Annual Summary of Reserve Management and
Science Transfer Needs
For the 2023 Merged Catalyst/Science Transfer RFP
Compiled October 2022

Collaborative science projects supported by the National Estuarine Research Reserve System (NERRS) Science Collaborative must address a management and/or science transfer need of one or more reserves. This document is a compilation of the current management and science transfer needs within NOAA's reserve system. These needs are submitted by the reserves and updated on an annual basis. In this year's merged RFP, catalyst style proposals will need to respond to a reserve management need, science transfer style proposals will need to respond to a reserve science transfer need. This is one mechanism we have developed to ensure catalyst and science transfer proposals are given equal footing during the proposal development and review processes.

This reserve management and science transfer needs summary supports the development of proposals in response to the 2023 NERRS Science Collaborative Request for Proposals. Potential applicants are encouraged to review the management and science transfers needs described here and reach out to the point of contact listed for a reserve to discuss the reserve's current needs and opportunities for collaboration. Project ideas that emerge after this document was developed and do not align perfectly with a specific need statement, including project ideas that engage multiple reserves, can be considered for funding if the relevance and value to the reserve system and potential end users are well justified in the proposal in the form of a letter from the reserve manager.

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

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

- **Climate change:** Research and monitoring related to biophysical, social, economic, and behavioral impacts of habitat change resulting from climate change and/or coastal development.
- **Habitat resilience:** Investigating options for improving estuarine habitat resilience; processes for identifying, prioritizing, and restoring sites; and monitoring and evaluating success.
- **Ecosystem services:** Understanding how an ecosystem service approach and human dimensions research can be utilized to support the protection and restoration of estuarine systems.
- **Water quality:** Understanding the impacts of land use change, eutrophication, and contamination in estuarine ecosystems and the options for management and mitigation.
- **Monitoring data synthesis:** Syntheses of long-term monitoring data and information, originating from programs such as the NERRS System-wide Monitoring Program and associated monitoring efforts, to develop regional and national data products that address coastal management priorities for the NERRS and NOAA.

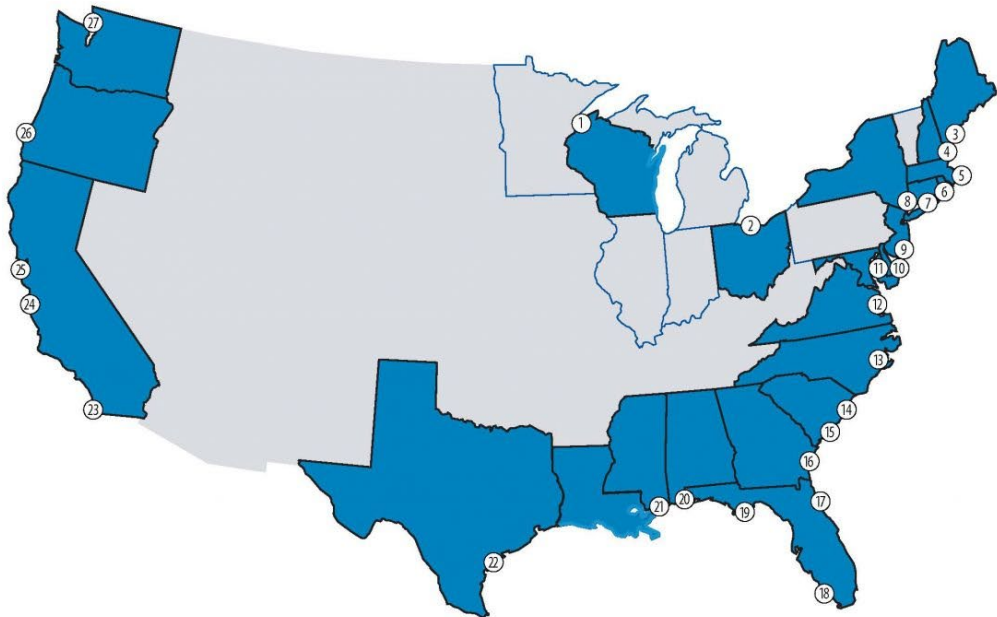For questions about this summary, please contact:

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Please use the NERRS national map to identify regions and reserves of interest.

NATIONAL ESTUARINE RESEARCH RESERVES

Great Lakes
1. Lake Superior, Wisconsin
2. Old Woman Creek, Ohio

Northeast
3. Wells, Maine
4. Great Bay, New Hampshire
5. Waquoit Bay, Massachusetts
6. Narragansett Bay, Rhode Island
7. Connecticut

Mid-Atlantic
8. Hudson River, New York
9. Jacques Cousteau, New Jersey
10. Delaware
11. Chesapeake Bay, Maryland
12. Chesapeake Bay, Virginia

Southeast
13. North Carolina
14. North Inlet-Winyah Bay, South Carolina
15. ACE Basin, South Carolina
16. Sapelo Island, Georgia
17. Guana Tolomato Matanzas, Florida

Gulf of Mexico
18. Rookery Bay, Florida
19. Apalachicola, Florida
20. Weeks Bay, Alabama
21. Grand Bay, Mississippi
22. Mission-Aransas, Texas

West
23. Tijuana River, California
24. Elkhorn Slough, California
25. San Francisco Bay, California
26. South Slough, Oregon
27. Padilla Bay, Washington
28. Kachemak Bay, Alaska

Pacific
29. He'eia, Hawai'i

Caribbean
30. Jobos Bay, Puerto Rico

PROPOSED
Bay of Green Bay, Wisconsin
Louisiana
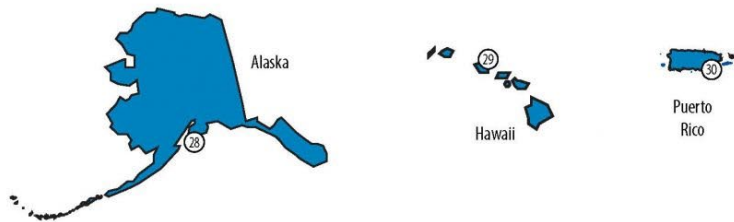
Management and Science Transfer Need Key Words

Key words for each reserve's management and science transfer needs are listed below. Each reserve provided up to 5 priority needs for either management or science transfer. Click on a reserve's name to jump to their need statements.

Caribbean Region

- Jobos Bay, Puerto Rico
    1. Seagrass; invasive species; endoparasites; ecology
    2. Corals; SCTLD; restoration
    3. Mangroves; resilience; socioeconomic; services
    4. Restoration; resilience; living shorelines
    5. SWMP; water quality; data management; modeling

Great Lakes Region

- Lake Superior, WI
    1. Mapping; habitat; restoration; tool
    2. Drivers; change; monitoring; synthesis
    3. Data accessibility
    4. Biocultural; restoration; experiential
    5. Stressors; climate change; pollution
- Old Woman Creek, OH
    1. Policy; sustainable development; water resources; human dimensions
    2. Soil; sedimentation; erosion; carbon
    3. Marine debris; single-use plastics; Great Lakes debris; circular economy; water quality
    4. Habitat suitability; habitat preference; fish; model
    5. Phenology; citizen science; species monitoring; keystone species; indicator species

Gulf of Mexico Region

- Apalachicola, FL
    1. Fisheries; ecosystem
    2. Socioeconomic; ecosystem services; social
    3. Climate; storm; heat; sea level
    4. Shoreline stabilization; erosion; ecosystem services
    5. Communications; behavior change
- Grand Bay, MS
    1. Restoration; effectiveness; monitoring data
    2. Water quality; ecological processes; hydrology; dynamics
    3. Flora; fauna; population change
    4. Socio-economic indicators; ecosystem services; green infrastructure
    5. Trophic interactions; ecosystem functions; food webs
- Mission-Aransas, TX
    1. Marine debris; plastics; trash; impacts
    2. Climate change; sea level rise; invasive species; contamination
    3. Habitat; Protection; development; erosion
    4. eDNA; sound; invasive; biodiversity
    5. SWMP; SET; managers

- Rookery Bay, FL
  1. Vulnerability; assessment; planning; disaster response
  2. Blue carbon; mangroves
  3. Restoration; salinity; freshwater; fisheries
  4. Behavior; citizen science; training; outreach
  5. Oyster; seagrass; submerged habitat; habitat mapping
- Weeks Bay, AL
  1. Marsh migration; living shoreline
  2. Social science; community resilience
  3. Marine debris
  4. Prescribed fire; invasive species; marsh migration

Mid-Atlantic Region
- Chesapeake Bay, MD
  1. Blue carbon; wetland migration; sea level rise; coastal resilience
  2. Community engagement; DEIJ; environmental justice; social science
  3. Environmental restoration; monitoring; beneficial use; adaptive management
  4. Submerged aquatic vegetation; benthic habitat; fisheries; ecosystem services
- Chesapeake Bay, VA
  1. Wetlands; seagrass; restoration; carbon sequestration
  2. Algal blooms; HABs; toxins; aquaculture
  3. Nutrients; sediments; oxygen; water clarity
  4. Conservation; marsh birds; community science; resource management
  5. Community; conservation; behavior change; human dimensions
- Delaware, DE
  1. Bioacoustics; biodiversity; faunal changes
  2. Marsh birds; population decline; conservation
  3. Vernal pool; analysis; forested wetlands
  4. Valuation; community; visitor use; accessibility
  5. Virtual reality; conservation; education
- Hudson River, NY
  1. Outreach; climate; marginalized groups; environmental justice
  2. Submerged aquatic vegetation; *Vallisneria americana*; restoration
  3. Salt front; drinking water; freshwater tidal habitats; SWMP data
- Jacques Cousteau, NJ
  1. Bioacoustics; animal composition; species biodiversity
  2. Nature-based solutions; living shorelines; beneficial use; resilience
  3. Predictive models; ecosystem dynamics; water quality; habitat quality
  4. Community resilience; technical assistance; evaluation; resilience metrics
  5. Human dimensions; values; social science

Northeast Region
- Connecticut, CT
  1. Environmental justice; green infrastructure; stormwater
  2. Blue carbon; economic valuation; biogeochemical processes; living shoreline

3. Nutrient load mitigation strategies; macroalgal and microalgal harmful algal blooms; hypoxia
4. Habitat restoration; eelgrass restoration and assisted migration; marsh resilience; invasive species interactions

- Great Bay, NH
  1. Climate change; ecosystem function; habitat
  2. Pollution; nitrogen; contaminants; water quality
  3. Restoration; oysters; eelgrass; saltmarsh
  4. Data analysis; data visualization; forecasting
  5. Outreach; private landowner engagement; climate; pollution; wildlife
- Narragansett Bay, RI
  1. Climate change; resilience; habitat; community
  2. Ecosystem services; behavior change; management
  3. Habitat; resilience; wildlife; restoration
  4. Stormwater; water quality; management; BMPs
  5. Monitoring; trends analysis; management; SWMP
- Waquoit Bay, MA
  1. Climate impacts; freshwater inputs; nutrient management; monitoring data
  2. Restoration; ecosystem services; biogeochemical processes; management
  3. Nutrient pollution; water quality; solutions; aquaculture
  4. Coastal hazards; habitat resilience; best management practices; risk reduction
  5. Sea level rise; marsh resilience; ecosystem services; adaptation
- Wells, ME
  1. Biophysical modeling; invasive species; anthropogenic impacts, bioacoustic telemetry, eDNA
  2. Climate change; coastal resilience; social, economic, and behavioral impacts; biosensors
  3. Ecosystem service approach; sentinel site; data science; estuarine and marsh restoration and protection
  4. Land use change; eutrophication; contamination; water chemistry; nutrients
  5. Habitat resilience; restoration science; living shorelines

Southeast Region
- ACE Basin, SC
  1. Sea level rise; adaptation strategies; climate change; salt marsh
  2. Stormwater; water quality; best practices; barriers
  3. Salt marsh health; synthesis; restoration; habitat resilience
  4. Data synthesis; water quality; integrated assessment; modeling
- Guana Tolomato Matanzas, FL
  1. Groundwater; saltwater; intrusion; migration
  2. Sediment; elevation; restoration; barrier island
- North Carolina, NC
  1. Sediment dynamics; vulnerability; resilience
  2. Habitat mapping; benthic; methods
  3. Water quality; System-wide Monitoring Program
- North Inlet-Winyah Bay, SC
  1. Marsh; vulnerability; sea level rise
  2. Natural resources; ecosystem-based management; human dimensions
  3. Urbanization; stormwater; best management practices

4. Marsh; oyster reef; restoration; monitoring techniques
5. Data synthesis; integrated assessments; interacting effects
- Sapelo Island, GA
  1. Impacts; natural resources; coastal communities
  2. Local community; flooding; resilience
  3. Ditching; hydrology; community impacts
  4. Fish monitoring; training; public education; citizen scientists

West Coast Region
- Elkhorn Slough, CA
  1. Restoration; recovery; resilience
  2. Eutrophication; invasion; diking
  3. Sea-level rise; adaptation; resilience; community
  4. National; habitat; water quality
- Kachemak Bay, AK
  1. Climate; humans; applications; data
  2. Cultural; ecosystems; conservation; communities
  3. Water; land uses; management; population growth
  4. Monitoring; datasets; analysis; management
- Padilla Bay, WA
  1. Climate change; eelgrass; sociocultural systems; resilience
  2. Blue carbon; ecosystem services; eelgrass; sociocultural systems
  3. Restoration; resilience; agricultural practices; eelgrass
  4. Data synthesis; data literacy; education; land use
  5. Land use; contamination; agriculture; carbon sequestration
- San Francisco Bay, CA
  1. Nature-based solutions; resiliency; adaptive management; living shorelines
  2. Oysters; living shorelines
  3. Invasive species; feral pigs; invasive plants
  4. Nature-based adaptation; community engagement; education; training; equity
- South Slough, OR
  1. Climate change; habitats; species; resilience
  2. Ecosystem services; native species; sustainability
  3. Ocean acidification; land-use; invasive species
  4. Restoration effectiveness; invasive species; evaluation
  5. Synthesis; modelling; summarize
- Tijuana River, CA
  1. Restoration; monitoring; habitats; species
  2. Sediment; beneficial re-use; restoration
  3. Marine debris; management; plastics
  4. Inlet; tidal prism; ocean-estuary exchange
  5. Climate change; socio-ecological system

Pacific Islands Region
- He'eia, HI

1. Biocultural; restoration; experiential
2. Biocultural; restoration; models; applications
3. Climate change; drivers; habitat change
4. Collaborative educational programming; coordination; capacity; knowledge systems
5. Indigenous resource management tools; training; skills; technology

Management and science transfer needs mapped with Science Collaborative focus areas

Management needs are noted with **M** and Science Transfer needs are noted by **ST**. Click on each reserve's name to read about their specific management and science transfer needs.

