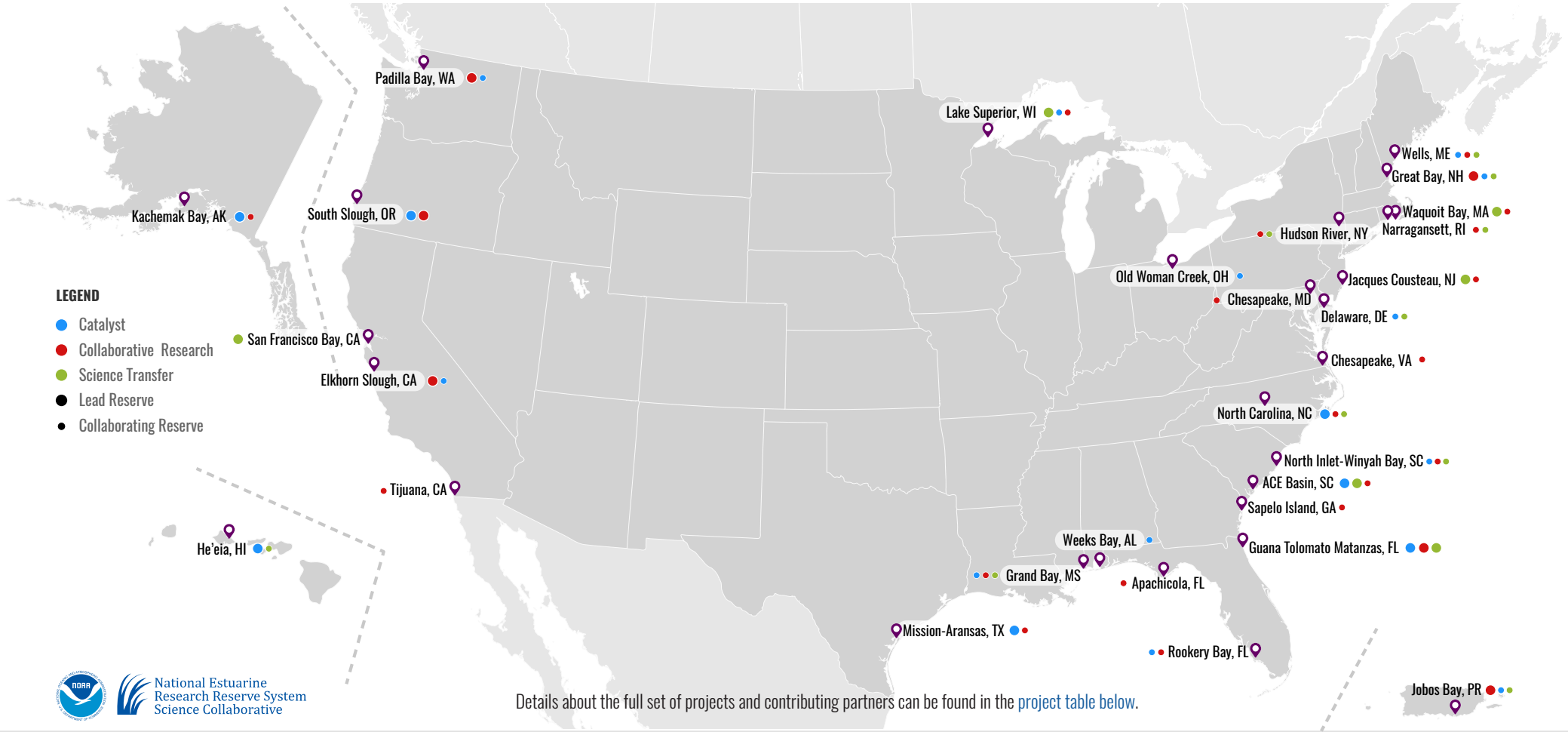
2020 NERRS SCIENCE COLLABORATIVE GRANT AWARDS



National Estuarine Research Reserve System Science Collaborative

Details about the full set of projects and contributing partners can be found in the project table below.

