Welcome

Coastal Change Program Review

Opening Session

NOVEMBER 15th - 17th, 2022 | SILVER SPRING, MD

Review Panel

Neil Ganju, PhD (Chair)
Research Oceanographer, Woods Hole Coastal and Marine Science Center
The U.S. Geological Survey

Hilary Stockdon, PhD
Acting Program Coordinator, Coastal and Marine Hazards and Resources Program,
The U.S. Geological Survey

Tina Hodges
Climate Change Policy Analyst, Office of the Secretary of Transportation,
The U.S. Department of Transportation

John Callaway, PhD
Professor, Environmental Management (MSEM) Graduate Program Director,
University of San Francisco

Lisa Auermuller
Assistant Manager, Jacques Cousteau National Estuarine Research Reserve
Administrative Director, Megalopolitan Coastal Transformation Hub, Rutgers

Angelina Freeman, PhD
Research Scientist,
Coastal Protection and Restoration Authority of Louisiana (CPRA)

Program Review Structure & Schedule

Tuesday

- NCCOS and Coastal Change Program Overview
- Internal Coastal Change Science Part 1
- Effects of Sea Level Rise Program
- Internal Coastal Change Science Part 2
- Executive Session - Review Panel Only

Wednesday

- Coastal Change By The Numbers
- Open Discussion with Management
- Partner Panels (Virtual)
- Closing remarks
- Executive Session - Review Panel Only

Thursday

- Panel Deliberations & Initial Recommendation Development
- Panel Presentation(s) & Summary to Program Leadership
- Thanks & Final Remarks

Web Application Demo

NCCOS Coastal Change Program Review

Resilience Project Areas

Choose a item below to learn more about individual projects within that category. **Or view the projects on a map**

Questions & Comments

MARGO SCHULZE-HAUGEN

Director (Acting)

David Kidwell

Deputy Director (Acting)

NCCOS and Coastal Change Program Overview

Leadership Remarks,Organization Mission, History, & Priorities

Margo Schulze-Haugen, David Kidwell

Review Purpose

NOAA requires external, peer-reviews of its research and development programs on a periodic basis. Such reviews can play a key role in program planning, management and oversight by providing feedback on both program design and execution. NCCOS is further interested in evaluation of its information products and their delivery to users, and engagement with stakeholder

NOAA, through an Administrative Order (NAO 216-115B), has adopted Quality, Relevance and Performance as core evaluation criteria.

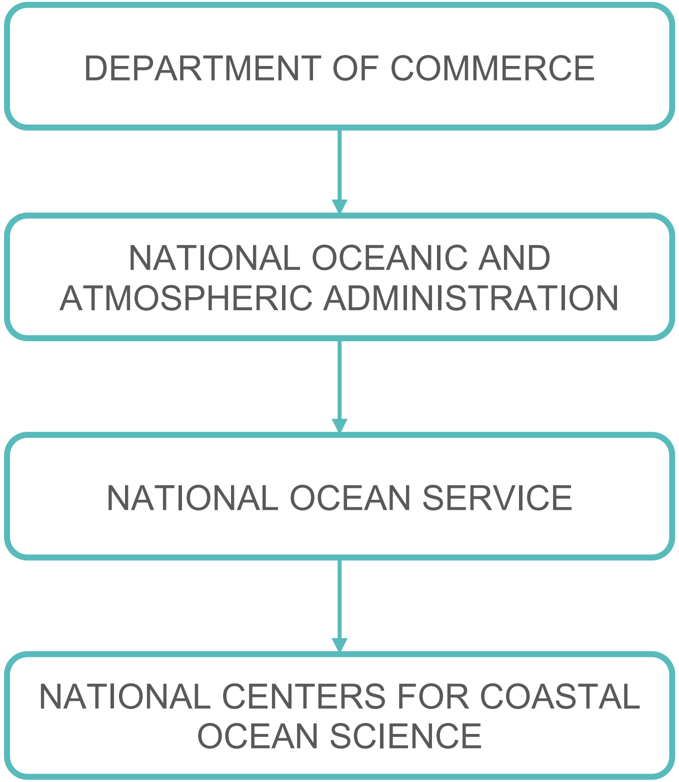
Charge to Reviewers

NCCOS will present information relevant to the Coastal Change program during the course of the review. Each member of the Review Panel will use that information and any ensuing discussion to come up with independent observations, evaluation, and recommendations on different aspects of the portfolio.

Individual written reports will be due within 60 days after the review. No consensus report will be submitted.

NCCOS Mission:

The National Centers for Coastal Ocean Science delivers ecosystem science solutions for stewardship of the nation's ocean and coastal resources in direct support of National Ocean Service (NOS) priorities, offices, and customers to sustain thriving coastal communities and economies



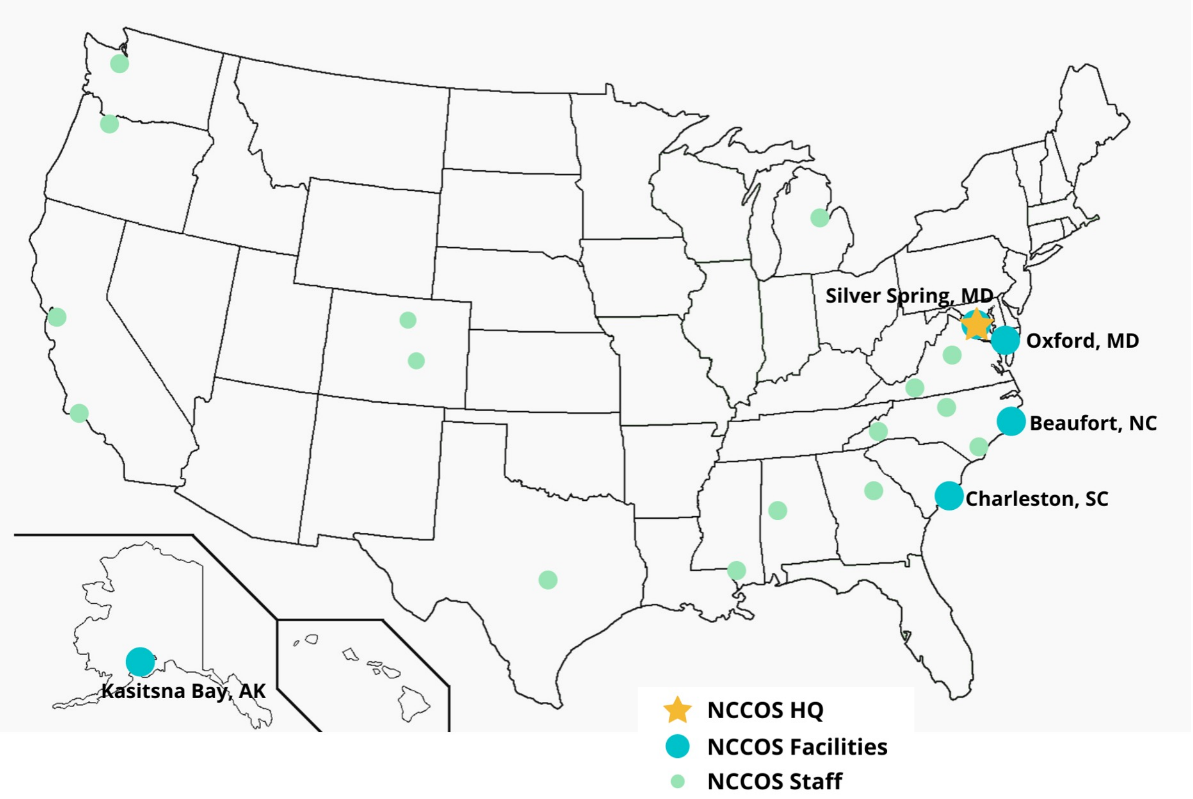
History and Structure

Science office in NOAA's National Ocean Service:

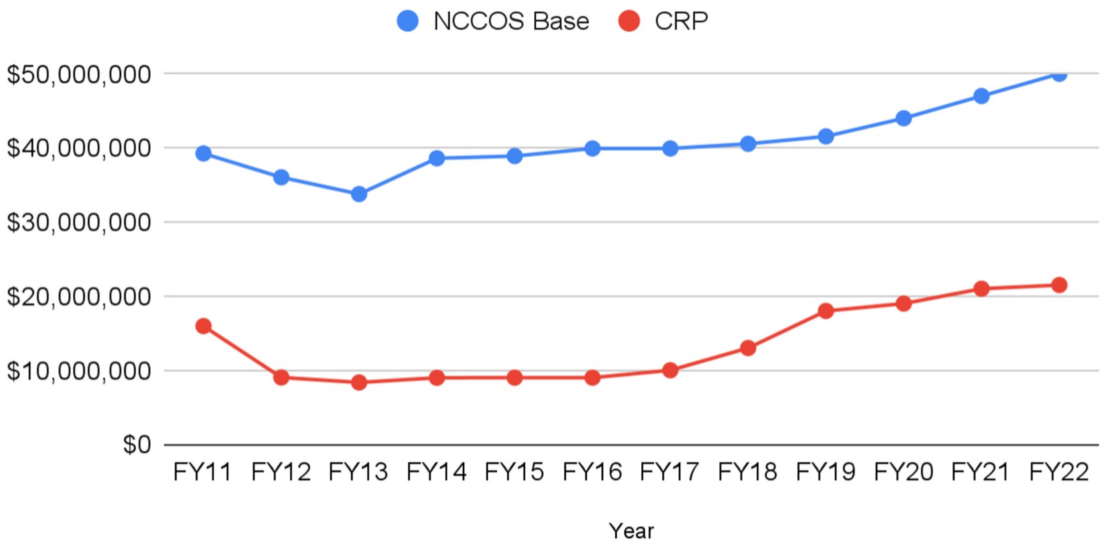
- Created in 1999 as the focal point for NOAA's coastal ocean science

Staffing & Facilities:

- HQ in Silver Spring
- 4 NCCOS Labs
- Staff nationwide



Funding Mechanism



In our annual Congressional appropriations, NCCOS has two budget lines (PPAs).

- NCCOS Base
  - Federal salary
  - Discretionary science funding for internal research.
- Competitive Research Program (CRP)
  - external science.

Science Priorities (2017-2021)

National Ocean Service (NOS) Priorities Roadmap

1. **Coastal Resilience, Preparedness, Response, and Recovery**
2. Coastal Intelligence
3. Place-based Conservation

Science Priorities (2017-2021)

National Ocean Service (NOS) Priorities Roadmap

1. **Coastal Resilience, Preparedness, Response, and Recovery**
2. Coastal Intelligence
3. Place-based Conservation

NCCOS Research Priorities

1. Marine Spatial Ecology
2. Stressor Impacts & Mitigation
3. **Coastal Change: Vulnerability, Mitigation, and Restoration**
4. Social Sciences

Science Priorities (2017-2021)

National Ocean Service (NOS) Priorities Roadmap

1. **Coastal Resilience, Preparedness, Response, and Recovery**
2. Coastal Intelligence
3. Place-based Conservation

NCCOS Research Priorities

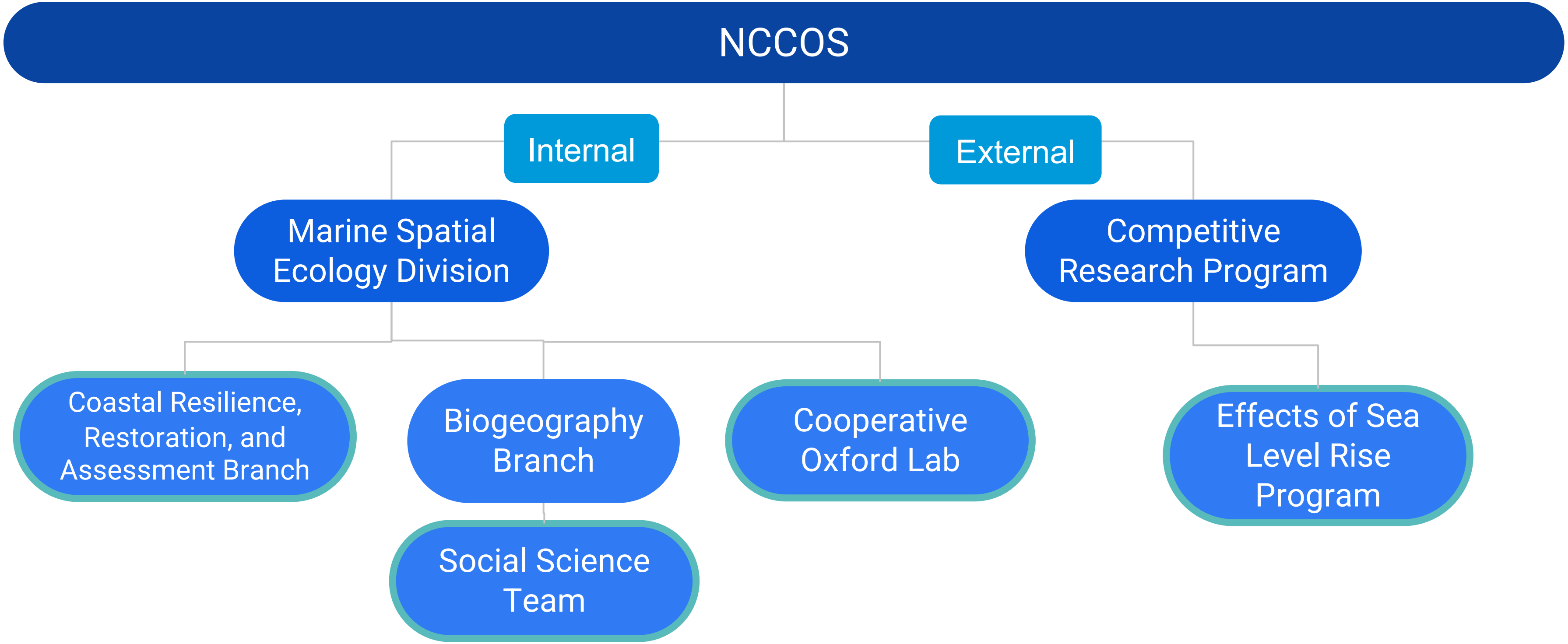
1. Marine Spatial Ecology
2. Stressor Impacts & Mitigation
3. **Coastal Change: Vulnerability, Mitigation, and Restoration**
4. Social Sciences

Coastal Change Sub-Priorities

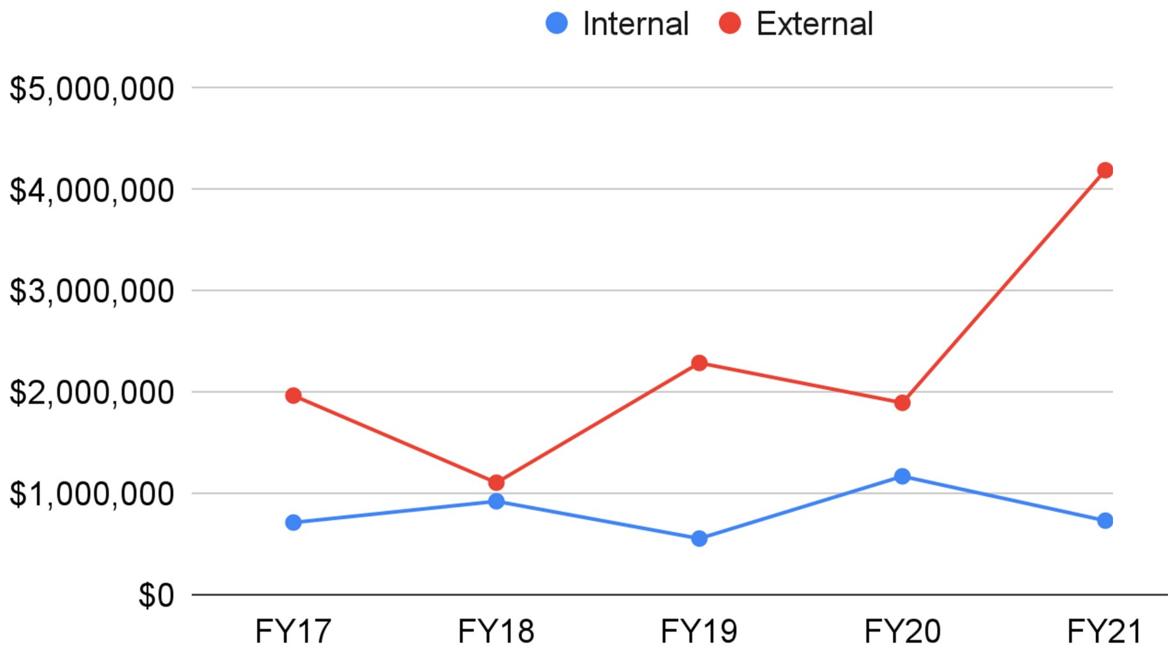
1. Vulnerability and Risk Assessment
2. Natural and Nature-based Features
3. *Climate Impacts on Ecosystems*
4. Restoration

Leveraging partnerships

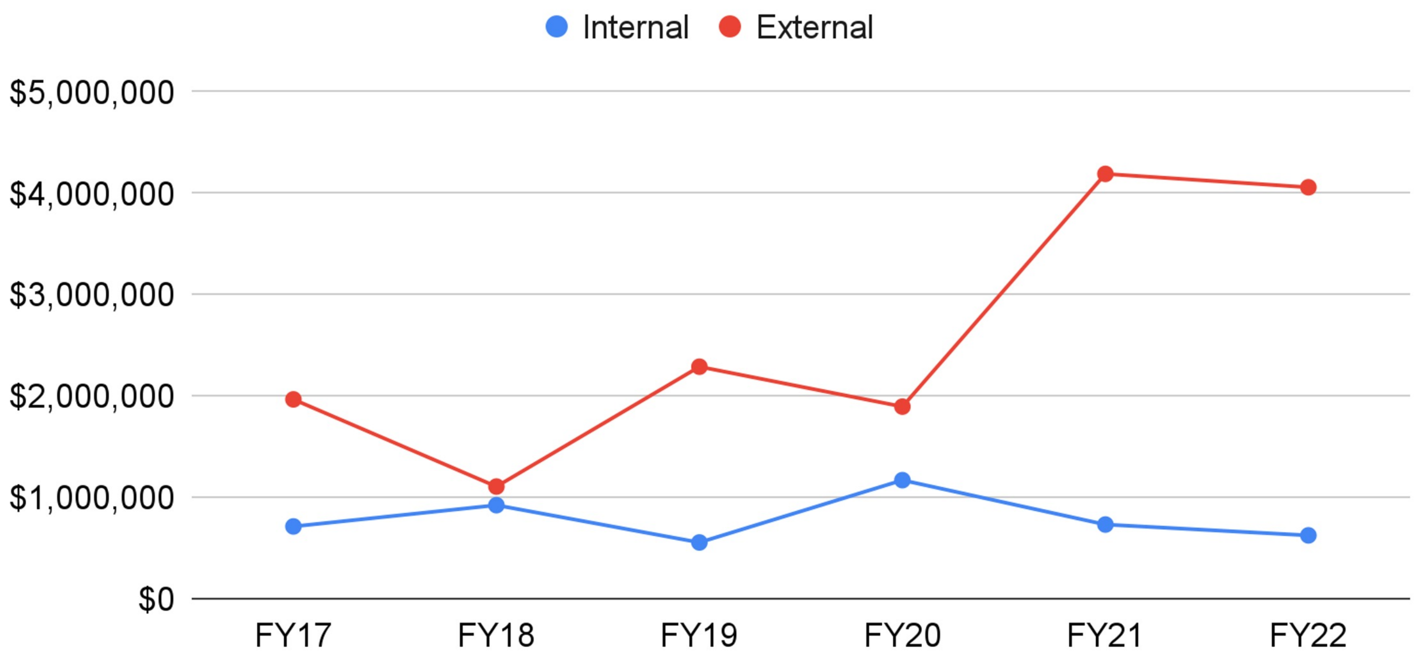
The Coastal Change science portfolio is executed by scientists across NCCOS



Coastal Change Project Funding



Coastal Change Project Funding



Facilitating Resilience and Adaptation to Inundation and Climate Impacts Priority (FY22-26)

- Science to support restoration and implementation of nature based solutions.
- User-driven science to inform holistic coastal planning.
- Science to quantify the social and economic vulnerability of human communities under sea level rise to inform action.
- Science to understand, predict, and reduce climate change impacts on coastal processes and ecosystems.

Future Directions of the Coastal Change Portfolio

- **Congressional direction for NCCOS to do more Coastal Change work.**
  - From the FY 23 Senate Mark:

National Centers for Coastal Ocean Science [NCCOS].—The Committee provides $51,500,000 for NCCOS and encourages NCCOS to expand efforts related to offshore wind and coastal sustainability and resilience.

Improving Coastal Resilience.—Within the funding for Competitive Research, NOAA is encouraged to provide information and predictive capabilities to coastal communities, especially those with underserved populations, and to encourage natural-based solutions to address coastal hazards like sea level rise, flooding, and inundation.

Questions?

Internal Coastal Change Science

Tomma Barnes
Chief, Coastal Resilience, Restoration, and Assessment Branch

Provide science to support coastal resilience through ecosystem protection, restoration, and management and the use of natural or nature-based infrastructure to reduce impacts and increase resilience of coastal communities, infrastructure, and economies.

History of Coastal Change Science at NCCOS

17 year Climate and Resilience Science Portfolio

NCCOS STRATEGIC PLANS

2005-2010

Extreme Events

- Forecast ecological impacts of climate change (incl. hurricanes and weather patterns)

2011-2015

Climate Impacts

- Develop impact scenario models for climate change in coastal ecosystems
- Characterize ecosystem and habitat vulnerabilities to climate change impacts
- Develop new conservation & restoration strategies for coastal ecosystems impacted by climate change

2017-2021

Coastal Change

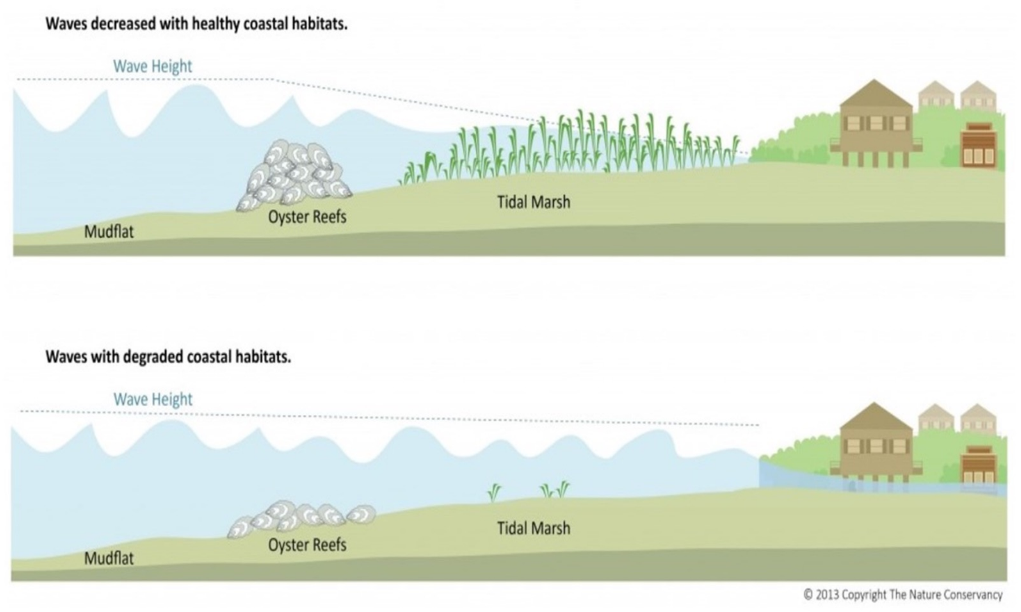
- Vulnerability and Risk Assessment
- Natural and Nature-based Features
- Climate Impacts on Ecosystems
- Restoration

2022-2026

Facilitating Resilience and Adaptation

- Ecosystem Change
- Community and Ecosystem Vulnerability
- Restoration and Natural and Nature-based Features

WHY WE CARE



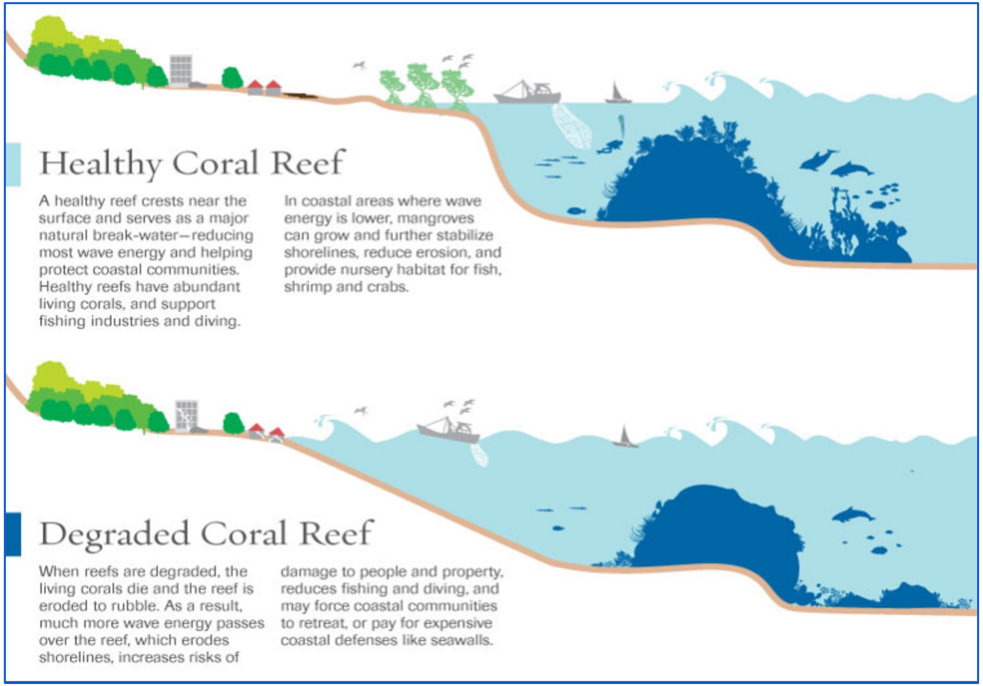
Natural coastal habitats have the capacity to mitigate the impacts of coastal hazards.