Reserve	Climate Change		Habitat Resilience		Ecosystem Services		Water Quality		Monitoring Data Synthesis	
Caribbean										
Jobos Bay, Puerto Rico	M	ST	M	ST	M	ST	M	ST		ST
Great Lakes										
Lake Superior, WI	M	ST		ST		ST		ST	M	ST
Old Woman Creek, OH	M				M		M		M	ST
Gulf of Mexico										
Apalachicola, FL	M	ST	M	ST	M	ST		ST	M	
Grand Bay, MS	M	ST	M	ST	M	ST	M	ST	M	ST
Mission-Aransas, TX	M	ST	M		M		M	ST	M	
Rookery Bay, FL	M	ST	M	ST		ST	M		M	
Weeks Bay, AL	M	ST	M	ST	M	ST	M	ST		
Mid-Atlantic										
Chesapeake Bay, MD	M	ST	M	ST	M	ST	M	ST	M	ST
Chesapeake Bay, VA	M	ST	M	ST	M	ST	M	ST	M	ST
Delaware, DE			M		M					
Hudson River, NY	M	ST	M	ST					M	ST
Jacques Cousteau, NJ	M	ST	M	ST	M	ST	M	ST	M	ST
Northeast										
Connecticut, CT	M	ST	M	ST	M	ST	M	ST		
Great Bay, NH	M	ST	M	ST	M	ST	M	ST	M	ST
Narragansett Bay, RI	M	ST	M	ST	M	ST	M	ST	M	ST
Waquoit Bay, MA	M	ST	M	ST	M	ST	M	ST	M	ST
Wells, ME	M	ST	M	ST	M	ST	M	ST	M	ST
Southeast										
ACE Basin, SC	M	ST	M	ST	M	ST	M	ST	M	ST
Guana Tolomato Matanzas, FL			M	ST			M	ST		
North Carolina, NC	M	ST	M	ST					M	ST
North Inlet – Winyah Bay, SC	M	ST	M	ST	M	ST	M	ST	M	ST
Sapelo Island, GA	M	ST	M				M			
West Coast										
Elkhorn Slough, CA	M	ST	M	ST	M	ST	M	ST	M	
Kachemak Bay, AK	M	ST	M	ST	M	ST	M	ST	M	ST
Padilla Bay, WA	M	ST	M		M		M		M	ST
San Francisco Bay, CA	M	ST	M	ST	M	ST				
South Slough, OR	M	ST	M	ST	M	ST	M	ST	M	ST
Tijuana River, CA	M	ST	M	ST	M	ST	M	ST	M	ST
Pacific Islands										
He'eia, HI	M	ST	M	ST	M	ST	M	ST	M	ST

Caribbean Region

Jobos Bay Reserve, Puerto Rico

Contact: Angel Dieppa, Research Coordinator, adieppa.jbnerr@gmail.com, 787-502-9302

Need 1

Ecological-economic-livelihood assessment of seagrasses:

One important resource among JBNERR are the extensive seagrass meadows and the ecosystem services it provides. Our reserve has been impacted by the invasive seagrass *Halophila stipulacea* (Hs) since 2015 AND we want to address its effects over native species by an effective native seagrass and associated species management. BUT few is known how Hs is affecting not only native species but benthic and demersal fauna, also by possible impacts from its phytomyxid endoparasite threat to other species. THEREFORE our reserve hopes to partner with researchers to address these into this landscape within JBNERR.

Keywords:

Seagrass; Invasive species; Endoparasites; Ecology

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services

Need 2

Coral reef resilience and recovery:

Our reserve is composed of three major tropical ecosystems, Mangroves, Seagrasses, and Coral reefs. It is important to maintain an equilibrium among them due to interdependency in terms of genetic pool, biodiversity, and health. Corals recovery by restoration and diseases such as the stony coral tissue loss disease (SCTLD) management have been pointed as a need by collaborators in order to maintain such equilibrium and their services. BUT we need the expertise from the scientific community to address this need. THEREFORE our reserve hopes to partner with researchers to implement BMP's into these landscapes within JBNERR.

Keywords:

Corals; SCTLD; Restoration

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services
	Monitoring Data Synthesis

Need 3	
Ecological-economic-livelihood assessment of mangroves:	
Mangroves are a key component of coastal ecosystems including human settlements. It interacts with seagrass and coral reefs ecosystems by interchanging nutrients, food, and fauna that in absence of any of those will result in a misbalance. An important part of the threats is anthropic pressure. BUT managers need to understand the extent of knowledge that residents have, what is the valorization of mangroves ecosystem, and how they visualize how much of their resilience against climate change comes from coastal ecosystems. THEREFORE our reserve hopes to partner with researchers from interdisciplinary fields to address this within JBNERR.	**Need Type** → **Focus Areas** Management: Climate Change; Habitat Resilience; Ecosystem Services Science Transfer: Climate Change; Habitat Resilience; Ecosystem Services; Water Quality; Monitoring Data Synthesis
Keywords:	
Mangroves; Resilience; Socioeconomic; Services	
Need 4	
Habitat restoration:	
Mangroves provide socio-economic and ecological benefits as living shorelines that account for the entire ecosystem health. It has been affected by poor watershed management and by natural processes such intense storms. BUT there is a need to understand factors and drivers that affect its resilience and how they help other ecosystems resilience as well including the human settlements. THEREFORE our reserve hopes to partner with researchers and managers in this field to address mangrove recovery within JBNERR in order to preserve its ecosystem services.	**Need Type** → **Focus Areas** Management: Climate Change; Habitat Resilience; Ecosystem Services; Water Quality
Keywords:	
Restoration; Resilience; Living Shorelines	
Need 5	
Understanding environmental responses to climate and anthropic pressure:	
Jobos Bay reserve has a long-term monitoring program that gathered water quality, meteorological, and biological data which its analysis may help to identify processes and drivers of environmental response. BUT we are lacking of personnel with such expertise and managers need this data to be analyzed in order to identify such processes and model it to forecast best management practices. THEREFORE our reserve hopes to partner with researchers to provide a data synthesis of water quality and meteorological data and its trends.	**Need Type** → **Focus Areas** Management: Climate Change Science Transfer: Water Quality; Monitoring Data Synthesis
Keywords:	
SWMP; Water Quality; Data Management; Modeling	

Great Lakes Region

Lake Superior Reserve, Wisconsin

Contact: Deanna Erickson, Reserve Manager, deanna.erickson@wisc.edu, 608-234-1510

Need 1

A bi-state, tribal nation, and multi-agency team working towards updating the St. Louis River Habitat Plan needs a modern habitat mapping tool to help identify and prioritize areas for future restoration and conservation and the Lake Superior Reserve is developing a new repeatable habitat mapping process but the Reserve only has capacity to map habitats within the Reserve's boundaries, which captures only part of the estuary. Therefore, Reserve partners need assistance applying these mapping techniques to the whole estuary, so that it is a useful and applicable tool for estuary-wide habitat restoration planning and vulnerability assessment. Contact: Kirsten Rhude, Stewardship Coordinator, kirsten.rhude@wisc.edu

Keywords:

Mapping, habitat, restoration, tool

Need Type	Focus Areas
Science Transfer	Habitat Resilience

Need 2

Natural and anthropogenic factors act at multiple spatiotemporal scales to drive change in estuarine ecosystems and understanding how varying drivers interact at different temporal (e.g., short-to-long term) and spatial (e.g., watershed-to-global) scales is essential for addressing management needs, but our understanding of drivers at varying spatial and temporal scales is lacking. Therefore, we are interested in quantitative analyses (e.g. multivariate, time-series, spatial) that synthesize long-term, system-wide monitoring data collected at the Lake Superior reserve and across the NERRS, specifically when applied to investigate natural and anthropogenic drivers of variability in estuarine responses (e.g. in wetland vegetation, water quality, productivity). Contact: Dr. Kait Reinl, Research Coordinator, kreinl@wisc.edu

Keywords:

Drivers, change, monitoring, synthesis

Need Type	Focus Areas
Management	Monitoring Data Synthesis
Science Transfer	Monitoring Data Synthesis

Need 3

The Lake Superior Reserve and partners produce high-quality environmental data related to the St. Louis River estuary and this data is valuable to many users across a broad suite of research, management, and educational contexts but simplified and direct access to Reserve data has been a challenge for partners and collaborators of the Reserve and data needs are varied. Therefore, the development of a new data sharing tool or interface that improves a wide range of users' ability to connect and interact with Reserve and select partner's data would help serve the programmatic needs of the Reserve and its many partners. Contact: Dr. Kait Reinl, Research Coordinator, kreinl@wisc.edu.

Keywords:

Data accessibility

Need Type	Focus Areas
Science Transfer	Monitoring Data Synthesis

Need 4

Across the NERRS, Reserve staff and partners have a wide range of understandings of the role of Indigenous science in restoring social-ecological estuarine systems and have increasingly identified a need for deeper experience and applied knowledge but learning opportunities related to biocultural restoration and cultural ecosystem service approaches that center Indigenous knowledges do not yet exist for the system. Therefore, Reserves would benefit from in-depth experiential learning related to these approaches to better support thriving estuaries and just coastal communities. Contact: Deanna Erickson, Reserve manager, deanna.erickson@wisc.edu

Keywords:

Biocultural; restoration; experiential

Need Type	Focus Areas
Science Transfer	Habitat Resilience
	Ecosystem Services

Need 5

Lake Superior coastal zones are experiencing numerous stressors including climate change, eutrophication, and pollution, and this creates complexity for coastal stewards who wish to act swiftly and effectively to mitigate adverse impacts to human and natural communities; however, the differing ways in which climate change and other sources of anthropogenic stress (such as legacy contaminants) affect estuarine processes, species, and human communities is poorly understood. Therefore, research is needed to address how interacting stressors within Lake Superior estuaries affect coastal systems, leading to more nuanced management and restoration actions that address causal issues. Contact: Dr. Kait Reinl, Research Coordinator, kreinl@wisc.edu

Keywords:

Stressors, climate change, pollution

Need Type	Focus Areas
Management	Climate Change
	Water Quality
Science Transfer	Climate Change
	Water Quality

Old Woman Creek Reserve, Ohio

Contact: Janice Kerns, Reserve Manager, Janice.Kerns@dnr.ohio.gov, 567-623-4865

Need 1

Continued demand on water resources around the globe poses a risk for the Great Lakes where water is abundant and land plentiful. The Great Lakes are projected to be an immigration hotspot. [AND] OWC NERR has monitored water quality and land use change, informing watershed partners and communities of how wetlands protect water resources. [HOWEVER,] Preparedness by local governments to accommodate increased development pressure has not been investigated regarding policy for protection of water resources. [THEREFORE,] OWC NERR is interested in how local governments will handle increased development pressure should significant population increase occur and which policies to adopt. Need Contact: Sebastian.Mejia@dnr.ohio.gov

Keywords:

Policy; Sustainable Development; Water Resources; Human Dimensions

Need Type	Focus Areas
Management	Climate Change

Need 2

Great Lakes coastal communities are struggling to mitigate impacts of nutrient loading, greenhouse gases, and sedimentation. The properties and composition of wetland soils and sediments are known to influence the cycling of carbon and nutrients AND OWC NERR has worked to improve this understanding within the estuary water column; HOWEVER, little is known about how soils may influence these processes and how their properties and functions may vary over space and time. THEREFORE, research is needed to understand the heterogeneity of soils and sediment and how their properties influence carbon, nutrient, and sediment transport within the OWC estuary. Need Contact: Steve.McMurray@dnr.ohio.gov

Keywords:

Soil; sedimentation; erosion; carbon

Need Type	Focus Areas
Management	Ecosystem Services

Need 3

Single-use plastic items associated with the food and drink industries are among the most frequent items found in the Great Lakes environment AND threaten the human health of over 11 million people, as well as the local economy. HOWEVER, the impact of single-use plastic vs. multi-use items on the economics of Lake Erie coastal businesses has not been fully analyzed. THEREFORE, evaluating the abundance and cost of single-use plastics compared to multi-use items within local business models would allow the restaurant

Need Type	Focus Areas
Management	Water Quality

industry to better understand their economic decisions and environmental impact. Need contact: Emily.Kuzmick@dnr.ohio.gov

Keywords:

Marine debris; single-use plastics; Great Lakes debris; circular economy; water quality

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Need 4

Anecdotal reports indicate that fish species using OWC for habitat has shifted over time, AND being able to understand how changes in habitat quality will influence future species use will inform fishery management within OWC and the larger Lake Erie region. HOWEVER, no formal investigation exists into which species may be using OWC. THEREFORE, developing an assessment of habitat suitability throughout OWC is a priority. Knowing how OWC is being used by fish, and how usage may shift with a changing environment, will benefit fishery manager partners, as well as future research within OWC. Need contact: Steve.McMurray@dnr.ohio.gov

Keywords:

Habitat suitability; Habitat preference; Fish; Model

Need Type	Focus Areas
Management	Ecosystem Services
	Monitoring Data Synthesis

Need 5

Phenological data has the potential to provide important information to management goals for Great Lakes coastal wetlands. Old Woman Creek NERR has established a long-term phenology monitoring program for keystone and indicator wildlife species BUT has had capacity limitations that prevent the program from expanding its initiatives and protocols to address gaps in monitoring protocol. THEREFORE, to better inform management questions associated with wetland ecosystem services, additional synthesis and integration of parameters into monitoring are needed in order to successfully compare these datasets to others in the Great Lakes region. Need Contact: Emily.Kuzmick@dnr.ohio.gov

Keywords:

Phenology; citizen science; species monitoring; keystone species; indicator species

Need Type	Focus Areas
Management	Monitoring Data Synthesis
Science Transfer	Monitoring Data Synthesis

Gulf Coast Region

Apalachicola Reserve, Florida

Contact: Jennifer Harper, Reserve Manager, jennifer.harper@dep.state.fl.us, 850-670-7716

Need 1

The Reserve and its partners have collected decades of fisheries-dependent and independent data about local fisheries AND ongoing declines are exhibited across most fisheries BUT the fisheries have never been assessed at a Bay-wide or Ecosystem level, THEREFORE a comprehensive stock assessment on local fisheries (shrimp, reef fishes, blue crab, recreational) is needed to inform the development of a broad-based Bay Management plan. Co-development of the plan would utilize input from seafood workers and county residents. What are their concerns? What strategies do they see as valid ways to address these concerns? What novel techniques could aid in restoration of the bay? What information would convince them that any techniques or strategies are, or are not, successful?