2020 NERRS SCIENCE COLLABORATIVE GRANT AWARDS

CATALYST | Targeted investment for advancing collaborative science

PROJECT LEAD AND AFFILIATION	PROJECT TITLE	PARTICIPATING RESERVE(S)
Samantha Chapman, Villanova University	**Experimenting with elevation: Building a new collaboration to explore management options for wetland elevation maintenance** (Abstract)	GTM—Guana Tolomato Matanzas (FL)
Catherine de Rivera, Portland State University	**Determining salt marsh and restoration success using focus groups of managers and the public and past data** (Abstract)	South Slough (OR)
Nikki Dix, Guana Tolomato Matanzas NERR	**Refining techniques for high-frequency monitoring of chlorophyll a (alpha) in the NERRS** (Abstract)	GTM (FL), Old Woman Creek (OH), Mission-Aransas (TX), He'eia (HI), Padilla Bay (WA), Lake Superior (WI), North Inlet-Winyah Bay (SC), Weeks Bay (AL), Great Bay (NH), Grand Bay (MS), Elkhorn Slough (CA), Wells (ME), Sapelo Island (GA)
Brad Erisman, University of Texas at Austin	**Listen in: Acoustic monitoring of estuarine communities facing ecosystem change** (Abstract)	Mission-Aransas (TX), Rookery Bay (FL), North Inlet-Winyah Bay (SC)
Pua'ala Pascua, American Museum of Natural History	**Cultural ecosystem services in estuary stewardship and management** (Abstract)	He'eia (HI), Kachemak Bay (AK)
Brandon Puckett, North Carolina NERR	**Bridging the gap between quadrats and satellites: Assessing utility of drone-based imagery to enhance emergent vegetation biomonitoring** (Abstract)	North Carolina (NC), North Inlet-Winyah Bay (SC), ACE Basin (SC), Sapelo Island (GA), GTM (FL), Jobos Bay (PR)
Andrew Tweel, South Carolina Department of Natural Resources	**Identifying optimal foraging characteristics to inform piping plover and red knot habitat management** (Abstract)	ACE Basin (SC)
Coowe Walker, Kachemak Bay NERR	**Collaborative assessment of research efforts and emerging issues concerning forage fish exposure to paralytic shellfish toxins in Alaska** (Abstract)	Kachemak Bay (AK)

2020 NERRS SCIENCE COLLABORATIVE GRANT AWARDS

COLLABORATIVE RESEARCH | Generating new science that informs decisions

PROJECT LEAD AND AFFILIATION	PROJECT TITLE	PARTICIPATING RESERVE(S)
Craig Cornu, Institute for Applied Ecology	**Pacific Northwest Blue Carbon Working Group, Phase 2: Land use and environmental effects on greenhouse gas emissions and carbon sequestration, informing blue carbon project feasibility assessments for tidal wetland management** (Abstract)	Padilla Bay (WA), South Slough (OR)
Danielle Ogurcak, Florida International University	**Resilience of the mangrove coast: Understanding links between degradation, recovery, and community benefits** (Abstract)	Jobos Bay (PR), Rookery Bay (FL)
Chris Peter, Great Bay NERR	**Detecting impacts from climate change across multiple scales: A national synthesis of tidal marshes** (Abstract)	Great Bay (NH), ACE Basin (SC), Apalachicola (FL), Chesapeake Bay (MD), Chesapeake Bay (VA), Delaware (DE), Elkhorn Slough (CA), Grand Bay (MS), GTM (FL), Hudson River (NY), Jacques Cousteau (NJ), Kachemak Bay (AK), Mission-Aransas (TX), Narragansett Bay (RI), North Carolina (NC), North Inlet-Winyah Bay (SC), Padilla Bay (WA), South Slough (OR), Tijuana River (CA), Waquoit Bay (MA), Wells (ME)
Ashley Smyth, University of Florida/ Institute of Food and Agricultural Sciences	**Using collaborative science to assess the current and potential role of shellfish in improving water quality** (Abstract)	GTM—Guana Tolomato Matanzas (FL)
Dave Sutherland, University of Oregon	**Buried or fried? Understanding sedimentation and temperature effects on native species restoration in the South Slough National Estuarine Research Reserve and the Coos estuary** (Abstract)	South Slough (OR)
Kerstin Wasson, Elkhorn Slough NERR	**The nation's past and future estuaries: Detecting estuarine habitat loss and opportunities for future restoration in and around National Estuarine Research Reserves** (Abstract)	Elkhorn Slough (CA), Padilla Bay (WA), Tijuana River (CA), Lake Superior (WI), Great Bay (NH), ACE Basin (SC)

2020 NERRS SCIENCE COLLABORATIVE GRANT AWARDS

SCIENCE TRANSFER | Promoting the use of science

PROJECT LEAD AND AFFILIATION	PROJECT TITLE	PARTICIPATING RESERVE(S)
Kaitlyn Dietz, Guana Tolomato Matanzas NERR	**Developing a template to communicate hurricanes and hurricane impacts using NERRS SWMP data** (Abstract)	GTM—Guana Tolomato Matanzas (FL), Delaware (DE), North Carolina (NC), North Inlet-Winyah Bay (SC), ACE Basin (SC), Jobos Bay (PR)
Deanna Erickson, Lake Superior NERR	**The future of site profiles: An innovative cross-sector approach to incorporating end user and reserve needs** (Abstract)	Lake Superior (WI), He'eia (HI)
Matt Ferner, San Francisco Bay NERR	**Translating sediment research in San Francisco Bay NERR into management recommendations for improving marsh habitat resilience** (Abstract)	San Francisco Bay (CA)
Kaitlin Gannon, Jacques Cousteau NERR	**Adopting program coordination methods and best practices to launch community-driven research efforts on the American eel *(Anguilla rostrata)*** (Abstract)	Jacques Cousteau (NJ), Hudson River (NY)
Blaik Keppler, ACE Basin NERR	**Building capacity for reserves to be Motus Wildlife Tracking leaders** (Abstract)	ACE Basin (SC), San Francisco Bay (CA), Grand Bay (MS), Hudson River (NY)
Vitalii Sheremet, Okeanolog/ Woods Hole Oceanographic Institution	**Transfer of a low-cost tidal wetland water level monitoring system: Hyperlocal calculations of inundation and tidal datums for understanding change and restoration planning** (Abstract)	Waquoit Bay (MA), Wells (ME), Great Bay (NH), Narragansett Bay (RI), Delaware (DE), North Inlet-Winyah Bay (SC), GTM (FL)