How do we evaluate climate resilient ecosystems (e.g., coral reefs and wetlands) protection and restoration approaches?

WHY WE CARE

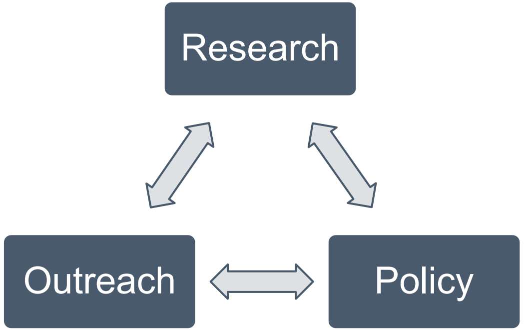
How do we utilize Nature Based Solutions in a way that:
- optimizes benefits?
- minimizes impacts?

How do we quantify the benefits at the scale of the individual project?



Credit: The Nature Conservancy

Our work addresses questions about **Why**, **Where**, and **How** with respect to implementation of Nature Based Solutions for Coastal Resilience.



To ensure that our science is relevant and actionable we work:

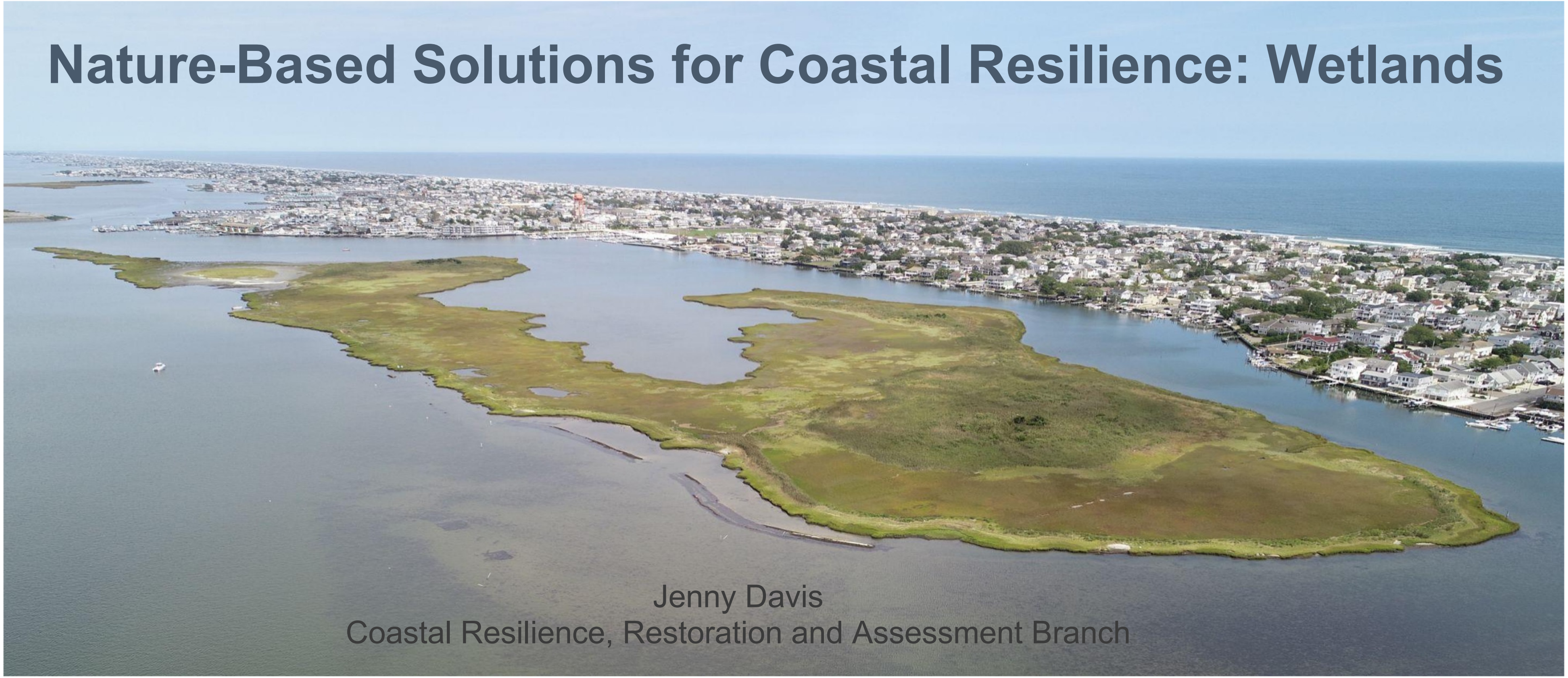
- directly with state and federal resource managers and regulatory agencies to support the development of regulatory frameworks
    - IAA with USACE-EWN
    - USFWS, NMFS - guidance for TLP permit applicants
    - Living Shoreline Streamlined Permit NC
    - FKNMS - guidance for coral restoration permit requirements
    - USVI DNER - guidance for reef conservation MPA prioritization
- with practitioners/project designers to inform project siting, design, implementation and monitoring
    - EA Engineering,Science and Technology - CRADA to support development of siting and implementation guidelines
    - NOAA Restoration Center and Florida Keys National Marine Sanctuary - to support coral restoration siting, implementation, design and monitoring


Jenny Davis--Nature-Based Solutions for Coastal Resilience: Wetlands


Shay Viehman--Nature-Based Solutions for Coastal Resilience: Coral Reefs


Brandon Puckett--Science to support NBS implementation: a coordinated path forward

Nature-Based Solutions for Coastal Resilience: Wetlands



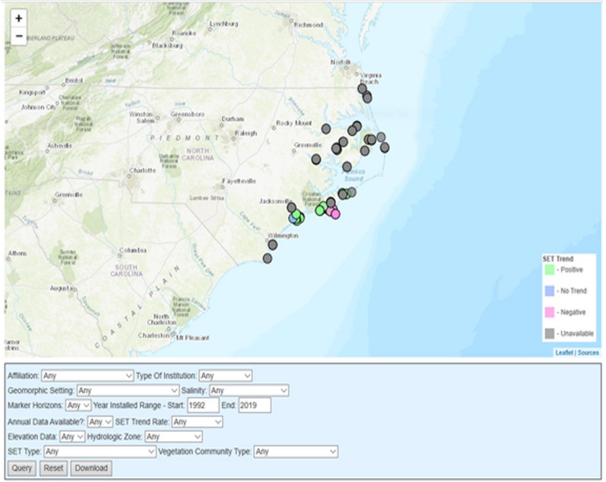
Jenny Davis
Coastal Resilience, Restoration and Assessment Branch

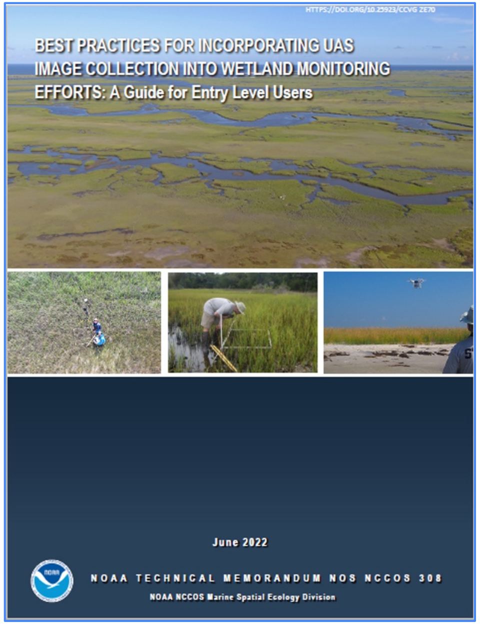
1. Fundamental Research to Understand Ecosystem Function & Advance Methodologies

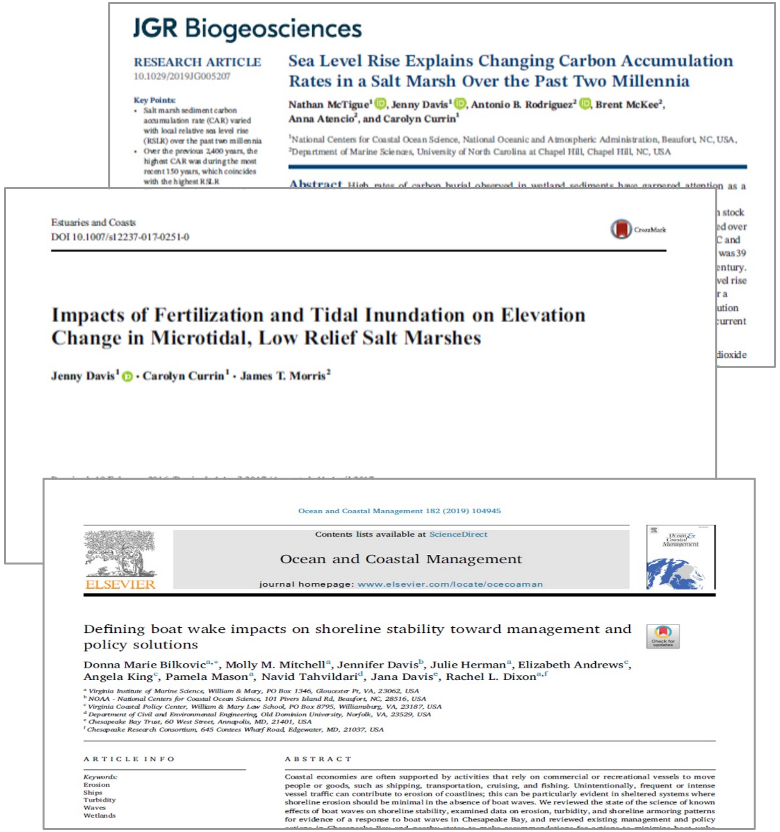
- How do vegetated tidal wetlands respond to sea level rise, storms, and other stressors ?
- How do carbon burial rates vary as a function of geography, marsh age, and sea level rise?
- How effectively can we use UAS-collected imagery to quantify habitat change?

Fundamental Research Products

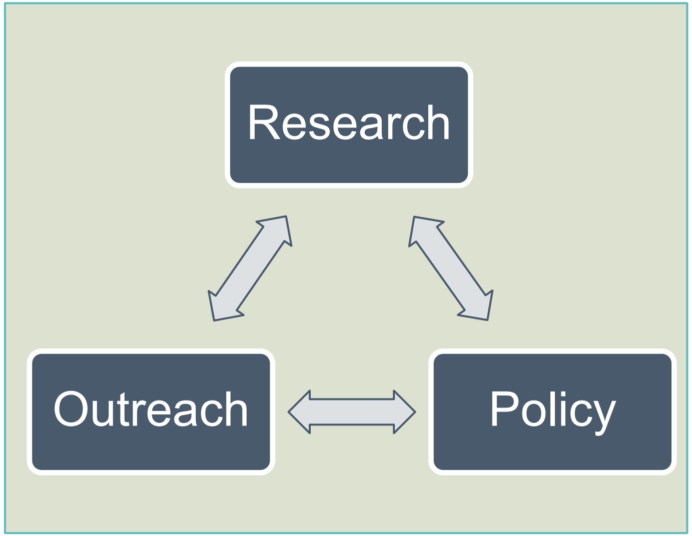
Data Mapping Tools







2. Applied Research to Inform the Optimal use of Nature Based Solutions (Why, Where & How?)



U.S. DEPARTMENT OF THE INTERIOR U.S. Fish and Wildlife Service NATIONAL WILDLIFE REFUGE SYSTEM

EWN Engineering With Nature

North Inlet – Winyah Bay National Estuarine Research Reserve

The Nature Conservancy

Maryland Department of Natural Resources

UNC Institute for the Environment

Audubon

NC Coastal Reserve & National Estuarine Research Reserve

Florida Department of Environmental Protection

moffatt & nichol

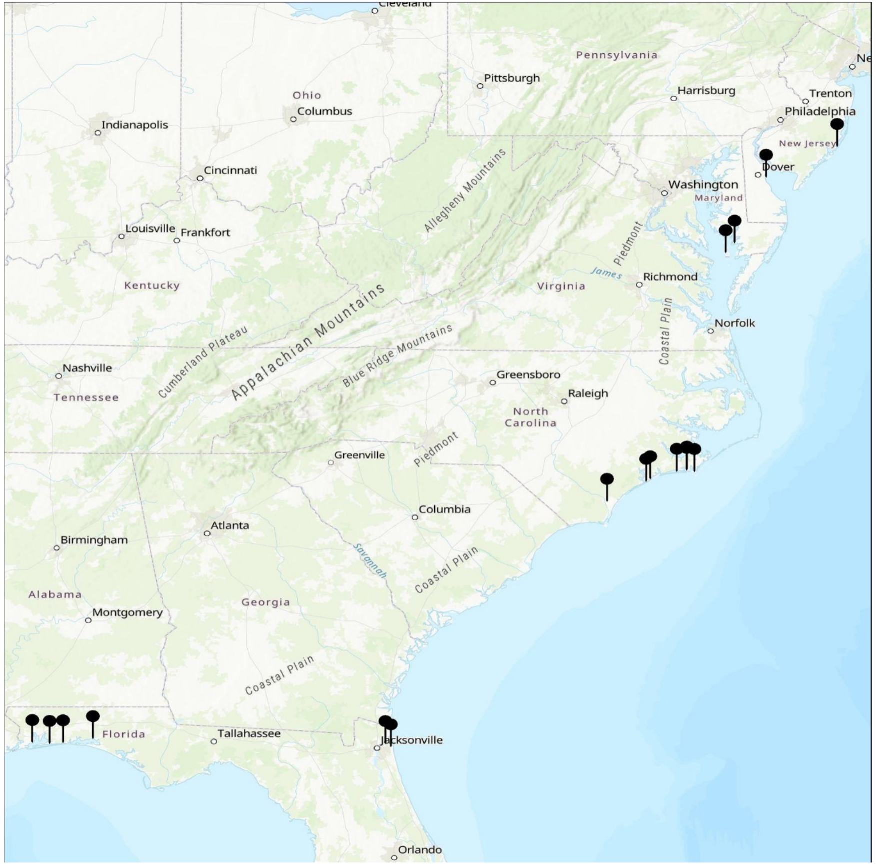
Battleship North Carolina

US Army Corps of Engineers

EA Engineering, Science, and Technology, Inc., PBC

Duke Nicholas School of the Environment Duke University Marine Lab

ERDC Engineer Research & Development Center



Living Shorelines Research

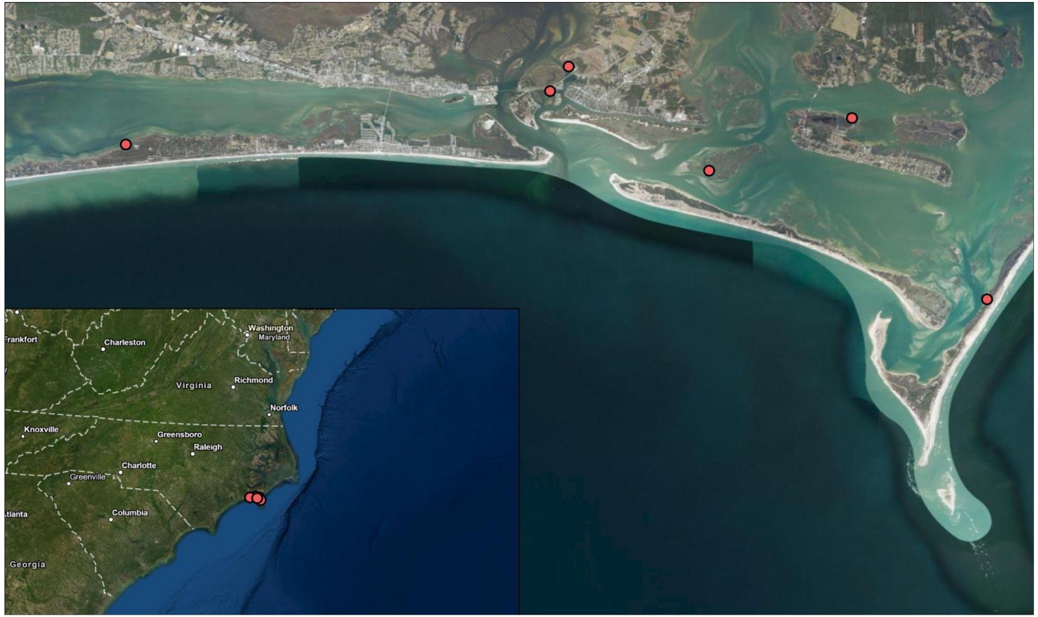
- How green should/can my living shoreline be?

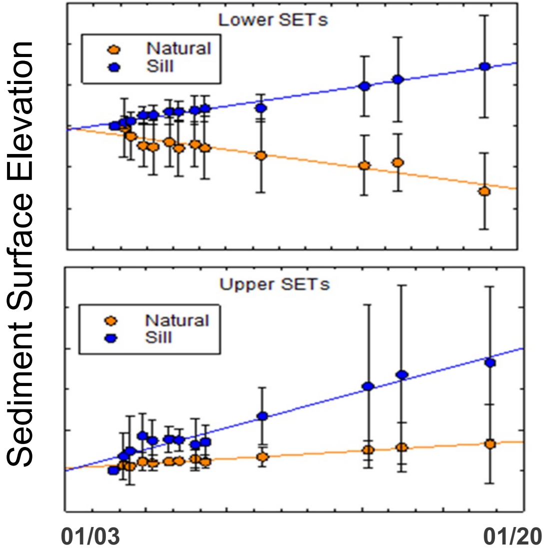
- How do created living shorelines respond to storms and SLR and does their response differ from that of natural shorelines?

Living Shorelines Research

Long-term Monitoring of Paired Natural and Sill-Based Living Shorelines

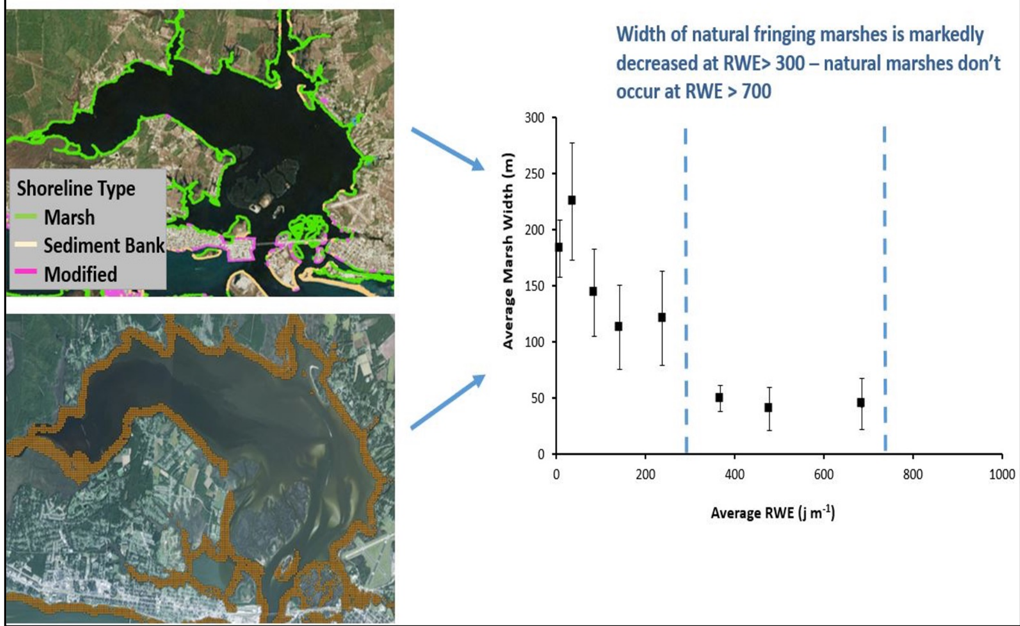
- Surface Elevation
- Soil Development
- Vegetative Community
- Storm Response





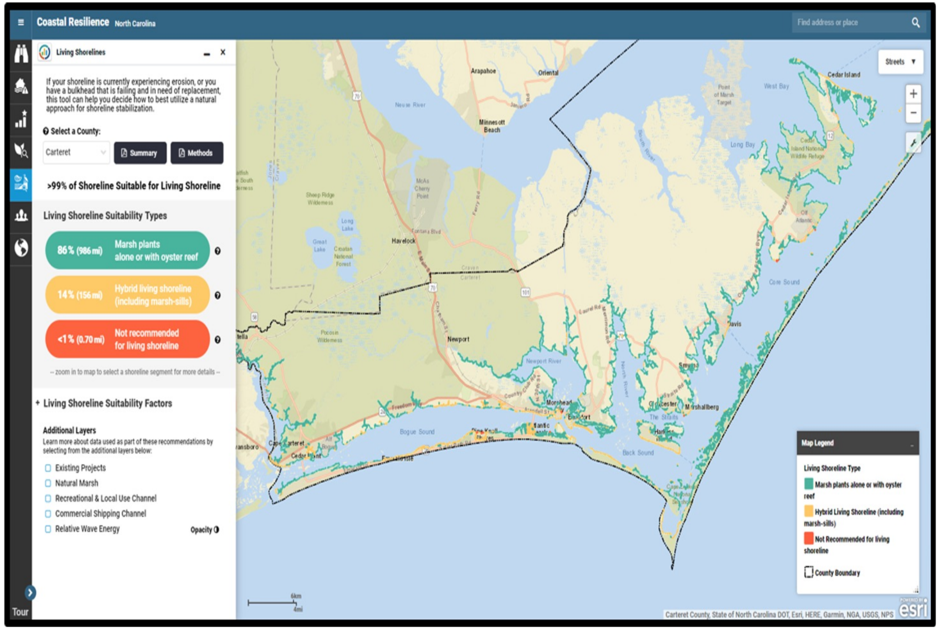
Living Shorelines Research - Wave Energy-Based Guidance for LS Design

Shoreline Wave Energy and Natural Fringing Marshes



Living Shorelines Policy

Wave Energy Based Living Shoreline Siting Tool



SECTION .2700 – GENERAL PERMIT FOR THE CONSTRUCTION OF MARSH SILLS

15A NCAC 07H .2701 PURPOSE

A general permit under this Section shall allow for the construction of marsh sills for wetland enhancement and shoreline stabilization in estuarine and public trust waters as set out in 15A NCAC 07J .1100 and according to the rules in this Section. Marsh sills are defined as sills that are shore-parallel structures built in conjunction with existing, created, or restored wetlands. This general permit shall not apply within the Ocean Hazard System AECs or waters adjacent to these AECs with the exception of those portions of shoreline within the Inlet Hazard Area AEC that feature characteristics of Estuarine Shorelines. Such features include the presence of wetland vegetation, lower wave energy, and lower erosion rates than in the adjoining Ocean Erodible Area.

History Note: Authority G.S. 113A-107; 113A-118.1;
Temporary Adoption Eff. June 15, 2004;
Eff. April 1, 2005;
Temporary Amendment Eff. April 1, 2019;
Amended Eff. July 1, 2019.

15A NCAC 07H .2702 APPROVAL PROCEDURES

(a) An applicant for a General Permit under this Subchapter shall contact the Division of Coastal Management and request approval for development. The applicant shall provide information on site location, dimensions of the project area, and applicant name and address.

(b) The applicant shall provide:

(1) confirmation that a written statement has been obtained signed by the adjacent riparian property owners indicating that they have no objections to the proposed work; or

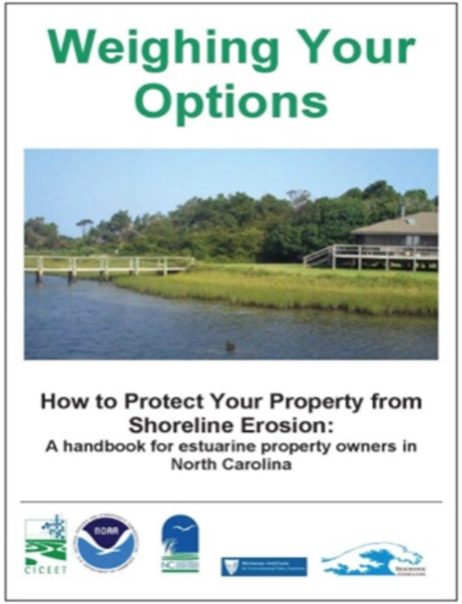
(2) confirmation that the adjacent riparian property owners have been notified by certified mail of the proposed work. The notice shall instruct adjacent property owners to provide any comments on the proposed development in writing for consideration by permitting officials to the Division of ... no response will be interpreted as no objection.