Keywords:

Fisheries; ecosystem

Need Type	Focus Areas
Management	Ecosystem Services
	Monitoring Data Synthesis

Need 2

The Reserve desires to understand the linkages between ecosystem services (SWMP data; Reserve data) and our local community well-being and values (socio-economic data) THEREFORE is would be valuable to conduct ongoing monitoring of pertinent socio-economic indicators to determine the changes over time, especially regarding restoration projects. Outcomes: convene a social science working group. Grow capacity to conduct ongoing and demographically diverse social science research in the Gulf. Establish metrics/measures of socio-economic data that are appropriate for use at multiple locations.

Keywords:

Socioeconomic; ecosystem services; social

Need Type	Focus Areas
Management	Ecosystem Services
	Monitoring Data Synthesis

Need 3

With increasing sea level rise and other climate-related impacts, our coastal zone is changing dramatically. The Reserve collects data on erosion and accretion rates AND proactively identifies locations for restoration, BUT much is unknown about ongoing changes in coastal ecosystem structure, THEREFORE mechanisms for the shifts (including but not limited to climate, storm events, heat intensity), and/or resulting changes in ecosystem function as a result of these shifts, need to be investigated.

Keywords:

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience

Climate; storm; heat; sea level

Need 4

The Reserve continues to document a loss of sand and sediment in shoreline and marsh habitats, AND an inability of accretion rates to keep up with sea level rise in critical habitats, BUT techniques to stabilize shoreline and marshes are limited, THEREFORE novel techniques need to be considered and tested. What methods are best for stabilization, provision of ecosystem services and longevity? What factors or considerations (shore slope, natural community type, physical processes) may be of most importance for the success of shoreline stabilization.

Keywords:

Shoreline stabilization; erosion; ecosystem services

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
Science Transfer	Climate Change
	Habitat Resilience

Need 5

Communicating science and/or behavior change. The Reserves in the Gulf desire training on how to transfer existing behavior change research to successfully create new or improve existing programs. Programs may include direct visitor/resident interactions with Reserve staff or volunteers, communication campaigns, professional trainings, citizen science, or K-12 formal programs. These programs should aim to increase environmentally friendly behavior of visitors/residents to at least one of the Gulf of Mexico NERRs. All programs are expected to be tailored to address locally relevant issues. Suggested activities include an evaluation of behavior change for a new or existing program, or a framework to better understand the mechanisms of behavior change in our community. We would prioritize an emphasis on the inclusion of diverse audiences.

Keywords:

Communications; behavior change

Need Type	Focus Areas
Science Transfer	Habitat Resilience
	Ecosystem Services
	Water Quality

Grand Bay Reserve, Mississippi

Contact: See needs below

Need 1

Restoration effectiveness monitoring: Coastal habitats are being restored with a variety of methods throughout the northern Gulf of Mexico, and many of these efforts have well-defined end points and criteria that can be used to determine restoration success, but effectiveness monitoring is rarely conducted and/or monitoring data is not often available for synthesis. Prescribed fire is a particularly important method and management approach in Grand Bay's wet pine savanna uplands but is costly and difficult to implement; understanding how alternatives such as mechanical clearing or conservation grazing could be useful in maintaining our habitats and how end points differ is important to management. Methods for invasive species management is another key issue faced in our uplands, with benefits and drawbacks to different techniques that need to be better understood through detailed monitoring. Green infrastructure such as living shorelines is another potentially valuable restoration technique with few studies detailing project effects. Therefore, more data and sound studies on the effectiveness of restoration approaches in both upland and estuarine systems is needed to guide future management efforts in the region.
Contact: Dr. Ayesha Gray, ayesha.gray@dmr.ms.gov
Keywords:

Restoration; effectiveness; monitoring data

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality
	Monitoring Data Synthesis

Need 2

Physical and hydrological processes: The GNDNERR marshes are affected by several ecological and physical processes, but the physical processes driving how critical ecological functions are affected by restoration actions, infrastructure, or climate change are not well understood. Therefore, studies to better understand overland and groundwater flow, marsh migration, water quality (e.g., contaminants) and circulation patterns (e.g., quantification of inputs from Mobile Bay vs. Mississippi Sound, possible impacts from Bonnet Carre spillway openings including HABs), and sediment dynamics (e.g., composition, erosion, transport, deposition) in the GNDNERR are needed to assess management actions with the potential to better conserve estuarine ecosystem function.
Contact: Dr. Ayesha Gray, ayesha.gray@dmr.ms.gov

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services

	Water Quality
	Monitoring Data Synthesis

Need 3

Species population distribution, abundance, and ecology: The GNDNERR is a reference site for many research studies and on-going restoration projects across the Mississippi Coast, but questions remain about issues as varied as feral hog management, terrapin nesting success, extent of submerged aquatic vegetation, prey species in carnivorous plant bogs, occurrence of rare and endangered species, etc. Answering questions about species population distribution, abundance, and ecology provides baseline information and informs management decisions. Therefore, population distribution and ecological studies for terrestrial and aquatic flora and fauna are needed to increase understanding of these species' population dynamics in GNDNERR and allow GNDNERR to serve in its role of a reference estuary.
Contact: Dr. Ayesha Gray, ayesha.gray@dmr.ms.gov
Keywords:
Flora; fauna; population change

Need Type	Focus Areas
Management	Habitat Resilience
	Ecosystem Services
Science Transfer	Habitat Resilience
	Ecosystem Services

Need 4

Socio-economic impacts of ecosystem restoration: There has been increased effort in recent years to restore coastal habitats. These efforts aim to recover ecological processes lost due to various reasons and are expected to improve the socio-economic condition of communities. Typical habitat restoration improves environmental condition and has ancillary socio-economic impacts that are not well understood. Green infrastructure practices have the objective of improving socio-economic conditions by recovering those ecosystem services that get lost with development. In both cases, few research efforts focus on the socio-economic impacts of restoration; therefore, more information is needed on whether and how habitat restoration and green infrastructure projects impact local communities and economies.
Contact: Dr. Ayesha Gray, ayesha.gray@dmr.ms.gov
Keywords:

Socio-economic indicators; ecosystem services; green infrastructure

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality

Need 5

Habitat functions and trophic flows: It is important to understand what ecosystems do and how energy moves through them especially in the context of restoration. There are a range of interconnected habitat types throughout the Grand Bay NERR, including emergent marsh, wet pine savannas under different management regimes, bog habitats, tidal bayous, fringing oyster reefs, constructed inter- and sub-tidal reefs, submerged aquatic vegetation, and open water. Understanding trophic links is essential to understanding habitat function and energy flow but is not an area of research commonly pursued in Grand Bay. Therefore, we encourage projects that enable us to better understand habitat functions and trophic interactions to inform resource management decisions. Contact: Dr. Ayesha Gray, ayesha.gray@dmr.ms.gov

Keywords:

Trophic interactions; ecosystem functions; food webs

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality
	Monitoring Data Synthesis

Mission-Aransas Reserve, Texas

Contact: Jace Tunnell, Reserve Manager, jace.tunnell@austin.utexas.edu, 361-244-8665

Need 1

Marine debris research: The Reserve completed a study in 2017 that shows the Mission-Aransas Reserve Gulf-facing beaches have 10 times the amount of trash accumulation than the beach shorelines located along the eastern side of the Gulf of Mexico. Marine debris, including microplastics, is a growing concern in the Reserve and future studies should look at ecological impacts of plastics on the environment and biological communities.

Keywords:

Marine debris; plastics; trash; impacts

Need Type	Focus Areas
Management	Water Quality
Science Transfer	Water Quality

Need 2

Climate change impacts: The Reserve is subjected to numerous impacts from climate change, including: tropicalization of plant species, alternations in contaminant bioavailability/toxicity, relative sea level rise rate of 5.2mm per year, our location in an area where intense drought followed by heavy rains is frequent, and more intense hurricanes. The Reserve needs to identify the predicted impacts of climate change and determine mitigation strategies from the impacts of the Coastal Bend and to subsequently relay that information to decision makers.

Keywords:

Climate change; sea level rise; invasive species; contamination

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Water Quality

Need 3

Protect key habitats: Wave, current and ship wake erosion, subsidence, sea level rise, storms, climate change, and human development have changed the landscape of the reserve. We need to examine the most vulnerable habitats that are in decline (such as oyster reefs, fresh- and saltwater marsh, rookery islands, tidal flats, seagrass beds, coastal prairie), identify their associated stressors and risks, and work to protect these habitats in sustainable ways. The Reserve needs to determine the reasons behind specific species population decline and work on strategies to protect these species from further decline, including habitat protection in key spawning, nesting, or feeding locations.

Keywords:

Habitat; Protection; development; erosion

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
Science Transfer	Climate Change

Need 4	
Biodiversity monitoring data: Changes in species composition of our natural communities is going unnoticed except in species specific research projects. The use of DNA barcoding and eDNA needs to be developed to potentially assess biodiversity of all biota within the reserve, understand trophic relationships, monitor for species range extensions driven by climate change and for invasive species. The use of bioacoustic monitoring (using recorded sound to describe a habitat's biodiversity) allows Reserves to gather baseline data and analyze changes to habitat biodiversity both geographically or temporally. Creating an ecoacoustic community of practice for the Reserve System that would develop standard monitoring protocols, gather baseline and change analysis data, would benefit Reserves system-wide as well as engage and inform community partners. *Keywords:* eDNA; sound; invasive; biodiversity	**Need Type** / **Focus Areas** Management — Climate Change; Habitat Resilience; Ecosystem Services

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services

Need 5	
SWMP and Sentinel Site data: The Reserve needs to utilize SWMP and sentinel site data to inform proposed research of benefit to our priority issues and initiatives and make these data relevant and accessible to resource managers. *Keywords:* SWMP; SET; managers;	

Need Type	Focus Areas
Management	Climate Change
	Water Quality
	Monitoring Data Synthesis

Rookery Bay Reserve, Florida

Contact: Keith Laakkonen, Reserve Manager, Keith.Laakkonen@floridadep.gov, 239-530-5942

Need 1

With climate change comes the need for adaptation AND the first step toward such is to conduct a climate change vulnerability assessment (CCVA). BUT we need to quantify the risk to resources, natural or otherwise, caused by climate change stressors (e.g., sea level rise, changes in precipitation, changing storm patterns). THEREFORE, our reserve seeks well-qualified partners to conduct this CCVA using a combination of, but not limited to, LIDAR data, habitat maps, and projected NOAA sea-level rise scenarios. With this, we can address management needs, climate change and habitat conservation planning, cultural resource protection, and storm disaster response plans. - Jay Black, Jeff Carter, Keith Laakkonen

Keywords:

Vulnerability; assessment; planning; disaster response

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience

Need 2

The degradation of blue carbon ecosystems has adverse impacts on climate change AND the restoration of these ecosystems can enhance carbon burial and help remove excess CO_2 from the atmosphere. BUT it is vital to understand the mechanisms of organic blue carbon storage and to verify its long-term stability within these ecosystems. THEREFORE, we seek partners to inventory various forms of total organic carbon within mangrove communities in differing stages of degradation and recovery. This can be expanded upon to look at the impacts of habitat change on alkaline flux, organic matter sulfurization, methane emissions, and other abiotic factors. Jay Black, Jeff Carter, Keith Laakkonen

Keywords:

Blue carbon, mangroves

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
Science Transfer	Climate Change
	Habitat Resilience

Need 3

Multiple watersheds that connect to the Rookery Bay and Ten Thousand Islands embayments have been modified via canals and control structures, affecting seasonal freshwater input to coastal vegetation and estuarine habitats AND Rookery Bay has several freshwater restoration projects currently under design and/or implementation phases, BUT it is unknown what effects these projects will have on the coastal ecosystem, including fisheries. THEREFORE, we seek partnerships that will lead to a greater understanding of the integrative impacts of freshwater management and other changes (e.g., nutrient input, sea level rise) on coastal habitat, salinity regimes, and community structure and production.

Need Type	Focus Areas
Management	Water Quality
	Monitoring Data Synthesis

Jay Black, Jeff Carter, Keith Laakkonen ***Keywords:*** Restoration; salinity; freshwater; fisheries	
Need 4 In the Gulf there is a need to successfully create new or make improvements to existing programs (e.g., communication campaigns, professional training, citizen science, K-12) that aim to increase the environmentally friendly behavior of visitors, AND we need to transfer existing behavior change research to these. THEREFORE, we need training or technical assistance on how to do so while addressing locally relevant issues. Suggested activities include an evaluation of behavior change for a new or existing program, or a framework to better understand the mechanisms of behavior change in our community with an emphasis on the inclusion of diverse audiences. Jay Black- Jeff Carter, Keith Laakkonen ***Keywords***: Behavior, citizen science, training; outreach	**Need Type** **Focus Areas** Management Water Quality Monitoring Data Synthesis
Need 5 Even though extensive habitat mapping was conducted in 2015, episodic events, resource use, and land use changes have likely altered the habitat since then AND the reserve needs new assessments of benthic habitats. BUT we want an emphasis on oyster and seagrass areas, as well as sediment transport. THEREFORE, we need partners to assess the impact of natural or human-influenced events on submerged habitat structure and function, identify and prioritize vulnerable habitats, and/or model and compare potential management solutions. Jay Black, Jeff Carter, Keith Laakkonen ***Keywords:*** Oyster; seagrass; submerged habitat; habitat mapping	**Need Type** **Focus Areas** Management Habitat Resilience

Weeks Bay Reserve, Alabama

Contact: Angela Underwood, Interim Manager/Education Coordinator, angela.underwood@dcnr.alabama.gov, 251-508-7782

Need 1

● Weeks Bay has many over-water structures on the shoreline and those structures shade benthic sediments. Benthic primary productivity has been found to be high in Weeks Bay and is presumed to contribute to high levels of secondary productivity. The link between high levels of productivity to light levels has not been determined although it is assumed to be high. Therefore, we need to know how the cumulative effects of shading impact primary and secondary productivity. This can be accomplished through experimental field study and monitoring of light attenuation and its overall effects on productivity. This knowledge would help to justify appropriate permitting for docks and encourage better designs that promote light availability.