Brief project summaries are below, organized by the following project types:

- **Catalyst**
- **Collaborative Research**
- **Science Transfer**

Experimenting with elevation: Building a new collaboration to explore management options for wetland elevation maintenance

Project Lead: Samantha Chapman, Villanova University

Reserve: Guana Tolomato Matanzas (FL)

Budget Request: $138,287

Project Summary: As coastal ecosystems continue to suffer the onslaught of rising seas and big storms, land managers have to explore proactive techniques to promote coastal wetland resilience. Northeastern Florida and the Guana Tolomato Matanzas NERR (GTM NERR) have some of the most intact estuarine ecosystems in the southeastern U.S., but their susceptibility is still somewhat unknown. The GTM NERR's management plan prioritizes sustaining "surface elevation" in coastal wetlands, which is controlled by plant and sediment inputs. As an interdisciplinary team, the researchers will explore the question: Which management option is most effective for maintaining or increasing wetland surface elevation—thin-layer sediment deposition, berm redistribution, living shorelines, or the facilitation of mangrove encroachment? Specifically, the project proposes to 1) identify portions of the GTM NERR that are particularly vulnerable by refining an existing coastal vulnerability index assessment with elevation data, 2) engage both land manager and scientist end users in northeast Florida in a new collaboration to investigate the above-mentioned four management options. Outputs and outcomes of this project will include a coastal vulnerability map for GTM NERR managers, two workshops with currently engaged end users, and a plan for targeting wetland restoration pilot projects.

Determining salt marsh and restoration success using focus groups of managers and the public and past data

Project Lead: Catherine de Rivera, Portland State University

Reserve: South Slough (OR)

Budget Request: $153,604

Project Summary: Understanding why estuarine habitat restoration is viewed as successful or not is key to evaluating past projects and building future support, and has been flagged as a key need by the project end users in iterative project development meetings. Using restoration projects from the South Slough NERR (SS NERR) and the Wetlands Conservancy, this project will take a three-pronged approach aimed at improving estuarine restoration success. The research team will acquire project planning documents, post-project data, and focus group data at the SS NERR and two comparator bays to measure the perception of various user groups involved with or potentially affected by estuarine restoration. The team will interview restoration practitioners to examine metrics used for project assessment and investigate how assessments with social metrics inform perceptions of success. Outputs were developed to address end user requests and include a summary of human values and perceptions, recommendations for future restoration work, a draft brochure for outreach, and assessment of the social value of a long-term NERR. This project will increase outreach effectiveness surrounding restoration and industry assessment frameworks. It aligns with the SS NERR management need of habitat restoration, and the NERRS focus areas of estuarine habitat resilience and monitoring and evaluating success.

Refining techniques for high-frequency monitoring of chlorophyll a (alpha) in the NERRS

Project Lead: Nikki Dix, Guana Tolomato Matanzas NERR

Reserves: Guana Tolomato Matanzas (FL), Old Woman Creek (OH), Mission-Aransas (TX), He'eia (HI), Padilla Bay (WA), Lake Superior (WI), North Inlet-Winyah Bay (SC), Weeks Bay (AL), Great Bay (NH), Grand Bay (MS), Elkhorn Slough (CA), Wells (ME), Sapelo Island (GA)

Budget Request: $172,471

Project Summary: Concentrations of the photosynthetic pigment chlorophyll a are used as a proxy for phytoplankton biomass by estuarine scientists and managers to study eutrophication, food web dynamics, and harmful algal blooms. Traditionally, chlorophyll has been measured by filtering a water sample and extracting pigments from the filter in a laboratory, which is the current practice employed by the NERRS in monthly grab samples; however, monthly measurements are not sufficient for tracking plankton dynamics, which fluctuate hourly. Recent sensor technology development allows high-frequency, *in situ* measurement of chlorophyll on the same YSI EXO sondes used in the NERRS System-Wide Monitoring Program (SWMP). While *in situ* measurements are related to extracted measurements, there are variations in the environment that cause inconsistencies. Currently, no tested relationships exist for the EXO sensors, and SWMP practitioners have been asking for this information so that they can respond to local and national needs for algal bloom research. The proposed project will 1) assess EXO sensor performance via field- and laboratory-based comparisons with extracted chlorophyll, 2) identify sources of interferences and develop corrections, and 3) develop standard protocols and recommendations for the NERRS, catalyzing the SWMP into the most comprehensive algal bloom monitoring program in the nation.