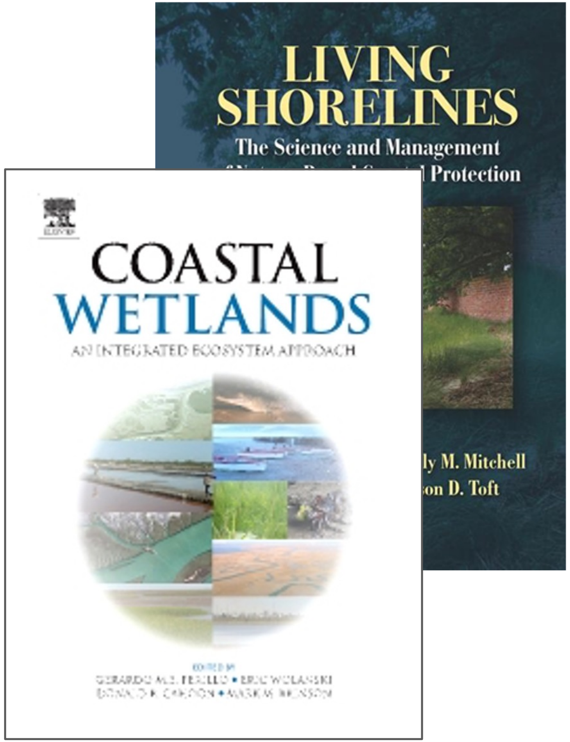
(c) DCM staff ... impacts of the proposed project ...

(d) No work shall begin until an on-site meeting is held with the applicant and a Division of Coastal Management representative to review the ... to proceed with the proposed development shall be issued if the Division representative finds that the application meets all the requirements of this Subchapter. Construction shall be completed within 120 days of the issuance of the general authorization or the authorization shall expire ... to determine if the general authorization may be reissued.

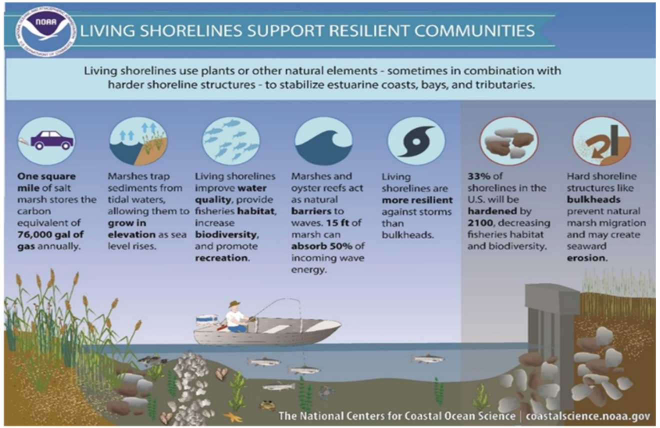
Worked with state and federal regulators on development of rule language for a streamlined permit for residential living shoreline applicants.

Living Shorelines Outreach





NCNERR Continuing Ed Workshops



Living Shorelines Outreach

UAS imagery-supported water level visualization in support of living shoreline design at USS North Carolina

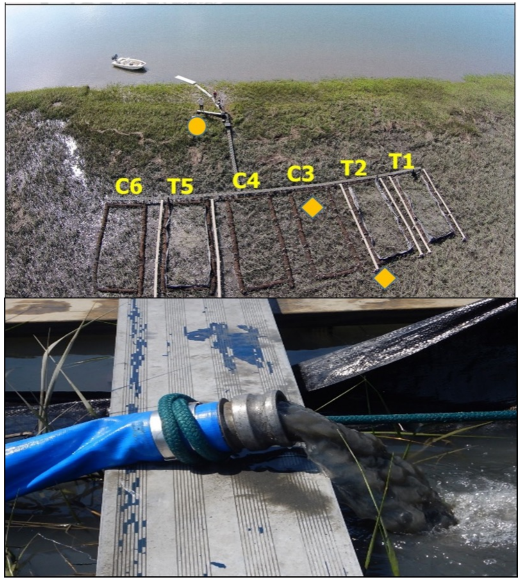
This product is for illustrative purposes only and does not represent a legal survey

Beneficial Use of Sediments Research

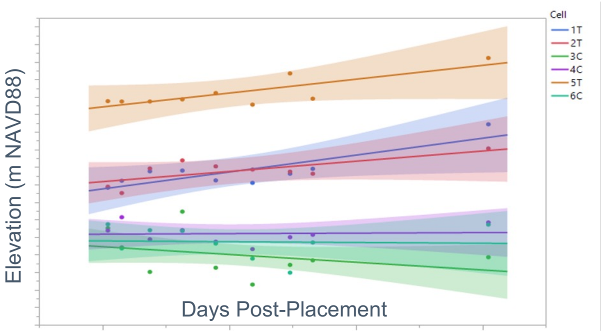
- Contribute to development of regulatory frameworks
- Document Project Performance

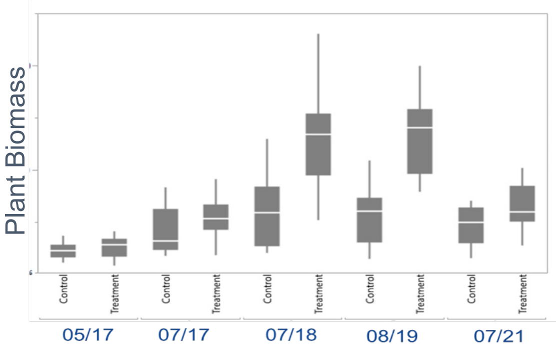
Two Beneficial Use Demonstration Projects, Camp LeJeune, NC

Mile Hammock Bay



Freeman Creek





Beneficial Use of Sediments Research

Inter Agency Agreement with USACE - Engineering With Nature

- Evaluate performance & benefits of NBS through empirical data collection and modelling

Formal agreement to collaborate with ERDC scientists and USACE district personnel on field data collection and modeling efforts at multiple NBS project sites

Beneficial Use of Sediments Policy

- Inform thin layer permitting requirements

- Partner with practitioners/project designers to inform project siting, design, implementation and monitoring

- "Keep It In The System" – ESLR funded project to develop guidance for matching future dredging needs with opportunities to restore vulnerable habitats

Beneficial Use of Sediments Outreach

Ecological Engineering 177 (2022) 106566
Contents lists available at ScienceDirect
Ecological Engineering
journal homepage: www.elsevier.com/locate/ecoleng

Effective use of thin layer sediment application in *Spartina alterniflora* marshes is guided by elevation-biomass relationship

Jenny Davis *, Carolyn Currin, Natalia Mushegian
NOAA/National Centers for Coastal Ocean Science, 101 Pivers Island Rd. Beaufort, NC 28516, United States of America

Integrated Environmental Assessment and Management — Volume 00, Number 00—pp. 1–7
Received: 7 January 2021 | Accepted: 7 April 2021

Special Series

A framework for evaluating island restoration performance: A case study from the Chesapeake Bay

Jenny Davis,[1] Paula Whitfield,[1] Danielle Szimanski,[2] Becky R. Golden,[3] Matt Whitbeck,[4] Joe Gailani,[5] Brook Herman,[5] Amanda Tritinger,[5] Sally C. Dillon,[5] and Jeffrey King[5]
[1]National Oceanic and Atmospheric Administration, National Centers for Coastal Ocean Science, Silver Spring, Maryland, USA
[2]US Army Corps of Engineers Baltimore District, Baltimore, Maryland, USA
[3]Maryland Department of Natural Resources, Annapolis, Maryland, USA
[4]US Fish and Wildlife Service, Chesapeake Marshlands National Wildlife Refuge Complex, Cambridge, Maryland, USA
[5]US Army Corps of Engineers, Engineer Research and Development Center, Vicksburg, Mississippi, USA

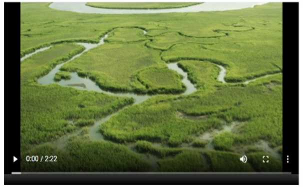
EDITOR'S NOTE:
This article is part of the special series "Incorporating Nature-based Solutions to the Built Environment." The series documents the way in which the United Nations Sustainable Development Goal (SDG) targets can be addressed when nature-based solutions (NBS) are incorporated into the built environment. This series presents cutting-edge environmental research and policy solutions that promote sustainability from the perspective of how the science community contributes to SDG implementation through new technologies, assessment and monitoring methods, management best practices, and scientific research.

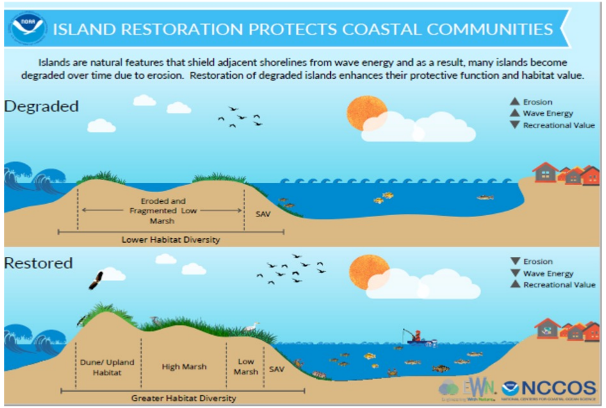
Abstract
The use of natural habitats for coastal protection (also known as Nature-Based Solutions or NBS) in place of engineered structures like breakwaters and seawalls can yield a wide range of ecological and economic benefits. Despite these advantages, NBS are not commonly implemented for shoreline protection due to uncertainty over the amount of protection

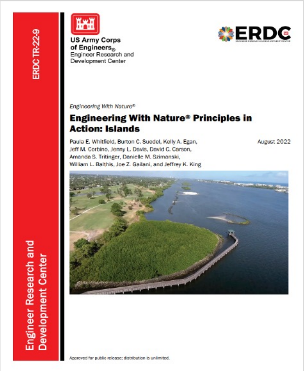
NCCOS The Swan Island Project

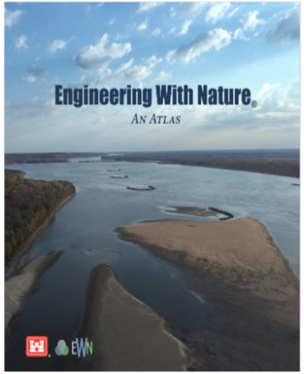
NCCOS, USACE Help Marines Keep Pace with Sea Level Rise at Camp Lejeune (video)

Published on: 07/09/2018
Research Area(s): Coastal Change / Natural and Nature-based Features, Restoration, Sea Level Rise
Region(s) of Study: U.S. States and Territories / North Carolina
Primary Contact(s): carolyn.currin@noaa.gov; jenny.davis@noaa.gov







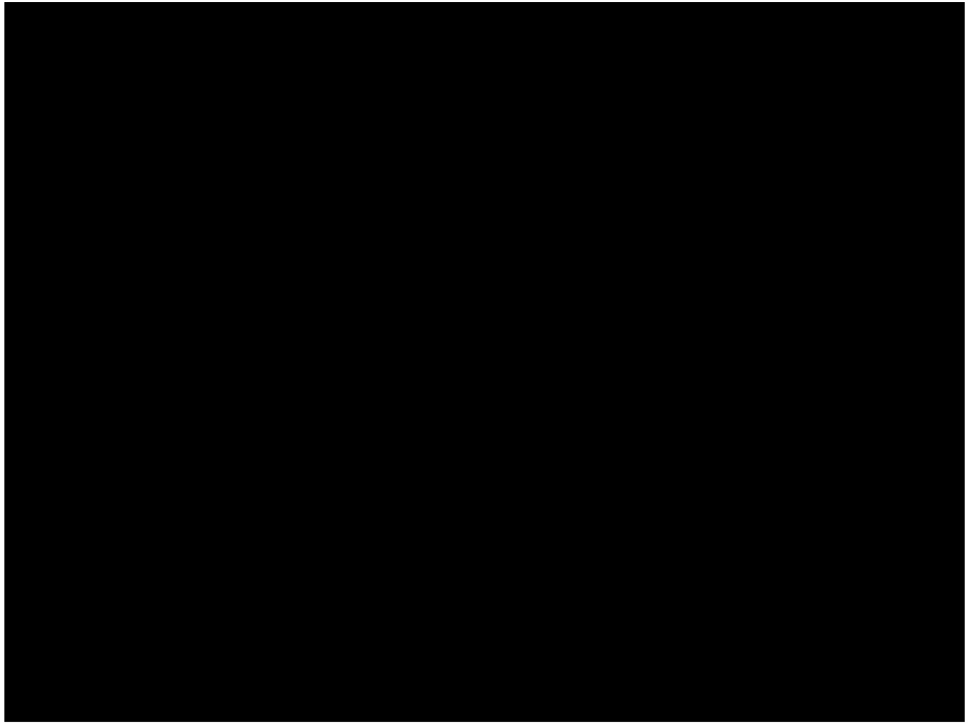


Future Directions

- Continued Advancement of UxS Methods

- Advancing Modeling Applications to Quantify and Predict NBS Benefits

- Performance Evaluation of Historical NBI Projects



Nature-Based Solutions for Coastal Resilience

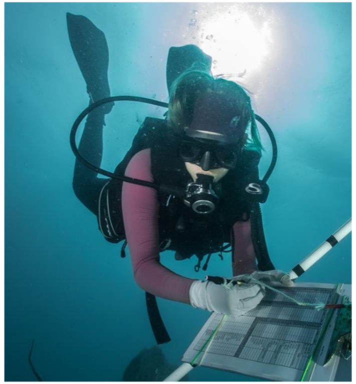
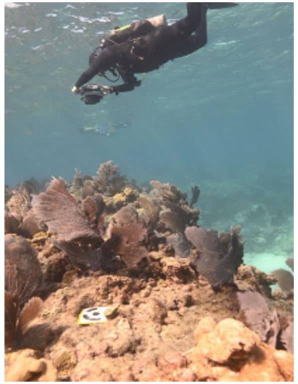
Coral Reefs

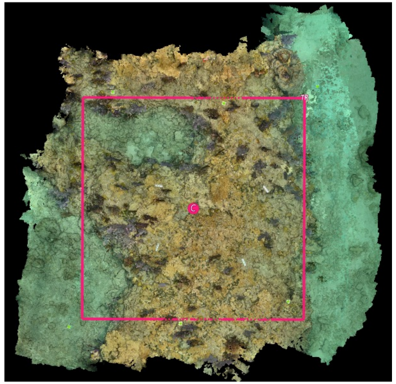
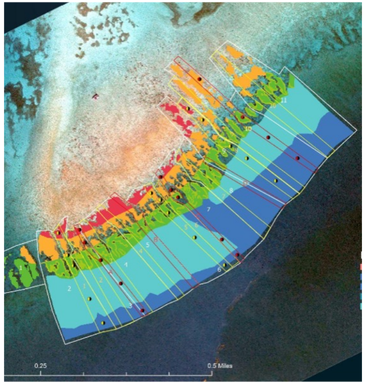
Shay Viehman

Coastal Resilience, Restoration, and Assessment Branch

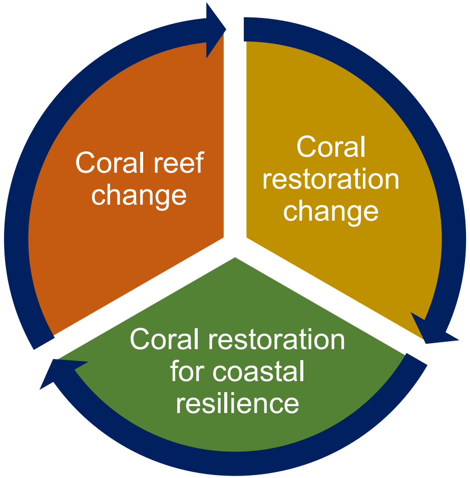
Coral Reefs as Nature-Based Solutions

- Status and change of reef-building corals that provide coastal resilience
- Restoration design and evaluation of progress towards goals
- Optimizing coral restoration for coastal resilience

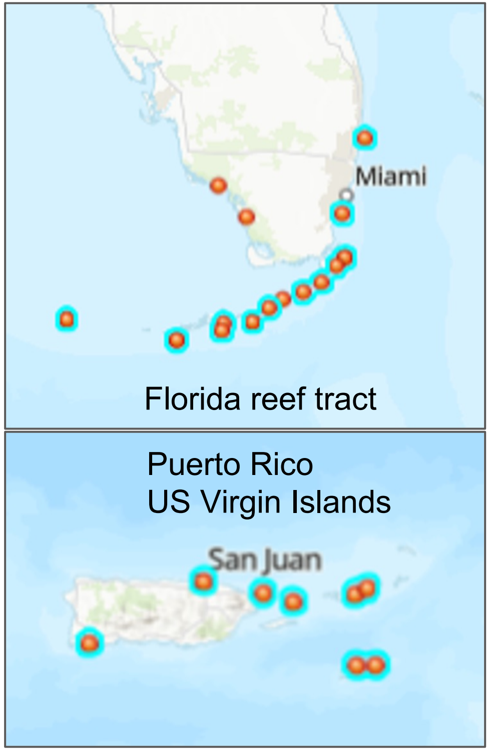



WHAT



WHERE

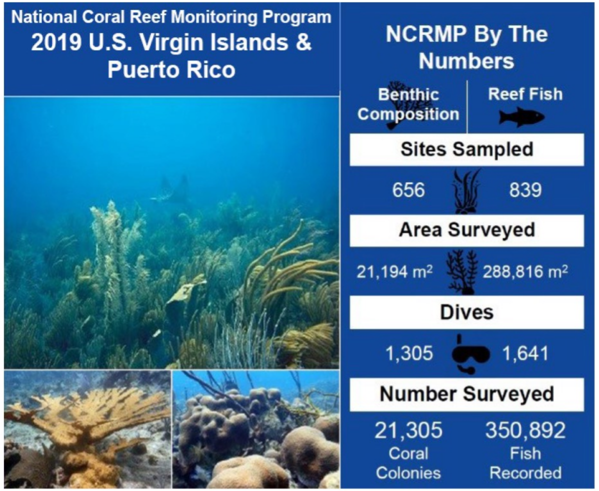


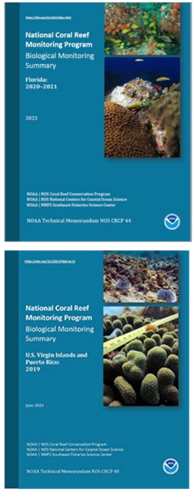
WITH

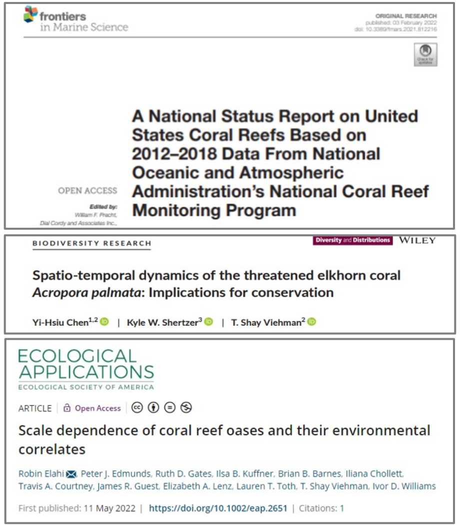
MISSION: ICONIC REEFS
NOAA FISHERIES
NOAA CORAL REEF CONSERVATION PROGRAM
NOAA's Atlantic Oceanographic and Meteorological Laboratory, U.S. Department of Commerce
NOPP National Oceanographic Partnership Program
FEMA
National Marine Sanctuaries Florida Keys
USGS science for a changing world
National Park Service
Florida Fish and Wildlife Conservation Commission
Duke NICHOLAS SCHOOL of the ENVIRONMENT, Duke University Marine Lab
SCRIPPS INSTITUTION OF OCEANOGRAPHY
UC San Diego
UNIVERSITY OF MIAMI
University of the Virgin Islands
CORAL RESTORATION CONSORTIUM
CORAL RESTORATION FOUNDATION
Mote Marine Laboratory
Reef Renewal USA

Evaluate the status of reef-building corals

National Coral Reef Monitoring Program (Atlantic)





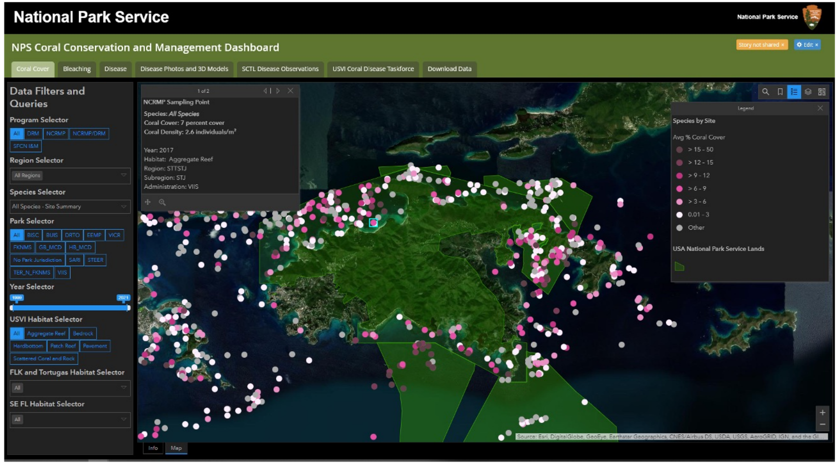


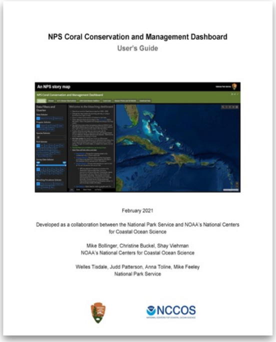
Partners

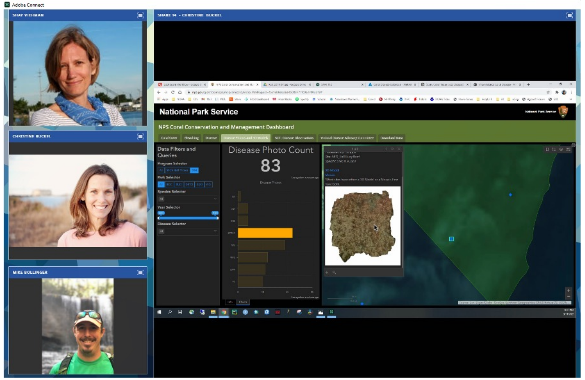
NOAA Coral Reef Conservation Program, Southeast Fisheries Science Center, Atlantic Oceanographic and Meteorological Lab, Florida Keys National Marine Sanctuary
NPS, FWC, FDEP, PR DRNA, USVI DPNR, UVI, NSU

Evaluate the status of reef-building corals

Coral Conservation Visualization Tools **Policy and Outreach**







OneNOAA/Coral collaboration webinar

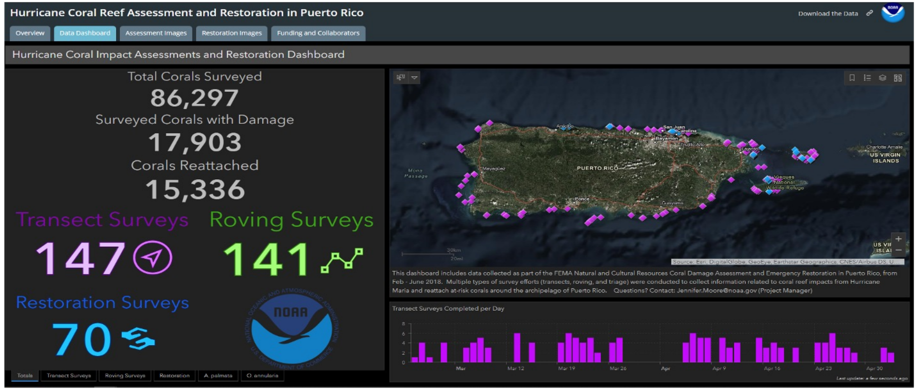
Users and Partners

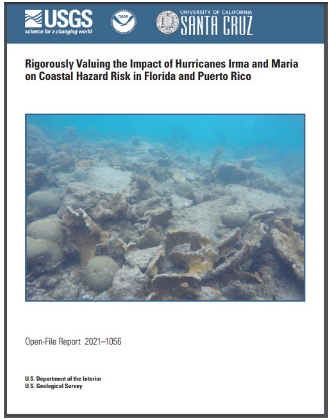
NOAA Southeast Regional Office
National Park Service
All state and federal long-term coral monitoring programs

Evaluate change to corals and coral reefs

Assess impacts to coral reef infrastructure after major hurricanes to inform emergency restoration

- FEMA Natural Resource Assessment post Hurricane Maria *2018*
- Florida Keys National Marine Sanctuary assessment post Hurricane Irma *2017*