● Weeks Bay Reserve is faced with the problem of managing a narrow but critical marsh habitat under the increasing impact of sea level rise. This need has produced a preliminary body of research that has increased our knowledge of the ecology of these critical habitats, but we need more refined projections of how changes to coastal habitat will develop. Better refined models on the small scale will inform future management of these narrow but important habitats.

● Weeks Bay Reserve and other sub-estuaries in the Mobile Bay system need design guidance and shoreline protection plans for restoration and living shorelines in relation to wave climate, sediment budgets and rising seas. In addition, we are motivated to improve community focused conservation and general stewardship. Therefore, we need research in the areas of the relative effectiveness of various popular methods of shoreline protection and green infrastructure; the resistance to adoption of more natural and sustainable methods; and ways to overcome this resistance such as incentive programs, improving the permitting process, training, and ways to improve coastal homeowner buy-in to nature-based solutions to resiliency and shoreline stabilization.

Contact: Weeks Bay NERR; Scott Phipps, scott.phipps@dcnr.alabama.gov

Keywords:

Marsh migration; living shoreline

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
Science Transfer	Climate Change
	Habitat Resilience

Need 2

Coastal ecosystems provide many natural benefits to human well-being. However, current conservation strategies in the coastal region are unable to cope with the acceleration of human-caused environmental degradation. Additionally, lack of compliance with management policies, and failure to consider the social dimensions and realities of local communities have hindered the success of conservation initiatives. Therefore, increasing engagement with social science to better understand human-nature connections and values are necessary to produce more effective integrated coastal management strategies.

Contact: Weeks Bay NERR; Scott Phipps, scott.phipps@dcnr.alabama.gov
Keywords:
Social science; community resilience

Need Type	Focus Areas
Management	Habitat Resilience
	Ecosystem Services
Science Transfer	Habitat Resilience
	Ecosystem Services

Need 3

Many coastal habitats along the northern Gulf Coast are impacted by marine debris, including abandoned and derelict vessels. This problem has been addressed in Weeks Bay through a short-term grant, from NOAA, to remove derelict vessels and other debris in 2018 and by new Abandoned and Derelict Vessel regulations passed by Alabama in 2019. There have been many economic problems associated with the new regulations' enforcement. Several solutions to address the problems have been suggested including a Vessel Turn-In Program (VTIP) and investigation into the social science behind what causes people to discard trash, debris, and to abandon vessels. Therefore, we need to determine solutions to clean up our coastal habitats and social solutions to prevent future deposition of marine debris in all its forms. This social science study would also address the willingness of coastal residents to support these efforts and to fund these efforts through taxes.

Contact: Weeks Bay NERR; Scott Phipps, scott.phipps@dcnr.alabama.gov
Keywords: Marine debris

Need Type	Focus Areas
Management	Water Quality

Need 4

● Weeks Bay Reserve uses prescribed fire for a variety of management needs including increasing ecological diversity and resilience, reduction of unwanted species in bog and marsh habitats, and for increasing the ability of marsh habitats to migrate upslope under pressure of sea level rise – as well as the reduction of the risk of wildfire in an increasingly urban habitat. We have increased our

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Water Quality

Science Transfer	Habitat Resilience	
	Water Quality	

knowledge of fire effects on habitats through interactions with other land managers, professional training, tracking vegetation response to application of prescribed fire, and collection of short-term measurements of carbon dioxide release and uptake in burned and unburned marshes on a preliminary scale. However, there are significant gaps in our knowledge of how prescribed fire affects the coastal habitats that we manage. Therefore, we need research to determine how fire intensity, periodicity and seasonality of application affect the ecology of our coastal habitats. Additionally, we need to know how prescribed fire affects the carbon and nutrient cycles in our habitats and need efficient tools and methods to educate youth and adult audiences on the benefits of prescribed fire and the dangers of wildfire in an increasingly urban environment.

● Techniques essential to restoration and management of northern Gulf of Mexico coastal habitats often includes physical clearing and/or incorporation of prescribed fires to reduce undesirable woody plant species as well as the physical removal and/or herbicidal treatment of invasive species. However, management of coastal uplands is becoming more difficult with coastal development and the impacts of climate change limiting the use of traditional restoration techniques. A potential alternative, complementary, and/or less intrusive technique to achieve similar goals may be conservation grazing, which involves using livestock to increase and/or maintain biodiversity of natural areas. Therefore, determining feasibility, best management practices, and understanding the long-term effects of conservation grazing upon habitats will allow transfer of results to regional land managers for consideration as a potential management option.

Contact: Weeks Bay NERR; Scott Phipps, scott.phipps@dcnr.alabama.gov

Keywords:

Prescribed fire; invasive species; marsh migration

Mid-Atlantic Region

Chesapeake Bay Reserve, Maryland

Contact: Robert Kyle Derby, Research Coordinator, kyle.derby@maryland.gov, 410-302-8724

Need 1

There is a need to prioritize tidal wetland restoration and conservation to enhance coastal resilience, not only at the local level, but at a regional scale as well. Research and decision-making tools are needed to inform marsh persistence and migration strategies through land acquisition, restoration, and partnership opportunities. Specifically, additional research is needed in the following areas: 1) The effects of marsh migration on both human and natural communities; 2) Strategies and research needs to inform an approach to addressing saltwater intrusion and salinization impacts in the State and Mid-Atlantic region; 3) Blue Carbon research, accounting and project feasibility in the Chesapeake Bay Region.

Keywords:
Blue Carbon, Wetland Migration, Sea Level Rise, Coastal Resilience

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality

Need 2

Environmental justice and social science considerations are critical to addressing the impacts of climate change and meeting habitat protection/restoration goals. However, there is a need to more purposefully integrate such considerations as well as diversity, equity, inclusion, and justice (DEIJ) in the work to do outreach and engagement with communities that are most affected by climate change, including communities of color and low-income communities, as well as work to engage communities in habitat migration projects

Keywords:
Community Engagement, DEIJ, Environmental Justice, Social Science

Need Type	Focus Areas
Management	Climate Change
	Ecosystem Services
	Monitoring Data Synthesis
Science Transfer	Climate Change
	Ecosystem Services
	Monitoring Data Synthesis

Need 3

The State of Maryland is prioritizing the selection and implementation of tidal wetland restoration and conservation to enhance ecological and community resilience. The Maryland Reserve has been a foundational member in developing and implementing monitoring protocols to better understand and track the benefits of these projects (including beneficial use of dredge material, living shorelines, etc), but it is unclear how

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality

monitoring data can be translated into effective tools to inform broader restoration efforts and adaptive management needs, therefore, an applied science process is needed that advances the use of existing monitoring data in site-specific adaptive management and state-wide restoration. The pathway through which the data and information moves could inform both adaptive management of resilience-specific projects and implementation of best management practices across the state.

Keywords:

Environmental Restoration, Monitoring, Beneficial Use, Adaptive Management

	Monitoring Data Synthesis
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality

Need 4

Healthy benthic habitat 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 submerged aquatic vegetation (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.

Keywords:

Submerged Aquatic Vegetation, Benthic Habitat, Fisheries, Ecosystem Services

Need Type	Focus Areas
Management	Habitat Resilience
	Ecosystem Services
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Habitat Resilience
	Ecosystem Services
	Water Quality

Chesapeake Bay Reserve, Virginia

Contact: Carl Friedrichs, Research Coordinator, Carl.Friedrichs@vims.edu, 804-684-7303

Need 1

Research that advances the identification, quantification, valuation, and socialization of ecosystem services of tidal wetlands and seagrasses (e.g., water quality, carbon sequestration, storm buffering, erosion control) under different environmental conditions and climate change scenarios is a Reserve priority. CBNERR-VA needs to expand their role in habitat restoration and monitoring of reserve properties and test new technologies and adaptive management techniques designed to mitigate current and anticipated stressors and enhance tidal wetland and seagrass resiliency (and associated ecosystem services) within the York River estuary. This information would greatly inform future management and communication strategies at the Reserve and elsewhere.

Keywords:

Wetlands; seagrass, restoration; carbon sequestration

Need Type	Focus Areas
Management	Habitat Resilience
	Ecosystem Services
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Habitat Resilience
	Ecosystem Services
	Water Quality

Need 2

Harmful algal blooms (HABs) have become more common within the York River estuary, and resulting toxins can have detrimental 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, assess toxin production dynamics and impacts, and inform strategies to counter their detrimental effects on estuarine aquatic biota and human ecologies and economies (e.g., aquaculture).

Keywords:

Algal blooms; HABs; toxins; aquaculture

Need Type	Focus Areas
Management	Climate Change
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Climate Change
	Water Quality
	Monitoring Data Synthesis

Need 3

The York River estuary suffers from chronic water quality issues driven by excessive loads of sediment, nutrients, and oxygen-consuming material resulting in intense algal blooms, low oxygen, and reduced water clarity. The ability to explain observed variability in estuarine response to watershed loads, internal cycling, episodic events, and longer-term climatic changes is somewhat limited. Therefore, syntheses of long-term meteorological, water quality, physical, and biological datasets that provide greater understanding and predictability of estuarine response in the York and other water bodies to multi-factor drivers through the development of empirical (data-driven) models and verification of theory-based

Need Type	Focus Areas
Management	Climate Change
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Climate Change
	Water Quality
	Monitoring Data Synthesis

models is a priority.

Keywords:

Nutrients; sediments; oxygen; water clarity

Need 4

Having initiated elements of a diamondback terrapin management plan, CBNERR-VA is motivated to support conservation and protection efforts for additional target species or groups, especially marsh birds (waterfowl, wading birds, secretive marsh birds, and colonial waterbirds). Limited information is available regarding abundance, distribution, and population trends for most marsh bird species at CBNERR-VA components, as well as the potential role of community science programs in these assessments. This information would help CBNERR-VA understand what management actions might need to be taken to protect critical spawning, nesting, and nursery habitat for marsh birds and build important partnerships for long-term monitoring efforts.

Keywords:

Conservation; marsh birds; community science; resource management

Need Type	Focus Areas
Management	Habitat Resilience
	Ecosystem Services
Science Transfer	Habitat Resilience
	Ecosystem Services

Need 5

Human dimensions projects will allow CBNERR-VA to better understand how existing programs and interpretation in coastal Virginia result in participant knowledge, attitudinal, and behavioral change, particularly in increasing stewardship. Programs and interpretation include: classroom and field experiences, professional trainings and workshops, community engagement, community science, signage, and formal K-12 programs for teachers and students. Suggested projects include: 1) program evaluations and behavior change assessments; 2) frameworks to better understand the mechanisms of behavior change and programming impact in our focal area; and 3) social science/educational research projects exploring coupled human and natural systems. Emphasis on underrepresented audiences is welcomed.

Keywords:

Community; conservation; behavior change; human dimensions

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality
	Monitoring Data Synthesis

Delaware Reserve, Delaware

Contact: Christina Whiteman, Stewardship Coordinator, Christina.Whiteman@delaware.gov, 302-739-6377

Need 1

Marsh and coastal habitats are changing in response to climate change and local sea level rise. While the National Estuarine Research Reserve System implements a robust monitoring program to track vegetation and elevation change, current the monitoring program lacks information on changes in both land and marine animal composition. Therefore, the addition of bioacoustic research (using recorded sound to describe a habitat's biodiversity) would allow research and stewardship sectors to analyze changes to species biodiversity and engage and inform community partners about faunal composition changes in local habitats.

Keywords:

Bioacoustics; biodiversity; faunal changes

Need Type	Focus Areas
Management	Habitat Resilience

Need 2

The DNERR 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. Therefore, this information would help the DNERR and other land managers understand what actions can be taken to assist with marsh bird and wetland habitat conservation and protection.

Keywords:

Marsh birds; population decline; conservation

Need Type	Focus Areas
Management	Habitat Resilience

Need 3

The Delaware NERR is interested in projects that would benefit the understanding and management of Delmarva Bays within the boundaries of the Reserve. We are particularity interested in, but not limited to, the following:
• Historical analysis of a parcel that has been identified to have Delmarva Bays
• Ecological processes to understand hydrology, vegetation, wildlife or other biotic and abiotic features that contribute to ecosystem function
• Assessing the need for restoration and developing best management practices for the stewardship of Delmarva Bays within the DNERR.

Keywords:

Need Type	Focus Areas
Management	Habitat Resilience

Vernal pool; analysis; forested wetlands	
Need 4	
The Delaware NERR hosts hundreds of visitors each year that are engaging in research, education, and recreation onsite but lacks the capacity to quantitively assess the effectiveness and accessibility of Reserve resources. Therefore, we are particularly interested in projects that would: • Perform an ecosystem services valuation of the Reserve's habitats. • Lead to a better understanding of the linkages between ecosystem services and our local community well-being and values (socio-economic data). • Conduct discrete social science studies such as visitor/resource use and behavior, local economic impact of visitors, community relations, etc. *Keywords:* Valuation; community; visitor use; accessibility	**Need Type**: Management **Focus Areas**: Ecosystem Services
Need 5	
We are seeking research to better understand how using virtual reality in educational programs could result in human behavior change or to develop novel education methods to increase conservation behavior in program participants. These programs include visitor interactions in the classroom or field, professional trainings and workshops, facilitation of working groups, citizen science to assist with habitat and wildlife management actions, and K12 formal programs. Suggested activities include an evaluation of behavior change for a new or existing program, or a framework to better understand the mechanisms of behavior change in our community. We welcome an emphasis on the inclusion of diverse audiences. *Keywords:* Virtual reality; conservation; education	**Need Type**: Management **Focus Areas**: Ecosystem Services

Hudson River Reserve, New York

Contact: Sarah Fernald, Reserve Manager, sarah.fernald@dec.ny.gov, 845-889-4745 x111

Need 1

The Hudson River NERR 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 about climate or how successfully we are reaching environmental justice communities of color, low-income families, or member of the LGBTQ+ community. THEREFORE, we are interested in an analysis of the exchange of information with marginalized groups to inform how to improve this outreach so that Hudson Valley environmental justice communities are informed and enabled to withstand climate change stressors.