Listen in: Acoustic monitoring of estuarine communities facing ecosystem change

Project Lead: Brad Erisman, University of Texas at Austin

Reserves: Mission-Aransas (TX), Rookery Bay (FL), North Inlet-Winyah Bay (SC)

Budget Request: $148,013

Project Summary: Passive acoustics (hydrophones) are effective for monitoring underwater soundscapes across a range of biological complexity (e.g., shrimp, fish, mammals), while active acoustics (sonar) can noninvasively quantify patterns of organismal abundance, distribution, and behavior across complementary spatial and temporal scales. By combining acoustic data with traditional environmental monitoring, scientists and managers can identify key habitats for protection and measure how ecological communities respond to environmental changes (e.g., storm events, coastal development, eutrophication) in a cost-effective and low-impact manner. This project will bring together academic leaders in bioacoustics, estuarine ecology, and fisheries ecology with managers and staff from three NERRs that "book-end" the entire southeastern coast of the United States. The goal is to develop the framework for a new acoustic monitoring program that can be integrated within long-term monitoring (e.g., NERRS System-Wide Monitoring Program), targeted research (e.g., hurricane impacts), stewardship (e.g., protected area designations) and education programs (e.g., Teacher on the Estuary) of NERRS throughout the region. This framework holds great potential to address priority management needs of regional NERRs associated with climate change, water quality, and habitat restoration. The project will also engage state fishery managers in each region as end users to ensure the designed framework informs their efforts to manage coastal habitats, species, and fishery resources.

Cultural ecosystem services in estuary stewardship and management

Project Lead: Pua'ala Pascua, American Museum of Natural History

Reserves: He'eia (HI), Kachemak Bay (AK)

Budget Request: $196,047

Project Summary: This project will facilitate new collaborative science on the practical application of cultural ecosystem services (CES) to inform estuary stewardship and management across the NERRS. To do so, the research team will conduct a metasynthesis of CES assessment methods to inform the primary objective of exploring their practical application through site-based pilots of participatory assessment methods. Activities will encompass a series of workshops and focus groups with reserve staff and community partner organizations, first in He'eia NERR, then expanded to include a multi-reserve exchange with Kachemak Bay NERR. The researchers will use a variety of collaborative engagement methods during in-person convenings — a preferred form of exchange in the participating reserves—and evaluate the strengths and shortcomings of the various assessment methods, especially when applied across reserves and communities. Outputs include a technical report from the synthesis, workshop summaries and methods evaluations, preliminary conceptual CES models for both reserves, and outreach materials for broader sharing. Results are expected to support a variety of end users in He'eia NERR, Kachemak Bay NERR, and across the NERRS network. Ultimately, these efforts are intended to catalyze future collaborative research on CES toward developing best practices to identify and monitor long-term, locally and culturally responsive datasets for estuary stewardship and management.

Bridging the gap between quadrats and satellites: Assessing utility of drone-based imagery to enhance emergent vegetation biomonitoring

Project Lead: Brandon Puckett, North Carolina NERR

Reserves: North Inlet-Winyah Bay (SC), ACE Basin (SC), Sapelo Island (GA), Guana Tolomato Matanzas (FL), Jobos Bay (PR)

Budget Request: $161,619

Project Summary: The National Estuarine Research Reserve System (NERRS) has made a huge investment to monitor tidal wetlands. Through these efforts, important processes at intermediate spatial (i.e., marsh platform) and fine temporal (i.e., storm events) scales may be missed. Unmanned Aerial Systems (UAS, i.e., drones) can improve tidal wetland monitoring by providing high spatial resolution and coverage, with customizable sensors, at user-defined times. Based on a needs assessment and discussions with NERRS end users, the research team will conduct a regionally coordinated effort in tidal wetlands in all NERRs in the Southeast/Caribbean to develop a UAS-based tidal wetlands monitoring protocol. The team will assess the efficacy of UAS-based imagery for estimating common monitoring parameters (e.g., percent cover), delineating boundaries/ecotones, generating digital elevation models, and estimating biomass. Lastly, the team will communicate project findings to end users and strategize project expansion. There are four primary outputs: 1) UAS-based tidal wetlands monitoring protocol, 2) protocol implementation to generate monitoring products, 3) archive of high resolution imagery, and 4) strategy for project expansion. Anticipated outcomes include expansion of technical capacity to utilize UAS, improved NERRS-wide understanding of UAS capabilities, and a first-of-its-kind cross-reserve regional collaboration. The project serves as a critical first step for improving tidal wetlands monitoring.

