Margaret A. Davidson Fellowship
Reserve Management Needs for the 2022-23 Cohort

June 2021

Fellow research will be focused on addressing a key management question that helps to understand drivers or impacts of environmental change, or the reciprocal effects on human or community resilience. This document describes the current management needs of each national estuarine research reserve (NERR), and reflects the 2017-2022 National Estuarine Research Reserve System (NERRS) Strategic Plan and the focus areas of water quality, habitat, and environmental change. Proposed research projects must address one of the research reserves' priorities specified below.

Applicants are strongly encouraged to contact the reserve before submitting a proposal application to discuss the feasibility of their project idea and the resources available at the reserve. Several reserves have identified comparative studies to address needs that are common to more than one reserve. Questions and applications for these studies should be addressed to the reserve identified in the listing.

For questions about how this summary was developed, please contact

NOAA Office for Coastal Management
Email: *ocm.davidsonfellowship@noaa.gov*

Participating Reserves

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

Reserve Management Needs, By Region

Caribbean Region

Jobos Bay Reserve, Puerto Rico
Mangrove forests, marshes, and associated ecosystems in Jobos Bay reserve are under constant threat of degradation by sea level and associated hydrological changes, and migration is limited by coastal development, but we do not know how to assess short-term relative sea-level changes and implement effective management action plans. Therefore, we seek additional information on short-term changes in relative sea level rise by implementing innovative biological, chemical, and physical proxies. *Reserve Contact: Angel Dieppa, Research Coordinator, adieppa.jbnerr@gmail.com, (787) 853-4617.*
Benthic marine ecosystems in Jobos Bay Reserve are being anthropogenically altered and pollutants in sediments have been translocated to terrestrial/coastal areas via trophic transfer, but we do not know the extent and magnitude of the impacts. Therefore, we need to implement high-impact and low-cost bioindicators to provide rapid environmental assessment that will provide essential information to design best mitigation and restoration practices. *Reserve Contact: Angel Dieppa, Research Coordinator, adieppa.jbnerr@gmail.com, (787) 853-4617.*

Great Lakes Region

Lake Superior Reserve, Wisconsin
The invasive emerald ash borer has begun to impact black ash-dominated forested wetlands in the St. Louis River estuary, and will likely cause shifts in species composition and wetland function, but the ecological impacts in the Lake Superior estuarine environment are unknown, especially in the context of daily, seasonal and long-term water level fluctuations and increasing flood events. Therefore, robust analysis of the extent and ecological function of these forested wetlands in Lake Superior estuaries may help inform future restoration and management efforts. *Reserve Contact: Dustin Haines, Research Coordinator, dustin.haines@wisc.edu.*
Decision-makers are concerned about meeting community needs when implementing St. Louis River estuary restoration and conservation projects, and value community input as a critical component of successful projects, but seek guidance on how to authentically and effectively engage diverse users of the landscape when restoration projects arise. Therefore, local decision-makers would benefit from place-grounded inquiry that builds robust community engagement processes into project outcomes, culminating in recommendations and/or applied tools that can guide engagement efforts in the future. *Reserve Contact: Deanna Erickson, Reserve Manager, deanna.erickson@wisc.edu.*
Through protection, remediation and restoration efforts, the St. Louis River estuary is overcoming a legacy of contamination, however, a lack of suitable spatial and temporal water quality data inhibits the ability to understand how flood events and other climate change stressors may impact the long-term health of the estuary. Therefore, additional research that elucidates past and current sediment and nutrient dynamics is needed to identify future monitoring needs and tools that will help the reserve strengthen partner and community restoration and resilience efforts. *Reserve Contact: Hannah Ramage, Monitoring (SWMP) Coordinator, hannah.ramage@wisc.edu.*

Lake Superior Reserve, Wisconsin

Flood events and high water levels over the past decade have severely impacted regional communities and observing the impacts of these changes on the Lake Superior coast can motivate decision-makers to prioritize resilience, but the impacts and benefits of resilient coastal infrastructure solutions are not always clear to communities considering their implementation. Therefore, assessments of targeted policy or engineering options would help Lake Superior coastal communities understand how to take action in the context of increasing flood events and fluctuating water levels. *Reserve Contact: Karina Heim, Coastal Training Program Coordinator, karina.heim@wisc.edu*

Western Lake Superior is experiencing more precipitation, warmer winters and increasing storm events and these environmental changes impact human health and well-being in complex ways, but the myriad of impacts of climate change on place-based seasonal recreation and subsistence activities in communities surrounding Lake Superior estuaries are not well understood. Therefore, an analysis of the local impacts of climate change on individual and community well-being and identity related to these activities may help inform adaptation strategies, plan for transitions and integrate future recreation and subsistence needs in land management decisions. *Reserve Contact: Deanna Erickson, Reserve Manager, deanna.erickson@wisc.edu*

Old Woman Creek Reserve, Ohio

Community Readiness and Capacity to Adopt/Implement Nature-Based Shorelines. Increased water levels and more frequent storm events in the Great Lakes are causing increased erosion along the lakeshore. Most coastal landowners are choosing to protect their shorelines by hardening the shoreline, but hardened shorelines displace natural habitats, alter shoreline characteristics, and adversely impact the availability of sand resources. Therefore, we need to understand available nature-based shoreline best practices along the Great Lakes as well as the needs of coastal landowners in order to develop effective outreach and communication materials to supplement a developing Lake Erie shorelines certification program and promote the adoption of nature-based shorelines. *Reserve Contact: Jennifer Bucheit, Education Coordinator, Jennifer.Bucheit@dnr.state.oh.us, (419) 433-4601*.

Economic Feasibility Study of Plastics Reduction Techniques for Coastal Businesses. Single-use plastic items associated with the food, fishing, and pharmaceutical industries are the most frequent items found in the Great Lakes environment, however, the financial implications in reducing dependency on single-use plastic items have not been fully analyzed across industries. Therefore, an economic feasibility study comparing business products and strategies is needed to identify reasonable alternatives that are sustainable for businesses (e.g., biodegradable options, decreased availability of non-essential items) in order to promote the long-term health and economic well-being of Lake Erie. *Reserve Contact: Emily Kuzmick, Coastal Training Program Coordinator, Emily.Kuzmick@dnr.ohio.gov, (567) 623-4868.*

Monitoring and Modeling Old Woman Creek Lower Estuary Hydrodynamics. Climate change is expected to cause increasing seiche events in Lake Erie, and understanding how estuaries respond to this change is vital to predicting the health of nearshore water in the future. However, while standard methods have been developed to measure nutrient concentration and loading in unidirectional coastal wetlands, measuring nutrient loads into Lake Erie is more complicated with bidirectional flows at the confluence of the estuary and the lake due to seiche events. Therefore, enhanced monitoring and the development of hydrodynamic modeling tools will allow us to more accurately measure nutrient loading in the Old Woman Creek estuary and predict the impacts of extreme weather events on Great Lakes coastal wetlands. *Reserve Contact: Breann Hohman, Watershed Coordinator, Bhohman@eriecounty.oh.gov, (419) 626-5211.*

Old Woman Creek Reserve, Ohio

Community Decision-Making Approach to Wastewater Improvements. There is no centralized municipal wastewater treatment system in the OWC watershed. Many of the existing home sewage treatment systems (HSTS) are concentrated in the center of the watershed and are greater than 20 years old making them out of date and in many cases not providing adequate treatment. As a result, water quality monitoring of the stream has observed excessive nutrient and bacteria levels upstream of the estuary. Replacement of these failing HSTSs is not an option due to the small lot sizes preventing individual homeowners from complying with new regulations. Therefore, a community level solution is needed to improve the stream being impacted from this region of the watershed. Community level decision-making centered on wastewater systems will require an approach that includes a socioeconomic and environmental understanding of the watershed as well as robust collaboration between local residents and governing agencies. *Reserve Contact: Breann Hohman, Watershed Coordinator, Bhohman@eriecounty.oh.gov, (419) 626-5211.*

Gulf Coast Region

Apalachicola Reserve, Florida

Our coastal areas may be vulnerable to changes in climate. These include, but are not limited to, temperature, rainfall, river flow, sea level rise, and tropicalization (transition of our marshes into mangroves). Our Sentinel Site Program aims to get a better understanding of the long-term impacts of climate change in this system, but the current methods of investigation only address changes in marsh surface and associated plant communities; therefore, we need information about how these changes may impact marsh migration and estuarine and tidal freshwater communities (herpetological, fish, and macroinvertebrate communities) in the Apalachicola system. *Reserve Contact: Jason Garwood, Research Coordinator, jason.garwood@floridadep.gov, (850)-670-7705.*

We have been able to link riverine input and our SWMP data to some of our biological monitoring programs, which show significant relationships in spatial and temporal distributions in communities suggesting that there are definable linkages in food webs within the Apalachicola estuary. However, we have limited information on the trophic interactions of species within the system. We need better resolution on the connection between water quality, quantity, and the connection between the lowest trophic levels of our estuarine food web. *Reserve Contact: Jason Garwood, Research Coordinator, jason.garwood@floridadep.gov, (850)-670-7705.*

We have seen changes in fisheries habitat and resources in the Apalachicola Bay system, and many can be attributed to riverine input and anthropogenic impacts, but we don't have a good understanding of the how the resources can be managed more effectively from a biological and socioeconomic standpoint; therefore, we need a management and recovery plan based upon a new ecosystem services evaluation to help our community become more resilient to future impacts. *Reserve Contact: Jason Garwood, Research Coordinator, jason.garwood@floridadep.gov, (850) 670-7705.*

Grand Bay Reserve, Mississippi

Coastal habitats are being restored throughout the northern Gulf of Mexico, and many of these efforts have well-defined end points that can be used to determine restoration success, but effectiveness monitoring is rarely conducted and/or monitoring data is not often available for synthesis. Therefore, we need more information on the effectiveness of restoration approaches in both upland and estuarine systems to guide future management efforts in the region. *Reserve Contact: Dr. Ayesha Gray, Reserve Manager, Ayehsa.Gray@dmr.ms.gov, (228) 475-7047.*

Grand Bay Reserve, Mississippi

Grand Bay has historically had low nutrient concentrations and high fecal coliform counts, and though the watershed is generally undeveloped, the waters are closed to shellfishing, but we don't know the source of fecal contamination or the potential impacts of contaminants from other nearby sources. Therefore, we need better information about the sources and impacts of contaminants across the reserve so we can develop effective mitigation strategies. *Reserve Contact: Dr. Ayesha Gray, Reserve Manager, Ayehsa.Gray@dmr.ms.gov, (228) 475-7047.*

