline Stabilization Identify and fill data gaps to improve management of estuarine habitats in the Coos estuary (e.g. sediment dynamics, estuary circulation, sea level rise vulnerability, ocean acidification, nutrient loading, and extreme temperature anomalies).
Water Quality, Habitat Restoration Increase our understanding of the impacts of human activities on estuarine water quality and habitats (e.g. land use effects on contaminant and bacterial loading, changes in sedimentation/erosion from dredging, invasive species, etc.).
Monitoring Applications Synthesize and interpret local and regional data from the System-Wide Monitoring Program (including Sentinel Sites data) to provide decision-making tools for coastal managers and decision makers.

Tijuana River Reserve, California
Climate Change Address the physical, biological, and socio-ecological interconnections between the estuary, watershed, and ocean, particularly using extreme events as a preview of potential climate impacts. Characterize the carbon sequestration capacity of Reserve habitats, including tidal marsh and adjacent upland-transition zones.

Habitat Restoration Incorporate innovate climate adaptation strategies into marsh restoration planning, implementation, and monitoring. Study the ecology and management of invasive species, with a focus on invaders capable of fundamentally altering ecosystem properties or processes.
Shoreline Stabilization, Habitat Restoration, Water Quality Address issues associated with excessive sedimentation in the Reserve, including beneficial re-use of sediment generated as a result of excavation of sediment catch basins or marsh restoration. This could include beach nourishment or sand dune restoration.
Water Quality Characterize the 1) cross-border flow of water, contaminants, and sediment, 2) ecosystem impacts of these flows, and 3) possible means of addressing these issues.