Identifying optimal foraging characteristics to inform piping plover and red knot habitat management

Project Lead: Andrew Tweel, South Carolina Department of Natural Resources

Reserve: ACE Basin (SC)

Budget Request: $91,293

Project Summary: The piping plover (*Charadrius melodus*) is a federally listed species that spends most of the year in its wintering range, including intertidal habitats in South Carolina (SC). The red knot (*Calidris canutus*) was recently listed and utilizes SC intertidal habitats during its annual migrations. Both species have exhibited population declines in recent years, and this is believed to result from impacts to migratory and overwintering habitats, rather than breeding grounds. Recent collaborative research between the SC Department of Natural Resources and the US Fish and Wildlife Service has established linkages between benthic prey abundance and foraging activity along SC beaches. However, most of these projects focused on determining impacts from shoreline modification, rather than quantifying habitat characteristics. The proposed project seeks to apply new genetic tools and reanalyze these datasets to identify a suite of optimal foraging habitat characteristics. The project team will work with end users to develop a habitat assessment tool for these species. This will be invaluable to those tasked with protecting endangered species and permitting coastal impacts, as well as resource managers faced with managing beaches and intertidal habitats in the face of sea level rise, increasing coastal development and shoreline modifications, and declining shorebird populations.

Collaborative assessment of research efforts and emerging issues concerning forage fish exposure to paralytic shellfish toxins in Alaska

Project Lead: Coowe Walker, Kachemak Bay NERR

Reserve: Kachemak Bay (AK)

Budget Request: $88,504

Project Summary: Harmful algal bloom (HAB) events are becoming more common in Alaska as ocean temperatures rise due to climate change. These events carry the risk of producing dangerous levels of HAB-derived toxins in the marine environment, including paralytic shellfish toxins (PSTs). PSTs pose a serious threat to upper-trophic populations (e.g., marine mammals, sea birds, predatory fish), where a likely mechanism of delivery is via consumption of forage fish that have, themselves, been exposed to the toxin. Recent events occurring state-wide, such as seabird die-offs and marine mammal strandings, have raised concerns about this pathway, highlighting a need to better understand its mechanisms. The issue is a lack of data-driven information regarding ecologically relevant PST exposure levels in forage fish. This project will facilitate new collaborative science that addresses this issue by becoming better positioned to pursue future funding opportunities. Objectives are to produce preliminary data through "proof of concept" activities and to gather end user input through a series of workshops. Kachemak Bay NERR, as the only reserve in Alaska, will provide a collaborative platform to bring the necessary expertise to the planning table, as well as engage end users for input on future research outcomes.

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Pacific Northwest Blue Carbon Working Group, Phase 2: Land use and environmental effects on greenhouse gas emissions and carbon sequestration, informing blue carbon project feasibility assessments for tidal wetland management

Project Lead: Craig Cornu, Institute for Applied Ecology

Reserves: Padilla Bay (WA), South Slough (OR)

Budget Request: $600,000

Project Summary: The Pacific Northwest (PNW) Blue Carbon Working Group has completed two NSC-funded blue carbon (BC) research projects representing critical "Phase 1" steps for providing data to regional end users in support of estuarine wetland restoration and conservation. The working group has filled critical BC stocks data gaps, developed a regional database, examined feasibility of carbon finance in support of local coastal management, and revealed remaining BC data gaps. This "Phase 2" study will build on Phase 1 results with these objectives: 1) fill greenhouse gas (GHG) emissions and carbon (C) sequestration data gaps for major PNW tidal wetland classes and land uses, 2) examine BC-ecosystem driver relationships, 3) expand the regional BC database and provide new data to the Smithsonian's Coastal Carbon Research Coordination Network working group to help validate a national methane emissions model, 4) examine how net ecosystem C balance differs among wetland types and land uses, and 5) continue engaging end users to ensure this work meets their needs. Outputs include reports summarizing C sequestration and GHG data, and an expanded regional database. Outcomes: end users, including Padilla Bay NERR and South Slough NERR, gain valuable regional data to inform coastal restoration efforts, including evaluating C finance opportunities for tidal wetland restoration initiatives.

Resilience of the mangrove coast: Understanding links between degradation, recovery, and community benefits

Project Lead: Danielle Ogurcak, Florida International University

Reserves: Jobos Bay (PR), Rookery Bay (FL)

Budget Request: $599,966

Project Summary: For tropical and subtropical coastlines, mangrove wetlands provide substantial ecosystem services and economic value, including storm buffering and essential wildlife habitat. Of the National Estuarine Research Reserve System, two reserves, Jobos Bay and Rookery Bay, are dominated by mangrove habitat, while reserves along the Gulf of Mexico and southeast United States are observing community shifts to mangroves with warming temperatures. In 2017, Hurricanes Maria and Irma severely impacted natural and human communities in Jobos Bay and Rookery Bay reserves, respectively. Following these major storms, reserve leaders and partners formed a collaborative team to identify research needs to build resilience. Both reserves identified a need to understand storm damage and recovery trends, as well as a need for a comprehensive assessment of the drivers of mangrove degradation. By combining a spatial profile of loss and recovery with an assessment of the drivers of mangrove degradation, this project will determine management options for enhanced recovery and resilience. Community-wide assessments of ecosystem services linked with mangrove ecosystem health will be conducted for each reserve and coupled with identified management needs to develop a framework for decision-making that will enhance the resilience of coupled human-natural systems along the tropical coast.