Due to the impacts of the Deepwater Horizon oil spill, restoration of coastal habitats is occurring throughout the northern Gulf of Mexico, and many of these efforts are expected to improve the socioeconomic condition of the Gulf Coast communities as well as the environmental condition, but few research efforts focus on ecosystem valuation in terms of the socioeconomic impacts of restoration. Therefore, we need more information on how and if restoration of the local environment affects local communities and economies. *Reserve Contact: Dr. Ayesha Gray, Reserve Manager, Ayehsa.Gray@dmr.ms.gov, (228) 475-7047.*

The Grand Bay Estuary serves as a reference site for many ongoing restoration projects across the Mississippi Coast, and reserve data are critical to evaluating restoration effectiveness, but we have little population or ecological data for many vertebrate species. Therefore, we need population and ecological studies for both terrestrial and aquatic vertebrates to continue to serve the critical role of a reference estuary. *Reserve Contact: Dr. Ayesha Gray, Reserve Manager, Ayehsa.Gray@dmr.ms.gov, (228) 475-7047.*

The Grand Bay Reserve marshes are affected by several ecological and physical processes, and are slowly being converted to open water, but we do not understand the physical processes affecting critical ecological functions. Therefore, we need studies to better understand overland flow, water circulation patterns, and sediment dynamics (e.g., erosion, transport, deposition) in the NERR to better conserve our estuarine ecosystem. *Reserve Contact: Dr. Ayesha Gray, Reserve Manager, Ayehsa.Gray@dmr.ms.gov, (228) 475-7047.*

Mission-Aransas Reserve, Texas

Resilience is the capacity of a linked anthropogenic-social and natural-ecological system to absorb extreme events and other drivers of change, yet maintain their essential structures and functions. Many coastal estuaries and their wetlands are impacted by major events such as hurricanes and by long-term drivers of ecological degradation, but often the links between these drivers of ecological change and their impacts on communities, economies, and livelihoods are poorly understood. Therefore, we need information on how long and short-term environmental drivers impact social/economic/ecological systems and how management actions can enhance resilience across the socio-ecological system. *Reserve Contact: Dr. Edward Buskey, Research Coordinator, ed.buskey@utexas.edu, (361) 749-3102.*

The reserve is vulnerable to numerous impacts from climate change, including sea level rise, ocean acidification, increasing water temperatures and decreasing frequency of hard freezes in winter, and our subtropical location makes us vulnerable to invasive species and range extensions of tropical species. Therefore, we need to understand how a changing climate will impact the structure and function of our estuarine ecosystem as climate change drivers favor new species and displace others. *Reserve Contact: Dr. Edward Buskey, Research Coordinator, ed.buskey@utexas.edu, (361) 749-3102.*

The reserve is located in South Texas which is known for extended periods of drought and increasing demands for freshwater by agriculture, industry and municipalities can leave little freshwater to flow into estuaries, reducing delivery of nutrients and sediments to the estuaries and increasing salinities for estuarine dependent species. Therefore, we need to assess the ecological consequences of natural and anthropogenic factors affecting freshwater inflows that could alter the diversity, structure and function of our reserve's ecosystem. *Reserve Contact: Dr. Edward Buskey, Research Coordinator, ed.buskey@utexas.edu, (361) 749-3102.*

Mission-Aransas Reserve, Texas

The Mission-Aransas Reserve is located next to the 6th largest port in the US in terms of tonnage, with deep channels dredged through otherwise shallow coastal bays and estuaries, and we know that most of the commercially and recreationally important species of finfish and shellfish are estuarine dependent species (shrimp, blue crabs, red drum, southern flounder), but little is known about the factors that are needed for the tiny larvae of these species to locate and enter widely dispersed channels connecting the estuaries to the open ocean. Therefore, we need more information about how plans to deepen these channels and alter the hydrography and salinity of the coastal bays and estuaries will impact recruitment of estuarine dependent species. *Reserve Contact: Dr. Edward Buskey, Research Coordinator, ed.buskey@utexas.edu, (361) 749-3102.*

In mid-2017, the reserve completed a marine debris accumulation rate study along the Gulf of Mexico facing beaches, and the beaches in South Texas have the highest marine debris accumulation rates of any other beaches in the United States, but not much is known about the long-term impacts of marine debris on the ecological system, fisheries, or human health risks. Therefore, we need to study in more detail the impact marine debris is having on habitats, food webs, reproductive cycles of wildlife, and human effects so that solutions and alternatives can be developed. *Reserve Contact: Dr. Edward Buskey, Research Coordinator, ed.buskey@utexas.edu, (361) 749-3102.*

Rookery Bay Reserve, Florida

Benthic estuarine habitats provide significant ecosystem services for estuarine wildlife and human communities and these habitats may be affected by chronic and acute drivers of change such as sedimentation, freshwater inputs, and hurricane damage, but limited resources and information have deterred effective monitoring and restoration programs for these habitats. Therefore, additional information is needed to understand the distribution, historic decline, and restoration options for habitats such as seagrass, macroalgae, live bottom and bivalves (oyster and clam) and the ecosystem services they provide. *Reserve Contact: Jill Schmid, GIS Specialist, jill.schmid@dep.state.fl.us, (239) 530-5968.*

The distribution and diversity of native flora in our system depends on many factors such as hydrology, soils, natural fire regimes and regional-scale changes in climate and sea level, all of which are affecting seasonal cues, but we don't understand the interactions between climate, fire, and invasive species. Therefore, we need monitoring and analysis to help us understand how fire management can be applied within the context of regional environmental change. *Reserve Contact: Jeffrey Carter, Stewardship Coordinator, jeffrey.a.carter@dep.state.fl.us, (239) 530-5960.*

The Education department at Rookery Bay Reserve reaches audiences "from K through Grey" to provide science-based information on natural resources and environmental change in southwest Florida, and the department is continuing to grow its programming on issues pertaining to climate change, but we don't know how this information drives behavior changes at the individual or community level. Therefore, an evaluation of the impact of education programs for visitors to Rookery Bay Reserve is needed to inform future programs by identifying target audiences and/or information needs. *Reserve Contact: Sarah Falkowski, Education Coordinator, Sarah.Falkowski@dep.state.fl.us, (239) 530-5975.*

Climate change is altering the natural range of botanical and wildlife species in the sub-tropics (known as "tropicalization"), and Rookery Bay Reserve is partnering with a local botanical garden to identify and protect some species of concern or importance to enhance resilience, but we don't have enough information to assess projected change factors (e.g., rainfall, lack of seasonal freeze, sea-level rise, fire, pests, storms). Therefore, analyses are needed to develop and recommend best practices (e.g. changing application of prescribed fire, assisted habitat migration, seed banking and replanting) to enhance current and future landscape level habitat conservation and management. *Reserve Contact: Jeffrey Carter, Stewardship Coordinator, jeffrey.a.carter@dep.state.fl.us, (239) 530-5960.*

Rookery Bay Reserve, Florida

A 2019 Science Catalyst project led by Dr. Lydia Olander and Sara Mason at the Duke Nicholas School of the Environment created an Ecosystem Services Conceptual Model (ESCM) focused on a large mangrove die-off area known as Fruit Farm Creek (FFC) within Rookery Bay NERR. Hydrologic restoration at FFC will begin in 2021, but there currently is no monitoring planned to study the socioeconomic effects of this restoration. Therefore, we welcome a project that will build upon the Olander-Mason ESCM to study ecosystem services outcomes of mangrove restoration in Goodland, Florida. *Reserve Contact: Jessica McIntosh, Coastal Training Program Coordinator, Jessica.McIntosh@dep.state.fl.us, 239-530-5956.*

Weeks Bay Reserve, Alabama

High levels of pathogens in the Fish River have the potential to harm human health, and the total maximum daily load (TMDL) completed in 2013 identified stormwater pathogens entering the Fish River from urbanizing landscapes, but microbial source tracking didn't quantify proportional pathogen inputs from known or common sources (i.e. pets or wildlife). Therefore, we need information on the proportion of pathogens contributed by identified sources to implement effective management to reduce human health threat & meet the TMDL-mandated pathogen reduction target. *Reserve Contact: Mike Shelton, Coastal Training Program Coordinator, Mike.Shelton@dcnr.alabama.gov, (251) 928-9792.*

We have research from the Southeast that the use of fire in the management of coastal ecosystems increases diversity and reduces encroachment of woody plant species. We have managed Weeks Bay Reserve marshes and adjacent pine flatwoods with fire for many years, but we do not have empirical data on how the use of fire affects carbon, nutrient and water cycles (transpiration and residence time). Therefore, we need information about effects of fire on coastal ecosystems as it concerns carbon, nutrient and/or water cycles and that incorporates anticipated changes in habitat composition and climate variation and how that interacts with marsh ecotone migration, diversity, productivity, and prevalence of invasive species with ultimate outcome of planning an overall best fire management regime. *Reserve Contact: Eric Brunden, Stewardship Coordinator, Eric.Brunden@dcnr.alabama.gov, (251) 928-9792.*

Weeks Bay is considered a eutrophic estuary and we have gathered data on nutrient concentration and productivity estimates (primary and secondary). We have data on changes in land use and land cover illustrating loss of wetlands in the Weeks Bay watershed. But, we do not have empirical data to predict how these will interact along with climate change effects on rainfall. Therefore, we need information about: nutrients (N and P) from surface water, runoff and groundwater impacts, loading, sources and sinks; the carbon cycle, including effects of current management and restoration of Weeks Bay habitats on the overall carbon cycle; phytoplankton assemblage dynamics, trophic interactions, factors controlling primary productivity and HABs; effects of eutrophication on secondary productivity; identification of possible trophic thresholds via monitoring of nutrient and carbon cycle inputs and disruptions (i.e. dystrophy); and changes in hydrology, climate & nitrogen loading and effects on productivity of the Weeks Bay estuary and the possibility of future harmful algal blooms. *Reserve Contact: Dr. Scott Phipps, Research Coordinator, Scott.Phipps@dcnr.alabama.gov, (251) 928-9792.*

Marine debris is a threat to human health, the environment, and the economy. The reserve and its partners participate in many regional programs to prevent and clean up marine debris, but marine debris remains a persistent problem. Therefore, reserve staff need an understanding of citizen knowledge and attitudes towards marine debris and the development of outreach strategies that result in measurable behavior change that reduces local sources of marine debris. Research into the regional human and ecological impacts of marine debris is also needed to guide management. *Reserve Contact: Angela Underwood, Interim Manager, Angela.Underwood@dcnr.alabama.gov, (251) 928-9792.*