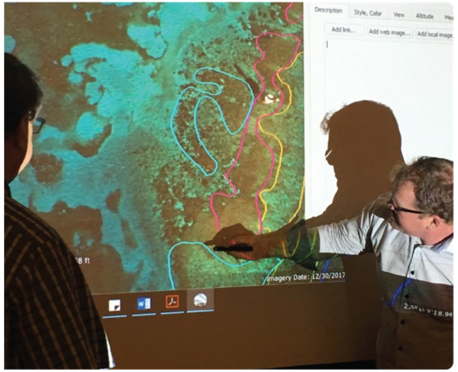


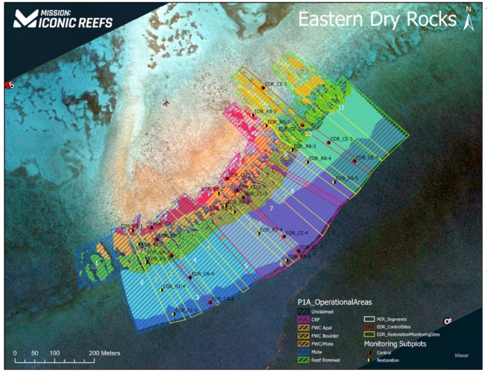


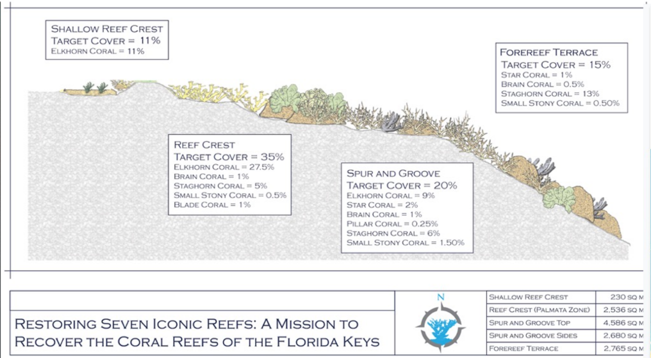
Partners: NOAA Restoration Center (RC), Coral Reef Conservation Program (CRCP), FKNMS, FWC
Users: Puerto Rico Department of Natural Environmental Resources, FEMA; RC; FKNMS

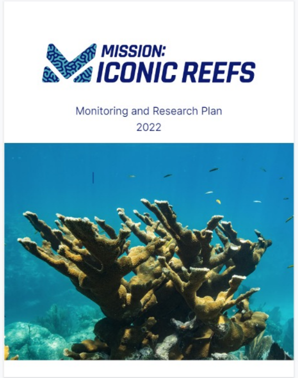
Coral Restoration Planning and Evaluation

- Develop habitat maps and spatial planning to guide restoration
- Co-led Working Group to develop and implement Mission:Iconic Reefs Monitoring and Research Plan *2022*



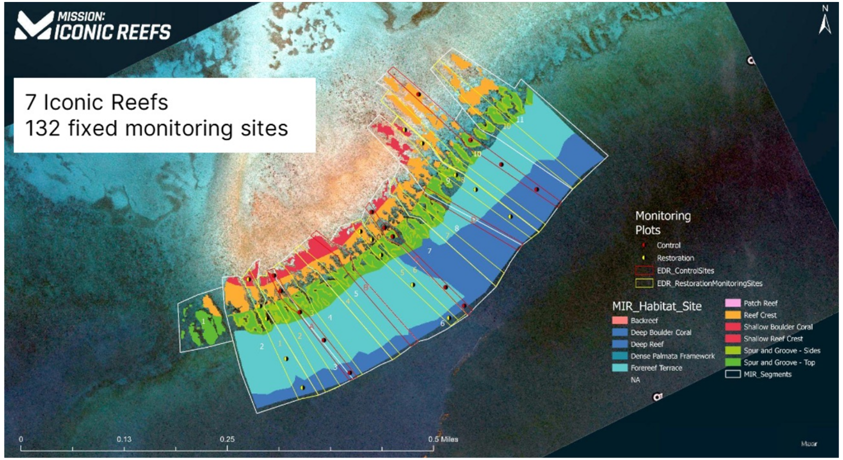






Partners and users: NOAA RC, FKNMS, Coral Reef Conservation Program (CRCP)

Coral Restoration Evaluation



Evaluation Metrics

Benthic community % cover
- Corals**
- Benthic community

Corals
- Species
- Size
- Density
- Condition
- Recruitment
- Survival/growth

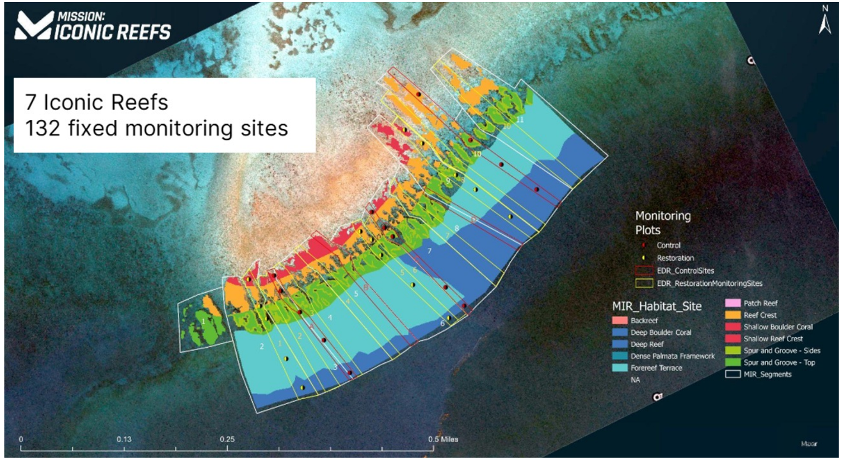
Reef complexity

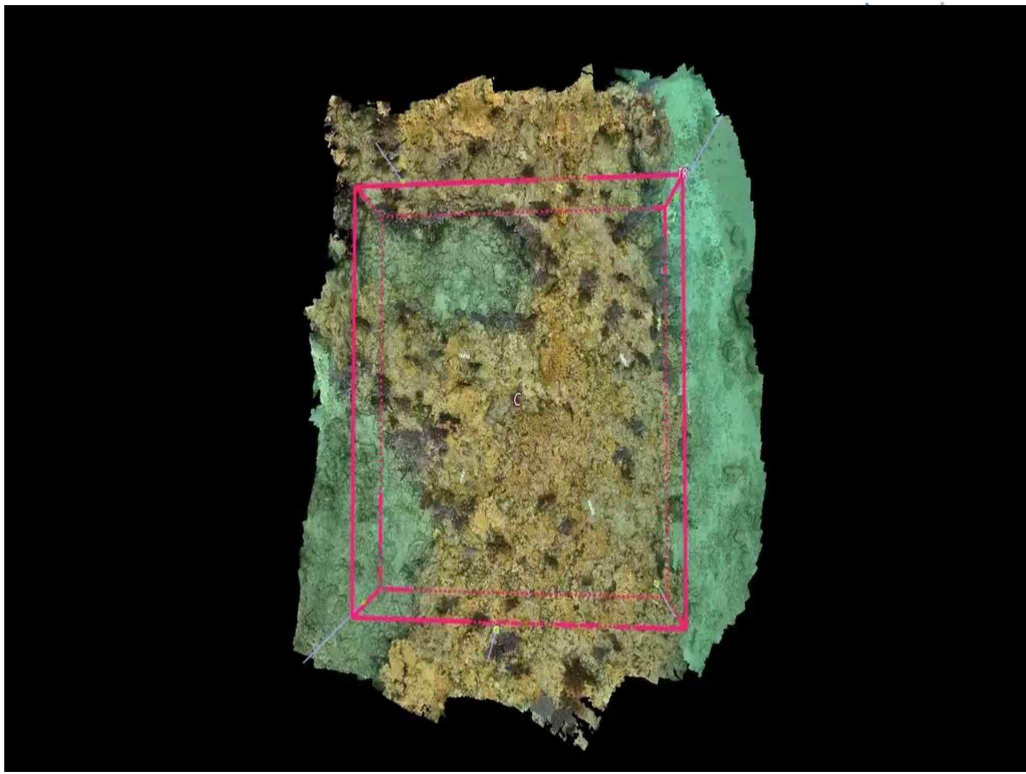
Fish
- Species
- Size
- Abundance

Herbivorous invertebrates (night)
- Urchins
- Crabs

Coral Restoration Evaluation

MISSION: ICONIC REEFS





MISSION: ICONIC REEFS

NOPP National Oceanographic Partnership Program

National Marine Sanctuaries Florida Keys

NOAA FISHERIES

NOAA's Atlantic Oceanographic and Meteorological Laboratory
U.S. Department of Commerce

USGS science for a changing world

SCRIPPS INSTITUTION OF OCEANOGRAPHY

UC San Diego

UNIVERSITY OF MIAMI

Duke UNIVERSITY

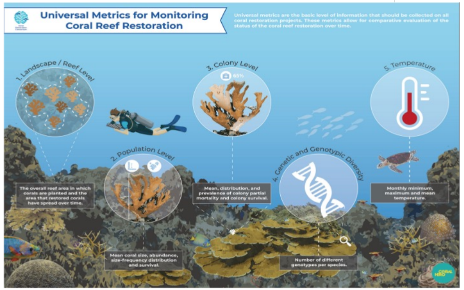
CORAL RESTORATION FOUNDATION™

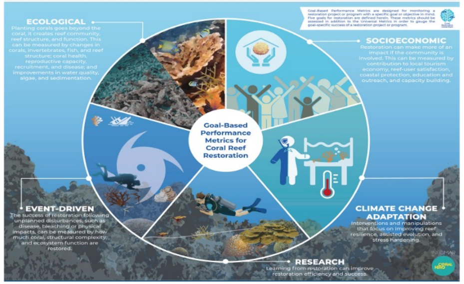
MOTE MARINE LABORATORY

Reef Renewal USA

Evaluating Restoration Success Outreach

CORAL RESTORATION CONSORTIUM





Coral Reef Restoration

English, Spanish

Latest Restoration Best Practices For Coral Reef Ecosystems, Including Guidance On Restoration Planning And...

Read More

Coral Reef Restoration for Coastal Resilience

Expert workshop

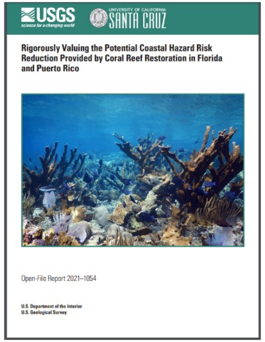
Recommendations to integrate ecology, hydrodynamics, and engineering into coral restoration to provide coastal protection

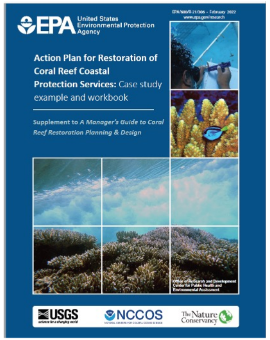
Partners

NOAA CORAL REEF CONSERVATION PROGRAM · NOAA FISHERIES · USGS science for a changing world · National Marine Sanctuaries Florida Keys · Duke University · University of Miami · UC Santa Cruz · UPR Recinto Universitario de Mayagüez · UC Santa Barbara · UNC Institute of Marine Sciences

Products

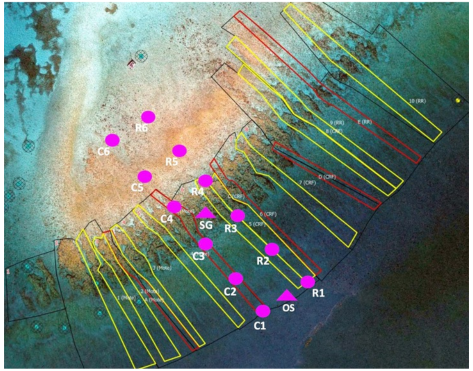
Viehman et al (in review). Coral restoration for coastal resilience: a framework for multi-scale integration of ecology, hydrodynamics, and engineering. Ecosphere.



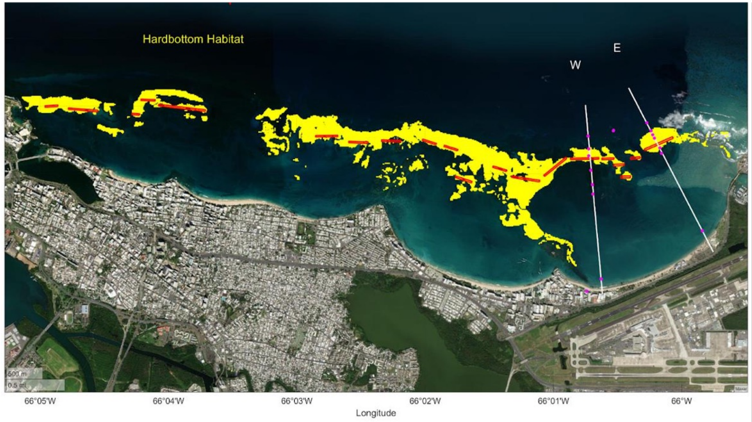


Coral Reef Restoration for Coastal Resilience

How do intact and restored coral reefs reduce wave energy?



How can coral reef restoration be designed to reduce coastal inundation?



Partners and users: Mission:Iconic Reefs (FKNMS & RC)
Partners: Duke University, Nortek

Partners: NOAA RC, USGS
Users: RC, PR DNER

Current and future directions

- Scaling up restoration design, implementation, and evaluation
  - Evaluate Iconic Reefs change
- Application of emerging technology
  - Reef-scale imagery (AUV, UAS)
  - Big Data and AI for optimizing image analyses for change in metrics
- Forecast modeling for optimal species and habitats for restorations in a changing climate
- Optimizing and evaluating coral restoration for coastal protection
  - Starting review of coral reef restoration and engineered structures with ACE EWN

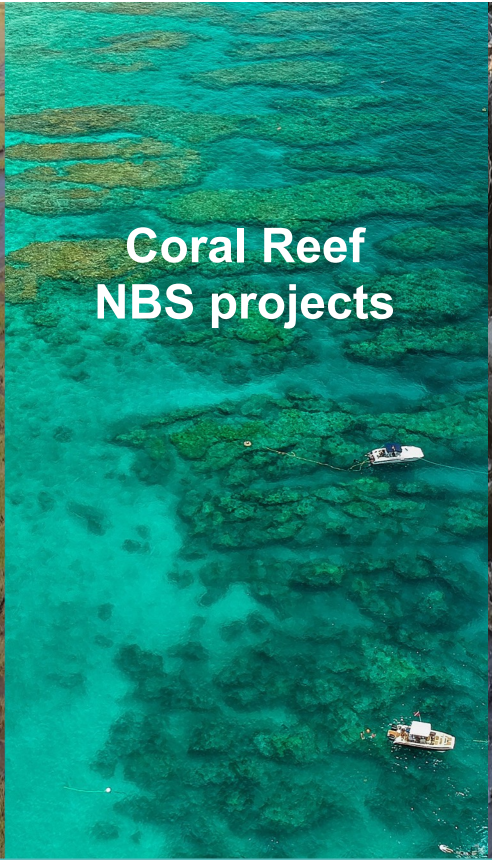
Science to support NBS implementation: a coordinated path forward

Brandon Puckett

Avery Paxton, Jenny Davis,
Shay Viehman, Christine Buckel

Photo: Nature-based Infrastructure Global Resource Centre


Coastal Marsh
NBS projects

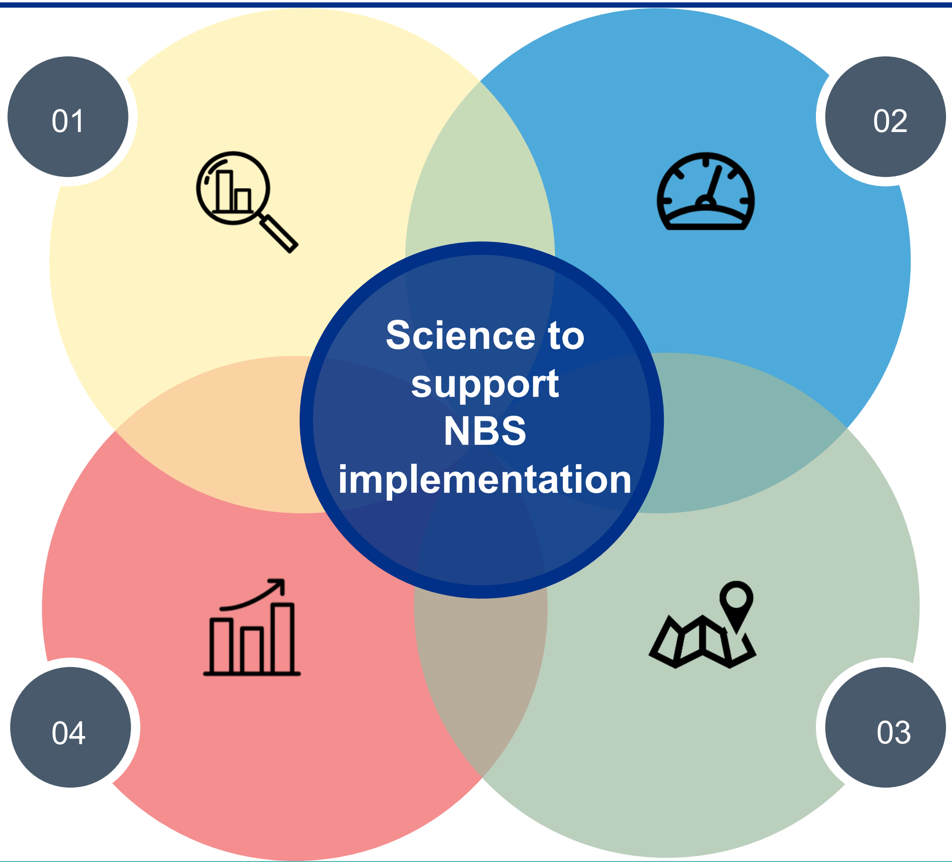

Coral Reef
NBS projects


Oyster Reef
NBS projects


Kelp
NBS projects

What are knowledge gaps on NBS performance?

How does NBS evolve and perform over time?



How can NBS implementation be improved?

What is the extent and distribution of NBS?

1: What are knowledge gaps on NBS performance?

- Assess state of science using evidence synthesis
  - Across physical, ecological, social, and economic performance outcomes
  - Six systems—marsh, coral, seagrass, shellfish, kelp, mangrove
  - User groups: NCCOS, federal agencies (e.g., USACE, USGS), academics, NBS practitioners

2. How does NBS evolve and perform over time?

NBS Type & Project Selection

Input from stakeholder (e.g., NOAA RC)

Projects 5-10+ yrs old

National in scale

Performance Analysis (individual projects)

Compare as-built surveys and initial monitoring data to current conditions

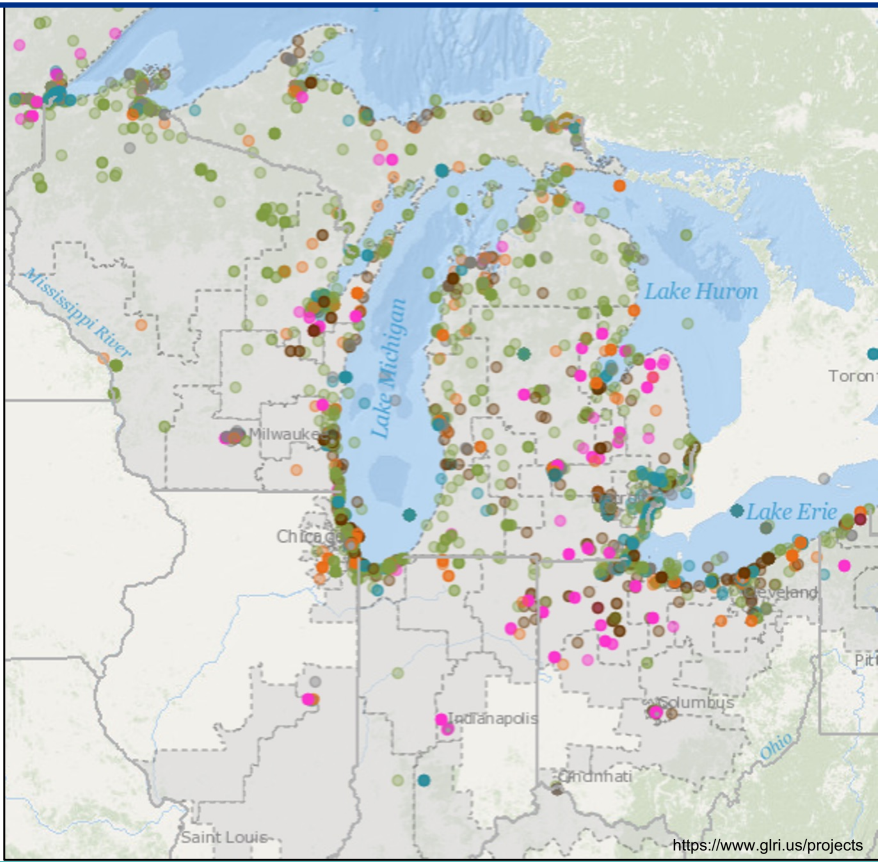
Multi-site Synthesis

Evaluation of outcomes across environmental gradients

Guidance on NBS performance

3. What is the extent and distribution of NBS?

- Census of federally funded NBS
  - Calculate NBS extent
  - Examine distribution by factors such as NBS type, age, intended benefit, monitoring actions, and socioeconomic setting
  - User groups: federal and state agencies, academics, practitioners and general public



4. How can NBS implementation be improved?

NBS Decision Support Tools

Data Visualizations

Evaluation Guidance

- Informing and improving future decisions
- Learning from previous projects
- Evaluating success and adaptively managing

Planners, Permitters, Practitioners, Funders, Managers, Researchers

The Effects of Sea Level Rise Program (ESLR)

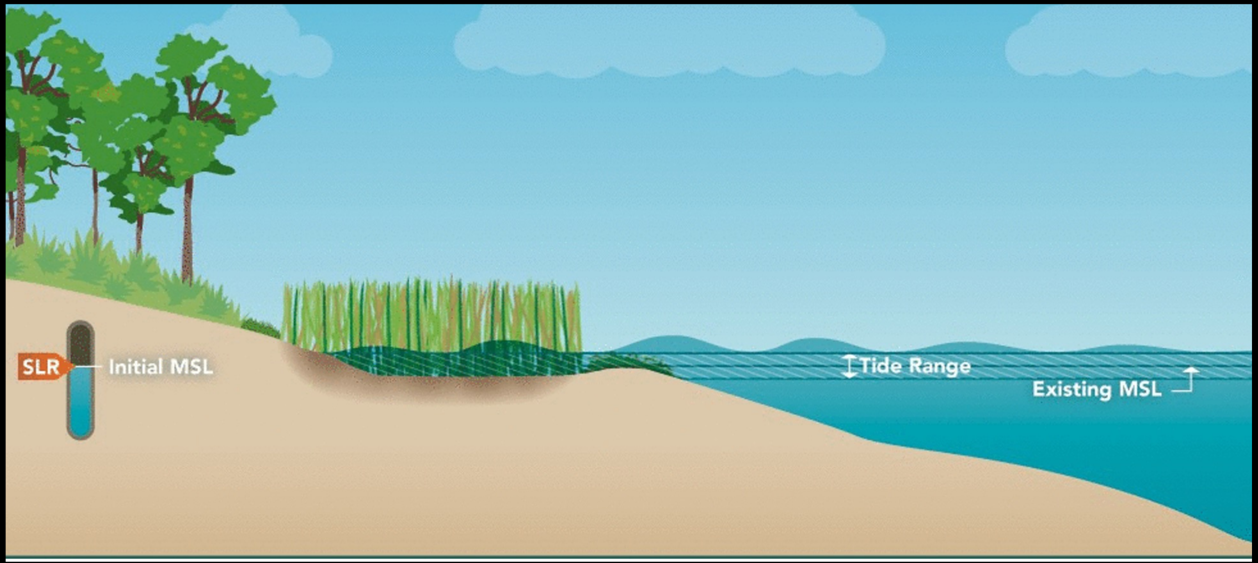
ESLR Overview and Accomplishments

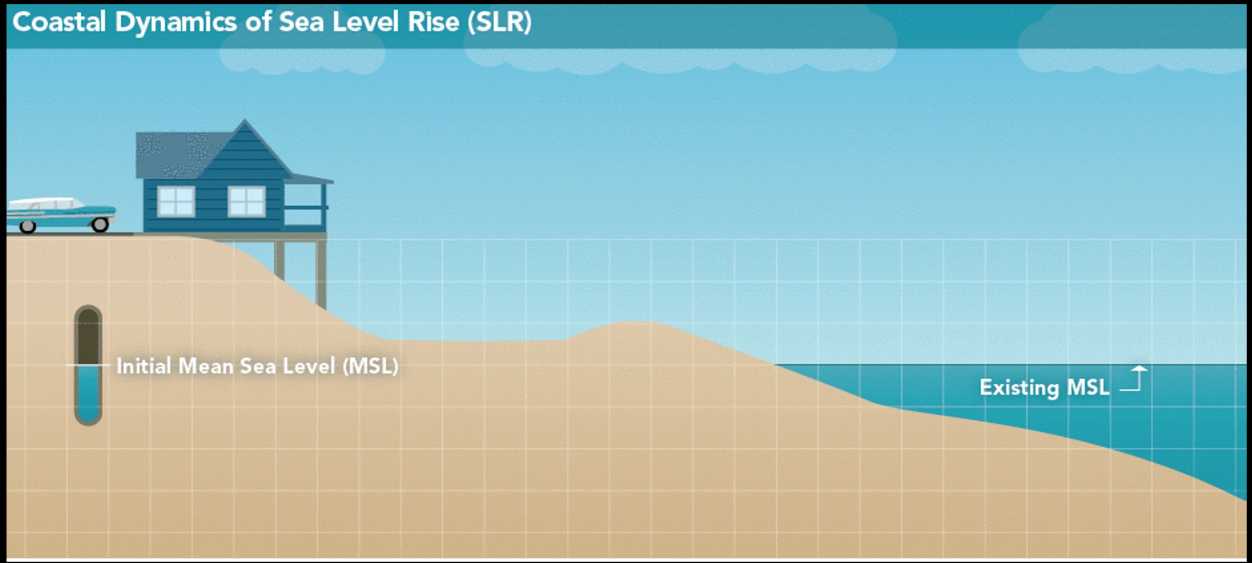
Trevor Meckley

Science to explore natural solutions and policy changes that protect ecosystems, infrastructure, and communities against flooding from sea level rise and storm surge