Detecting impacts from climate change across multiple scales: A national synthesis of tidal marshes

Project Lead: Chris Peter, Great Bay NERR

Reserves: Great Bay (NH), ACE Basin (SC), Apalachicola (FL), Chesapeake Bay (MD), Chesapeake Bay (VA), Delaware (DE), Elkhorn Slough (CA), Grand Bay (MS), Guana Tolomato Matanzas (FL), Hudson River (NY), Jacques Cousteau (NJ), Kachemak Bay (AK), Mission-Aransas (TX), Narragansett Bay (RI), North Carolina (NC), North Inlet-Winyah Bay (SC), Padilla Bay (WA), South Slough (OR), Tijuana River (CA), Waquoit Bay (MA), Wells (ME)

Budget Request: $599,894

Project Summary: Building upon two NERRS Science Collaborative catalyst projects that established a prototype methodology for standardizing, visualizing, and analyzing tidal marsh monitoring data, this project proposes a detailed, national-scale synthesis of tidal marsh responses to climate change, specifically changes in marsh vegetation community responses to sea level rise (SLR). National Estuarine Research Reserves (NERRs) are uniquely situated to address this topic, given our decade-long monitoring focused on understanding effects of changing sea levels and inundation regimes on coastal habitats. Accelerated rates of SLR and shifts in marsh vegetation communities have occurred nationwide, however a dedicated nationwide synthesis has yet to be conducted. Using a variety of NERR datasets, the researchers will quantify climate-induced shifts in marsh integrity and resilience at local to national scales that document ecological responses and inform best management practices. Additionally, shifts in species ranges and patterns of diversity across latitudes and biogeographic regions will be investigated. The proposed work will provide: 1) insight on how climate change is affecting marshes nationwide, 2) NERRs-specific templates and automated tools for data analysis and visualization, 3) transferable utility to other organizations with marsh monitoring datasets, 4) transferable utility to other coastal habitats (seagrass, mangroves), and 5) a framework for guiding and facilitating other national-level research.

Using collaborative science to assess the current and potential role of shellfish in improving water quality

Project Lead: Ashley Smyth, University of Florida/Institute of Food and Agricultural Sciences

Reserve: Guana Tolomato Matanzas (FL)

Budget Request: $594,966

Project Summary: Restoring shellfish to control eutrophication and achieve mandated nutrient load reductions requires knowledge of sources and sinks of nitrogen in the watershed and of the ecosystem functions and services provided by shellfish. This information is relevant to our end users at the Guana Tolomato Matanzas NERR and a diverse stakeholder network concerned about the water quality and ecosystem health of the Guana River Estuary (GRE). To assist with the development of restoration and management plans for the GRE, the research team will: 1) identify how land use change affects water quality in Guana Lake and nitrogen export to the Guana River, 2) survey shellfish distributions and health, 3) quantify filtration and nitrogen removal by shellfish, and 4) conduct field and lab experiments to assess how water quality affects shellfish health, and shellfish affect water quality in GRE. Specific outputs, developed through iterative discussions with end users and stakeholders but transferable to other sites, include a coupled hydrodynamic-biogeochemical model for Guana Lake, shellfish distribution maps, shellfish filtration and denitrification rates, monitoring and restoration recommendations, a stakeholder workshop on ways to reduce nutrient inputs into the GRE, a training program using shellfish for water quality, and peer-reviewed and outreach publications.

Buried or fried? Understanding sedimentation and temperature effects on native species restoration in the South Slough National Estuarine Research Reserve and the Coos estuary

Project Lead: Dave Sutherland, University of Oregon

Reserve: South Slough (OR)

Budget Request: $598,307

Project Summary: South Slough NERR is located in the ecologically, economically, and culturally important Coos estuary. Yet the area is vulnerable to natural and human causes of environmental decline. This project will investigate the impacts of water quality deterioration, climate change, and land use changes on native oyster and eelgrass beds, both of which are critical habitats in the Coos estuary ecosystem. In particular, the researchers will examine how temperature and sediment affect oysters and eelgrass in the Coos estuary, providing comprehensive analyses of sedimentation and water temperature changes over seasonal to decadal timescales, recommendations for future restoration efforts, and specific end user identified outputs such as educational programs, GIS layers applicable to management objectives, and public-friendly outreach that conveys our main findings. This work will improve collaboration among agencies in the area, increase the success of restoration efforts, increase access to long-term monitoring data, and enhance the understanding of estuarine processes across the region. The project team will work iteratively with a diversity of end users who share a need for an improved understanding of estuary processes, combining state-of-the-art science with identified management needs to maintain a healthy, productive, and resilient estuary.