Weeks Bay Reserve, Alabama
We know socioeconomic data can be used to inform revisions of reserve programs and we know there is information to be obtained in the community from resource users, but gathered information is lacking to understand these data and their impacts. Therefore, investigation is needed to perform ecosystem services valuation of the reserve's habitats, better understand linkages between ecosystems services and local community well-being & values, & to conduct ongoing monitoring of pertinent socioeconomic indicators to determine change over time. *Reserve Contact: Clara Zubrick, Interim EC, clara.zubrick@dcnr.alabama.gov, (251) 928-9792.*

Mid-Atlantic Region

Chesapeake Bay Reserve, Maryland
The State of Maryland is prioritizing the selection and implementation of tidal wetland restoration and conservation to enhance ecological and community resilience, but questions remain about regional tidal wetland health and the intricacies of new management and restoration designs and methods. Therefore, we need to investigate new and existing wetland conditions and management actions. *Reserve Contact: Kyle Derby, Research Coordinator, kyle.derby@maryland.gov, (410) 260-8724.*
Submerged aquatic vegetation (SAV) is critical to the health of the Chesapeake Bay and its fisheries, while also providing valuable ecosystem services such as carbon sequestration, water quality improvements and more to the region as a whole. In recent years, shifts in SAV density, coverage, and dominant species have been observed across the Bay, and the Reserve, but the causes of these shifts, and their impacts to ecosystem services, are not well understood. Therefore, more data collection and analysis of the benthic habitats in the reserve are needed to inform appropriate management and restoration strategies. *Reserve Contact: Becky Swerida, Reserve Biologist, rebecca.swerida@maryland.gov, (410) 260-8722.*
Currently, we have a good understanding of nutrient and sediment water quality issues in the Chesapeake Bay and this data has informed management actions through the Bay total maximum daily load. However, other water quality issues are continually identified in our estuary, such as PCBs, road salt usage, and macro/microplastics, and additional information is needed to assess potential threats and investigate mitigation and outreach strategies for emerging water quality concerns. *Reserve Contact: Becky Swerida, Reserve Biologist, rebecca.swerida@maryland.gov, (410) 260-8722.*
Marsh migration is affecting existing human and natural communities (through impacts such as saltwater intrusion, wetland habitat loss, and increased flooding risk) and is of concern within the state, but policymakers need more information to develop solutions. Therefore, we need additional information to evaluate risk and adaptation options. *Reserve Contact: Kyle Derby, Research Coordinator, kyle.derby@maryland.gov, (410) 260-8724.*

Chesapeake Bay Reserve, Virginia

Syntheses of Long-term Data & Information. The York River estuary and adjacent waters continue 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). Responses to material loads include intense algal blooms, low oxygen, and reduced water clarity that impact living resources. Moreover, emerging issues such as estuarine and coastal water acidification are becoming of greater local concern. The ability to explain observed variability in estuarine response to watershed material loads, internal cycling, episodic events and longer-term climatic changes is somewhat limited. Therefore, integration and syntheses of the long-term meteorological, water quality, physical, and biological datasets that provide greater understanding and predictability of estuarine response to multi-factor drivers through development of empirical (data driven) models and verification theory-based models is a priority. In addition to traditional agency and academic collected data and information, the integration of community and NGO collected data (e.g., Chesapeake Monitoring Cooperative) would provide additional and valuable information (e.g., enhanced spatial coverage) and add to a more comprehensive understanding. *Reserve Contact: Carl Friedrichs, Ph.D., Loretta and Lewis Glucksman Professor of Marine Science, Carl.Friedrichs@vims.edu, (804) 684-7303; William Reay, Ph.D., Manager, wreay@vims.edu, (804) 684-7119; or Cirse Gonzalez, Coastal Training Program Coordinator, cagonzalez@vims.edu, (804) 684-7144*.

Harmful Algal Blooms. Harmful algal blooms (HABs) have become more common within the York River estuary, and produced toxins can have harmful effects on shell and finfish, shallow water ecosystems and humans. Although a topic of active study, understanding of bloom initiation, dynamics and impacts on water quality and natural resources is limited. Therefore, synthesis of York River estuary observing network data and focused field and/or modeling studies are needed to provide guidance on reducing HAB occurrence and their detrimental effects on composition, abundance and persistence of estuarine aquatic biota and human activities (e.g., aquaculture). *Reserve Contact: Carl Friedrichs, Ph.D., Loretta and Lewis Glucksman Professor of Marine Science, Carl.Friedrichs@vims.edu, (804) 684-7303; or William Reay, Ph.D., Manager, wreay@vims.edu, (804) 684-7119*.

Seagrass Bed Resiliency. Highly valued seagrass beds within the York River estuary have undergone significant declines and research and monitoring are shedding light on the impacts of eutrophication, reduced water clarity and elevated water temperature. But, many questions still remain about resiliency, including genetic diversity, sexual reproduction, natural metabolic adaptations, and mixed species interactions. Therefore, additional information is needed to evaluate seagrass bed resiliency in response to changes under future climate and water quality scenarios along with innovative ways to facilitate seagrass resilience in the York River estuary and associated small coastal basin system (i.e., Mobjack Bay and Piankatank River). *Reserve Contact: Erin Shields, Marine Scientist, eshields@vims.edu, (804) 684-7702.*

Tidal Wetland Vulnerability. The York River estuary exhibits diverse and vulnerable wetland communities distributed along a broad salinity gradient, ranging from tidal fresh to polyhaline conditions. It is anticipated the degree of vulnerability and degradation arising from major episodic events and longer-term climate change-related impacts will vary between sites and wetland community types. Additional information is needed on how physical (e.g., RSLR, salt intrusion, sediment load, elevation capital) and biological (e.g., vegetative community type, above and below ground productivity) site variability influences measures of wetland community integrity and resiliency in light of episodic and chronic stressors. *Reserve Contact: Scott Lerberg, Stewardship Coordinator, Lerbergs@vims.edu, (804) 684-7129; or William Reay, Ph.D., Manager, wreay@vims.edu, (804) 684-7119.*

Ecosystem Services Approach to Tidal Wetland Restoration Strategies. Research that advances the identification, quantification and valuation of ecosystem services of tidal wetlands (e.g., water quality, carbon sequestration, storm buffering, erosion control) under different environmental conditions and climate change scenarios is a reserve priority. Based on this information, research that explores (or tests) ecosystem restoration strategies designed to mitigate current and anticipated stressors and enhance tidal wetland resiliency (and associated ecosystem services) within the York River estuary would greatly inform future management strategies. *Reserve Contact: Scott Lerberg, Stewardship Coordinator, Lerbergs@vims.edu, (804) 684-7129; or William Reay, Ph.D., Manager, wreay@vims.edu, (804) 684-7119.*

Delaware Reserve, Delaware

The Delaware Reserve hosts hundreds of visitors each year that are engaging in research, education, and recreation onsite, but lacks the capacity to quantitatively assess how they heard about the reserve and use its resources. Therefore, a visitor use study is needed to measure the value the Delaware Reserve is bringing to the community and identify ways to better meet community needs. *Reserve Contact: Laurel Sullivan, Education Coordinator, laurel.sullivan@delaware.gov.*

The Delaware Reserve has been monitoring marsh birds since 2012 and data analysis has concluded that species abundance has been declining. Marsh birds can be a potentially valuable "indicator" for the ecological integrity of salt marshes due to sensitivity to habitat changes, but research is needed to better understand marsh bird population dynamics, stressors, and causes to these declines. This information would help the Delaware Reserve and other land managers understand what actions can be taken to assist with marsh bird species and wetland habitat conservation and protection. *Reserve Contact: Christina Whiteman, Stewardship Coordinator, christina.whiteman@delaware.gov.*

Pollution from nutrients, organic contaminants, and heavy metals are a major anthropogenic stressor and could impact tidal wetland ecosystems, but we have little data on how estuarine food webs are being impacted or the effectiveness of innovative remediation strategies like biochar applications. Therefore, we need research to better assess ecosystem level impacts of pollution to best inform management strategies. *Reserve Contact: Kari St.Laurent, Research Coordinator, kari.stlaurent@delaware.gov.*

Coastal acidification and hypoxia is an emerging concern and could have significant impacts on the ecosystems of Delaware Bay, but we have very little data which robustly monitors the carbonate chemistry and/or effects on Delaware's coastal environment. Therefore, we need research which can best categorize carbonate chemistry baselines, ranges, and variability at different timelines and/or localized ecosystem effects of coastal acidification. *Reserve Contact: Kari St.Laurent, Research Coordinator, kari.stlaurent@delaware.gov.*

Coastal wetlands are considered to be carbon sinks and have complex biogeochemical processes. However, methane, nitrous oxide, and carbon release due to wetland loss could offset this carbon sequestration benefit. Therefore, we need more information on the greenhouse gas exchange of mesohaline and oligohaline tidal marshes in order to best inform tidal marsh restoration and protection strategies. *Reserve Contact: Kari St.Laurent, Research Coordinator, kari.stlaurent@delaware.gov.*

Hudson River Reserve, New York

Elevation of Structures. We know that sea-level rise will change the location of mean high water and this will affect public trust lands. But, we know that actual, observed daily water levels often exceed the calculated mean depending on conditions at the moment of observation, including large storm events. The potential daily water elevations that exceed the mean level under "normal" conditions is especially valuable information when designing and permitting coastal shoreline projects. Therefore, we would like a framework to pursue this issue that could include an inventory of existing guidance and the development of an economic cost/benefit analysis of providing coastal flood protection at elevations above mean high water versus the expected frequency of exceeding those elevations and identifying the point of diminishing returns of investment in coastal protection to increasing heights. *Reserve Contact: Dan Miller, Habitat Restoration Coordinator, Daniel.Miller@dec.ny.gov, (845) 889-4745 x110.*

Social Science and Outreach. Hudson River Reserve conducts several local outreach and education events and we know the audience includes several minority groups. But, we do not know how effectively we are communicating our core messages and successfully reaching communities of color, low-income families, or members of the LGBTQ+ community. Therefore, an analysis of the exchange of Hudson Valley information with marginalized groups would inform how to improve this outreach. *Reserve Contact: Maija Niemisto, Educator, Maija.Niemisto@dec.ny.gov, (845) 889-4745 x107.*