Improve models to capture coastal processes to predict coastal change

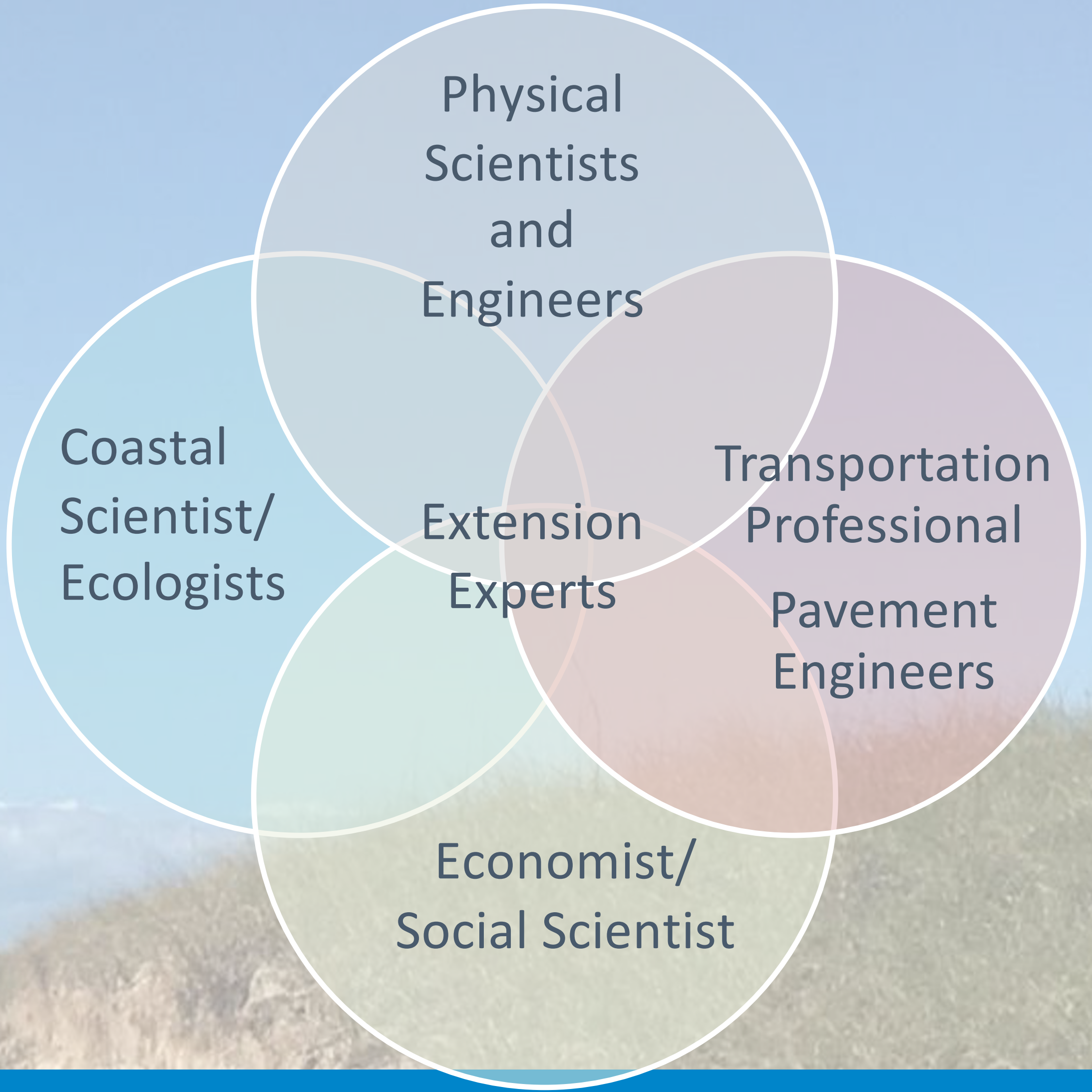
...and subsequent impacts

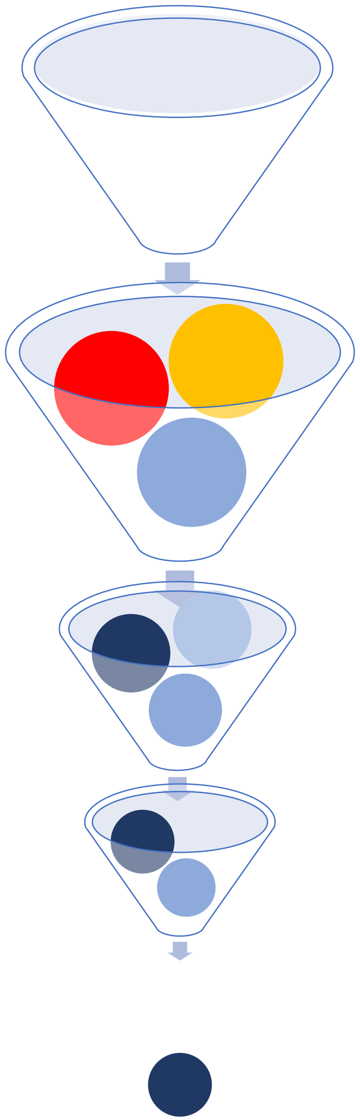




…to inform policy action and land management

ESLR uses a co-production approach and transdisciplinary research teams.





Develop a funding prospectus based on scientific gaps for informing coastal management

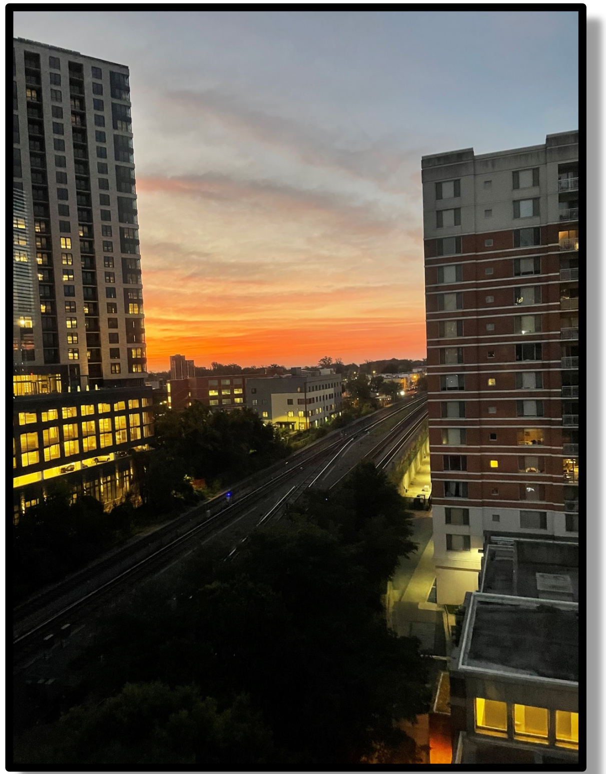
Develop FFO priorities and requirements and post on Grants.Gov to solicit proposals

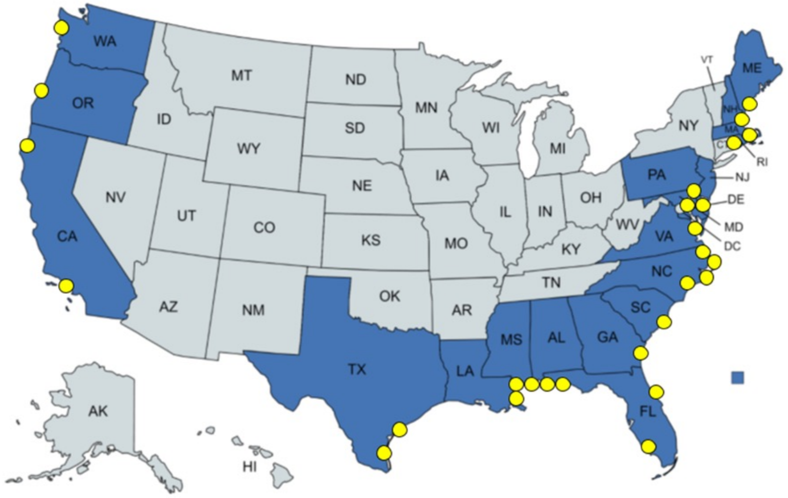
Provided feedback on letter of Intent

Expert reviews inform our selection of projects

Select awards for funding

ESLR research projects are managed as cooperative agreements.

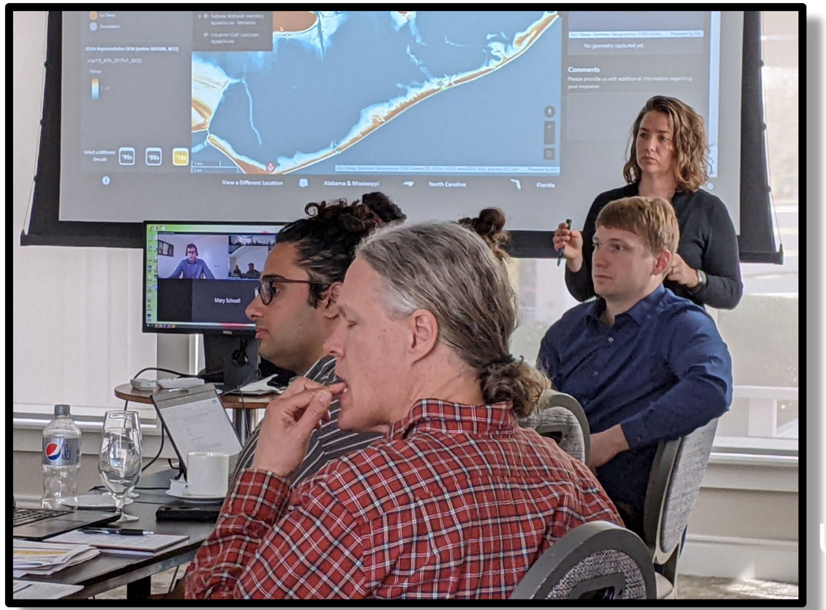




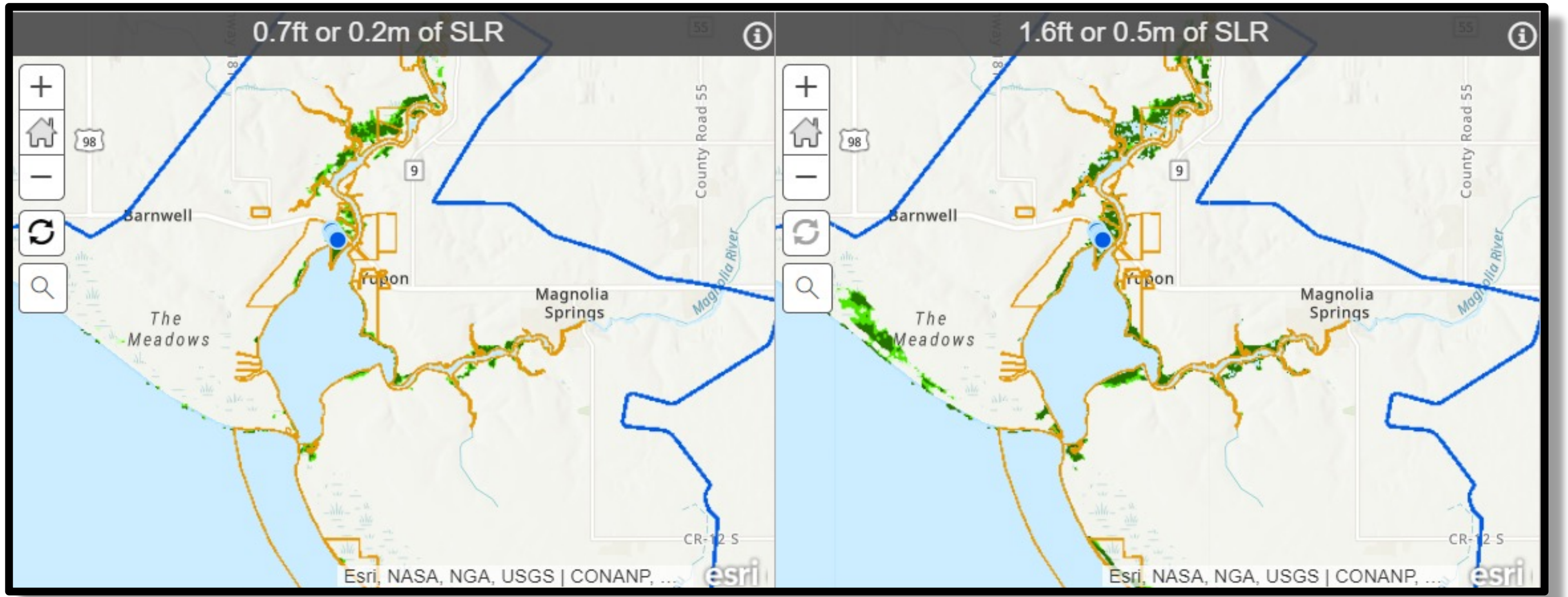
Field visits help with understanding scale, existing science challenges or needs, and cementing relationships.

USACE FRF, NC

We serve as boundary experts, supporting engagement between scientists and science users and usually attend meetings.



Attend Advisory Group Meetings



Support Science Extension Products

2005 Program Initiated in NC (1)

2015 Sentinel Site FFO (4)

2019 FFO NNBF National (8)

Annual Budget

1.8

0.7

1.3

2.3

2.3

4.6

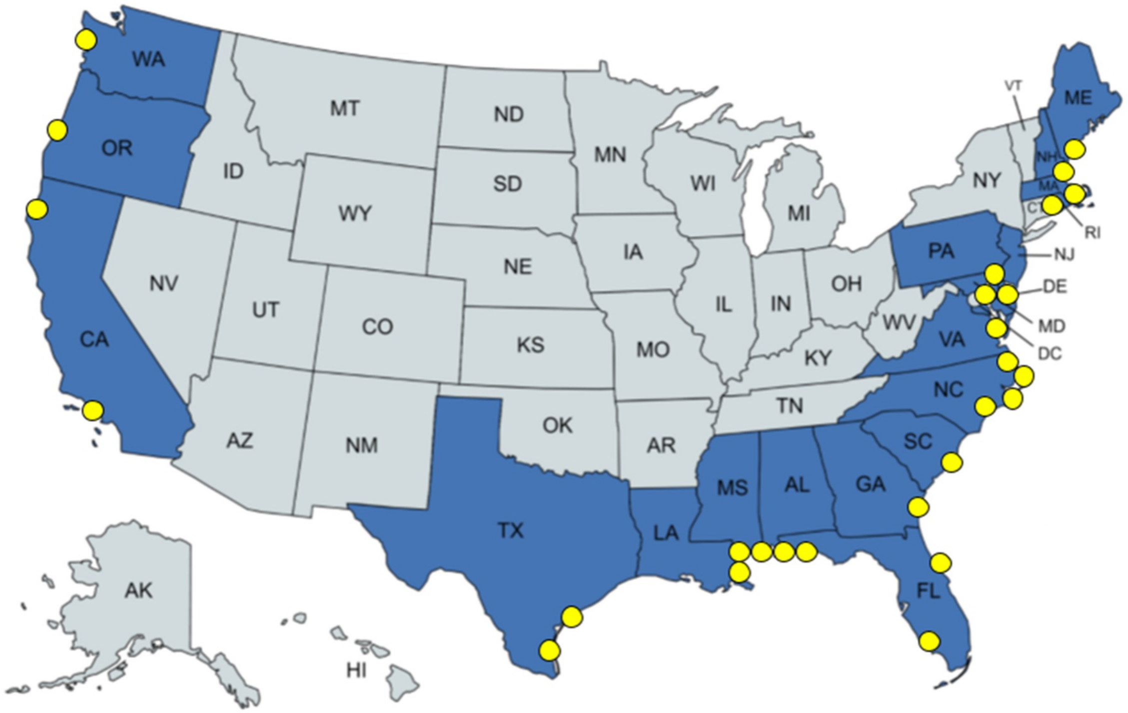
Currently 16 active projects budget and an annual budget of 4M

2009 Gulf (1)

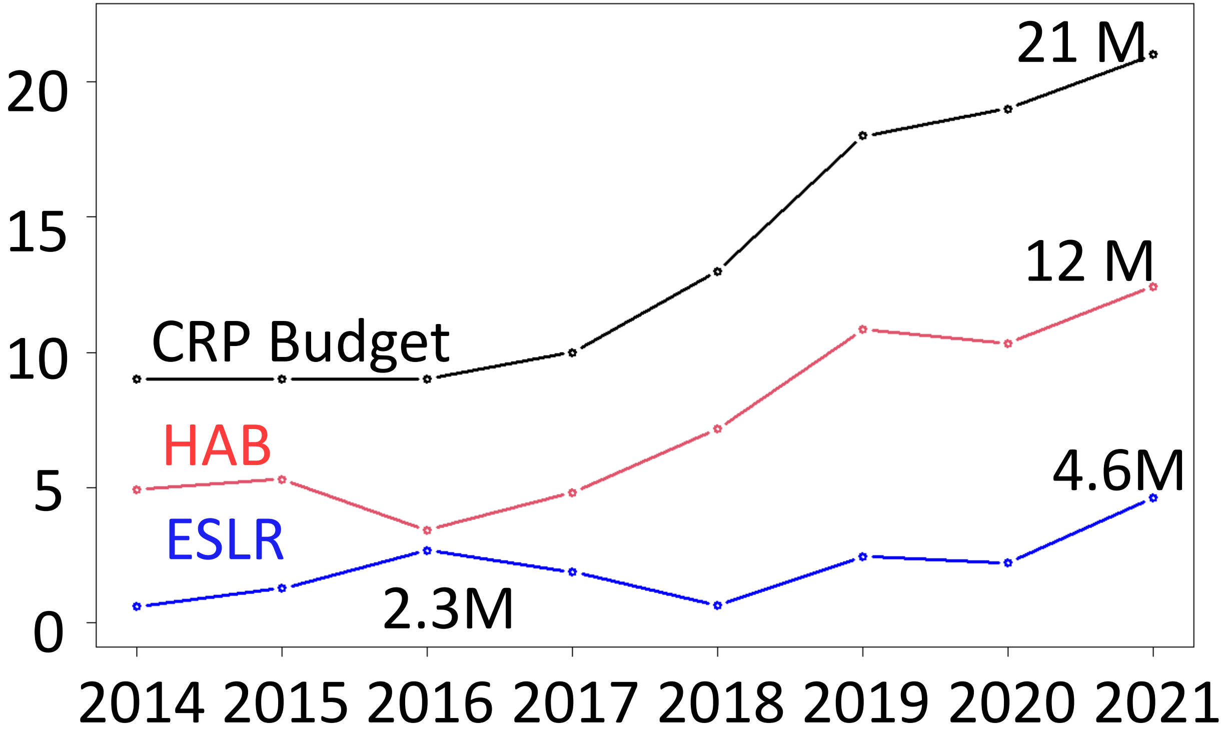
2016 FFO NNBF in Gulf and CA (3)

2019 ESLR Event Response Begins (3)

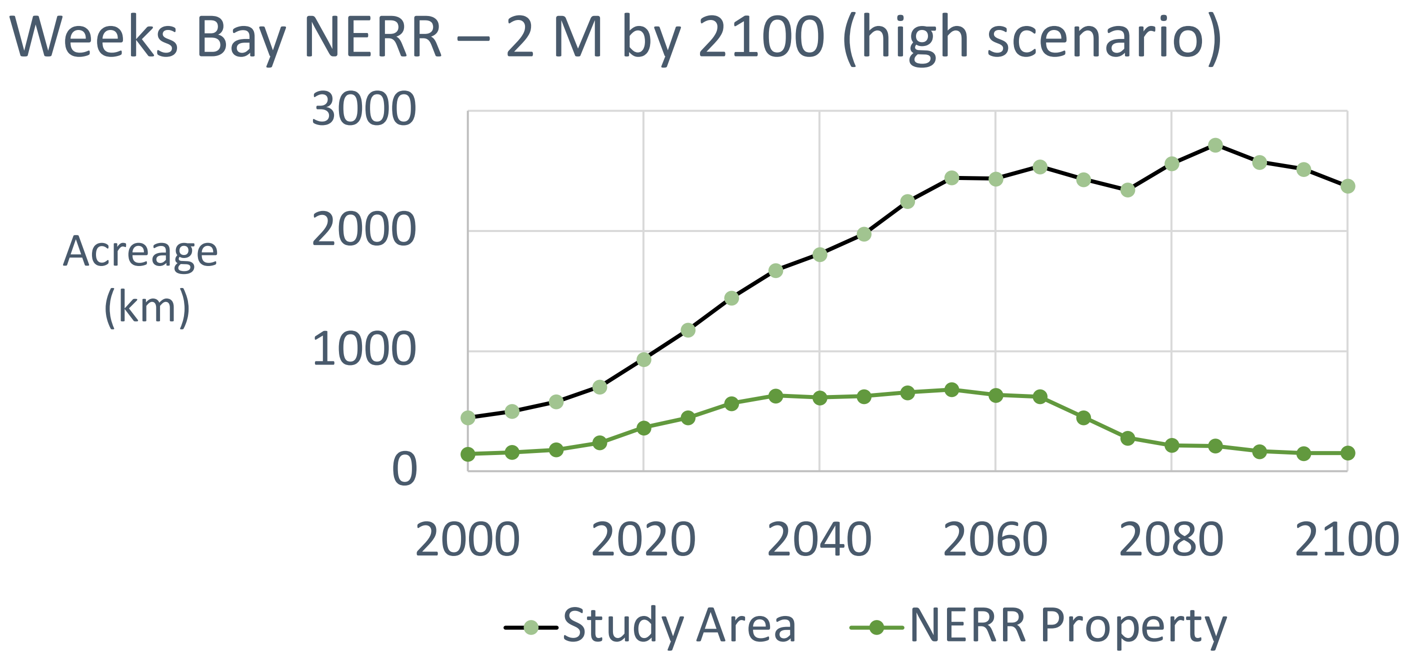
2021 FFO NNBF and FHWA (8)