Keywords:

Outreach; climate; marginalized groups; environmental justice

Need Type	Focus Areas
Management	Climate Change

Need 2

Submerged aquatic vegetation (SAV) in the Hudson River Estuary plummeted by ~64% after two powerful storms scoured the riverbed in 2011, AND we know SAV is important for the maintenance of ecosystem functioning and services. More than a decade has passed, BUT GIS and on-the-ground monitoring continues to show that some areas are still unvegetated or support SAV beds with low genetic diversity. THEREFORE, SAV restoration techniques that are feasible and effective within the environmental conditions of the Hudson need to be evaluated. Research is needed on transplanting local SAV and planting Hudson-specific genotypes of *Vallisneria americana*.

Keywords:

Submerged aquatic vegetation; *Vallisneria americana*; restoration

Need Type	Focus Areas
Management	Habitat Resilience

Need 3

Submerged aquatic vegetation (SAV) in the Hudson River Estuary plummeted by ~64% after two powerful storms scoured the riverbed in 2011, AND we know SAV is important for the maintenance of ecosystem functioning and services. More than a decade has passed, BUT GIS and on-the-ground monitoring continues to show that some areas are still unvegetated or support SAV beds with low genetic diversity. THEREFORE, SAV restoration techniques that are feasible and effective within the environmental conditions of the Hudson need to be evaluated. Research is needed on transplanting local SAV

Need Type	Focus Areas
Science Transfer	Habitat Resilience

and planting Hudson-specific genotypes of *Vallisneria americana.* ***Keywords:*** Submerged aquatic vegetation; *Vallisneria americana*; restoration	
Need 4 The Hudson River salt front is expected to move upstream with sea level rise, AND seven municipalities in the present-day tidal freshwater zone draw their drinking water from the Hudson River. A shifting salt front would impact drinking water supplies, and also impact freshwater tidal habitats and the endangered fish that spawn in these habitats, BUT we do not know the extent or timeframe for these impacts. THEREFORE, we want to leverage our SWMP data and local water quality stations along the present-day salt front to model the impact of sea level rise to the Hudson salt front. ***Keywords***: Salt front; drinking water; freshwater tidal habitats; SWMP data	**Need Type** / **Focus Areas** Management / Monitoring Data Synthesis
Need 5 The Hudson River salt front is expected to move upstream with sea level rise, AND seven municipalities in the present-day tidal freshwater zone draw their drinking water from the Hudson River. A shifting salt front would impact drinking water supplies, and also impact freshwater tidal habitats and the endangered fish that spawn in these habitats, BUT we do not know the extent or timeframe for these impacts. THEREFORE, we want to leverage our SWMP data and local water quality stations along the present-day salt front to model the impact of sea level rise to the Hudson salt front. ***Keywords***: Salt front; drinking water; freshwater tidal habitats; SWMP data	**Need Type** / **Focus Areas** Science Transfer / Monitoring Data Synthesis

Jacques Cousteau Reserve, New Jersey

Contact: Lisa Auermuller, Reserve Assistant Manager, Auermull@marine.rutgers.edu, 609-249-8820

Need 1

Marsh and coastal habitats are changing in response to climate change and local sea level rise and the National Estuarine Research Reserve System implements a robust monitoring program to track vegetation and elevation change, but, the monitoring program lacks information on changes in both land and marine animal composition. Therefore, the addition of bioacoustic research (using recorded sound, including hydrophones to describe a habitat's biodiversity) would allow research and stewardship sectors to analyze changes to species biodiversity and engage and inform community partners about faunal composition changes in local habitats. (Contact: Mike De Luca, Manager)

Keywords:

Bioacoustics; animal composition; species biodiversity

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Monitoring Data Synthesis
Science Transfer	Climate Change
	Habitat Resilience
	Monitoring Data Synthesis

Need 2

Tidal wetlands and other estuarine ecosystems are threatened with increasing rates of loss due to sea level rise and more intense coastal storms and our reserve supports statewide efforts to increase resilience through nature-based solutions including living shorelines and beneficial use of dredged sediment, but knowledge gaps about the implementation and efficacy of these techniques limits their widespread use. Therefore, our reserve and coastal management partners need research that tests hypotheses to address knowledge gaps and better understand processes to develop standards and best practices for nature-based solutions to increase the resilience of tidal wetlands. (Contact: Mike De Luca, Manager)

Keywords:

Nature-based solutions; living shorelines; beneficial use; resilience

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services

Need 3

Water and habitat quality of the pristine Mullica River-Great Bay Estuary are excellent, but periodic upwelling, ocean acidification and saltwater intrusion, and increased precipitation and storms are changing estuary dynamics. Therefore, science-based information and predictive models are needed by the coastal management community to determine how and how fast this environment is changing. Research on and modeling of changing ecosystem dynamics and range shifts in habitats and species will help coastal managers inform future management of coastal ecosystems and communities. (Contact: Mike De Luca, Manager)

Keywords:

Predictive models; ecosystem dynamics; water quality; habitat quality

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Climate Change
	Habitat Resilience
	Water Quality
	Monitoring Data Synthesis

Need 4

New Jersey's coastal decision-makers have been provided with data, tools, and technical assistance to increase the resilience of built and natural communities to climate change and have used these resources to support resilience planning and actions, but the impact of these efforts on overall coastal community resilience has not been evaluated. Therefore, our reserve and coastal management partners need research to assess the effectiveness of resilience efforts, including the establishment of resilience metrics, to inform the delivery of future data, tools, and technical assistance to coastal communities. (Contact: Mike De Luca, Manager)

Keywords:

Community resilience; technical assistance; evaluation; resilience metrics

Need Type	Focus Areas
Management	Climate Change
Science Transfer	Climate Change

Need 5

Human dimensions interwoven throughout all Reserve projects, programs, and operations, but little is known (or has been recorded) about the local community: about how and why people value a Place and its natural resources, what benefits people seek and derive from those Places and resources, and how people affect and are affected by those Places, resources, and their management. Therefore, social science research is needed to understand the dynamics of the reciprocal relationship between humans and nature to inform and improve environmental policy, practice, and outcomes within the JC NERR. (Contact: Mike De Luca, Manager)

Keywords:

Human dimensions; values; social science

Need Type	Focus Areas
Management	Climate Change
	Ecosystem Services
Science Transfer	Climate Change
	Ecosystem Services

Northeast Region

Connecticut Reserve, Connecticut

Contact: Jamie Vaudrey, Research Coordinator, jamie.vaudrey@uconn.edu, 860-405-9140

Need 1

Estuarine habitats and coastal communities are threatened by climate change. Distressed municipalities are often disproportionately impacted by these effects, with 44% of Connecticut's environmental justice communities located within the Reserve watershed. Nature-based infrastructure is promoted as a method of increasing community resilience to climate change, but the ecosystem services provided and the impact on local communities is largely under-assessed at the local level. Therefore, our reserve partners need more research on the ecological and socio-economic efficacy of these mitigation strategies, as well as social science research to better understand the barriers to adopting these nature-based strategies.

Keywords:

Environmental justice; Green infrastructure; Stormwater

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality

Need 2

Coastal blue carbon is a potentially valuable pathway towards achieving goals at reducing greenhouse gases in our atmosphere. Recommendations from Connecticut's Governors Council on Climate Change included preserving and restoring forests and coastal wetlands as a tool for achieving the targeted 45% reduction in greenhouse gases by 2030. But relatively few habitats within Connecticut have been assessed for carbon storage capacity. Therefore, research and monitoring assessing the boundaries, typology, and carbon sequestration capacity in these habitats is critical to evaluating preservation priorities, assessing the contribution of these habitats to the state goal, and setting restoration targets within the reserve area.

Keywords:

Blue carbon; Economic valuation; Biogeochemical processes; Living shoreline

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services

Need 3

Continuing attention to water quality is necessary to support habitat integrity in an era where climate change can act synergistically with nutrient pollution to impair water quality. Recent nitrogen loading estimates, high resolution land-use mapping, and planned modeling of embayments advance the information available to inform

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience

decision makers and the public. But habitat assessments related to water quality within the reserve boundaries are intermittent or lacking. Therefore, a broadscale assessment of water quality within the reserve's fresh- and saltwater environments is necessary to make the link between loading and land-use data and expressions of eutrophication in the estuary.

Keywords:

Nutrient load mitigation strategies; Macroalgal and microalgal harmful algal blooms; Hypoxia

	Ecosystem Services
	Water Quality
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality

Need 4

Stewardship of endangered species, other species of conservation concern, and critical terrestrial and aquatic habitats, maintaining habitat connectivity, and supporting decisions that consider the carrying capacity of the ecosystem are identified as priorities in Connecticut. However, our partners note a need for applied research and demonstration projects into sea level rise impacts on natural and built infrastructure and the role techniques such as living shorelines or thin-layer placement in marshes may play in mitigating climate-related impacts. Therefore, the CT NERR will establish itself as a site where restoration practices can be tested and applied broadly to other coastal areas.

Keywords:

Habitat restoration; Eelgrass restoration and assisted migration; Marsh resilience; Invasive species interactions

Need Type	**Focus Areas**
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality

Great Bay Reserve, New Hampshire
Contact: Cory Riley, Reserve Manager, Cory.A.Riley@wildlife.nh.gov, 603 868 1095

Need 1

Further research is needed to advance the science and management around the impacts and future threats of climate change on Great Bay's key species and habitats. In a rapidly changing climate, the Estuary is experiencing shifts in physical and chemical conditions that impact the biota and their associated ecosystem functions. The Reserve is interested in understanding and connecting these trends and potential future impacts to natural resource management decisions in New Hampshire.

Keywords:

Climate change; ecosystem function; habitat

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services

Need 2

Greater science is needed around the impact and interaction of anthropogenic stressors (nutrients, disease, emerging contaminants, sedimentation) on water quality and biota in Great Bay to inform how to manage permitted and unpermitted pollutants. Water quality is of high interest to local regulators, communities, and individuals concerned about human and ecosystem health, and municipal spending. The Reserve and its partners work to track and understand trends which inform point and non-point pollution management, however, further research is necessary to understand the impacts of pollutants on human and biological communities and to increase the effectiveness of water quality management approaches.

Keywords:

Pollution; nitrogen; contaminants; water quality

Need Type	Focus Areas
Management	Water Quality
Science Transfer	Water Quality

Need 3

Key sub- and intertidal estuarine habitats (e.g., saltmarsh, eelgrass, oysters beds) in Great Bay are under direct and indirect human pressure prompting managers including the Reserve to support restoration and protection efforts. However, current and past efforts on restoring and protecting these habitats have had variable success. Therefore, we need research and innovative techniques that advance our understanding of stressors, identify and prioritize suitable sites, and evaluate management options aimed at improving the long-term health of critical habitats.

Keywords:

Restoration; oysters; eelgrass; saltmarsh

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services

Need 4

Data analysis for long-term monitoring often stagnates at collection. Therefore, our Reserve would benefit from additional visualization and analysis tools of our long-term monitoring data and national products that advance our understanding of environmental impacts to our estuaries by contributing to newer science and enhanced communication products, as well as tools that facilitate or conduct multi-reserve research at larger regional or national scales. The NERR system collects a suite of water quality, organismal and habitat parameters to track, forecast and better understand coastal impacts to human and natural communities.

Keywords:

Data analysis; data visualization; forecasting

Need Type	Focus Areas
Management	Monitoring Data Synthesis
Science Transfer	Monitoring Data Synthesis

Need 5

The impacts of climate change affect shoreline stability and the way people manage their land and yards. There is a program to provide assistance to landowner's experiencing shoreline erosion and flooding, and other programs to encourage sustainable lawn care practices, stormwater management, and wildlife friendly gardening, but these programs have limited reach, they offer advice about just one issue, and they don't engage land care professionals. Therefore, Great Bay Reserve and its partners are seeking new ways to integrate messages, recommendations, and programs to further engage professionals and residents about steps they can take at home to increase their own resilience and minimize their ecological impact on Great Bay.

Keywords:

Outreach; private landowner engagement; climate; pollution; wildlife

Need Type	Focus Areas
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality

Narragansett Bay Reserve, Rhode Island

Contact: Caitlin Chaffee, Reserve Manager, caitlin.chaffee@dem.ri.gov, 401-683-7365

Need 1

Sea level rise and other climate change stressors such as changes in precipitation, temperature, interspecific competition, and phenology are negatively impacting habitats and threatening coastal communities in Narragansett Bay and its watershed. Coastal decision-makers need information to help them prioritize locations and approaches for preserving these habitats such as:
- The impacts of climate change on coastal and estuarine habitats and communities.
- The costs and methodologies of different adaptation approaches, and their efficacy in improving resilience of habitats and communities.
- The social and economic barriers (and opportunities) to sound decision-making related to climate change adaptation and increased community resilience.

Keywords:

Climate change; resilience; habitat; community

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
Science Transfer	Climate Change
	Habitat Resilience

Need 2

The value (monetary or non-monetary) that humans place on natural resources and processes can influence management strategies and build a case for investment in natural systems. To advance this concept, coastal decision makers and conservation practitioners need a better understanding of:
-The value placed on ecosystem services such as carbon sequestration, storm buffering, wildlife habitat, recreation, and cultural identity of various coastal and estuarine habitats, particularly salt marshes.
-How ecosystem services valuation studies may support protection and restoration efforts.
-If/how increased awareness and understanding of ecosystem services results in behavior change, and what frameworks could be used to understand behavior and to design behavior change programs.

Keywords:

Ecosystem services; behavior change; management

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
Science Transfer	Habitat Resilience
	Ecosystem Services

Need 3

Restoration and adaptation projects have taken place in a variety of habitats within the Reserve and throughout the Narragansett Bay Region, but there is limited information on the results of these interventions. NBNERR has historically played a role in restoration project monitoring; however, restoration practitioners and coastal decision makers need a better understanding of:
- The effects of climate change stressors on upland to subtidal coastal habitats, and how habitat functions and values change as a result of restoration / adaptation projects.
- Which techniques are the most effective at increasing habitat resilience to climate change stressors, and what lessons learned from implemented projects can be shared with practitioners to increase the likelihood of success of future projects.
- How wildlife use of habitats varies by condition and vulnerability to climate change, and effects of adaptation projects on wildlife community structure and function.