Hudson River Reserve, New York

SAV. There was a 90% loss of submerged aquatic vegetation (SAV) in the Hudson during an extreme storm event in 2012, and we know from GIS data that while *Vallisneria americana* is recovering, it does not include all pre-2012 areas and seems to be a genetic monoculture, but we do not know if transplanting native Hudson River SAV is a viable restoration option, or why invasive *Trapa natans* expanded in to some shallow water areas but not others. Therefore, to prepare for large-scale restoration, we want to know if transplantation of native Hudson River SAV is feasible and if so, what conditions maximize restoration success and inhibit *Trapa* invasion. *Reserve Contact: Sarah Fernald, Research Coordinator, Sarah.Fernald@dec.ny.gov, (845) 889-4745 x111.*

Plant Herbivory. Native tidal marsh plant species, particularly smooth cordgrass (*Spartina alterniflora*), play a critical role in stabilizing and protecting marsh edges, and are experiencing significant grazing pressure and additional stresses from sea-level rise, invasive species, and nitrogen pollution at Piermont Marsh. But, little is known about how these stressors might be interacting to affect vegetation composition and dynamics. Therefore, we need to identify the primary sources of herbivory and understand how they are potentially interacting with other stressors to affect marsh structure and resilience. *Reserve Contact: Brian DeGasperis, Restoration Biologist, Brian.DeGasperis@dec.ny.gov, (845) 889-4745 x116.*

Jacques Cousteau Reserve, New Jersey

Communities bordering the Jacques Cousteau Reserve, such as Atlantic City and Pleasantville, New Jersey, are "overburdened communities" – low-income, minority and limited English-speaking families subject to environmental and/or public health stressors, making them potentially more vulnerable to the impacts of climate change. New cross-curricular K-12 climate change state standards can provide an ideal opportunity for the JC NERR to engage with teachers and students within these communities regarding climate literacy and community resiliency. But, it is unclear if students and teachers are aware of local climate change-related impacts, how the topics of climate change and resiliency are being incorporated into curriculums, and what climate vulnerabilities mean for the future of their communities. Therefore, the Jacques Cousteau Reserve needs to assess what K-12 teachers within these overburdened communities are currently teaching, how the Jacques Cousteau Reserve can provide support in improving content knowledge in local climate change impacts and community resiliency and come up with appropriate resiliency solutions teachers and students can engage in within their schools and/or local community. *Reserve Contact: Kaitlin Gannon, Education Coordinator, gannon@marine.rutgers.edu, (609) 812-0649.*

Increasing the resilience of built and ecological communities to coastal hazards like sea level rise and storm surge has been a priority in New Jersey since Hurricane Sandy, and the coastal data, tools and technical assistance provided by the reserve have established it as a state leader in coastal resilience planning, but there has been no assessment of how effectively this work implemented over the last decade has increased coastal community resilience to-date. Therefore, we need to assess the reserve's existing resilience portfolio and resulting community resilience planning actions to determine what has been effective over various timeframes and why, what barriers exist to continued utilization of these resources, and how these resources may be updated to better serve coastal communities. *Reserve Contact: Vanessa Dornisch, Coastal Training Program Coordinator, dornisch@marine.rutgers.edu, (609) 812-0649.*

Water and habitat quality of the Mullica River-Great Bay Estuary has been excellent due to limited development, low nutrient loading, and the fact that the nutrients that enter upriver typically are not effectively utilized, but periodic upwelling, ocean acidification, and saltwater intrusion along with increasing precipitation projected by climate change models are likely to lead to changes to the estuarine system. Therefore, we need to understand any resulting organism and habitat range shifts to inform future management strategies. *Reserve Contact: Mike De Luca, Manager, deluca@marine.rutgers.edu, (609) 812-0649.*

Jacques Cousteau Reserve, New Jersey
Shellfish farms are low impact forms of coastal food production and they provide ecosystem services such as nutrient reduction and habitat provisioning, but we lack a thorough understanding of the types of fish and wildlife interactions that occur at these farms. Therefore, with farm production expanding in the Barnegat Bay estuary it is important to collect data about fish habitat on farms and how these influence fish and wildlife communities in the bay. *Reserve Contact: Mike De Luca, Manager, deluca@marine.rutgers.edu, (609) 812-0649.*

Northeast Region

Great Bay Reserve, New Hampshire
Salt Marsh Resilience. Salt marshes along the New Hampshire coast are threatened by sea level rise, and the Great Bay reserve is actively conducting several research and monitoring efforts to understand this threat and how to plan protection, restoration, and land use decisions that will allow salt marsh habitat to persist. But, we do not know what types of restoration activities are best suited for different types of marshes and different restoration goals (fish and wildlife habitat, flood protection, etc.). Therefore, we need to explore the potential of innovative ways to facilitate marsh resilience and how to site those activities appropriately. *Reserve Contact: Rachel Stevens, Stewardship Coordinator, Rachel.Stevens@wildlife.nh.gov, (603) 778-0015.*
Visitor Motivation. National Estuarine Research Reserves are natural places where visitors come to explore, study, recreate, rest and learn about coastal ecosystems. But unlike a theme park, museum, or National Park, the Great Bay Discovery Center and associated reserve properties have a variety of indoor and outdoor spaces that visitors are interested in experiencing; making it difficult to count, categorize, and capture motivation for initial and repeat visitation. Therefore, we need to develop innovative ways to accurately quantify how many people visit our sites and sites like ours, as well as understand their motivations, to help with future visitor management and programming. *Reserve Contact: Kelle Loughlin, Education Coordinator, Kelle.Loughlin@wildilfe.nh.gov, (603) 556-1049.*
Improving outdoor access. Environmental education visitor centers and natural outdoor spaces and experiences are intended to serve all. But, access to these opportunities varies across demographic groups. Therefore, understanding those barriers, as well as the elements that encourage full access to the outdoors for all, will help with future management and programming. *Reserve Contact: Kelle Loughlin, Education Coordinator, Kelle.Loughlin@wildlife.nh.gov, (603) 556-1049.*
Habitat Resilience. Our estuaries are under unprecedented pressure from climate change and land use change, and initial investigations into inherent resilience of certain habitats (marshes, seagrasses and oysters) have been conducted. However, further understanding of how key natural habitats enhance resilience from anthropogenic stressors is necessary to help to better protect and manage our estuaries. *Reserve Contact: Chris Peter, Research Coordinator, Christopher.Peter@wildlife.nh.gov, (603) 294-0146.*
Aquaculture. In Great Bay, oyster aquaculture has increased over the past decade, leading to difficult management decisions on habitat prioritization. But, more information is needed to thoroughly understand how aquaculture may be benefiting and impacting the Bay, allowing for more informed management of oyster aquaculture and other associated habitats. *Reserve Contact: Chris Peter, Research Coordinator, Christopher.Peter@wildlife.nh.gov, (603) 294-0146.*

Narragansett Bay Reserve, Rhode Island
Tidal marsh functions and services. Tidal marshes are subject to ongoing effects from climate change and sea-level rise. In response, coastal managers are now implementing adaptation projects (e.g., thin-layer sediment placement, drainage enhancement, migration facilitation) to help build marsh resilience against these stressors. Research is urgently needed on how these stressors and adaptation projects affect marsh functions and services including carbon sequestration, nutrient cycling, and especially habitat use by wildlife, among others. *Reserve Contact: Kenny Raposa, Research Coordinator, kenneth.raposa@dem.ri.gov, (401) 683-7849.*
Tidal marsh migration. Researchers and managers are increasingly focusing on migration facilitation as a tool for building tidal marsh resilience, but are hindered by significant knowledge gaps. We therefore need research to identify and evaluate techniques in which upland marsh buffers and barriers can be managed to facilitate migration. We also have limited knowledge on historic and current rates of natural marsh migration and need new research to examine migration rates and understand how they might differ depending on upland habitat type. *Reserve Contact: Kenny Raposa, Research Coordinator, kenneth.raposa@dem.ri.gov, (401) 683-7849.*
Social science. Researchers understand the value of restoring or modifying uplands adjacent to marshes to facilitate migration, and some degree of outreach to coastal landowners is generally associated with migration project. But a thorough assessment of how the public and other non-scientific stakeholders values the potential trade-offs between different types of coastal uplands and marshes has not been undertaken. Therefore, such a quantitative assessment is needed to help guide best practices for future migration facilitation studies and implementation. *Reserve Contact: Jennifer West, Coastal Training Program Coordinator, jennifer.west@dem.ri.gov, (401) 222-4700 x7413.*
Submerged aquatic vegetation. In recent decades, significant investments in the reduction of nutrients entering Narragansett Bay have improved water quality conditions and moderately increased the health and spatial extent of submerged aquatic vegetation (SAV), but we don't have a thorough understanding of how future climate change drivers will affect the distribution, resilience and ecosystem functions of SAV in the Bay. Therefore, additional studies are needed on the response to potential future conditions to inform coastal management of this valuable resource. *Reserve Contact: Kenny Raposa, Research Coordinator, kenneth.raposa@dem.ri.gov, (401) 683-7849.*
Upland habitat management. Coastal uplands in the reserve are heavily impacted by multiple stressors including invasive pests (e.g., Asian long-horned beetle, gypsy moth), invasive plants, and changes in precipitation and temperature associated with climate change. Reserve uplands are also managed using a suite of ongoing maintenance and restoration strategies. Research is needed to understand the extent and degree of impacts from individual and multiple stressors and to better understand and guide best management practices for coastal uplands under changing climatic conditions. *Reserve Contact: Kenny Raposa, Research Coordinator, kenneth.raposa@dem.ri.gov, (401) 683-7849.*
***Phragmites* management.** Researchers and coastal managers have been studying and trying to control invasive *Phragmites australis* in Rhode Island tidal marshes for over 20 years, but the degree to which *Phragmites* affects marsh resilience and migration remains unclear, and there is no consensus on how to best manage *Phragmites* in marshes, and in light of emerging benefits of *Phragmites*, if there is even a need to manage it. We need to understand the role of *Phragmites* in tidal marsh ecology in the context of accelerating sea-level rise and to evaluate management practices to guide future policy. *Reserve Contact: Kenny Raposa, Research Coordinator, kenneth.raposa@dem.ri.gov, (401) 683-7849.*

Wells Reserve, Maine

Invasive Species Interactions. Anthropogenic and climate-mediated processes are driving shifts in the distribution of invasive and range-expanding species (e.g., green crab, blue crab), and estuarine systems are especially vulnerable to high rates of invasions. However, interactions between native vs. non-native species in our estuaries and coastal waters remain poorly understood. Therefore, we seek to leverage novel technologies (e.g., eDNA, telemetry) to advance ongoing and future monitoring programs that expand our understanding of invasive species and their impacts on native population dynamics and ecosystem services. *Reserve Contact: Dr. Jason Goldstein, Research Director, jgoldstein@wellsnerr.org, (207) 646.1555 x136.*