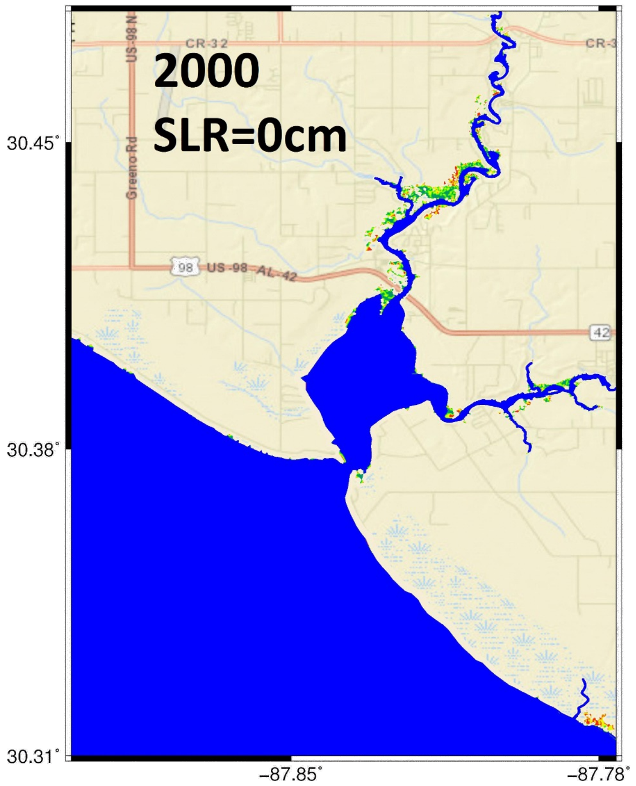


FY21 Map of Project locations, some projects have multiple sites



Weeks Bay area will gain marsh but lose it in the reserve

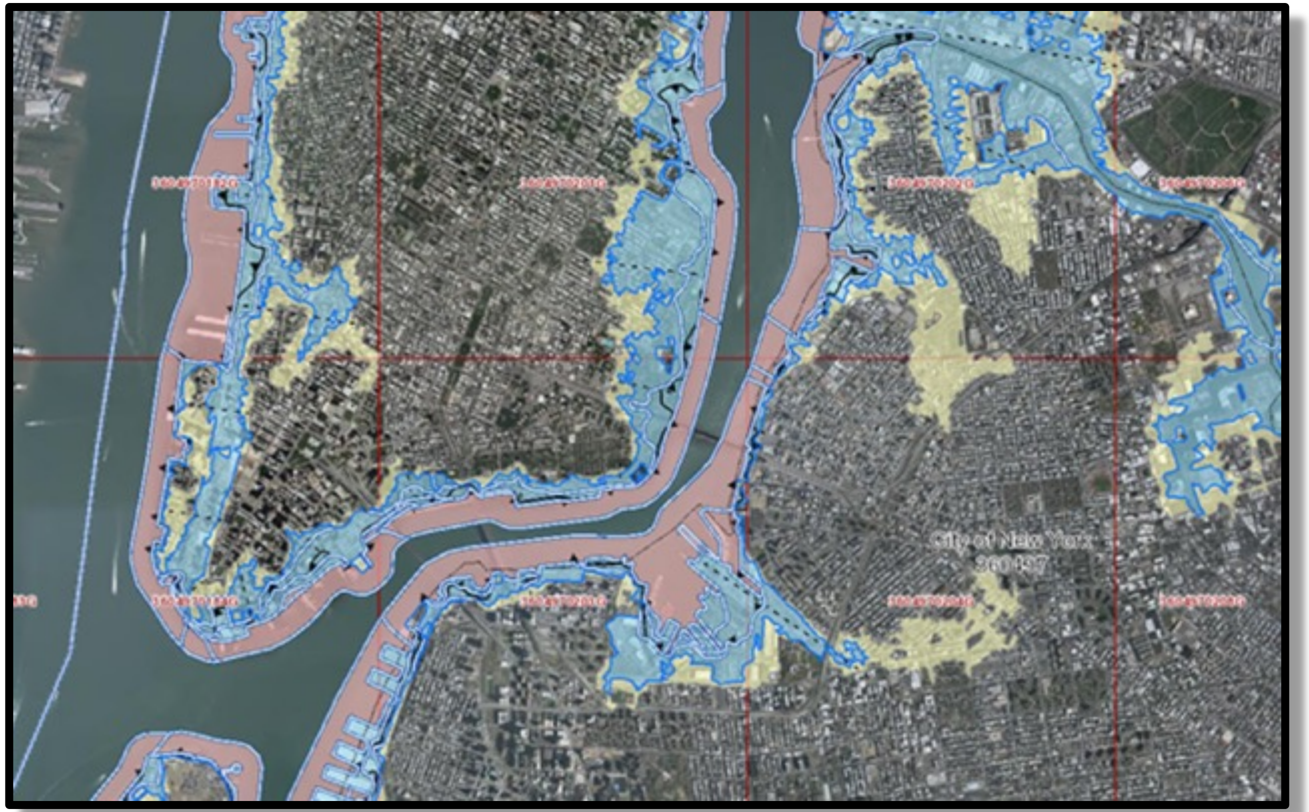




Hydro-MEM: Water, Low, Medium, High

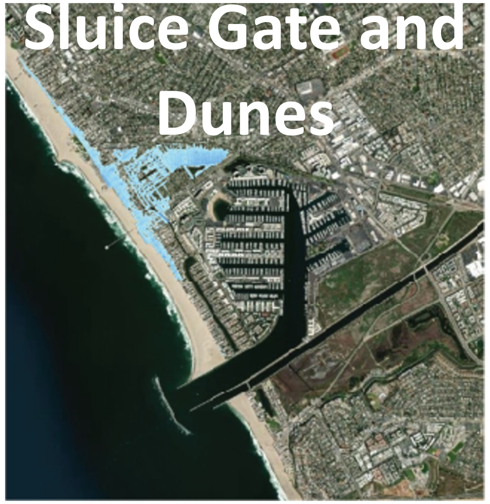
2. Vulnerability to flood under SLR

- Update floodplain results
- Inform planning for historic buildings or critical facilities
- Guide watershed management

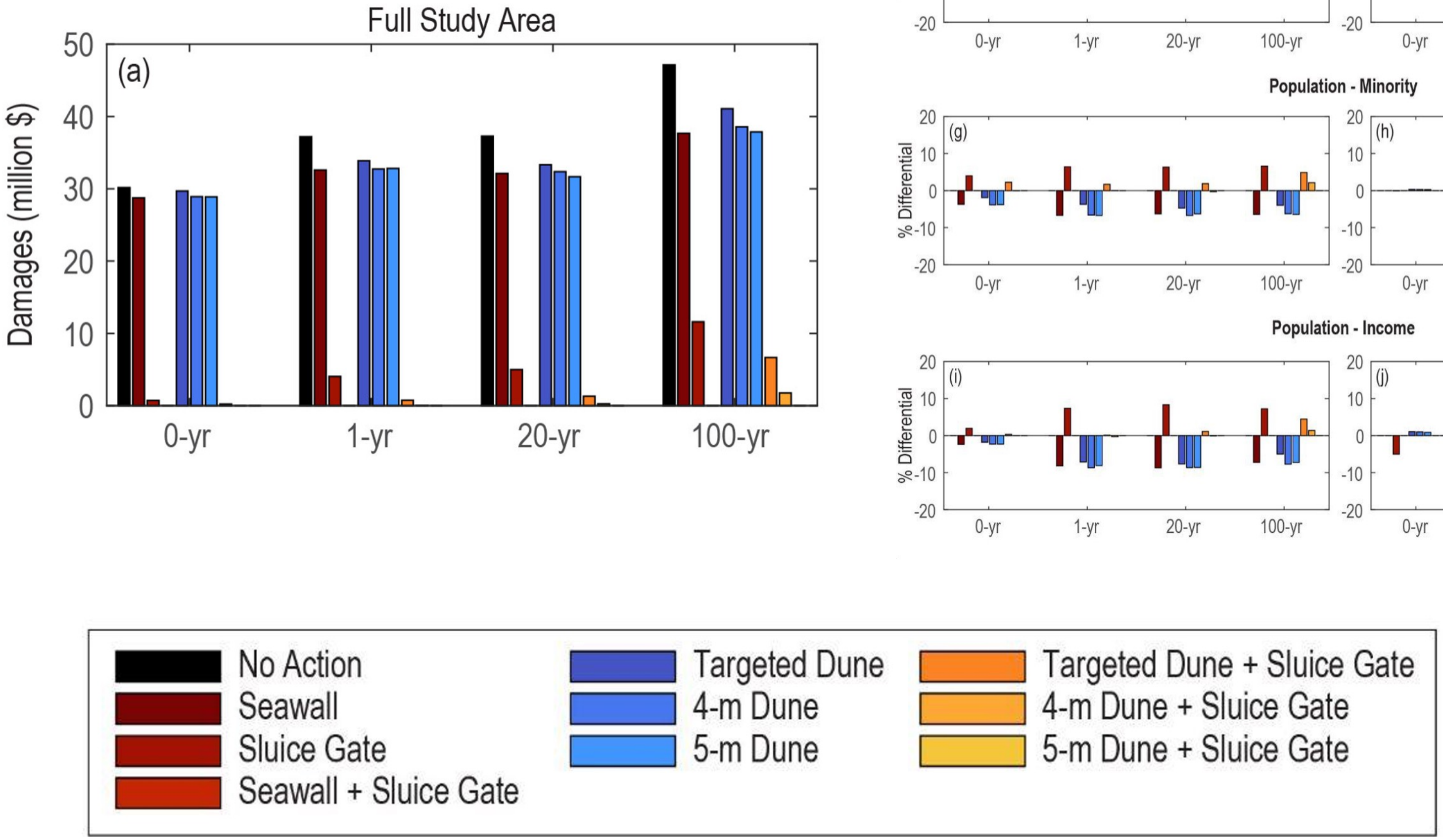


FEMA Floodplain Map

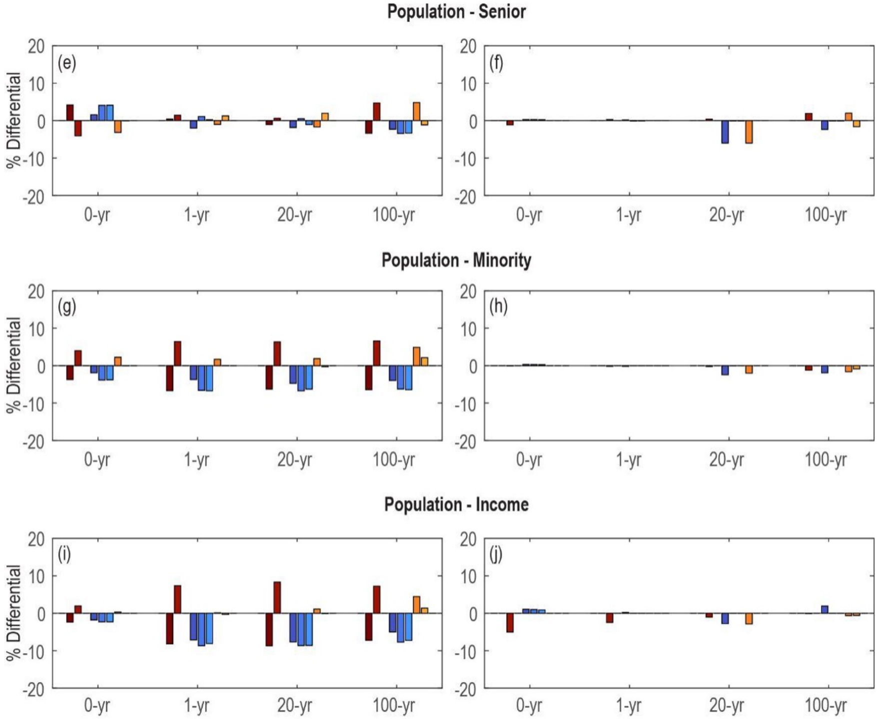
Possible Actions:



What approach saves $?



Who is Impacted?



1. ELSR is responsible for a paradigm shift in model approaches to include process based models.

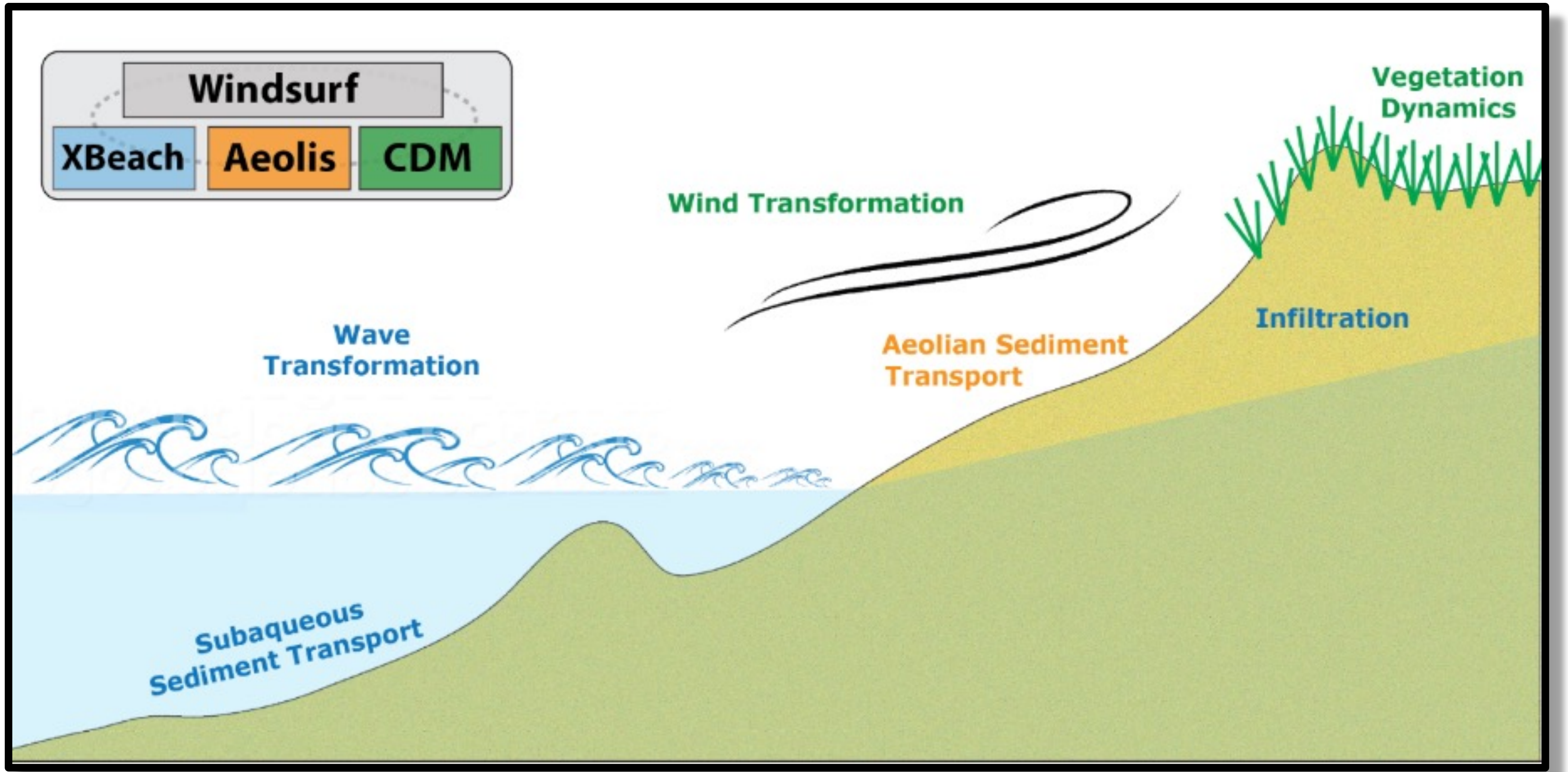
ACUNE+

CoSMoS-ModFlow

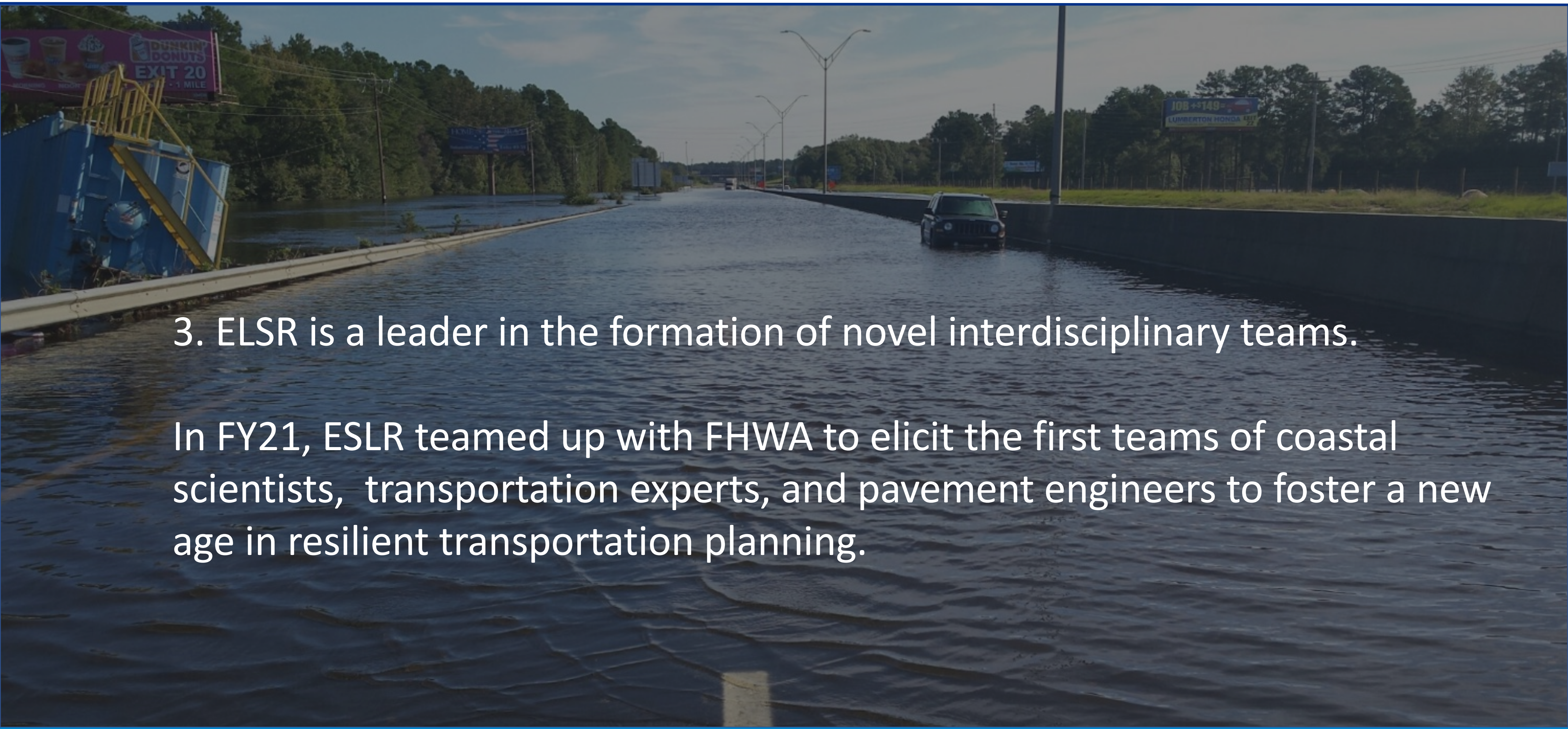
Hydro-MEM

WARMER-Delft-3D

WindSurf →



2. ESLR brought the co-produced science concept to coastal modeling and management that has become a standard for applied NOAA science.



3. ELSR is a leader in the formation of novel interdisciplinary teams.

In FY21, ESLR teamed up with FHWA to elicit the first teams of coastal scientists, transportation experts, and pavement engineers to foster a new age in resilient transportation planning.

4. ESLR functions as a bridge across NOAA and other agency missions.

This includes connecting NOAA extension and NOAA water level prediction.

We are innovating in several ways:

ESLR is growing, 65% of projects are still active

A new funding opportunity will be offered called ESLR Technical Assistance.

FEMA Building Resilient Infrastructure and Communities Direct Technical Assistance is collaborating with the new funding opportunity

Dr. Peter Ruggiero – Oregon State University

Dr. Davina Passeri – St. Petersburg Coastal and Marine Science Center USGS

Dr. Renee Collini – Mississippi State University, Mississippi-Alabama and Florida Sea Grant

Dr. Brett Sanders – University of California at Irvine

The Coastal Recovery from Storms Tool (CReST): A Model for Assessing the Impact of Sea Level Rise on Natural and Managed Beaches and Dunes

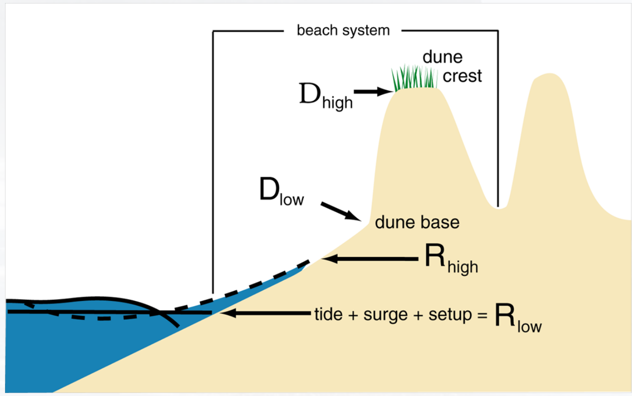
Project Overview November 15th, 2022

The Coastal Recovery from Storms Tool (CReST)

Beaches and foredunes provide important ecosystem services

1. Coastal Protection

- serve as barriers from extreme storms, sea level rise, and tsunamis
- prevent beach erosion compared to gray infrastructure (e.g., sea walls, rip-rap, etc.)
- capture and stabilize blowing sand, which can damage infrastructure



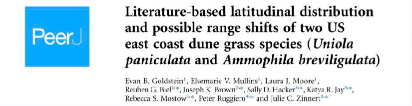
The Coastal Recovery from Storms Tool (CReST)

Beaches and foredunes provide important ecosystem services

2. **Recreation** (e.g., beach activities)
3. **Aesthetics** (e.g., viewshed)
4. **Biodiversity conservation** (e.g., native species)

The Coastal Recovery from Storms Tool (CReST)

Project Motivation: Storm impact assessments are incredibly valuable **but do not account for dune evolution**; Dune Shape, dune Evolution, and dune management impacts coastal Protection services; Gradients in grass species may influence dune evolution



PeerJ

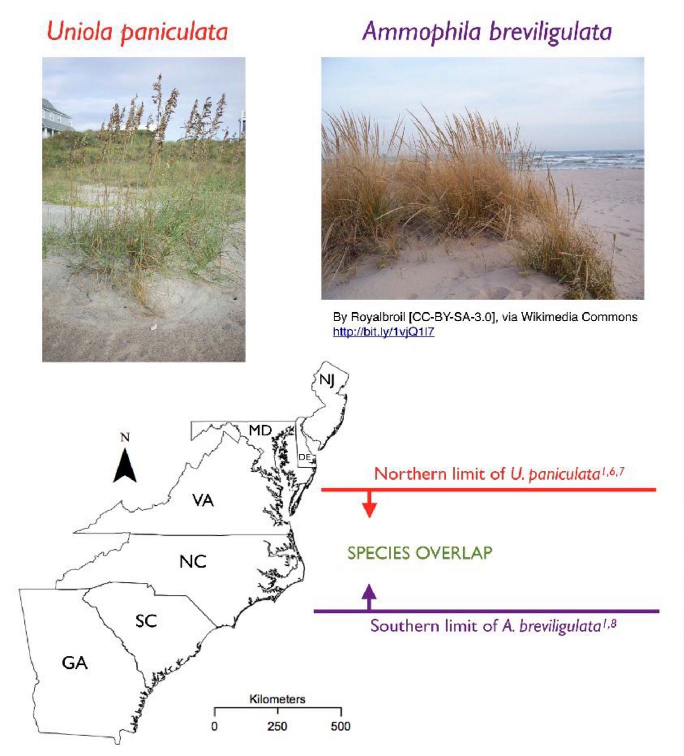
Literature-based latitudinal distribution and possible range shifts of two US east coast dune grass species (*Uniola paniculata* and *Ammophila breviligulata*)

Evan B. Goldstein[1], Elsemarie V. Mullins[1], Laura J. Moore[1], Reuben G. Biel[1,*], Joseph K. Brown[2,*], Sally D. Hacker[3,*], Katya R. Jay[3,*], Rebecca S. Mostow[3,*], Peter Ruggiero[4,*] and Julie C. Zinnert[2,*]

Probability (%) of inundation (inner), overwash (middle), and collision (outer) during a CAT3 hurricane

Hurricane Floyd impacts

Hurricane Irene impacts



The Coastal Recovery from Storms Tool (CReST)

Project Motivation: Beach/dune management Issues within NCSSC

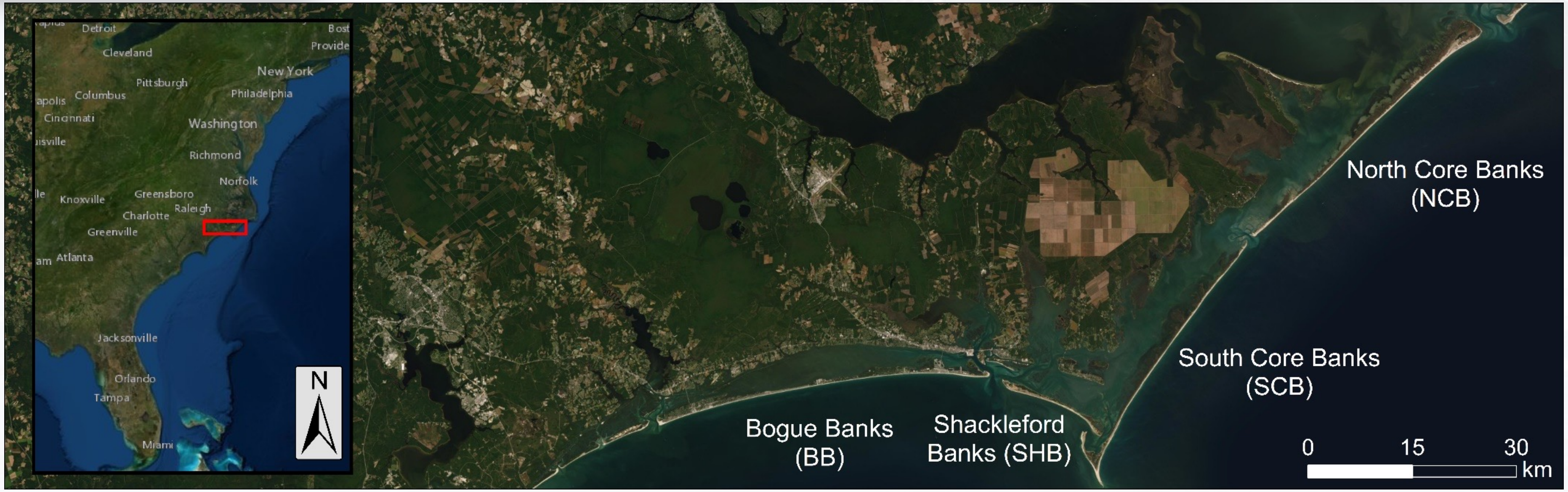
BB: Beach nourishment, grass planting, and sand fencing to protect against flooding and erosion
SHB: Dune erosion, pony and bird habitat
SCB: Bird and turtle habitat, infrastructure, driving impacts
NCB: Bird and turtle habitat, erosion near cabins – possible plantings/fencing, driving impacts
NCSSC: climate change impacts on coastal hazards/coastal ecosystems