Keywords:

Habitat; resilience; wildlife; restoration

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
Science Transfer	Climate Change
	Habitat Resilience

Need 4

Stormwater continues to be a key issue throughout the Narragansett Bay region. Increased storm intensity due to climate change along with high percentages of impervious cover in many communities are driving the need for additional tools to help mitigate its negative effects on coastal habitats and communities. Coastal decision makers need information to help them assess:
- The barriers to the implementation of best management practices, particularly low impact development and green infrastructure.
- The efficacy of education and engagement strategies to advance the adoption of stormwater best management practices, particularly at the local level.

Keywords:

Stormwater; water quality; management; BMPs

Need Type	Focus Areas
Management	Ecosystem Services
Science Transfer	Ecosystem Services

Need 5

The Reserve has led the establishment of the salt marsh sentinel monitoring and national metrics. However, there is a need to further develop and refine user-based products from the SWMP and sentinel sites programs as well as other Reserve monitoring efforts. We need to better understand end user needs related to information, products, and tools needed to inform efforts to increase habitat and community resilience to the impacts of climate change.

There is also a need to further analyze water quality and other long-term datasets collected at the Reserve and in Narragansett Bay to determine trends and patterns. While there are various reports and data summaries for some datasets, there has been little long-term data analysis to show changes over time. This type of analysis would help to identify impacts of climate change and other stressors and inform coastal management decision making.

Keywords:

Monitoring; trends analysis; management; SWMP

Need Type	Focus Areas
Management	Water Quality
	Monitoring Data Synthesis
Science Transfer	Water Quality
	Monitoring Data Synthesis

Waquoit Bay Reserve, Massachusetts

Contact: Tonna-Marie Rogers, Reserve Manager, tonna-marie.surgeon-rogers@mass.gov, 860-280-1864

Need 1

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 invite research that examines the effects of changes in freshwater inputs and other factors on salinity and flow regimes, as well as the impact of climate and other drivers on nutrient management models. This information will be useful for informing restoration and remediation efforts within Waquoit Bay and the surrounding watershed. We also seek research and transfer projects that focus on utilizing and analyzing monitoring data such as data from the Reserve's System-Wide Monitoring Bay Program (SWMP) to deliver information that can be applied in resource management.

Contact: Megan Tyrrell, Research Coordinator, megan.tyrrell@mass.gov; 857-378-1858

Keywords:
Climate impacts; freshwater inputs; nutrient management; monitoring data

Need Type	Focus Areas
Management	Climate Change
Science Transfer	Climate Change

Need 2

As coastal ecosystems become increasingly stressed the need for restoration to bring back healthy functions and essential ecosystem services has never been greater. Many restoration projects that the Reserve and other partners have been involved in have been successful in achieving discrete habitat or species goals. But there is incomplete understanding of how these types of projects affect larger ecosystem processes and functions. We seek research projects to further explore the impacts of restoration projects on biogeochemical processes (e.g. on carbon or nitrogen cycling) and other ecosystem functions in a watershed setting, to help guide resource management decisions and increase restoration success.

Contact: Megan Tyrrell, Research Coordinator, megan.tyrrell@mass.gov; 857-378-1858

Keywords:
Restoration; ecosystem services; biogeochemical processes; management

Need Type	Focus Areas
Management	Habitat Resilience
	Ecosystem Services
Science Transfer	Habitat Resilience
	Ecosystem Services

Need 3

Addressing pollution from excess nutrients and contaminants of emerging concern is a pressing management issue for many communities. Managers have prioritized the need for research-based information on the efficacy of watershed and embayment solutions including 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 on effective policy, regulatory, financing and community engagement approaches to guide adaptive management, as well as on socioeconomic factors that affect public acceptance and implementation of solutions.

Many coastal communities are providing aquaculture leases for animals and macroalgae to improve water quality and simultaneously provide economic opportunities for growers. The dual benefits of providing economic opportunities through locally grown food and improving coastal conditions is appealing but there are many uncertainties regarding anthropogenically induced environmental conditions and sustaining cultured species through vulnerable life history stages. Therefore, we need more research examining growth and survival under coastal acidification, eutrophication, increased temperatures, and potentially stressful oxygen and salinity conditions in our nearshore waters.

Keywords:
Nutrient pollution; water quality; solutions; aquaculture

Need Type	Focus Areas
Management	Water Quality
Science Transfer	Water Quality

Need 4

Many municipalities are dealing with intensifying impacts from coastal hazards. State and local officials have been supporting efforts to strengthen community and habitat resilience and the Reserve has been working with partners to educate and equip stakeholders to take action to reduce vulnerability. But decision-makers need information on where and how nature-based solutions and information and tools focused on enhancing resilience can best be applied to reduce risk, strengthen shorelines, and protect people, property, and ecosystems. Promoting adoption of best management practices and identifying better ways to communicate about risks and involve the whole community in planning and implementation are also needed. The Reserve is also interested in researching and using effective social science methods to engage

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
Science Transfer	Climate Change
	Habitat Resilience

diverse stakeholder groups and better reach under-served and traditionally under-represented audiences.

Keywords:

Coastal hazards; habitat resilience; best management practices; risk reduction

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Need 5

Rising sea levels are threatening salt marshes across New England. Locally we are observing impacts such as increase in the size of pools and declining abundance of vulnerable species in marshes within the Reserve and elsewhere. Research is needed to help managers better understand and respond to changes occurring in marsh environments, as well as identify effective management strategies to enhance marsh resilience and protect and restore ecosystem services. We also invite research on adaptation strategies such as facilitated migration as well as studies that demonstrate the value of salt marshes and assess true costs if marsh ecosystem services (e.g. blue carbon) are lost or impacted.

Contact: Megan Tyrrell, Research Coordinator, megan.tyrrell@mass.gov; 857-378-1858

Keywords:

Sea level rise, marsh resilience, ecosystem services, adaptation

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
	Monitoring Data Synthesis
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services
	Monitoring Data Synthesis

Wells Reserve, Maine

Contact: Jason Goldstein, Research Coordinator, jgoldstein2@wellsnerr.org, 207-646-1555 x139

Need 1

Non-native species interactions: Anthropogenic and climate-mediated processes are driving shifts in the distribution of invasive and range-expanding species (e.g., crabs), 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 and methods to advance ongoing and future research and monitoring programs that detect and expand our understanding of non-native species and their impacts on native population dynamics and interactions with important local fisheries.

Keywords:

Biophysical modeling; invasive species; anthropogenic impacts, bioacoustic telemetry, eDNA

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services

Need 2

Sentinel organisms and coastal habitats: Our Nation's estuaries provide 'early alert' indicators about the effects of climate change and the mechanisms of environmental change. However, there is limited fine resolution data to assess the impacts of these changes on coastal habitats, including marshes and the organisms that reside there, and the social and economic impacts of these changes on coastal communities Therefore, we wish to expand our understanding of the responses and changes to sentinel salt marshes and estuarine species and how the economic and social consequences of these changes can be addressed to improve coastal management.

Keywords:

Climate change; coastal resilience; social, economic, and behavioral impacts; biosensors

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services

Need 3

Climate risk: Current NERRS research and sentinel site programs document tidal marsh condition and responses to environmental change but the methods and findings documenting marsh health (e.g., vegetation communities) and change (e.g., sea level rise) are not always useful to decision makers because they are not connected to the ecosystem services recognized as valuable by decision-makers. Therefore, research is needed to identify, communicate and, where possible, quantify the ecosystem services

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
Science Transfer	Climate Change
	Habitat Resilience

provided by tidal marshes to support decision making about tradeoffs for conservation, nature-based solutions, restoration, and planned relocation of human and natural infrastructure.

Keywords:

Ecosystem service approach; sentinel site, data science; estuarine and marsh restoration and protection

| | Ecosystem Services |

Need 4

Coastal and ocean acidification (COA): Coastal acidification is a growing concern in estuarine waters, and we recently embarked on a regional monitoring initiative with to better understand the potential vulnerabilities coastal resources are facing due to changing marine carbonate chemistry; but standardized approaches to monitoring and communicating the importance of carbonate chemistry and the resulting critical datasets are lacking for our region. Therefore, we seek to expand our coastal monitoring to include additional measures of carbonate chemistry, while working with local and regional partners, to provide a more focused and standardized approach to COA monitoring that links directly with decision making for management and mitigation.

Keywords:

Land use change; eutrophication; contamination; water chemistry; nutrients

Need Type	Focus Areas
Management	Climate Change
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Climate Change
	Water Quality
	Monitoring Data Synthesis

Need 5

Climate adaptation: Research to understand the social and policy challenges of climate adaptation strategies impacting tidal wetlands, coastal carbon sequestration and marsh migration pathways to develop methods for engaging communities in dialogues to build resilience and to foster adoption and evaluation of nature-based solutions including conservation, living shoreline approaches and beach replenishment strategies.

Keywords:

Habitat resilience; restoration science; living shorelines

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services

Southeast Region

ACE Basin Reserve, South Carolina

Contact: Julie Binz, Reserve Manager, binzj@dnr.sc.gov, 843-729-0995

Need 1

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 in the ACE Basin to assess these changes. Therefore, we need to learn from organizations that have led the way on this topic to better understand how salt marshes, our dominant ecosystem, will change and then develop potential adaptation or mitigation strategies. Denise Sanger, sangerd@dnr.sc.gov

Keywords:
Sea level rise; adaptation strategies; climate change; salt marsh

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Monitoring Data Synthesis
Science Transfer	Climate Change
	Habitat Resilience
	Monitoring Data Synthesis

Need 2

The metropolitan areas of Charleston and Beaufort surrounding the ACE Basin continue to develop and cause water quality impacts. Awareness of the collective impact on the health of our coastal waterways and of solutions that will have a positive effect on water quality has spread, but there are still barriers that prevent implementation of best practices for improvement. Therefore, we need to remove identified barriers to action by providing up-to-date tools, and research-based case studies and design best practices, to minimize stormwater impacts to the ACE Basin estuary. Abi Locatis Prochaska prochaskaa@dnr.sc.gov

Keywords:
Stormwater; water quality; best practices; barriers

Need Type	Focus Areas
Management	Habitat Resilience
	Ecosystem Services
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Habitat Resilience
	Ecosystem Services
	Water Quality
	Monitoring Data Synthesis

Need 3

Many projects have researched different factors of salt marsh health, but these analyses have not been synthesized. Therefore, integration and syntheses of different parameters of marsh health such as vegetation diversity, sediment transport, erosion rates, and oyster reef health need to be analyzed on a reserve-wide scale to plan for and prioritize restoration projects. Denise Sanger, sangerd@dnr.sc.gov

Keywords:
Salt marsh health; synthesis; restoration; habitat

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
Science Transfer	Climate Change
	Habitat Resilience

resilience	
Need 4 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. Denise Sanger, sangerd@dnr.sc.gov ***Keywords***: Data synthesis; water quality; integrated assessment; modeling	

Need Type	Focus Areas
Management	Climate Change
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Climate Change
	Water Quality
	Monitoring Data Synthesis

Guana Tolomato Matanzas Reserve, Florida
Contact: Lia Sansom, Reserve Manager, lia.sansom@floridadep.gov, 904-380-8602

Need 1

The Guana peninsula includes coastal upland habitats and a 27-acre freshwater marsh between the Guana and Tolomato rivers. Current management by GTMNERR is focused on visitor use, biodiversity monitoring, hydrologic connectivity, invasive species removal, and prescribed fire. However, climate change is expected to increase lateral and groundwater saltwater intrusion and modeling efforts have predicted that the peninsula could be a rare opportunity for salt marsh migration. Therefore, a science-based plan is needed to adaptively manage this area with respect to human uses, biodiversity, and climate change. (Contact: Nikki Dix, Nikki.Dix@FloridaDEP.gov)

Keywords:

Groundwater; Saltwater; Intrusion; Migration

Need Type	Focus Areas
Management	Habitat Resilience

Need 2

Evidence from long-term monitoring at six sites in GTMNERR has indicated that most coastal wetlands are not gaining elevation sufficiently to keep pace with sea level rise but sediment dynamics in the barrier island estuary are unknown. Therefore, studies are needed that characterize spatiotemporal sediment accretion and erosion patterns to inform decisions by local restoration practitioners and permitters about suitable approaches for wetland conservation. (Contact: Nikki Dix, Nikki.Dix@FloridaDEP.gov)

Keywords:

Sediment; Elevation; Restoration; Barrier Island

Need Type	Focus Areas
Management	Habitat Resilience

North Carolina Reserve, North Carolina

Contact: Rebecca Ellin, Reserve Manager, rebecca.ellin@ncdenr.gov, 252-838-0880

Need 1

Sediment dynamics are poorly understood in estuarine ecosystems, but have important consequences on their function. The North Carolina NERR seeks research partnerships that provide information on sediment dynamics regarding the vulnerability of ocean beach and marsh habitats at the Masonboro Island Reserve and opportunities to enhance resilience via sand placement. Contact: Whitney Jenkins (whitney.jenkins@ncdenr.gov)

Keywords:

Sediment dynamics; vulnerability; resilience

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
Science Transfer	Climate Change
	Habitat Resilience

Need 2

As part of the NERRS System-wide Monitoring Program, the North Carolina NERR mapped its upland and intertidal habitats using standardized protocols AND mapping benthic habitats is an identified need. Work is underway to identify an effective methodology to map oyster habitat, BUT we do not know the trade-offs of different mapping technologies, mapping frequencies, and approaches to measure change in other benthic habitats. THEREFORE we need to develop best practices for non-oyster benthic habitat mapping and assessing change to inform NERRS protocols and habitat management actions for the North Carolina NERR. Contact: Whitney Jenkins (whitney.jenkins@ncdenr.gov)

Keywords:

Habitat mapping; benthic; methods

Need Type	Focus Areas
Management	Habitat Resilience
	Monitoring Data Synthesis
Science Transfer	Habitat Resilience
	Monitoring Data Synthesis

Need 3

The North Carolina NERR identified sedimentation and degraded water quality as stressors for the Zeke's Island Reserve in its 2020-2025 management plan, BUT the causes for changes at the site are not well understood AND this information is needed to inform restoration planning to improve habitat integrity and resilience. THEREFORE, the North Carolina NERR seeks research partnerships to understand water quality trends and other contributing factors that may be influencing changes in water depth and water quality at the Zeke's Island Reserve, including ecosystem metabolism, episodes of hypoxia, and algal mat growth, using System-wide Monitoring Program and other relevant data. Contact: Whitney Jenkins (whitney.jenkins@ncdenr.gov)

Keywords:

Need Type	Focus Areas
Management	Water Quality
	Monitoring Data Synthesis
Science Transfer	Water Quality
	Monitoring Data Synthesis

Water quality; System-wide Monitoring Program	

North Inlet – Winyah Bay Reserve, South Carolina

Contact: Erik M Smith, Reserve Manager, erik@baruch.sc.edu, 843-904-9035

Need 1

Saltmarshes are highly productive ecosystems that provide numerous ecosystem services and studies indicate that marshes are experiencing a variety of changes as a result of sea level rise, warming temperatures and increasing urbanization. Relatively little information exists, however, regarding the specific vulnerabilities of South Carolina's coastal marshes. Therefore, we need to better understand interacting effects of biotic and abiotic factors leading to changes in saltmarsh ecosystem services and to develop potential adaptation and mitigation strategies in light of these changes.