Healthy and Sustainable Fisheries in the Gulf of Maine. Ocean climate change is already having adverse impacts on economically- and ecologically-relevant marine species in the Gulf of Maine, and we expect stressful environmental conditions (e.g., thermal stress, coastal acidification, disease) to persist or intensify over time. Therefore, we seek to expand empirical studies and predictive modeling to inform coastal resource stakeholders of how such stressors affect finfish and shellfish species, especially for early life history stages that are considered data-poor (e.g., larvae, post-larvae). *Reserve Contact: Dr. Jason Goldstein, Research Director, jgoldstein@wellsnerr.org, (207) 646.1555 x136.*

Coastal Resiliency. Shorelines are increasingly vulnerable to storms, sea level rise, and erosion and, in response, vulnerable coastal communities are making complex management and policy decisions, but one issue remains difficult to discuss. 'Relocation' raises hard questions about financing, property rights, and emotional attachments to place. Therefore, research is needed to better understand the challenges of developing relocation strategies and methods for engaging communities in dialogues that build resilience. *Reserve Contact: Dr. Christine Feurt, Coastal Training Program Director, cfeurt@wellsnerr.org, (207) 646.1555 x111.*

SWMP Data Science and Synthesis. The System-wide Monitoring Program (SWMP) measures long-term changes and short-term variability in water quality, weather, and sea level to inform coastal zone management, and we seek to better synthesize these data, but we lack the analytical tools to comprehensively analyze such large datasets. Therefore, the development of novel tools and robust analyses are needed to efficiently summarize trends from these data and to facilitate the incorporation of other parameters in the future, particularly aspects of carbonate chemistry. *Reserve Contact: Dr. Jason Goldstein, Research Director, jgoldstein@wellsnerr.org, (207) 646.1555 x136.*

Ecosystem Services and Sentinel Site Data Science. Current NERRS research and sentinel site programs document tidal marsh condition and responses to environmental change, but the methods and findings documenting marsh health and change are not always useful to decision-makers because they are not connected to the ecosystem services provided by the marsh. Therefore, research is needed to identify and, where possible, quantify the ecosystem services (and disservices) provided by tidal marsh to support decision-making about trade-offs for conservation, nature-based solutions, restoration, and planned relocation of human and natural infrastructure. *Reserve Contact: Dr. Jason Goldstein, Research Director, jgoldstein@wellsnerr.org, (207) 646.1555 x136; and Dr. Christine Feurt, Coastal Training Program Director, cfeurt@wellsnerr.org, (207) 646.1555 x111.*

Waquoit Bay Reserve, Massachusetts

Water Quality. Addressing pollution from excess nutrients is a pressing management issue for many communities. Stakeholders have prioritized the need for research-based information on the efficacy of watershed and embayment management strategies including but not limited to use of non-traditional methods of remediation (e.g. shellfish aquaculture, floating and constructed wetlands, reactive barriers, phytoremediation, etc.) to preserve and restore clean water. Research is also needed to better understand impacts of other pollutants such as contaminants of emerging concern, heavy metals, microplastics, and harmful algal blooms on water quality, as well as effective management approaches. *Reserve Contact: Megan Tyrrell, Research Coordinator, megan.tyrrell@state.mass.gov.*

Waquoit Bay Reserve, Massachusetts
Climate Change. Research is needed to better understand climate change impacts on estuarine systems, including but not limited to, water quality, ecosystem service provision, habitat change and recovery, nutrient cycling, and species response. We also seek research that utilizes monitoring data such as abiotic and biotic monitoring data from the reserve's System-Wide Monitoring Program (SWMP) to generate ecological forecasts that can meaningfully inform planning, management, and restoration decisions in an era of great uncertainty. *Reserve Contact: Megan Tyrrell, Research Coordinator, megan.tyrrell@state.mass.gov.*
Ecosystem Services. As coastal ecosystems become increasingly stressed the need for restoration and mitigation to stem the losses of ecosystem services has never been greater. Many restoration projects have achieved discrete habitat or species goals, but we need better understanding of how these types of projects affect larger ecosystem processes and functions. Therefore, we seek research projects to further explore the impacts of restoration and mitigation projects on biogeochemical processes (e.g., carbon or nitrogen cycling) as well as on other ecosystem functions, to guide resource managers and increase ecosystem benefits. Studies that examine valuation of ecosystem services and potential losses as habitats are lost or severely degraded are also welcomed. *Reserve Contact: Megan Tyrrell, Research Coordinator, megan.tyrrell@state.mass.gov.*
Habitat Resilience. Rising sea levels, increased storm severity, and other climate change factors are threatening tidal marshes across New England. We are observing impacts such as increase in the size of pools, less vegetated area overall, and declining abundance of vulnerable species. Research is needed to help managers better understand and respond to changes occurring in marshes and other affected habitats, as well as to identify effective management strategies to enhance resilience. We also invite research on adaptation strategies such as facilitated migration, and novel approaches to prevent erosion or reduce excess nutrient inputs. *Reserve Contact: Megan Tyrrell, Research Coordinator, megan.tyrrell@state.mass.gov.*
Social Science. Addressing coastal management challenges is complex and there is increasing recognition of both the need for and benefit associated with utilizing social science research to better understand the human dimensions side of these issues. We invite research to address socioeconomic aspects of resource management and policy decisions on vulnerable populations as well as identifying and testing effective ways of engaging community input to advance implementation of management solutions that meet and balance stakeholder needs. *Reserve Contact: Megan Tyrrell, Research Coordinator, megan.tyrrell@state.mass.gov.*

Pacific Region

He'eia Reserve, Hawaii
The He'eia Reserve encompasses wetland, estuarine, and coral reef habitats, and the waters flowing through the wetland and estuary historically supported high biodiversity and productivity through sustainable agro-ecological systems that enhanced ecosystem services. Indigenous resource management of the agro-ecological system optimized the quality, quantity, and flow of water and sediment through these systems, with an ideal amount of nutrients and oxygen to fuel primary productivity in the estuary that in turn facilitated the trophic food web within the Indigenous aquaculture system developed at the coast. But, due to changes in land use and invasions of non-native species, the conditions that sustained productivity in the He'eia watershed have disappeared. Therefore, it is imperative to understand the baseline conditions of water movement and quality throughout the He'eia watershed in order to improve habitat health and inform restoration and adaptive management through Indigenous resource management in the wetland, stream, coastal fishpond, and reef ecosystems. *Reserve Contact: Shimi Rii, Research Coordinator, shimi@hawaii.edu, (808) 783-9621.*

He‘eia Reserve, Hawaii
Non-native vegetation, including mangroves and invasive grasses, are currently dominant in the He‘eia watershed, and they facilitate the persistence of non-native fauna (birds, fish, invertebrates) that compete for resources with native species, thereby decreasing overall estuarine biodiversity. But, the landscape in He‘eia is changing immensely due to mid- to large-scale restoration, involving removal of non-native vegetation, and rebuilding of structures and waterways that facilitate movement of water and passage of animals. Therefore, the trophic interactions (e.g., food web dynamics) and the abundance and diversity of native and non-native species, especially those that serve as biological indicators of ‘āina momona (productive lands), must be documented and monitored to evaluate the success of biocultural restoration over time. *Reserve Contact: Shimi Rii, Research Coordinator, shimi@hawaii.edu, (808) 783-9621.*
In the past century, much of Hawai‘i experienced degradation of land use, threats of development, and abandonment of Native Hawaiian management practices that sustained and protected ecosystem productivity and as a result, the connection of the community and its people to its land and environment also declined significantly. But, the He‘eia Reserve is striving to restore not only habitat health and productivity, but the ability for humans in the community to engage in reciprocity and connection with nature. Therefore, evaluating and understanding well-being and human health through social-ecological metrics of wellness at collective human scales is needed to evaluate future success of biocultural restoration in He‘eia. *Reserve Contact: Kawika Winter, Reserve Manager, kawikaw@hawaii.edu, (808) 346-5708.*
Major ecological regime shifts and social-ecological changes in population and land use have occurred in Hawai‘i, and current efforts to prepare for community resilience are focused on innovative technologies to promote adaptation to threats. But, as we face changing climate conditions such as intensified storm events, sea level rise, eutrophication, and ocean acidification, understanding through historical ecology how Native Hawaiians adapted to changes in climate and subsequent effects on resources will provide key information on how to restore with resilience in mind. Therefore, a comprehensive investigation of historical ecology in the Hawaiian Islands including how resources were managed is needed. In this way, Indigenous resource management of Hawaiian social-ecological systems in He‘eia, weaving together Indigenous knowledge with conventional management approaches, will serve as a model of sustainability in other areas within Hawai‘i, and beyond. *Reserve Contact: Kawika Winter, Reserve Manager, kawikaw@hawaii.edu, (808) 346-5708.*
As Hawai‘i recovers from the pandemic, the state is re-evaluating the model of a tourism-dependent economy as a sustainable solution to Hawai‘i’s economic well-being, and organizations within the He‘eia Reserve and in adjacent areas have collaborated to make this change on a generational timescale by implementing education programs that engage teachers and students to incorporate aloha ‘āina principles (love for the land) into educational systems. But, work still needs to be done to further network Indigenous restoration organizations with formal and informal education institutions, and connect place-based Indigenous education to college and career pathways that contribute to a robust, community-based, circular economy. Therefore, research is needed to understand the impact of current ‘āina-based education programs on educational and economic outcomes at individual and community scales, and the practices, policies, and structures that would extend that impact within education and career/professional development systems. *Reserve Contact: Fred Reppun, Education Coordinator, freppun@hawaii.edu, (808) 779-9411.*

Southeast Region

ACE Basin Reserve, South Carolina
Long-term meteorological and estuarine data exists for the ACE Basin NERR and analyses indicate increases in short-term variability and long-term trends occur, but integrated assessments of biological data with meteorological and water quality data has not been conducted. Therefore, integration and syntheses of the long-term meteorological, water quality, and biological datasets to understand the ecological implications of these changes is a high priority. *Reserve Contact: Denise Sanger, Research Coordinator, SangerD@dnr.sc.gov, (843) 953-9074.*
ACE Basin marshes are vulnerable to sea level rise and managers are only beginning to understand the consequences of the potential changes, but little research has been done to assess these impacts. Therefore, we need to conduct research to better understand how our dominant ecosystems will change and develop potential adaptation or mitigation strategies. *Reserve Contact: Denise Sanger, Research Coordinator, SangerD@dnr.sc.gov, (843) 953-9074.*
The ACE Basin NERR and the coast of South Carolina more generally are facing threats due to changing environmental conditions including sea level rise, flooding, storm surge, shoreline erosion, and changing weather and storm patterns which is compounded by coastal development, but little research has been done to assess these impacts in the reserve. Therefore, the impact of these acute and long-term hazards must be understood to increase our resiliency of both built and natural communities. *Reserve Contact: Denise Sanger, Research Coordinator, SangerD@dnr.sc.gov, (843) 953-9074.*