The Coastal Recovery from Storms Tool (CReST)

PIs: Peter Ruggiero, Sally Hacker, Laura Moore

Students/Postdocs/Technicians: Reuben Biel, Nick Cohn, Evan Goldstein, Paige Hovenga, Michael Itzkin, Katya Jay, Rebecca Mostow, Elsemarie Mullins, Ian Reeves, Orencio Duran Vinent, John Stepanek, Hannah Lawrence, Jeff Wood

Community Partners: Jennifer Dorton, Sarah Spiegler, Rudy Rudolph, Sue Stuska



Study Site: NCSSC outer coast

The Coastal Recovery from Storms Tool (CReST)

Oregon State University | NOAA | The University of North Carolina at Chapel Hill

Environmental Modelling and Software 153 (2022) 105404
Contents lists available at ScienceDirect
Environmental Modelling and Software
journal homepage: www.elsevier.com/locate/envsoft

Combining process-based and data-driven approaches to forecast beach and dune change

Michael Itzkin [a,*,1], Laura J. Moore [a], Peter Ruggiero [b], Paige A. Hovenga [b,2], Sally D. Hacker [c]

Journal of Marine Science and Engineering
MDPI
Article

Exploring Marine and Aeolian Controls on Coastal Foredune Growth Using a Coupled Numerical Model

Nicholas Cohn [1,†,*], Bas M. Hoonhout [2,3,‡], Evan B. Goldstein [4], Sierd de Vries [3], Laura J. Moore [4], Orencio Durán Vinent [5] and Peter Ruggiero [1]

TECHNICAL NOTE:

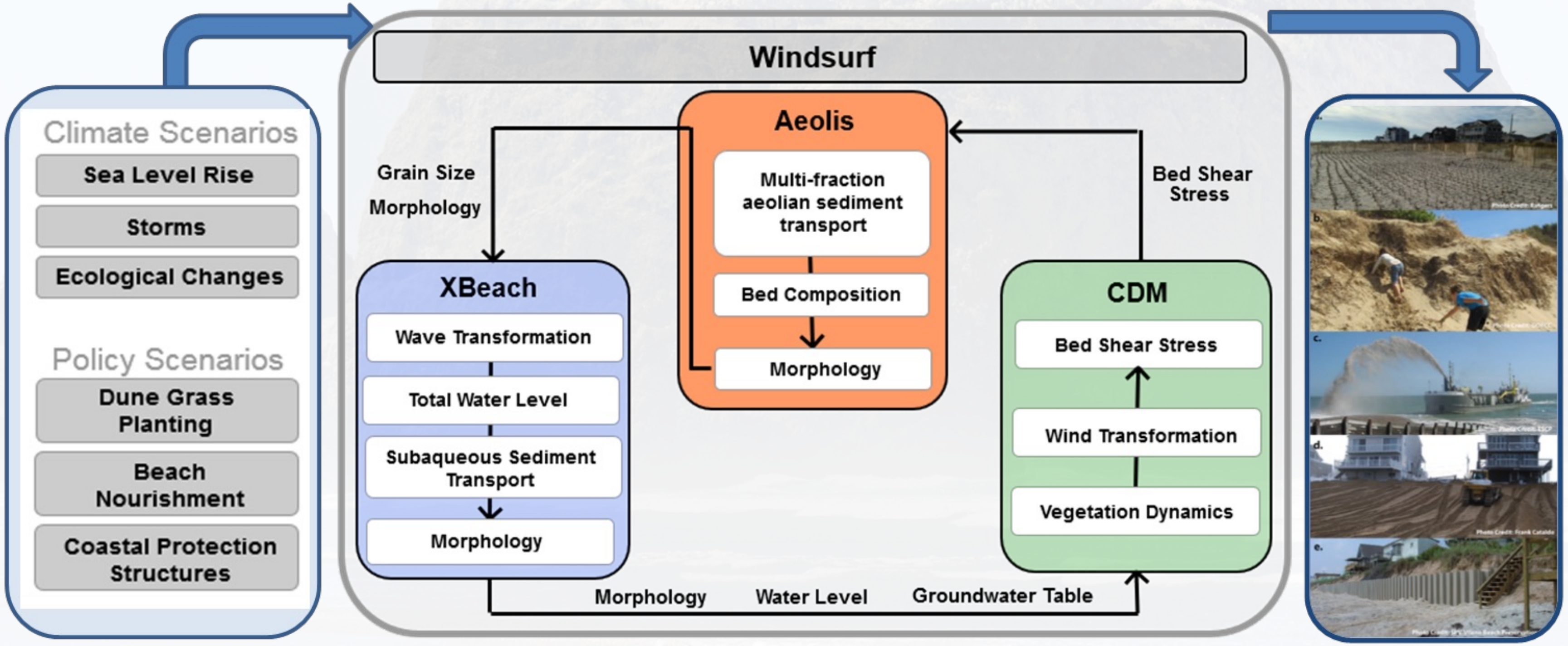
Simulating dune evolution on managed coastlines: Exploring management options with the Coastal Recovery from Storms Tool (CReST)

By

Peter Ruggiero[1], Nicholas Cohn[1,2], Bas Hoonhout[3,4], Evan Goldstein[5], Sierd de Vries[3], Laura Moore[6], Sally Hacker[7], and Orencio Durán Vinent[8]

Shore & Beach ■ Vol. 87, No. 2 ■ Spring 2019

The Coastal Recovery from Storms Tool (CReST)



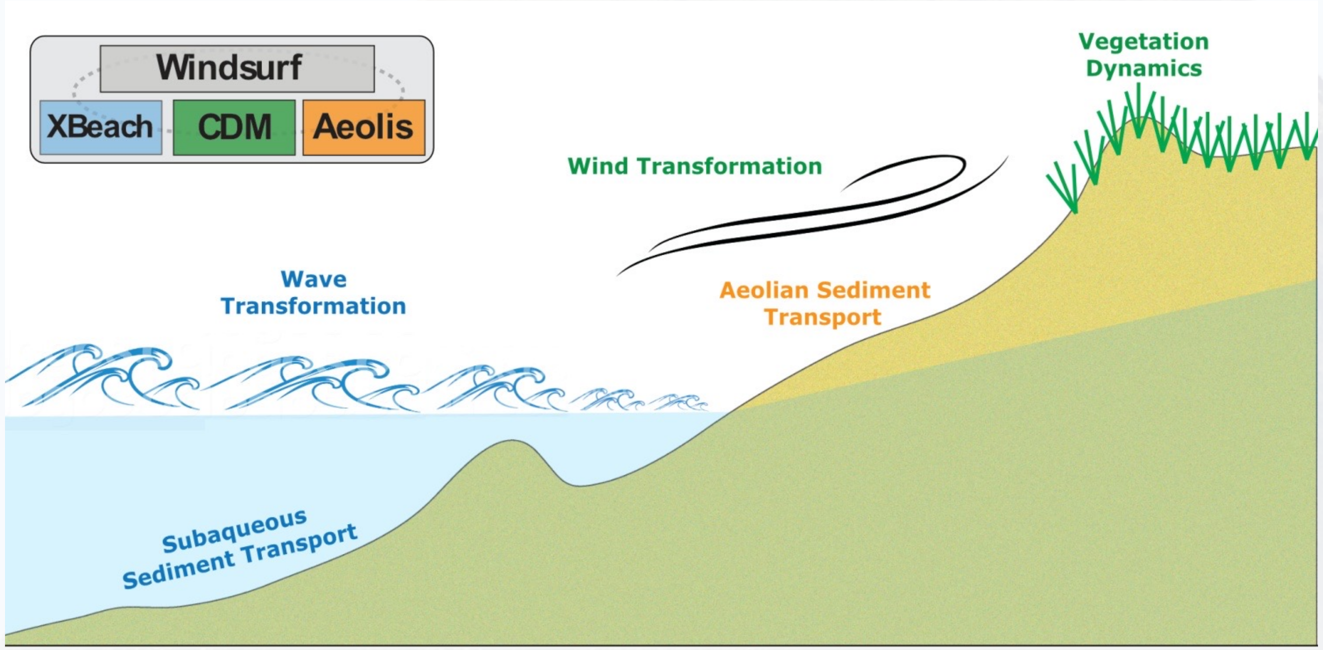
Cohn et al., 2019; Ruggiero et al., 2019; Itzkin et al., 2022; Hovenga et al., in revision

Roelvink et al., 2009

de Vries et al., 2014
Hoonhout and de Vries, 2016

Durán and Moore, 2013
Moore, Durán, and Ruggiero, 2016

The Coastal Recovery from Storms Tool (CReST)



Factors Controlling Beach and Dune Recovery/Growth

Environmental Conditions

- Wind, waves, storm frequency
- Water levels (tides, storm surge, runup)
- Groundwater, precipitation
- Climate change and variability

Physical/Ecological Factors

- Vegetation characteristics
- Sediment supply and type
- Tectonic setting

Anthropogenic Factors

- Engineering structures
- Management actions
- Recreation patterns

Data Collection Dates

- October 2016
- October 2017
- October 2018
- November 2019
  - Pre / post nor'easter on SCB
- 2020 - COVID

77 Site Locations

22 BGB
12 SHB
21 SCB
22 NCB

Data Types

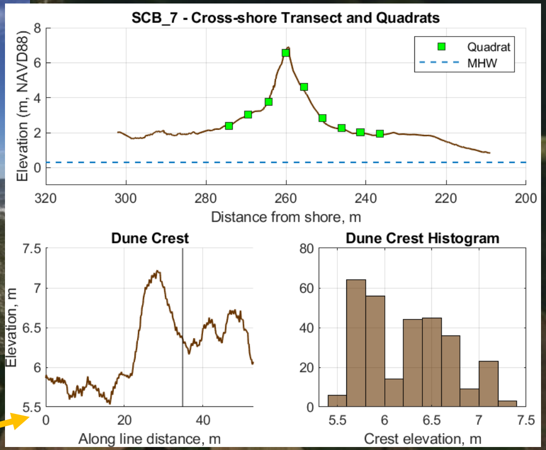
Real Time Kinematic GPS

- Cross-shore topographic profiles
- Along-crest topographic profiles
- Transect quadrat

Ecological quadrat sampling

- Percent ground / plant cover
- Tiller density

Sediment sample at dune toe



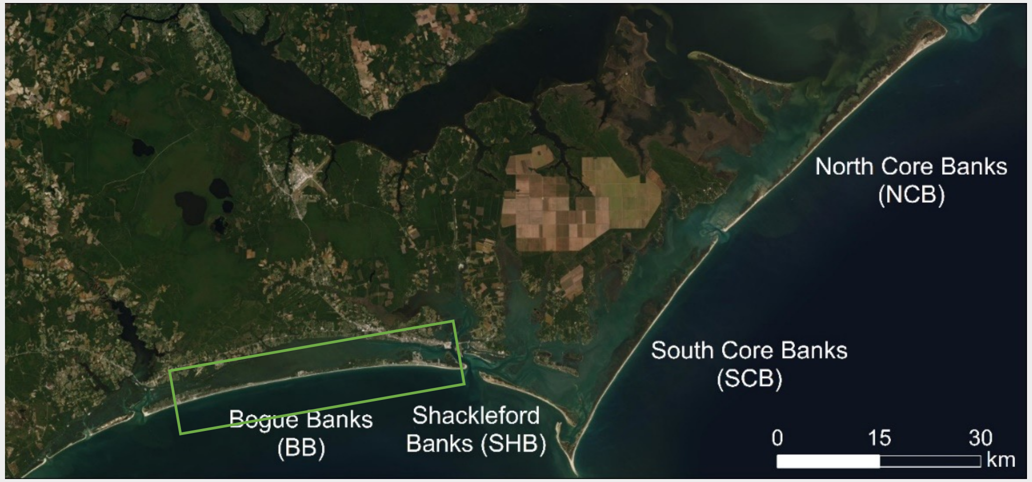
Field data collection to initialize, calibrate, verify, and apply numerical model

CReST Simulations
Relevant for NCSSC Coasts

- **Baseline Case**
  Show capabilities of model for beach and dune recovery

- **Additional Numerical Experiments**

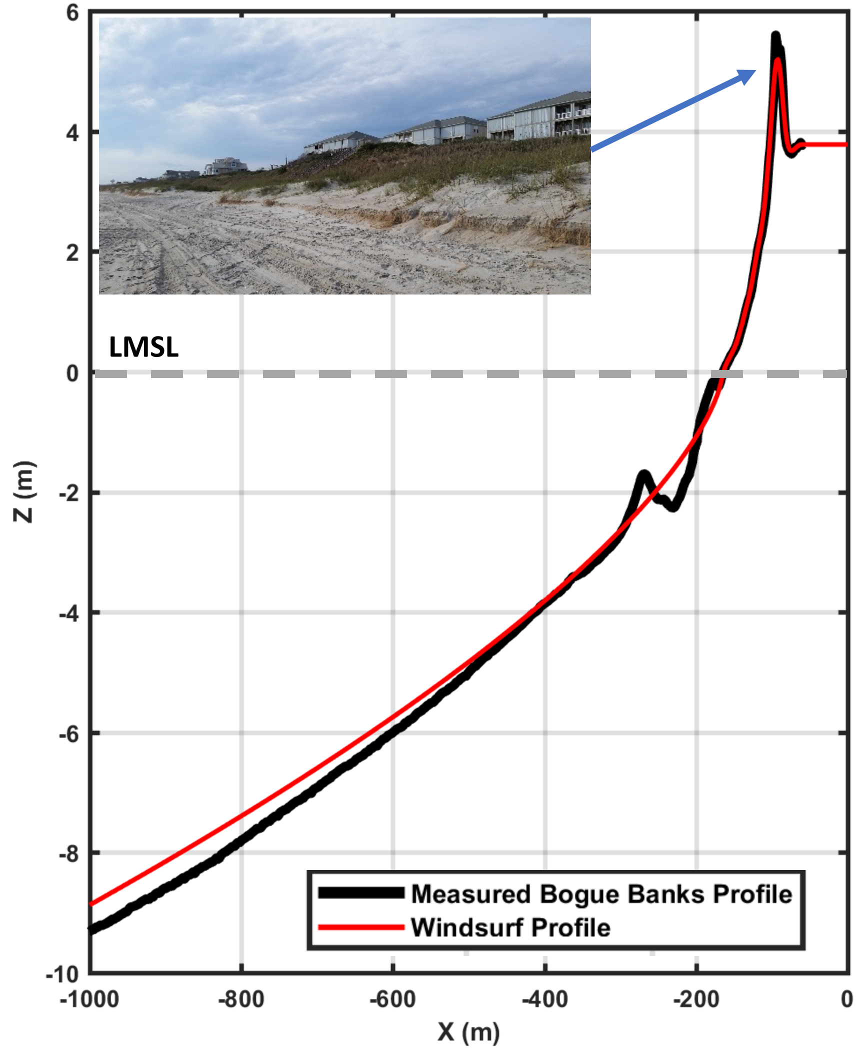
  - **Alter Vegetation**
  - **Alter Grain Size Properties**
  - **Explore Role of Climate Variability**
  - **Explore Timing of Beach Nourishments**



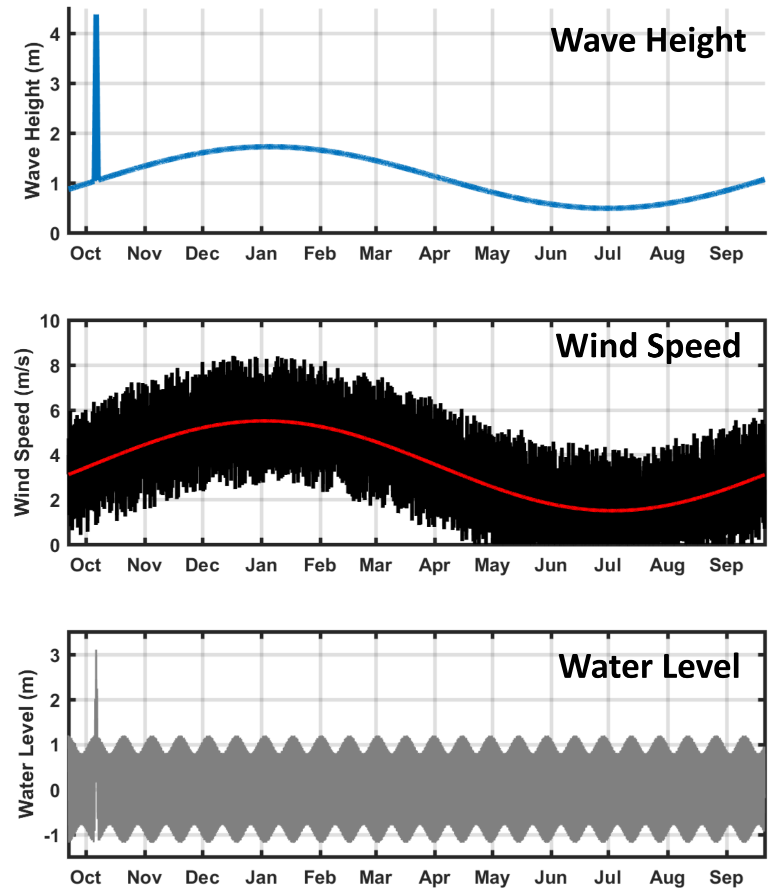
Ruggiero et al., 2019

CREST/Windsurf : Base Case Based on Bogue Banks, North Carolina

Morphology

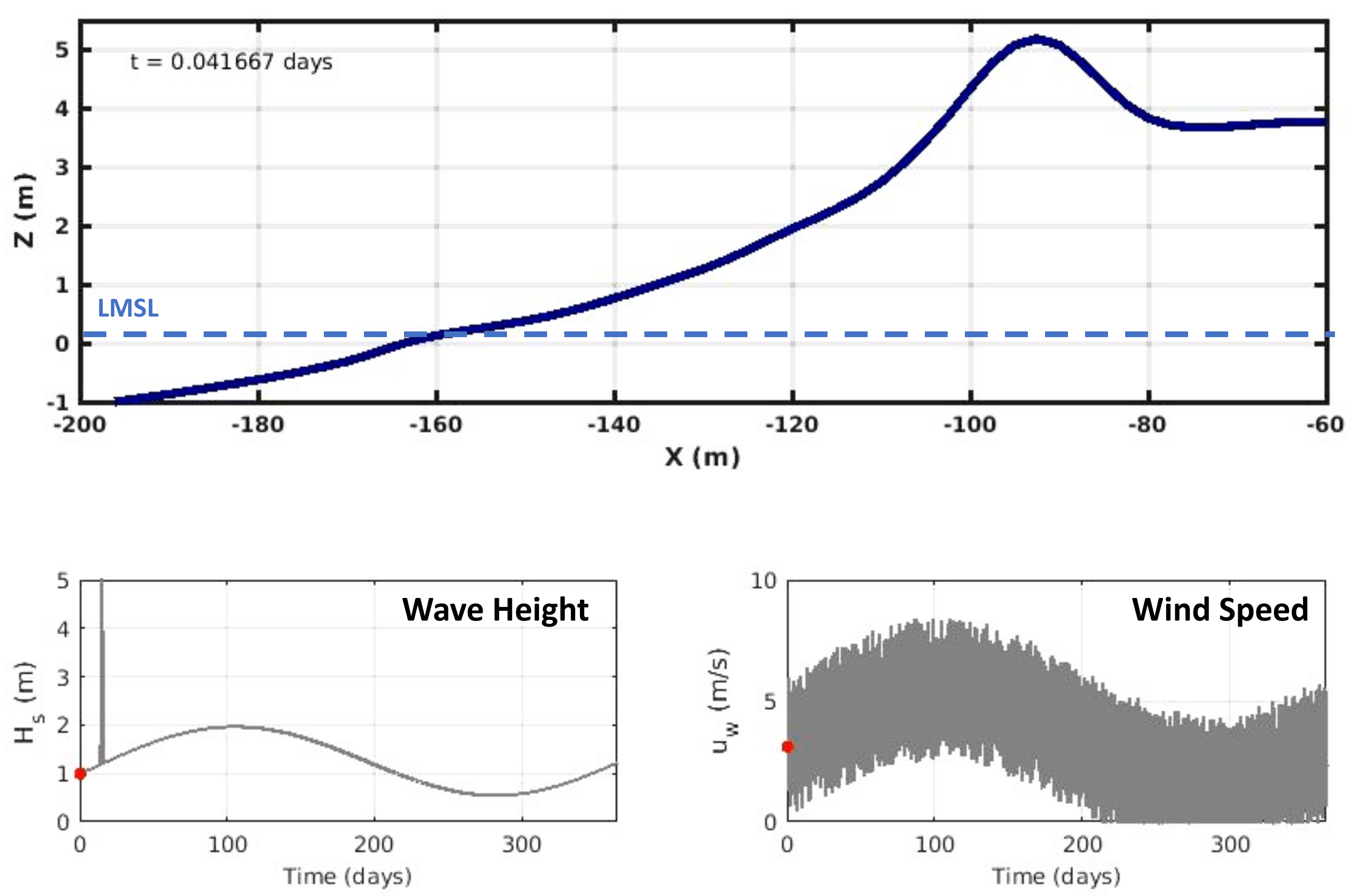


Environmental Conditions



Ruggiero et al., 2019

Base Case – 1 Year Simulation w/ Major Storm Event

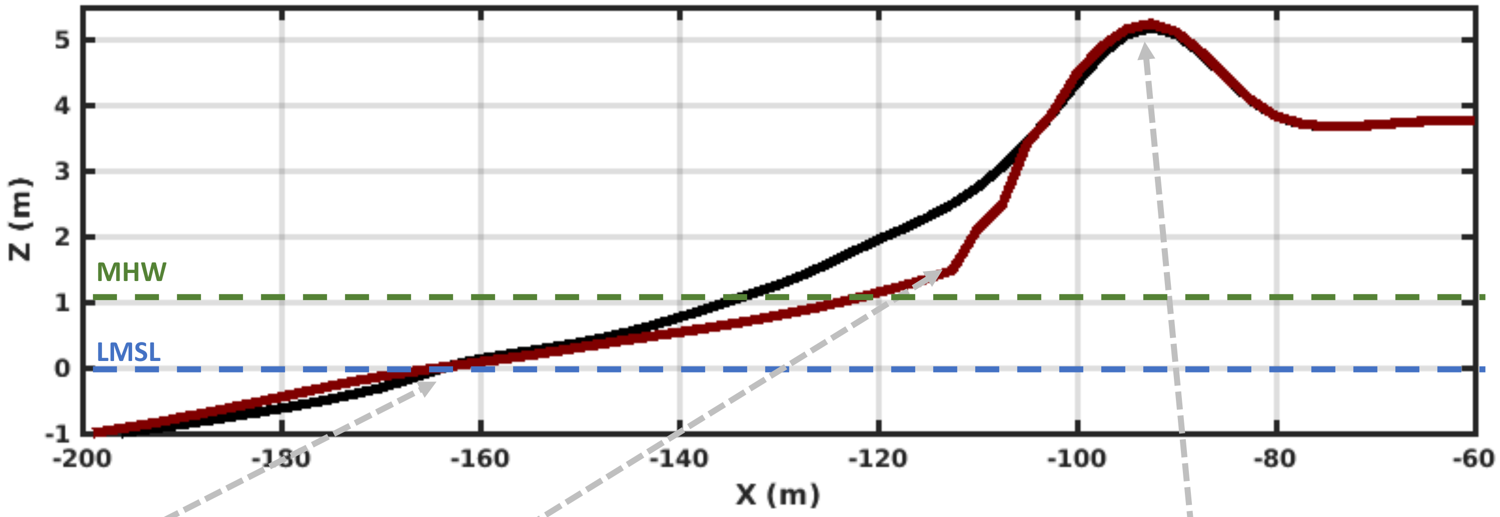


<u>Model attributes:</u>

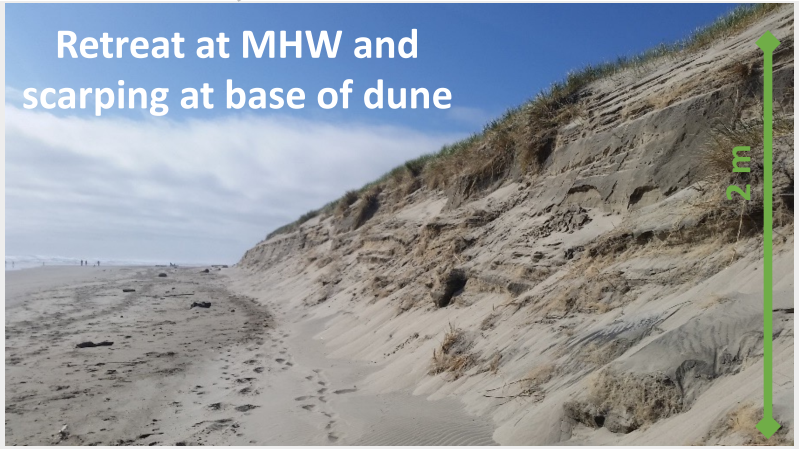
- Seasonal wind and wave climate
- 1 year simulation ≈ 1 day computation time
- Dense vegetation above 3 m
- D_{50} grain size of 300 microns