Keywords:

Marsh; vulnerability; sea level rise

Need Type	Focus Areas
Management	Climate Change
Science Transfer	Climate Change

Need 2

Provision of natural resources is a key ecosystem service provided by coastal habitats and growing human populations along the coastlines of the southeast 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 NERRs regionally and nationally.

Keywords:

Natural resources; ecosystem-based management; human dimensions

Need Type	Focus Areas
Management	Ecosystem Services
Science Transfer	Ecosystem Services

Need 3

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 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

Need Type	Focus Areas
Management	Water Quality
Science Transfer	Water Quality

pollutants is needed to better inform effective management of non-point source pollution.

Keywords:

Urbanization; stormwater; best management practices

Need 4

Various coastal habitats, such as marshes and oyster reefs, have the potential to enhance resilience of human and ecological communities to climate change. Providing these benefits could require the preservation, restoration, or creation of such habitats. However, more research is needed to improve understanding of how biotic and abiotic ecosystem components influence the effectiveness of these techniques, and to evaluate the efficacy of new monitoring techniques (e.g., comparative assessments of eDNA, bioacoustics, stable isotopes or others along with traditional monitoring approaches). An assessment of potential opportunities for integration of nature-based techniques in local development is also needed.

Keywords:

Marsh; oyster reef; restoration; monitoring techniques

Need Type	Focus Areas
Management	Habitat Resilience
Science Transfer	Habitat Resilience

Need 5

Numerous stressors, including climate change, eutrophication, and overfishing, among others, are expected to impact coastal zones, including in South Carolina. Understanding and communicating drivers of short- term variability and long-term change in coastal ecosystem conditions across spatial scales, is essential for effective coastal management. In particular, 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 that could be used to better understand how interacting stressors within estuaries affect the dynamics of coastal habitats and biota, as well as inform habitat assessment tools.

Keywords:

Data synthesis; integrated assessments; interacting effects

Need Type	Focus Areas
Management	Monitoring Data Synthesis
Science Transfer	Monitoring Data Synthesis

Sapelo Island Reserve, Georgia
Contact: Doug Samson, Reserve Manager, doug.samson@dnr.ga.gov, 912-485-2251

Need 1

Long-term data indicate that average air and water temperatures on Sapelo Island have increased significantly over time, AND that the rate of sea level rise has increased over the last twenty years AND these increases are impacting estuarine/coastal species, estuarine productivity, and the health of estuarine ecosystems. THEREFORE, we need quantification and characterization of the impacts of climate change to these natural resources. Also, because there are underserved and vulnerable human communities in McIntosh County, BUT studies of impacts to such communities have not been completed, THEREFORE we need research into the social impacts and implications of climate change and sea level rise.

Keywords:

Impacts; natural resources; coastal communities

Need Type	Focus Areas
Management	Climate Change

Need 2

The private community on Sapelo 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. THEREFORE, we need social science research to better understand these complex interacting factors to help enhance the resilience of the community and of the multiple State agencies and institutions on the island.

Keywords:

Local community; flooding; resilience

Need Type	Focus Areas
Management	Water Quality

Need 3

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 and nuisance flooding, some of these ditches may be facilitating the flow of tidal waters into upland natural habitats and the private residential community on Sapelo, the latter differentially affecting traditional Geechee residents and properties. BUT we don't know which ditches are having or may have the most significant impact on upland areas. THEREFORE, we need research on patterns of altered hydrology on the island and how flooding impacts to both natural and human communities might best be mitigated.

Need Type	Focus Areas
Management	Habitat Resilience

Keywords: Ditching; hydrology; community impacts	
Need 4 Climate change is likely altering estuarine nekton habitat and the Reserve's Estuarine Fish Monitoring Cooperative (EFMC) program fills geographic gaps in current Georgia monitoring programs. However, we have identified a need to expand our program's reach through training future coastal scientists in monitoring techniques and bring awareness to the public about lesser known, but ecological important, species. We would like to partner with organizations and stakeholders to create formal curriculum and outreach material from data gathered from the EFMC to engage the public and develop future partners and citizen scientists. Rachel Guy, Research Coordinator *Keywords*: Fish monitoring; training; public education; citizen scientists	<table><tr><td>Need Type</td><td>Focus Areas</td></tr><tr><td>Management</td><td>Climate Change</td></tr><tr><td>Science Transfer</td><td>Climate Change</td></tr></table>

West Coast Region

Elkhorn Slough Reserve, California

Contact: Kerstin Wasson, Research Coordinator, kerstin.wasson@gmail.com, 831-728-2822

Need 1

The Reserve is engaged in restoration of various coastal habitats (e.g. salt marsh, coastal prairie, freshwater wetlands) 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, THEREFORE we welcome investigations that ultimately yield improved restoration success.

Keywords:

Restoration; recovery; resilience

Need Type	Focus Areas
Management	Climate Change

Need 2

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.

Keywords:

Eutrophication; invasion; diking

Need Type	Focus Areas
Management	Climate Change
	Ecosystem Services
Science Transfer	Climate Change
	Ecosystem Services

Need 3

Responding to ongoing 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 SLR-resilient marsh restoration projects, BUT future restoration and other adaptation efforts within and beyond the Reserve will require expanded partnerships and collaborative planning, and strengthened understandings of local community and decision-making priorities, THEREFORE we welcome investigations of the human dimensions of coastal management, including community characterization (e.g., stakeholders, values, attitudes, beliefs, and social networks), resilience and adaptation, policy analysis, and impacts to coastal economies.

Contact: Dan Brumbaugh, dan@elkhornslough.org

Keywords:

Sea-level rise; adaptation; resilience; community

Need Type	Focus Areas
Management	Habitat Resilience
Science Transfer	Habitat Resilience

Need 4 Reserve staff have pioneered NERR syntheses, AND have led assessments of marsh resilience and crab dynamics across 15 Reserves, thin-layer sediment addition across 8 Reserves, and habitat change across all 30 Reserves, BUT there is no clear national plan for regular syntheses to be conducted repeatedly, THEREFORE we welcome multi-sectoral, collaborative efforts to develop and test templates for regular, repeated national syntheses of marsh resilience, water quality, or habitat mapping and change. ***Keywords***: National; habitat; water quality	**Need Type**	**Focus Areas**
	Management	Monitoring Data Synthesis

Kachemak Bay Reserve, Alaska

Contact: Coowe Walker, Reserve Manager, cmwalker9@alaska.edu, 907-399-3418

Need 1

Understanding environmental change in Alaskan coastal ecosystems requires approaches that can assess and address 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. However, information from these programs should be used more often in locally relevant climate and management scenarios. Therefore, there is a need for projects that include techniques for applying ecological data for example to mariculture approaches, novel techniques for environmental monitoring, remote sensing, and community monitoring, in order to expand information and skill sets available to coastal decision-makers.

Keywords:
Climate; humans; applications; data

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services
	Water Quality
	Monitoring Data Synthesis

Need 2

Contact: Syverine Bentz (isbentz@alaska.edu)
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 for long-term sustainability and maintenance of functional ecosystems. Therefore 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.

Keywords:
Cultural; ecosystems; conservation; communities

Need Type	Focus Areas
Management	Climate Change
	Ecosystem Services
Science Transfer	Climate Change
	Ecosystem Services

Need 3

The 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.

Need Type	Focus Areas
Management	Climate Change
	Ecosystem Services
	Water Quality
Science Transfer	Climate Change
	Ecosystem Services
	Water Quality

Keywords: Water; land uses; management; population growth	

Need 4
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.
Keywords:
Monitoring; datasets; analysis; management
	Need Type **Focus Areas**
	
	Management Climate Change
	     Habitat Resilience
	     Ecosystem Services
	     Water Quality
	     Monitoring Data Synthesis
	
	Science Transfer Climate Change
	     Habitat Resilience
	     Ecosystem Services
	     Water Quality
	     Monitoring Data Synthesis

Padilla Bay Reserve, Washington

Contact: Jude Apple, Reserve Manager, japple@padillabay.gov, 360-391-5438

Need 1

Research and monitoring related to biophysical, social, economic and behavioral impacts of habitat change resulting from climate change and/or coastal development.

Climate change and increasing atmospheric CO_2 are altering sea level, water temperature, pH, and other factors that cause shifts in the distribution, health, and/or performance of species in Padilla Bay. These effects manifest in eelgrass, saltmarsh, mudflat, rocky intertidal, beach, and other coastal habitats. Despite the diverse research and monitoring efforts and Padilla Bay, we often lack precise, measurable, and reliable metrics of emergent effects of climate change and increasing CO_2 on local waters. We need to predict how our ecosystem will change over time, and identify means of promoting resilience in natural habitats. Therefore, we need to assist local and regional stakeholders in identifying strategies to protect or increase threatened habitats and species, and seek projects that help us understand how climate change will alter species, ecosystem services, and the human communities connected with and reliant upon our coastal ecosystem.

Science transfer needs include:
Use existing data on the effects of climate change on coastal habitats and ecosystems services, and link that quantitatively to sociocultural needs, aspects of human well-being, and other community-based priorities. Develop management and conservation tools and guidance that can identify sociocultural vulnerabilities to climate change and other large-scale ecological perturbations.
Leverage climate research and monitoring data to support education programs at Padilla Bay, specifically developing web-based platforms to be populated with K-12 curriculum materials that incorporate climate science and SWMP data activities.

Keywords:
Climate change; eelgrass; sociocultural systems; resilience

Need Type	Focus Areas
Management	Climate Change
Science Transfer	Climate Change

Need 2

Understanding how an ecosystem service approach can be utilized to support the protection and restoration of estuarine systems.

Padilla Bay comprises native & non-native eelgrass, wetland and estuarine habitats, and agricultural lands that represent a valuable ecological, economic, and cultural resource for the region. Although these resources are changing dramatically, we lack quantitative evidence connecting ecosystem functions with ecosystem services. Processes of particular interest at Padilla Bay include utilization of eelgrass by fish, eelgrass-shellfish interactions, and carbon sequestration. Therefore, we seek projects that use an ecosystem service approach to understand the socio-ecological systems of Padilla Bay, and use this information to guide protection and/or restoration of local and regional estuarine ecosystems so that cultural, ecological and economic resources can be maintained in the face of global change.

Science transfer needs:
Develop tools that use existing data on blue carbon (stocks, sequestration, etc) in PNW wetlands that have been collected as part of NERRS Science Collaborative projects and incorporate these data into predictive decision tools and/or visualizations to inform management, planning, restoration and conservation efforts.
Identify quantitative linkages between ecosystem services and sociocultural needs, aspects of human well-being, and other community-based priorities.
Develop management and conservation tools and guidance that can identify sociocultural vulnerabilities as a result of loss of ecosystem services.
Keywords: blue carbon; ecosystem services; eelgrass; sociocultural systems

Need Type	Focus Areas
Management	Ecosystem Services
Science Transfer	Ecosystem Services

Need 3

Investigating options for improving estuarine habitat resilience; processes for identifying, prioritizing, and restoring sites; and monitoring and evaluating success.

Habitat resilience in Padilla Bay and across the region is being impacted by human and climate-driven processes. Priorities at Padilla Bay include sediment dynamics, which are critical to restoration and long-term resilience of our coastal habitats; eelgrass habitat restoration; and assessing the ecosystem-scale effects of invasive invertebrate and plant species that can

Need Type	Focus Areas
Management	Habitat Resilience
	Ecosystem Services
	Water Quality

alter biodiversity, sediment processes, and foodweb dynamics. Given these priorities, we need to better understand the stressors, impacts, and methods for increasing restoration success and are, therefore, particularly interested in projects that quantify processes related to sediment, eelgrass, and invasive species, or that test restoration methods. We are also seeking opportunities to expand the use of our 100 acre demonstration farm to explore the relationship between agricultural practices, carbon sequestration, and nutrient delivery to coastal waters and develop best-practices related to agricultural land use in coastal watersheds.

Keywords:
Restoration; resilience; agricultural practices; eelgrass

Need 4

Syntheses and analyses of long-term monitoring data collected through NERRS SWMP monitoring activities at Padilla Bay and across the nation, and using these analyses to conduct hypothesis-driven studies of coastal ecosystem function, variability, water quality, and response to climate change.

Natural and anthropogenic factors act at multiple spatiotemporal scales to drive change in estuarine ecosystems. Understanding how varying drivers interact at different temporal (e.g., short-to-long term) and spatial (e.g., watershed-to-global) scales is essential for addressing management needs. Thus, we are interested in quantitative analyses (e.g. multivariate, time-series, spatial) that synthesize long-term, system-wide monitoring data collected at Padilla Bay and across the NERRS, specifically when applied to investigate natural and anthropogenic drivers of variability in estuarine responses (e.g. in eelgrass, water quality, productivity). We are particularly interested in analyses that are conducted within the context of coastal habitats and land-use, and leverage existing NERRS data resources such as the SWMP Classifying Land-Use and Ecosystems (CLUE) classification tool.

Science transfer need: Use NERRS SWMP monitoring data to develop activities and modules focused on climate and data literacy, and contribute to existing K-12 curriculum at Padilla Bay.

Keywords:
Data synthesis; data literacy, education, land use

Need Type	Focus Areas
Management	Climate Change
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Monitoring Data Synthesis

Need 5

Understanding the impacts of land use change, eutrophication, and contamination in estuarine ecosystems and the options for management and mitigation.