Guana Tolomato Matanzas (GTM) Reserve, Florida
GTM Reserve is a bar-built estuary with a dynamic coastline, and an increasing population coupled with more frequent storm events has increased dredging, shoreline armoring, and sand placement activities, but local impacts of those activities on nearshore and estuarine structure and function are unknown. Therefore, our region is in need of habitat mapping, sediment transport, hydrodynamic, and ecosystem service studies to investigate the benefits and trade-offs of different management options. *Reserve Contact: Nikki Dix, Research Coordinator, Nikki.Dix@FloridaDEP.gov, (904) 823-4500.*
Intertidal oyster reefs are extensive and ecologically important in the GTM estuary and hand harvest of oysters on wild reefs occurs both recreationally and commercially, but positive and negative impacts of oyster harvest on the estuarine ecosystem have yet to be quantified locally. Therefore, harvest rates and the influence of harvest on oyster productivity and ecosystem services are needed to inform management. *Reserve Contact: Nikki Dix, Research Coordinator, Nikki.Dix@FloridaDEP.gov, (904) 823-4500.*
Stormwater is a major source of pollution to Florida's estuaries and the state is updating stormwater design and operation regulations, but we don't have enough local data to make specific recommendations for the GTM watershed. Therefore, GTM Reserve needs information on stormwater infrastructure locations, water quality impacts of stormwater, and the effectiveness of existing stormwater treatment throughout the GTM watershed to inform recommendations to agency officials and educate the public about stormwater, including actions available to reduce pollution. *Reserve Contact: Nikki Dix, Research Coordinator, Nikki.Dix@FloridaDEP.gov, (904) 823-4500.*

Guana Tolomato Matanzas (GTM) Reserve, Florida

Regional Management Needs Project. Significant investments in the NERRS System-wide Monitoring Program (SWMP) have led to high-quality environmental data available for coastal management and SWMP data play an important role in several coastal policy decisions, but many states and local governments either do not use SWMP data or do so in a limited way. Therefore, a stakeholder-driven project that examines lessons learned from relevant case studies and makes recommendations for enhancing the relevance of NERRS monitoring data in policy decisions in the GTM and other southeastern US and Caribbean research reserve watersheds would significantly increase the broader utility, funding, and significance of SWMP. This regional priority was co-developed with staff from the following research reserves: North Carolina, North Inlet-Winyah Bay, ACE Basin, Sapelo Island, and Jobos Bay. Applicants interested in addressing this management priority should contact the GTM Reserve, but we anticipate the applicant potentially working with all of the reserves listed. *Reserve Contact: Nikki Dix, Research Coordinator, Nikki.Dix@FloridaDEP.gov, (904) 823-4500.*

Educational opportunities for students on the autism spectrum are limited at the GTM Reserve due to sensory concerns and lack of appropriately interpreted programs, and many students within the GTM Reserve watershed cannot access reserve education programs due to distance limitations, but current education programs are not suitable for individuals on the spectrum and do not provide an adequate sense of place to inspire stewardship of local estuaries. Therefore, GTM Reserve education programs need to be adapted using locally-relevant, immersive activities that effectively educate these students about estuary science, improve social skills, and support access to STEM fields. *Reserve Contact: Josephine Spearman, Education Coordinator, Josephine.Spearman@FloridaDEP.gov, (904) 823-4500.*

North Carolina Reserve, North Carolina

Ecosystem Services. The North Carolina National Estuarine Research Reserve (NCNERR) sites provide ecosystem services and the habitats that provide these services are impacted by factors including climate change, invasive species, and coastal development, but we have limited information on how these factors influence the provision of ecosystem services. Therefore, research is needed to quantify and better understand the services our habitats provide and how they may change in association with these factors to inform future management strategies. *Reserve Contact: Brandon Puckett, Research Coordinator, (252) 838-0851,* Brandon.puckett@ncdenr.gov

Vulnerability. Habitats at the NCNERR sites are vulnerable to climate change impacts (e.g., sea-level rise, increases in storminess and temperature) and the vulnerability of habitats to climate change is influenced by human activities (e.g., sand placement, dredging), but it is not clear how vulnerable the habitats are to climate and human impacts and how to best mitigate vulnerability. Therefore, more information is needed to understand habitat vulnerability and evaluate future management strategies to enhance habitat resilience. *Reserve Contact: Brandon Puckett, Research Coordinator, (252) 838-0851, Brandon.puckett@ncdenr.gov*

North Carolina Reserve, North Carolina

Dredge Monitoring. Hopper dredging has typically been restricted to an environmental window from November through April to avoid potential natural resource impacts during biologically productive and ecologically important time periods, and this restriction along with increasing demand for dredging is making it increasingly difficult to complete dredging activities important for commerce. The Army Corps of Engineers has asked for and been granted a 3-year moratorium on the environmental window for dredging North Carolina's two state ports at Beaufort and Cape Fear River inlets (proximal to and within the watersheds of the Rachel Carson and Zeke's Island sites of the NCNERR, respectively), but the potential impacts of dredging outside of environmental windows on water quality, protected species, coastal habitats, and fishery species are largely unknown. Therefore, resource managers need targeted research that builds on existing studies and addresses one or more of the following knowledge gaps to make informed decisions regarding seasonal closures associated with hopper dredging: synthesis of research of inlet utilization by various species and regional studies of marine dredging impacts; spatiotemporal patterns of ichthyoplankton abundance and composition and potential interactions with dredging; spatiotemporal patterns of staging, migration, and spawning activity of commercially and recreationally important species and potential interactions with dredging; and characteristics of the sediment plume associated with dredging and implications for i) water quality, ii) sedimentation of nearby habitats, or iii) impacts on benthic communities. *Reserve Contact: Brandon Puckett, Research Coordinator, (252) 838-0851, Brandon.puckett@ncdenr.gov*

Habitat Mapping and Assessment. As part of the NERRS System-wide Monitoring Program, reserve habitats are mapped from the uplands to the intertidal marsh-water edge and reserve staff have used remote sensing, including use of Unoccupied Aerial Systems (drones), to map select areas of intertidal habitats, but we have not applied remote sensing approaches to assess the 'condition' of intertidal oyster reef habitat. Therefore, reserves within the Southeast are interested in developing novel methods and workflows to remotely assess the condition of intertidal oyster reef habitat at user-defined spatial (e.g., patch reefs to landscape) and temporal scales (e.g., before and after events). Note, this regional priority was co-developed with staff from the following research reserves: North Inlet-Winyah Bay, ACE Basin, Sapelo Island, and GTM. Applicants interested in addressing this management priority should contact North Carolina Research Reserve, but we anticipate the applicant potentially working with all of the reserves listed. *Reserve Contact: Brandon Puckett, Research Coordinator, (252) 838-0851, Brandon.puckett@ncdenr.gov*

North Inlet-Winyah Bay Reserve, South Carolina

South Carolina has some of the fastest rates of coastal development in the nation and effective stormwater management is essential for sustainable coastal development, but the effectiveness and cumulative impacts of various stormwater control measures and development practices remains a critical knowledge gap with regard to downstream water quality protection. Therefore, information on how land use, development practices, and stormwater management affect the transport, transformation and fate of stormwater pollutants is needed to better inform effective management of non-point source pollution. *Reserve Contact: Erik Smith, Reserve Manager, erik@belle.baruch.sc.edu, (843) 904-9035.*

Much of the area surrounding the reserve has been altered by urban development that includes infilling of isolated wetlands, and wetland loss is known to impact flooding and water quality. Development plans that disturb small wetlands (< 0.5 acres) will usually be permitted, but land-use policies do not take into account adjacent small area infilling or the total fill that has occurred over a watershed area. Therefore, assessments of the cumulative area, patterns, and impacts of isolated wetland loss in the coastal watershed of the reserve would contribute to the understanding of wetland management and restoration needs to reduce coastal flooding and protect water quality. *Reserve Contact: Jennifer Plunket, Stewardship Coordinator, jen@baruch.sc.edu, (843) 904-9033.*

North Inlet-Winyah Bay Reserve, South Carolina

Provision of natural resources is a key ecosystem service provided by coastal habitats, and growing human populations along the coastlines of the southeast US and Caribbean are likely putting increasing pressure on populations of key natural resource species, but we need improved understanding of the effects of natural resource use to implement ecosystem-based management. Therefore, assessment of the ecological effects and human dimensions of natural resource use (e.g., harvest of bivalves, crustaceans, or finfish, among others) is needed for North Inlet-Winyah Bay, and could be compared among other research reserves in the Southeast and Caribbean. Note, this priority was co-developed with staff from the following research reserves: North Carolina, ACE Basin, Sapelo Island, GTM, and Jobos Bay. Applicants interested in addressing this management priority should contact the North Inlet-Winyah Bay Reserve, but we anticipate the applicant potentially working with all of the reserves listed. *Reserve Contact: Robert Dunn, Research Coordinator, robert@baruch.sc.edu, (843) 904-9026.*

Saltmarshes are highly productive ecosystems that provide numerous ecosystem services (essential habitat, carbon storage, flood protection, etc.) and national studies indicate that marshes are experiencing a variety of changes as a result of sea level rise, warming temperatures and increasing urbanization, but there is still relatively little information regarding the specific vulnerabilities of South Carolina's coastal marshes. Therefore, locally relevant information on interacting effects of biotic and abiotic change on salt marsh ecosystem services is needed to inform adaptation and mitigation strategies for our coastal marshes. *Reserve Contact: Erik Smith, Reserve Manager, erik@belle.baruch.sc.edu, (843) 904-9035.*

Numerous stressors, including climate change, eutrophication, pollution, and overfishing, among others, are expected to impact coastal zones, including in South Carolina. How the interactions between climate change and other sources of anthropogenic stress may affect estuarine processes, species, and communities is poorly understood. NI-WB NERR has long-term datasets (including SWMP, SSAM-1, and long-term monitoring of zooplankton, nekton, and benthic infauna) that could be used to better understand how interacting stressors within estuaries affect the dynamics of coastal habitats and biota, as well as to inform habitat assessment tools (e.g., CCVATCH). *Reserve Contact: Robert Dunn, Research Coordinator, robert@baruch.sc.edu, (843) 904-9026.*