The nation's past and future estuaries: Detecting estuarine habitat loss and opportunities for future restoration in and around National Estuarine Research Reserves

Project Lead: Kerstin Wasson, Elkhorn Slough NERR

Reserves: Elkhorn Slough (CA), Padilla Bay (WA), Tijuana River (CA), Lake Superior (WI), Great Bay (NH), ACE Basin (SC)

Budget Request: $600,000

Project Summary: Understanding trajectories of change is instrumental for coastal management. This project will analyze estuarine habitat change across the 29 National Estuarine Research Reserves (NERRs). Researchers will apply an elevation-based mapping approach pioneered on the West Coast, modifying it as needed for regions with different habitats, hydrological regimes, and histories of human alteration. The project will highlight the value of NOAA resources, including habitat maps, digital elevation models, tidal and lake water levels, and historical topographic sheets. NERR sentinel site monitoring provides an unprecedented opportunity to ground-truth analyses. The mapping approach the team develops and implements will be applicable to any U.S. estuary.

There is an urgent need, at individual NERRs and across the nation, to identify the extent and spatial patterns of estuarine habitat loss and restoration opportunities for the future, particularly in the face of climate change. This analysis will highlight differing trends among regions and estuarine habitat types. The team will identify areas where estuarine habitats can be restored, along with their services, such as fish habitat and carbon sequestration. Working with local and national end users, the project will help build a shared understanding of past trajectories of change to design and build support for future restoration strategies.

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Developing a template to communicate hurricanes and hurricane impacts using NERRS SWMP data

Project Lead: Kaitlyn Dietz, Guana Tolomato Matanzas NERR

Reserves: Guana Tolomato Matanzas (FL), Delaware (DE), North Carolina (NC), North Inlet-Winyah Bay (SC), ACE Basin (SC), Jobos Bay (PR)

Budget Request: $100,000

Project Summary: Hurricanes Dorian, Michael, Florence, Maria, Irma, and Matthew have impacted coastal communities across the southeast and Caribbean, causing loss of life, injuries, property damage, financial disruption, and damage to sensitive environments. These hurricanes also impacted the National Estuarine Research Reserves (NERRs) in the hurricane paths. The NERRS System-Wide Monitoring Program (SWMP) continuously captures water quality and meteorological data before, during, and after storms. By pairing water quality and meteorological data with visible impacts, NERRs can illustrate storm impacts and connect communities to science. By using SWMP data (salinity, dissolved oxygen, wind speed, wind direction, rainfall, water depth, turbidity, and barometric pressure) this project will develop templates for hurricane-specific communication products. Key elements of these templates will be pictures, hurricane path maps, and SWMP data analyses and visualizations to connect the quantitative story to the visual impacts observed in coastal communities. The templates will serve as communication tools for several audiences, including teachers whose students have experienced a hurricane event, fisheries and land managers who have observed changes in their natural systems, local decision makers who want to provide numbers to a recovering community, and the NERRS and National Estuarine Research Reserve Association to share the value of SWMP to broader decision makers.

The future of site profiles: An innovative cross-sector approach to incorporating end user and reserve needs

Project Lead: Deanna Erickson, Lake Superior NERR

Reserves: Lake Superior (WI), He'eia (HI)

Budget Request: $99,989

Project Summary: The site profile is an essential and required product at every reserve that traditionally contains a summary of scientific information in report format for prospective academic, agency, and management partners. For the past year, Lake Superior and He'eia Reserves have collaborated on site profile development and established a shared set of aspirations for a dynamic, interactive online format that integrates technical and ecological information, perspectives of Indigenous peoples and local communities, and media. This science transfer grant proposes to: 1) support an end user evaluation to determine site profile content needs, 2) collaborate with a geospatial consultant to develop a digital template adaptable to the unique context of individual reserves, 3) create two model site profiles for Lake Superior and He'eia Reserves using the template, and 4) develop education and coastal training curricular extensions that provide opportunities to utilize site profiles with diverse audiences. This project improves the efficiency and depth of the orientation process for researchers and partners by immersing them virtually in the biocultural context of the reserves. Reserves creating site profiles or updating an existing profile will have access to a dynamic format responsive to evolving needs, capable of conveying the critical cultural and scientific landscapes that Indigenous and other community partners bring to the shared goal of protecting estuaries.