The Padilla Bay watershed includes natural areas, pastures, agricultural fields, hobby farms, and older homes with compromised septic systems. Fecal coliform contamination is a recurring problem in Padilla Bay and the surrounding waters, leading to the closure of local shellfish beds. Further, the lands surrounding Padilla Bay, and particularly Bayview Ridge, are seeing the effects of development and land-use change. The implications of these changes on water quality, community resilience, and landscape-estuary interactions is unclear. Therefore, the Reserve needs to identify causes of fecal coliform contamination, assist local stakeholders and management agencies to reduce these inputs, and explore linkages between large-scale changes in land use and water quality. We are also seeking opportunities to expand the use of our 100 acre demonstration farm to explore the relationship between agricultural practices, carbon sequestration, and nutrient delivery to coastal waters and develop best-practices related to agricultural land use in coastal watersheds.

Keywords:

Land use; contamination; agriculture; carbon sequestration

Need Type	Focus Areas
Management	Climate Change
	Ecosystem Services
	Monitoring Data Synthesis

San Francisco Bay Reserve, California

Contact: Stuart Siegel, Interim Reserve Manager, siegel@sfsu.edu, 415-299-8746

Need 1

The SF Bay NERR supports research on nature-based solutions for resilience of the SF Estuary and its human-built environment AND the NERR, partners and others plan, undertake, and assess projects and develop guidance and policy documents around a variety "NBS" project types to support future projects, funding, policy, and regulation BUT there are limited efforts of adaptive management "learning" and integrating findings into regional efforts; THEREFORE, we would like to support regional efforts by gathering new data, working with existing data, and collaborating with planners and researchers to develop "lessons learned" and their application to policy, planning, and new projects.

Keywords:

Nature-based solutions, resiliency, adaptive management, living shorelines

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services

Need 2

Oyster farming is a growing part of the sustainable food economy in northern California including within the targeted watershed of the SF Bay NERR. Conservation of native Olympia oysters is a priority for supporting healthy ecosystem function and living shoreline restoration, AND previous research has improved understanding of native oyster ecology, BUT more research is needed to understand how high variability throughout the oyster life cycle in different estuarine environments affects both natural, native populations and the oyster farming industry. THEREFORE, we welcome studies of how factors affecting oyster population stability impact conservation, restoration, and farming in the region.

Keywords:

Oysters, living shorelines

Need Type	Focus Areas
Management	Habitat Resilience

Need 3

The tidal marshlands at the Rush Ranch component of the SF Bay NERR are impaired ecologically by active feral pigs and extensive stands of the invasive plant perennial pepperweed (*Lepidium latifolium*) AND these adverse conditions have been worsening in recent years BUT limited past control efforts have not proven effective; THEREFORE, the SF Bay NERR in partnership with Solano Land Trust would like to establish expert elicitation and develop and test control or management options.

Keywords:

Need Type	Focus Areas
Management	Habitat Resilience

Invasive species, feral pigs, invasive plants	

South Slough Reserve, Oregon

Contact: Shon Schooler, Research Coordinator, shon.schooler@dsl.oregon.gov, 541-888-8270 ext315

Need 1

Climate change is expected to alter South Slough habitats, negatively impact native species, increase wildland fire risk, and facilitate establishment of invasive species. We are beginning to monitor these impacts, but we don't yet fully understand the potential effects of climate change. In addition, knowledge and action are essential for building communities resilient to climate change, but our impact on necessary behavior change is unknown. Therefore, we need additional research to understand the effect of climate change on habitats and species, as well as to assess our educational reach within the community to identify effective communication strategies.

Keywords:

Climate change; habitats; species, resilience

Need Type	Focus Areas
Management	Climate Change
Science Transfer	Climate Change

Need 2

Humans benefit from the ecosystem services (e.g., carbon sequestration, food production, water provision, timber production, recreational opportunities, and cultural identity) related to estuarine habitats (including uplands, riparian areas, forested tidal swamps, tidal marshes, and seagrass beds) and native species (e.g., eelgrass, lamprey, salmonids, shellfish). However, people often do not appreciate the magnitude of these services and the need to manage them effectively and sustainably. Therefore, we need additional research to better: 1) measure ecosystem services, 2) identify and prioritize management needs, and 3) communicate the valuable services functioning estuarine habitats provide to Pacific Northwest coastal communities.

Keywords:

Ecosystem services; native species; sustainability

Need Type	Focus Areas
Management	Ecosystem Services
Science Transfer	Ecosystem Services

Need 3

Human-induced stressors (i.e., changing climate, land-use practices, introduced species) impact water quality, populations, and habitats. Both abiotic (warming water, hypoxia, ocean acidification, contaminants (pesticides, herbicides), and sediments) and biotic (harmful algal blooms, pathogens, invasive species, and parasites) stressors impact the health of animal and plant communities and human health. In some cases, multiple stressors, such as green crabs, sediment, high temperature, and chemical pollutants potentially interact to affect essential habitat such as eelgrass beds. Research understanding how to predict and

Need Type	Focus Areas
Management	Water Quality
Science Transfer	Water Quality

manage these stressors (i.e., per capita green crab impacts on desired species) and how they interact is key for managing estuary species and functions. ***Keywords***: Ocean acidification; land-use; invasive species	
Need 4 The Reserve is restoring tidal wetlands and thinning dense re-growth forests. 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. In addition, invasive species (e.g., green crab, reed-canary grass, and Port-Orford-cedar root pathogen) are affecting habitats and native species, but we don't fully understand their impacts or know what management strategies will be effective. Therefore, we need both research on restoration trajectories in wetlands and forests and on the ecology, impacts, and management of invasive species. ***Keywords***: Restoration effectiveness; invasive species; evaluation	**Need Type** / **Focus Areas** Management — Habitat Resilience Science Transfer — Habitat Resilience
Need 5 The South Slough NERR has data from long-term monitoring programs, and we would like to better understand environmental change over time within and among Reserves, but we don't have the capacity to synthesize and interpret the data to identify environmental degradation issues and improvement opportunities. Therefore, we need assistance to: 1) analyze and summarize data, 2) provide decision-making tools (including modelling outputs) to meet the needs of coastal managers and decision makers, and 3) produce education tools for use by formal and non-formal educators with students. ***Keywords***: Synthesis; modelling; summarize	**Need Type** / **Focus Areas** Management — Monitoring Data Synthesis Science Transfer — Monitoring Data Synthesis

For Need 4:

Need Type	Focus Areas
Management	Habitat Resilience
Science Transfer	Habitat Resilience

For Need 5:

Need Type	Focus Areas
Management	Monitoring Data Synthesis
Science Transfer	Monitoring Data Synthesis

Tijuana River Reserve, California

Contact: Jeff Crooks, Research Coordinator, jcrooks@trnerr.org, 619 575 3613 x333

Need 1

The Tijuana Estuary is the largest, most intact coastal wetland left in Southern California, and ongoing 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, more restoration and conservation work is being planned, and we need research and sharing of information related to processes that support native biota and habitats (including marshes, dunes, and transitional areas), as well as approaches for tracking a wide variety of ecological and social indicators (e.g., biocultural ecosystem services) that might change in response to management action.

Keywords:

Restoration; Monitoring; Habitats; Species

Need Type	Focus Areas
Management	Habitat Resilience
	Ecosystem Services
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Habitat Resilience
	Ecosystem Services
	Water Quality
	Monitoring Data Synthesis

Need 2

Excessive sedimentation is one of the principal threats to the integrity of the Tijuana River Valley and efforts are underway to capture and effectively manage of this material, but we lack a full understanding of local sediment dynamics and how they might respond to both short- and long-term management interventions and environmental change. Therefore, we need studies and transfer of information related to the role of sediment in coastal ecosystems as well as approaches for sediment management and coastal resilience such as natural and nature-based solutions (e.g., beneficial use in restoration and nourishment).

Keywords:

Sediment; Beneficial Re-use; Restoration

Need Type	Focus Areas
Management	Habitat Resilience
	Monitoring Data Synthesis
Science Transfer	Habitat Resilience
	Monitoring Data Synthesis

Need 3

Debris is a significant source of impairment in the Tijuana Estuary and we have learned lessons related to its management and impacts, but there is still more work to be done in this complex international setting. Therefore, we need a deeper socio-ecological assessment of the role of debris and to identify behaviors and barriers that would inform training and technical assistance strategies. Additionally, understanding the Reserve's niche in a marine debris community of practice and in areas such as research, training, stewardship, and education is of interest.

Keywords:

Marine Debris; Management; Plastics

Need Type	Focus Areas
Management	Habitat Resilience
	Water Quality
Science Transfer	Habitat Resilience
	Water Quality

Need 4

Many Southern California lagoons, such as the Tijuana Estuary, are characterized by small, dynamic river mouths that connect to the sea, and the nature of these inlets fundamentally shape both estuarine and nearshore ecosystems, but changes in hydrology, tidal action, wave climate, and beach processes can dramatically affect inlet functioning. Therefore, we need studies of estuary-ocean connections (physical, chemical, and biological) and how these might change under varying conditions (including sea level rise).

Keywords:

Inlet; Tidal Prism; Ocean-Estuary Exchange

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Climate Change
	Habitat Resilience
	Water Quality
	Monitoring Data Synthesis

Need 5

Climate change will affect virtually every aspect of the natural systems and coastal communities in the Tijuana River Watershed. In this highly complex socio-ecological setting, three nations meet (the U.S., Mexico, and indigenous Kumeyaay) and climate impacts are being experienced disproportionately by marginalized communities on both sides of the border and occur against a backdrop of many other changes and intersectional stressors. Therefore, we are interested in assessing how to improve both ecosystem and pyscho-social resilience, including the practice of boundary-spanning (both physically and disciplinary) in coupled human and natural communities.

Keywords:

Climate Change; Socio-ecological system

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Ecosystem Services
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services

He'eia Reserve, Hawaii
Contact: Shimi Rii, Research Coordinator, shimi@hawaii.edu, 808-783-9621

Need 1

Across the NERRS, Reserve staff and partners have a wide range of understanding of the role of Indigenous science in restoring social-ecological estuarine systems AND have increasingly identified a need for deeper experience and applied knowledge. BUT learning opportunities related to biocultural restoration and cultural ecosystem service approaches that center Indigenous knowledge do not yet exist for the system. THEREFORE Reserves would benefit from in-depth experiential learning related to these approaches to better support thriving estuaries and just coastal communities.

Keywords:

Biocultural; restoration; experiential

Need Type	Focus Areas
Science Transfer	Habitat Resilience
	Ecosystem Services

Need 2

Our Reserve has started collecting NERR system long-term monitoring data through SWMP AND our collaborators and partners have amassed a large collection of data and information about our place, including the people and their relationships to the place. BUT currently, the data and information exists in different databases and are not easily retrievable for comparison or modeling for future data. THEREFORE, cross-sector collaborative efforts to synthesize historical and current cultural and scientific data are needed, with the goal of creating adaptable and accessible products as well as developing useful models to guide restoration and adaptive biocultural resource management.

Keywords:

Biocultural; restoration; models, applications

Need Type	Focus Areas
Management	Habitat Resilience
	Water Quality
	Monitoring Data Synthesis
Science Transfer	Habitat Resilience
	Water Quality
	Monitoring Data Synthesis

Need 3

Landscapes in our Reserve have altered dramatically due to large changes in land-use, development, and Indigenous resource management practices AND our Reserve collaborators and partners have been collecting baseline measurements of biophysical, social, economic, and behavioral impacts of habitat change. BUT it is still unknown how our watershed responds to impacts of climate change such as more intense and frequent storms, rising sea level and frequent king tides, warming temperatures, decreasing pH, and subsequent effects on groundwater, nutrient dynamics,

Need Type	Focus Areas
Management	Climate Change
	Habitat Resilience
	Water Quality

and the trophic food web of our estuarine ecosystems. THEREFORE, our stewards of place and restoration specialists have requested knowledge about the environmental drivers of spatial and temporal patterns of biodiversity and productivity in our watershed, with the long-range goal of supporting habitat resilience in the face of climate change.

Keywords:

Climate change, drivers, habitat change

Need 4

The Reserve's education program aims to 1) increase student, educator, and community understanding of coastal ecosystems and Hawaiian resource management, and 2) provide a comprehensive framework to integrate and enhance coordination and effectiveness of place based education and training programs, for the overall goal of cultivating cultural and educational ecosystem services and increasing community and habitat resilience in the face of stressors such as climate change in Heʻeia. AND the Reserve and its partners are currently reaching intended audiences through its Teachers on the Estuaries (TOTE) program, site visits for K-12 and college students, family programs, volunteer opportunities, internships, and graduate research fellowships. BUT the Reserve needs better systems and increased capacity to ensure efficient and effective collaboration among its various educational programs, to continue to deliver timely programming that adapts to our evolving understanding and ongoing data collection on climate and land-use change, habitat restoration and resilience, and other topics. THEREFORE we seek projects that enhance the capacity of the Reserve to develop, coordinate, and assess multi-site programming and collaboration among the various program providers and participants (e.g. place-based education professionals, NERR graduate assistants, and TOTE teacher-participants) and ultimately increase the Reserve's capacity to translate knowledge among multiple domains and promote "dual fluency" among different audiences.

Need Contact: Fred Reppun

Keywords:

Collaborative educational programming, coordination, capacity, knowledge systems

Need Type	Focus Areas
Management	Habitat Resilience
	Ecosystem Services
	Monitoring Data Synthesis
Science Transfer	Climate Change
	Habitat Resilience
	Ecosystem Services
	Monitoring Data Synthesis

Need 5

Our Reserve provides training and opportunities for exchange that integrate Indigenous and conventional scientific knowledge AND other community organizations and networks throughout the State of Hawaiʻi are developing tools to promote Indigenous resource management practices towards habitat resilience while adaptively managing current scenarios. BUT the Reserve needs to engage with these organizations to learn about these tools for the purpose of transferring knowledge and determine if they can be applied in Heʻeia and will be useful to its coastal decision makers. THEREFORE, we seek projects that enhance the transfer of knowledge between different organizations within Heʻeia and with the broader state and national network, through collaborative workshops and training. We seek knowledge transfer from other organizations or networks who have had success in using novel technologies to incorporate contemporary tools with Indigenous knowledge and promote dual fluency in management.

Need Contact: Casey Ching

Keywords:

Indigenous resource management tools, Training, Skills, Technology

Need Type	Focus Areas
Management	Habitat Resilience
Science Transfer	Habitat Resilience
	Ecosystem Services
	Water Quality