Sapelo Island Reserve, Georgia

Sapelo Island and other area barrier islands have upland freshwater wetlands that support a variety of coastal flora and fauna species, and these wetlands are potentially threatened with saltwater intrusion by sea level rise and decreased aquifers from increased groundwater withdrawal. But, we don't know what characteristics make these habitats important or vulnerable compared to their mainland counterparts. Therefore, we need research that characterizes the ecological importance and resilience of these freshwater habitats. *Reserve Contact: Rachel Guy, Research Coordinator, Rachel.guy@dnr.ga.gov, (912) 485-2251.*

Many of the large freshwater swamps and other wetlands found on Sapelo historically have been drained by extensive ditching carried out in the past, and now with sea level rise some of these ditches may be facilitating the flow of salt and brackish tidal waters into upland natural habitats and the residential community. But, we don't know which ditches are having or may have the most significant impact on upland areas. Therefore, we need research on the patterns of altered hydrology on the island and how impacts might best be mitigated. *Reserve Contact: Rachel Guy, Research Coordinator, Rachel.guy@dnr.ga.gov; or Suzanne VanParreren, Stewardship Coordinator, Suzanne.vanparreren@dnr.ga.gov, (912) 485-2251.*

Sapelo Island Reserve has been collecting continuous water quality data since 2004 through the System-wide Monitoring Program and we know that climate change will play a role in shifting water quality values. But, we don't know how such changes might affect estuarine organisms, populations, communities, and their interactions. Therefore, we need research that expands our knowledge of relationships between local water quality and patterns in the composition, abundance and persistence of estuarine aquatic biota. *Reserve Contact: Rachel Guy, Research Coordinator, Rachel.guy@dnr.ga.gov, (912) 485-2251.*

Sapelo Island Reserve, Georgia
The private community on Sapelo Island affects water quality, habitat integrity and ecosystem functions within the reserve and has been affected by major land use changes in the past and continues to be affected by ongoing socioeconomic/demographic changes. But, the community is increasingly vulnerable to sea level rise and nuisance flooding, and we need research to better understand these complex, interacting factors to help enhance the resilience of the community and the multiple state agencies and institutions on the island. *Reserve Contact: Doug Samson, Reserve Manager, doug.samson@dnr.ga.gov, (912) 485-2251.*
In the last 20 years, there have been significant changes in the types and diversity of private residents and homeowners on Sapelo, and in the numbers and types of short-term visitors. For example, many of the new property owners are building houses on previously undeveloped lots and these newcomers are increasingly leasing their homes as short-term vacation rentals. The number and diversity of private companies offering private tours of Sapelo have also increased in the last few years. But, there has been no quantification or assessment of new "visitor impacts" to the island's natural resources, public infrastructure or DNR-managed facilities, within the reserve or on other state-owned lands. Therefore, research is needed to understand the scope, magnitude and extent of current – and future – ecological and environmental impacts of a growing island population and increased visitors and tourism on Sapelo Island and in the reserve. *Reserve Contact: Rachel Guy, Research Coordinator, Rachel.guy@dnr.ga.gov, (912) 485-2251; or Doug Samson, Reserve Manager, doug.samson@dnr.ga.gov, (912) 485-2251.*

West Coast Region

Elkhorn Slough Reserve, California

The reserve is engaged in restoration of various coastal habitats (e.g., salt marsh, coastal prairie) supporting recovery of key coastal species (e.g., oysters, otters, listed amphibians), and collects monitoring data tracking efforts. But, there are still many uncertainties about best restoration methods and key barriers to success, and we welcome investigations that ultimately yield improved restoration success. *Reserve Contact: Kerstin Wasson, Research Coordinator, Kerstin.Wasson@gmail.com, (831) 728-2822.*

The reserve is impacted by a variety of anthropogenic activities (e.g., nutrient loading, diking, invasive species), and collects monitoring data characterizing indicators of estuarine health and anthropogenic disturbance, but mechanisms of impacts and how they have changed over time or vary spatially under different conditions are poorly understood. Therefore, we welcome investigations that reveal impacts of these anthropogenic activities on ecosystem functions, and how these impacts vary across time and space. *Reserve Contact: Kerstin Wasson, Research Coordinator, Kerstin.Wasson@gmail.com, (831) 728-2822.*

Responding to ongoing and projected changes from climate change and other stressors requires cooperative and collaborative planning among the reserve, many agencies, and local communities. The reserve has made some progress in conducting sea level rise-resilient marsh restoration projects, but future restoration and other adaptation efforts within and beyond current reserve jurisdictions will require expanded partnerships and collaborative planning, and strengthened understandings of local community and decision-making interests and priorities. Therefore, we welcome investigations of the human dimensions of (1) estuarine and other coastal management, and (2) coastal community resilience and adaptation, including community perspectives (e.g., stakeholders, values, attitudes, beliefs, and social networks), policy analysis, and impacts to coastal economies. *Reserve Contact: Dan Brumbaugh, Coastal Training Program Coordinator, dan@elkhornslough.org, (831) 728-2822.*

Kachemak Bay Reserve, Alaska

Climate Change. Understanding environmental change in Alaskan coastal ecosystems requires approaches that can assess both climate and human drivers. Kachemak Bay Reserve has well-established watershed, nearshore and ocean ecology programs that provide platforms for innovative methods that capture and interpret data about habitat change and human dynamics for use in locally relevant climate and management scenarios. There is a need for new information including soundscape monitoring, remote sensing, and community monitoring to expand information and skill sets available to coastal decision-makers. *Reserve Contact: Coowe Walker, cmwalker9@alaska.edu.*

Ecosystem Services. Healthy ecosystems of the Kachemak Bay Reserve provide commonly recognized natural benefits to coastal communities in the form of jobs, food, and recreational opportunities. Coastal stakeholders are aware of these benefits, but there is often a disconnect between behaviors and decision-making around long-term sustainability and maintenance of functional ecosystems. There is a need for a deeper understanding of the ways human and natural systems interact through an ecosystem service approach, as well as **community-relevant engagement** that links local values and conservation options. *Reserve Contact: Syverine Bentz, isbentz@alaska.edu.*

Kachemak Bay Reserve, Alaska

Water Quality. Kachemak Bay Reserve has years of research outlining how connectivity from the landscapes around headwaters to the nearshore is critical to salmon productivity. In a low regulatory environment, growing populations and industries put intact systems at risk of disconnection. Decision-makers require an **understanding** of **land use** change **and human impacts,** coupled with information about hydrology and nutrient cycling to select management and mitigation strategies that will preserve ecologically intact systems of the Kachemak Bay area, and serve as examples for other parts of Alaska. *Reserve Contact: Coowe Walker, cmwalker9@alaska.edu.*

Monitoring Data Synthesis. Kachemak Bay Reserve's **long-term ecosystem monitoring** programs include environment (water quality, nutrients and weather) and biological monitoring (salt marsh vegetation, marine primary productivity, harmful algae and invasive species). These datasets have potential to be developed into sentinel site applications to understand seasonality and trends to plan for future change relevant to the Gulf of Alaska bioregion. There is a need to analyze and outreach these datasets in the context of coastal management priorities for stakeholders in subarctic ecosystems. *Reserve Contact: Steve Baird, sjbaird@alaska.edu.*

Padilla Bay Reserve, Washington

Ecology of eelgrass in waters of the Salish Sea. Padilla Bay is home to one of the largest contiguous eelgrass meadows in North America and as such is a valuable ecological, economic, and cultural resource. However, we lack quantitative evidence for many of the important and emergent ecosystem services traditionally associated with eelgrass ecosystems. Therefore, we are seeking projects that can address the following questions: To what extent do eelgrass meadows of Padilla Bay provide habitat for commercially and ecologically important marine macrofauna such as forage fish, salmonids, crustaceans, black brant, and other organisms? What role do eelgrass play in supporting the commercial and recreational industries associated with these organisms? What are the ecosystem services and ecological implications of the presence and expansion of the non-native Zostera japonica when compared to Zostera marina or bare mud flats? How does the ecological role of Z. japonica compare to Z. marina and what are the implications with respect to the management of this non-native species? How do these eelgrass species respond differently to the effects of climate change? What are the interactions and potential impacts of non-native species (e.g. Japanese mud snail, European green crab) on eelgrass, sediment and food web dynamics, and other ecosystem scale processes? How does the distribution, health, performance and other characteristics of eelgrass in Padilla Bay change in response to climate change and sea-level rise? How can we apply a range of tools (e.g. ROVs, remote sensing, UAVs, in situ monitoring) to detect changes in these communities on multiple spatial and/or temporal scales? What is the carbon storage and sequestration capacity of Pacific Northwest eelgrass and how does this vary among eelgrass species, tidal elevation, and across different temporal scales (e.g. short vs long-term sequestration)? *Reserve Contact: Dr. Sylvia Yang, Research Coordinator, syang@padillabay.gov, (360) 428-1098.*

Interactions between eelgrass and shellfish aquaculture. Expansion and restoration of eelgrass habitat in Puget Sound is a high priority for Washington state. At the same time, NOAA Marine Fisheries has identified expansion of shellfish aquaculture as a regional priority. However, shellfish aquaculture and eelgrass generally utilize similar areas of the intertidal. Therefore, we are interested in projects that provide evidence regarding the mutual benefits and compromises of the co-location of eelgrass and shellfish aquaculture in intertidal waters of the Salish Sea. Examples of questions that address this topic include: What are the ecological benefits and impacts of shellfish aquaculture as it relates to eelgrass habitat? Are there mutual benefits of the co-location of eelgrass and aquaculture that can enhance local ecological and commercial productivity? Are there negative impacts to eelgrass or eelgrass-residents from co-location with aquaculture? What are the ecosystem services or ecological benefits provided by shellfish aquaculture (e.g. structural aspects) as it relates to commercially and ecologically valuable organisms such as Dungeness crab, forage fish, and salmonids. *Reserve Contact: Dr. Sylvia Yang, Research Coordinator, syang@padillabay.gov, (360) 428-1098.*

Padilla Bay Reserve, Washington

Human benefit and value associated with the socio-ecological system of Padilla Bay. Coastal and estuarine ecosystems provide a wide range of ecological benefits and ecosystem services. However, we lack quantitative evidence of the connection between measurable aspects of coastal ecosystem services and indicators of human well-being. Therefore, we are interested in projects that can help more fully evaluate the value of coastal ecosystems to local and regional communities. Specific questions related to this topic include: What are the sociocultural and economic benefits of eelgrass and how do these manifest on both regional and place-based (e.g., Padilla Bay NERR) scales? Can we generate ecosystem service frameworks linking eelgrass to metrics of human well-being and thus quantify the social, cultural and economic benefits for local and regional communities? What are the positive social and cultural benefits associated with eelgrass meadows and salt-marsh habitats and how can these be used to evaluate and promote restoration and conservation efforts across the region? Based on socio-ecological frameworks and ecosystems services models, what are the potential sociocultural and economic impacts of the loss of eelgrass and salt-marsh ecosystems associated with large-scale perturbations (e.g., climate change, sea-level rise) or other local catastrophic events (e.g., oil spills)? *Reserve Contact: Dr. Jude Apple, Director, japple@padillabay.gov, (360) 391-5438.*