Translating sediment research in San Francisco Bay NERR into management recommendations for improving marsh habitat resilience

Project Lead: Matt Ferner, San Francisco Bay NERR

Reserve: San Francisco Bay (CA)

Budget Request: $59,665

Project Summary: Resilience of tidal marshes in San Francisco Bay is threatened not only by sea level rise, but also by a downward trend in the amount of fine-grained sediment in the estuary. As a result, less sediment is available to accrete on marshes, increasing the likelihood that marsh vegetation will drown, leading to widespread habitat loss. Understanding how and when sediment is transported from the bay onto marshes is a critical need for decision makers who must consider sediment movement when they plan and implement management actions to enhance and restore tidal marsh habitat. Building on recently published sediment research in San Francisco Bay NERR, this project will synthesize and translate technical data on hydrodynamics, sediment transport, and sediment accretion, so end users can apply that knowledge to improve the resilience of existing and restored tidal marshes. Through an end-user engagement process involving surveys, collaborative workshops, and iterative document review and revision, the research team will work with natural resource managers, policy makers and regulators, restoration practitioners, and the NERRS community to clarify pressing management questions related to sediment dynamics, and to extract and convey relevant lessons learned from past research. Primary outputs will be a broadly relevant management-focused publication and a webinar.

Adopting program coordination methods and best practices to launch community-driven research efforts on the American eel (*Anguilla rostrata*)

Project Lead: Kaitlin Gannon, Jacques Cousteau NERR

Reserves: Jacques Cousteau (NJ), Hudson River (NY)

Budget Request: $42,879

Project Summary: Since 2008, the Hudson River NERR has been successfully monitoring glass, or juvenile, eels within various sites along the Hudson River with help from local citizens. Through this grant, the Jacques Cousteau NERR (JC NERR) is looking to transfer the Hudson River NERR's (HR NERR) Hudson River Eel Project as a mechanism to strengthen relationships between the reserve and surrounding communities, and provide useful information about the American eel (*Anguilla rostrata*) to fisheries managers beginning spring of 2023. The two-year project includes transferring best practices for implementing this citizen science effort at the JC NERR, developing outreach materials, testing potential monitoring/field work sites, and pilot training with volunteers and teachers. Project end users fall into three categories: current and new JC NERR volunteers, K-12 teachers and students, and (at the conclusion of the project) the New Jersey Division of Fish and Wildlife, Marine Fisheries Administration. Areas of interest for eel monitoring include Bass River State Park, Wharton State Park, Manahawkin Lake, and Tuckerton Creek, New Jersey. Guidance on monitoring locations and methods will be provided by Dr. Mark Sullivan of Stockton University and Chris Bowser from the HR NERR. End users will provide feedback about project logistics, feasibility, and the development of project-related resources. This community-based program will launch in spring of 2023.

Building capacity for reserves to be Motus Wildlife Tracking leaders

Project Lead: Blaik Keppler, ACE Basin NERR

Reserves: ACE Basin (SC), San Francisco Bay (CA), Grand Bay (MS), Hudson River (NY)

Budget Request: $96,413

Project Summary: In a time of climate change and coastal development, coastal estuarine habitats are becoming increasingly rare for flying, migratory animals, particularly coastal birds. The National Estuarine Research Reserve System operates in biogeographical regions that provide critical habitats for many migratory bird species, many of which are experiencing dramatic population loss. The Motus Wildlife Tracking System is an open-source international collaborative network of community hosted radio-telemetry receivers and wildlife researchers. Use of the Motus framework offers a platform for reserves not only to participate, but to become regional leaders for avian species research and conservation. Ultimately, this will position the reserves to serve as regional hubs, increasing the Motus network of receivers in respective regions, the amount of data collected, and the knowledge of how to conserve rare and declining species. Bolstering Motus networks in these key regions is expected to have a positive impact on local, regional, and flyway-scale research, and ultimately conservation efforts.

Transfer of a low-cost tidal wetland water level monitoring system: Hyperlocal calculations of inundation and tidal datums for understanding change and restoration planning

Project Lead: Vitalii Sheremet, Okeanolog/ Woods Hole Oceanographic Institution

Reserves: Waquoit Bay (MA), Wells (ME), Great Bay (NH), Narragansett Bay (RI), Delaware (DE), North Inlet-Winyah Bay (SC), Guana Tolomato Matanzas (FL)

Budget Request: $99,825

Project Summary: Waquoit Bay NERR has been fortunate to have a long-term collaborator who has calculated local tidal datums and inundation periods for many pools in its sentinel site marsh. When researchers gathered relevant data to conduct inundation modeling for understanding salt marsh vegetation change in the four New England NERRs, they were surprised to learn Waquoit's multi-year, locally relevant water level monitoring was unique. This transfer grant seeks to share the instrumentation and expertise that Waquoit Bay NERR has experienced with six recipient reserves that share a strong interest in salt marsh sentinel site monitoring. The recipient reserves also span a range of climactic and tidal regimes, thus allowing further testing and improvement of the Arm-and-Float water level logger for a variety of conditions. At the conclusion of this project, end users will have instrumentation, locally relevant tidal datums, and enhanced understanding of the differences in inundation regime for up to 14 salt marsh features, such as pools, or upstream from tidal restrictions. This information can be applied to restoration planning within the reserve, and the enhanced knowledge base will be useful for providing technical advice on other marsh restoration and adaptation projects.

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