Groundwater dynamics and their effects on nearshore habitats and coastal farmland. The delivery of freshwater to the nearshore environment affects species composition, productivity, and ecological functions of coastal habitats. Further, sediment composition (e.g. grain size, organic content) can affect groundwater dynamics and biogeochemical processes. However, our understanding of these interactions and their ecological implications in the nearshore is poorly described and the effects of climate change are not well understood. Therefore, we are seeking projects that advance our understanding of how biota will respond to changes in groundwater supply and quality, and inform management practices and restoration strategies that increase habitat resilience. We are particularly interested in projects that address the following: Can locations of fresh groundwater delivery to intertidal zones be identified based on plant, algae, invertebrate, or biofilm characteristics? Can we map the locations, quantify, and model the delivery of fresh groundwater and associated nutrients to Padilla Bay? How will sea level rise, warming air temperature, and shifting precipitation patterns affect groundwater levels, saltwater intrusion, and freshwater delivery in nearshore environments, and can this be used to predict habitat change? How does groundwater chemistry (salinity and nutrients) change seasonally and interannually? After major rain events, how fast does terrestrially-derived groundwater manifest in intertidal environments, and do benthic communities respond to rain-driven changes in groundwater chemistry? On low-lying coastal farmland, how does saltwater intrusion vary spatially and temporally, and how will sea level rise affect groundwater levels and saltwater intrusion? *Reserve Contact: Roger Fuller, Stewardship Coordinator, rfuller@padillabay.gov, (360) 428-1098.*

Land-use in the Padilla Bay watershed and connections to the health and function of eelgrass and nearshore habitats. Padilla Bay Reserve is located in Skagit County, where population has more than doubled over the past 50 years. Runoff from the developments required to support this population growth will impact the eelgrass meadows of Padilla Bay. However, the effect of changes in the quantity and quality of freshwater inputs to Padilla Bay - combined with increased and intensified storm events, sea-level rise, and rising temperatures - is unknown. Therefore, we are interested in projects that identify linkages between land use and water quality, as well as provide recommendations for land management practices that accommodate growth while optimizing eelgrass and nearshore ecosystem health and function. We are particularly interested in projects that: Develop and test scenarios defining linkages between water quality, submerged aquatic vegetation, benthic algae and invertebrates, freshwater inputs from upland sources, and changes in land cover and land use in the watershed. Document and recommend improvements to local and state policy and coastal planning as it relates to development of the Padilla Bay watershed. Utilize and leverage existing resources available at Padilla Bay, including SWMP water quality and weather data, high resolution LiDAR, aerial imagery, and water course/subbasin delineations, change maps, stream water quality data, and Watershed Characterization studies. *Reserve Contact: Suzanne Shull, GIS Specialist, sshull@padillabay.gov, (360) 428-1092.*

San Francisco Bay Reserve, California

Green Infrastructure. Given its location in a highly urbanized estuary, the San Francisco Bay Reserve recognizes the importance of integrating social science with biophysical science for effective management actions. However, the design, permitting, and implementation of these actions is often ensnared in the public participation and regulatory processes. Therefore, we would like a project to identify challenges to regional estuary governance and facilitate collaboration among stakeholders around a reserve research priority, such as climate change adaptation, to improve management of the reserve and its education and training programs. *Reserve Contact: Stuart Siegel, Coastal Resilience Specialist, siegel@sfsu.edu, (415) 299-8746; or Aimee Good, Coastal Training Program Coordinator, aimee@sfsu.edu, (415) 338-4759.*

Indigenous Knowledge. The two component sites of the San Francisco Bay Reserve each have a long history of human occupancy and use. The San Francisco Bay Reserve and our partners are interested in how past and current uses of the sites can inform and improve current land management, habitat restoration, understanding of cultural practices, and inclusive education programs. We have limited tribal contacts and expertise in this area; therefore, we would like a focused project to be conducted on this topic and educational training to be developed to increase knowledge at either or both of the two reserve sites. *Reserve Contact: Bella Mayorga, Education Coordinator, bmayorga1@sfsu.edu, (909) 373-5181.*

Pepperweed (*Lepidium latifolium*) is recognized as a serious regional threat to brackish tidal wetlands in the San Francisco Estuary and is known to potentially harm sensitive species (e.g., Suisun thistle) in remnant tidal wetlands such as Rush Ranch, but preliminary observations suggest that its abundance – thus threat-severity – is correlated with different annual climate water years over time. Therefore, if this pattern could be robustly determined through research and modeling, it might be possible to predict high abundance years and thus mobilize early intervention, such as hand-treatment by stewardship volunteers, rather than routinely relying upon potentially toxic herbicide control. *Reserve Contact: Stuart Siegel, Coastal Resilience Specialist, siegel@sfsu.edu, (415) 299-8746; or Matt Ferner, Research Coordinator, mferner@sfsu.edu, (415) 338-3724.*

South Slough Reserve, Oregon

Knowledge and action are essential for building resilient communities, but the reserve's impact on necessary behavior change is unknown. Therefore, we need additional research to assess our educational reach within the community to identify effective and universal communication strategies related to our priority issues of climate change, habitat protection, and invasive species. *Reserve Contact: Education Coordinator, Jaime Belanger, jaime.c.belanger@state.or.us, (541) 888-5558 x127.*

Climate change will potentially alter South Slough habitats (including uplands, riparian areas, forested tidal swamps, tidal marshes, and seagrass beds), negatively impact native species (e.g., eelgrass, lamprey, salmonids, shellfish), increase wildland fire risk, and facilitate establishment of invasive species. We are beginning to monitor these impacts, but we don't yet understand the potential effects of climate change or how to manage these impacts. Therefore, we need research to understand these effects and how to manage or mitigate these impacts (e.g., which wetlands if restored or protected would best buffer communities and/or provide wetland migration pathways; identify where in the community green infrastructure could be incorporated; determine strategies to maintain resilient habitats and species). *Reserve Contact: Research Coordinator, Shon Schooler, shon.schooler@state.or.us, (541) 888-8270 x315.*

Invasive species (e.g., green crab, reed-canary grass, and Port-Orford-cedar root pathogen) are affecting South Slough habitats and native species, but we don't fully understand their impacts or know what management strategies will be effective. Therefore, we need research on the ecology, impacts, and management of invasive species. *Reserve Contact: Research Coordinator, Shon Schooler, shon.schooler@state.or.us, (541) 888-8270 x315.*

South Slough Reserve, Oregon

Stressors (climate change, disturbance, land-use practices), impact the stability and resilience of South Slough water quality and habitats. For example, abiotic (warming water temperatures, hypoxia, ocean acidification, and sediment) and biotic (HABs, contaminants (pesticides, herbicides), pathogens, and parasites) impact the health of invertebrate, fish, and plant communities and human health. Many of these stressors affect fish/shellfish spawning and rearing habitat, including essential eelgrass beds. Therefore, research to understand how to predict and manage these stressors, how they interact, and how they may be affected by climate change is key for maintaining, improving, and restoring estuarine water quality and habitat functions. *Reserve Contact: Research Coordinator, Shon Schooler, shon.schooler@state.or.us, (541) 888-8270 x315.*

The reserve is restoring tidal wetlands and thinning dense re-growth forests and we want to understand the effects of this restoration. However, there are restored marshes that haven't been evaluated and we don't know the effects of restoration thinning (for late-successional old-growth forest conditions) on habitat resilience. Therefore, there are opportunities in South Slough to research restoration trajectories in both wetlands and forests. *Reserve Contact: Research Coordinator, Shon Schooler, shon.schooler@state.or.us, (541) 888-8270 x315.*

Tijuana River Reserve, California

The Tijuana Estuary is the largest, most intact coastal wetland left in Southern California and a variety of science-driven restoration and conservation efforts have resulted in a system that supports a diversity of habitats and species, but stressors such as biological invasions, habitat degradation, and pollution remain. Therefore, we need research addressing processes that support assemblages of native biota, approaches for tracking changes in both populations and stressors, and strategies for effective management of species and habitats. *Reserve Contact: Jeff Crooks, Research Coordinator, jcrooks@trnerr.org, (619) 575-3613 x333.*

Excessive sedimentation is one of the principal threats to the integrity of the Tijuana River Valley and efforts are underway to capture and dispose of this material, but we lack a full understanding of local sediment dynamics and how they might respond to various management interventions and changes in surrounding landscapes. Therefore, we need studies that address the role of sediment in this coastal ecosystem and develop innovative approaches for management and beneficial reuse. *Reserve Contact: Jeff Crooks, Research Coordinator, jcrooks@trnerr.org, (619) 575-3613 x333.*

Debris is a significant source of impairment in the Tijuana Estuary and presents a variety of risks, but efforts to reduce solid waste at the source have been limited in their success. Therefore, we need a deeper socio-ecological assessment of debris, including waste management in the City of Tijuana, Mexico, as well as household-level behaviors and barriers that would inform training and technical assistance strategies. *Reserve Contact: Kristen Goodrich, Coastal Training Program Coordinator, kgoodrich@trnerr.org, (619) 575-3613 x312.*

Southern California lagoons, such as the Tijuana Estuary, are characterized by relatively small, very dynamic river mouths and tidal exchange through these inlets fundamentally shapes the estuarine ecosystem, but anthropogenic changes in tidal prism and nourishment of adjacent beaches can compromise inlet functioning. Therefore, we need studies of estuary-ocean connections (physical, chemical, and biological) and how these change under varying conditions. *Reserve Contact: Jeff Crooks, Research Coordinator, jcrooks@trnerr.org, (619) 575-3613 x333.*

Climate change will affect virtually all aspects of the natural and built environment of the Tijuana River Valley and we are beginning to see apparent climate impacts, but these are against a backdrop of many other anthropogenic effects in this urban ecosystem. Therefore, we need studies that consider climate in the context of the unique socio-ecological setting of the Tijuana River Valley and address resilience to inter-related drivers of change. *Reserve Contact: Jeff Crooks, Research Coordinator, jcrooks@trnerr.org, (619) 575-3613 x333.*