Ruggiero et al., 2019

Base Case – 1 Year Simulation w/ Major Storm Event

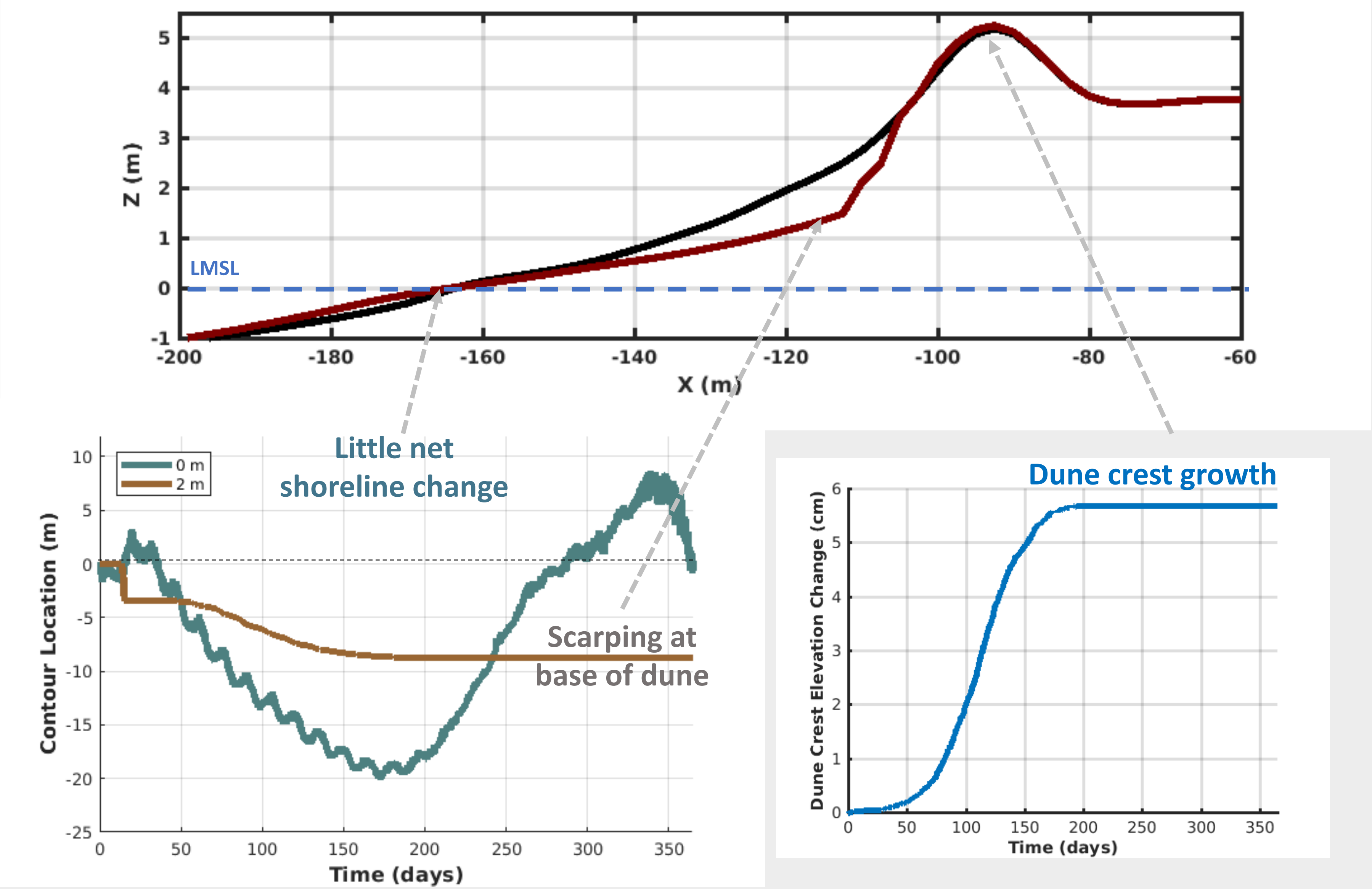


Little net shoreline change at LMSL



Ruggiero et al., 2019

Base Case – 1 Year Simulation w/ Major Storm Event

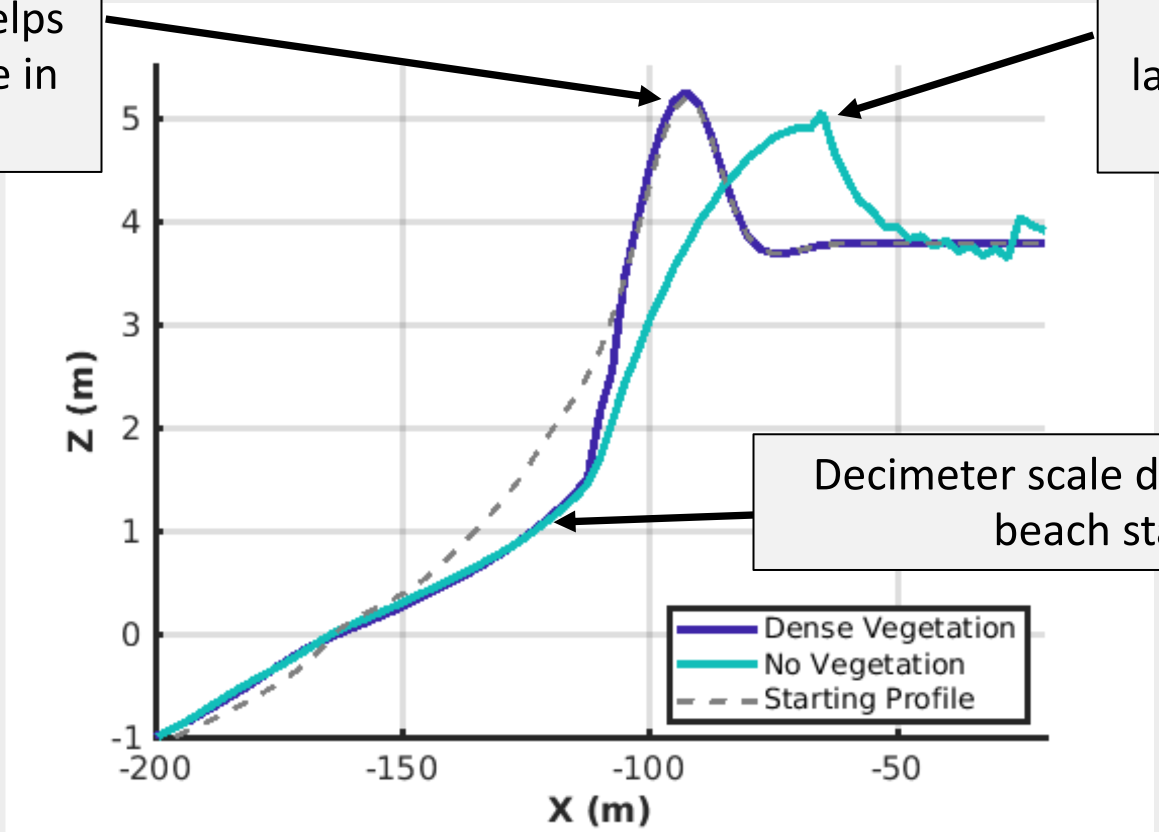


Ruggiero et al., 2019

Experiment 1: Role of Vegetation

Vegetation helps stabilize dune in place

Lack of vegetation on dune leads to landward migration of dune crest

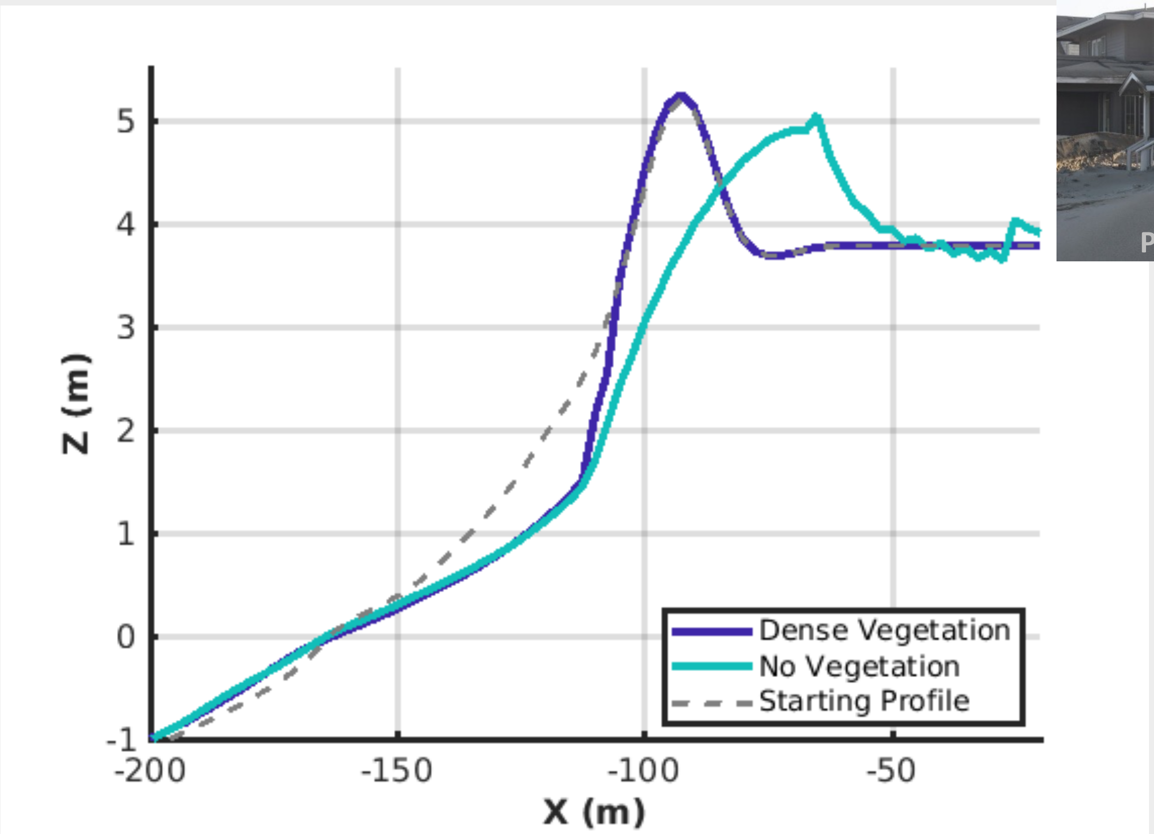


Decimeter scale differences in beach state

*Results After 1 Year Simulation

Ruggiero et al., 2019

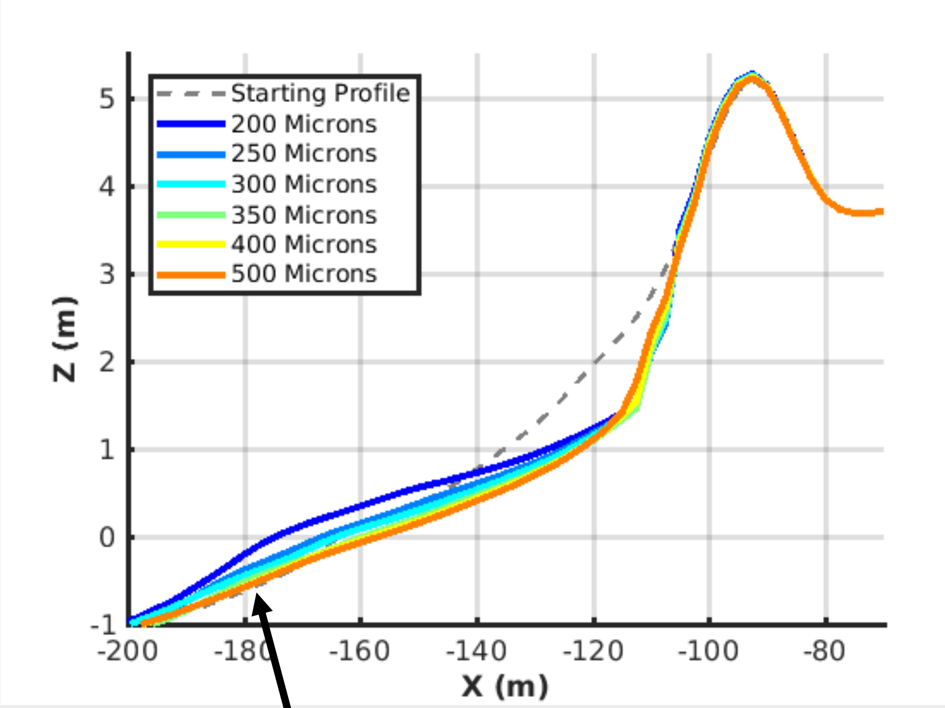
Experiment 1: Role of Vegetation



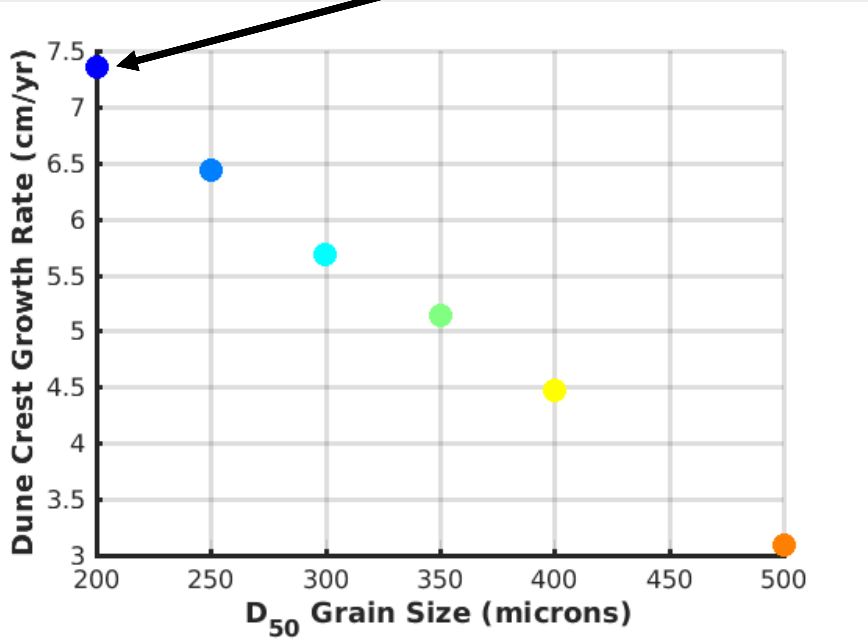
*Results After 1 Year Simulation

Ruggiero et al., 2019

Experiment 2: Role of grain size



Finer grains lead to more dune growth

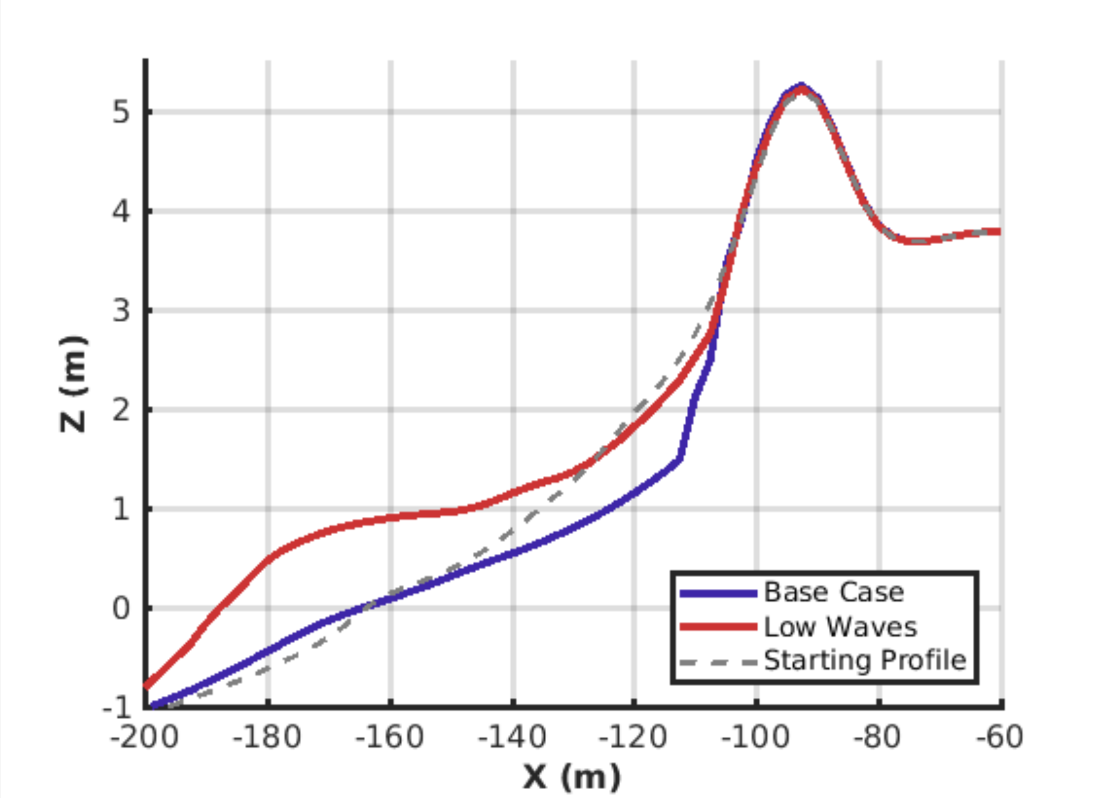


Coarser grains lead to less dynamic lower beach profile

*Results After 1 Year Simulation

Ruggiero et al., 2019

Experiment 3:
Ad hoc climate change scenario

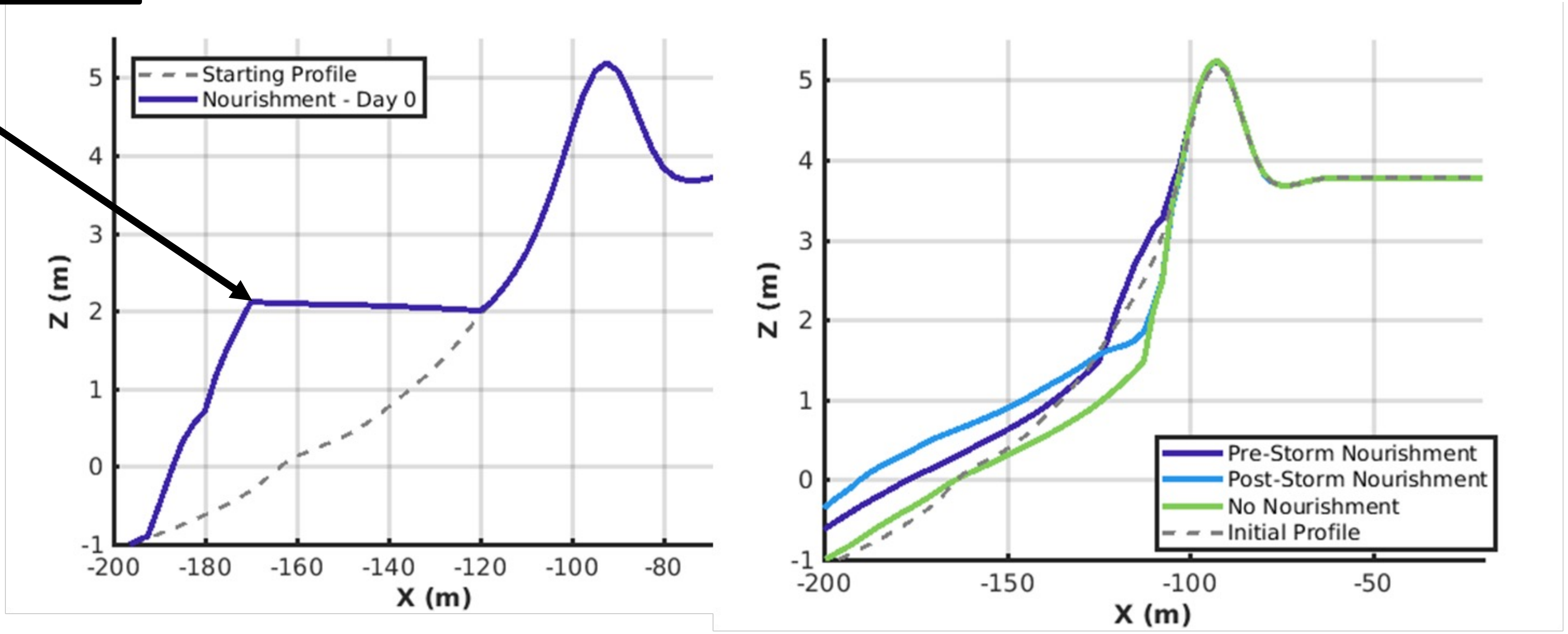


Case	Dune Vol Change (Above 2 m)	Beach Change (0 m Contour)
Base Case	-8.8 m^3/m	+ 0.4 m
50% Wave Reduction	-2.3 m^3/m	+ 24 m

Ruggiero et al., 2019

Example Initial Nourished Beach Profile

Experiment 4: Model application to Beach Nourishment Design



Management Action	Dune Volume Change	0 m Contour Change	2 m Contour Change
Pre-Storm Nourishment	+ 6.2 m^3/m	+14 m	+2.0 m
Post-Storm Nourishment	-5.9 m^3/m	+16 m	-3.0 m
No Nourishment	-8.8 m^3/m	+0.4 m	-9.0 m

Ruggiero et al., 2019

The Coastal Recovery from Storms Tool (CReSTT)

diversity MDPI

Article

Species-Specific Functional Morphology of Four US Atlantic Coast Dune Grasses: Biogeographic Implications for Dune Shape and Coastal Protection

Sally D. Hacker [1,*], Katya R. Jay [1], Nicholas Cohn [2], Evan B. Goldstein [3], Paige A. Hovenga [4], Michael Itzkin [5], Laura J. Moore [5], Rebecca S. Mostow [1], Elsemarie V. Mullins [5] and Peter Ruggiero [6]

Additional ecological, geomorphological, and modeling products

Environmental Modelling and Software 153 (2022) 105404
Contents lists available at ScienceDirect
Environmental Modelling and Software
journal homepage: www.elsevier.com/locate/envsoft

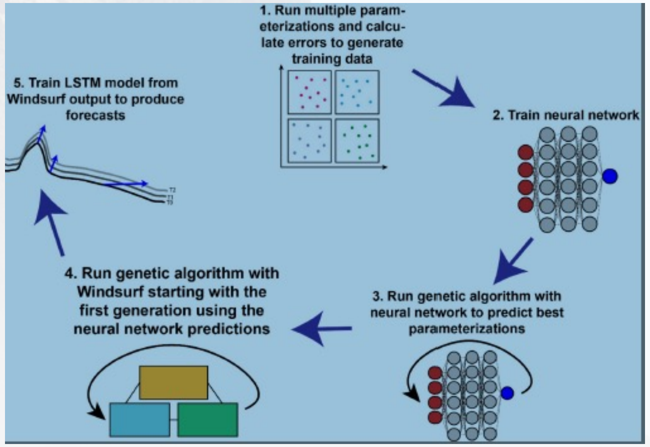
Combining process-based and data-driven approaches to forecast beach and dune change

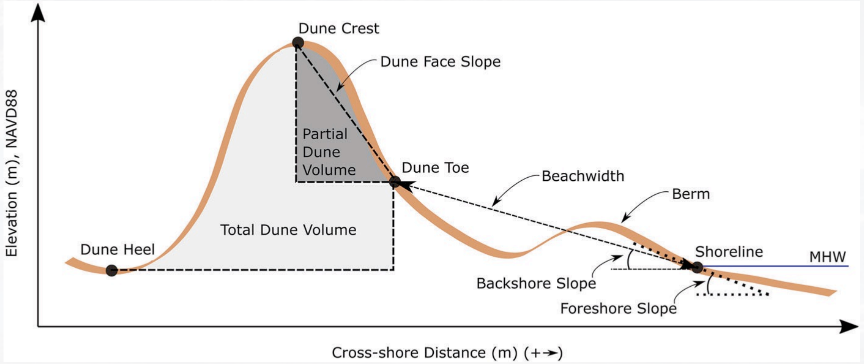
Michael Itzkin [a,*,1], Laura J. Moore [a], Peter Ruggiero [b], Paige A. Hovenga [b,2], Sally D. Hacker [c]

Received: 9 February 2021 | Revised: 1 June 2021 | Accepted: 18 July 2021
DOI: 10.1002/esp.5210
RESEARCH ARTICLE
ESPL WILEY

The relative role of constructive and destructive processes in dune evolution on Cape Lookout National Seashore, North Carolina, USA

Paige A. Hovenga[1] | Peter Ruggiero[2] | Evan B. Goldstein[3] | Sally D. Hacker[4] | Laura J. Moore[5]





Received: 13 January 2022 | Revised: 27 May 2022 | Accepted: 6 June 2022
DOI: 10.1002/ecs2.4256
ECOSPHERE
AN ESA OPEN ACCESS JOURNAL
ARTICLE
Coastal and Marine Ecology

Sand supply and dune grass species density affect foredune shape along the US Central Atlantic Coast

Katya R. Jay[1] | Sally D. Hacker[1] | Paige A. Hovenga[2] | Laura J. Moore[3] | Peter Ruggiero[4]

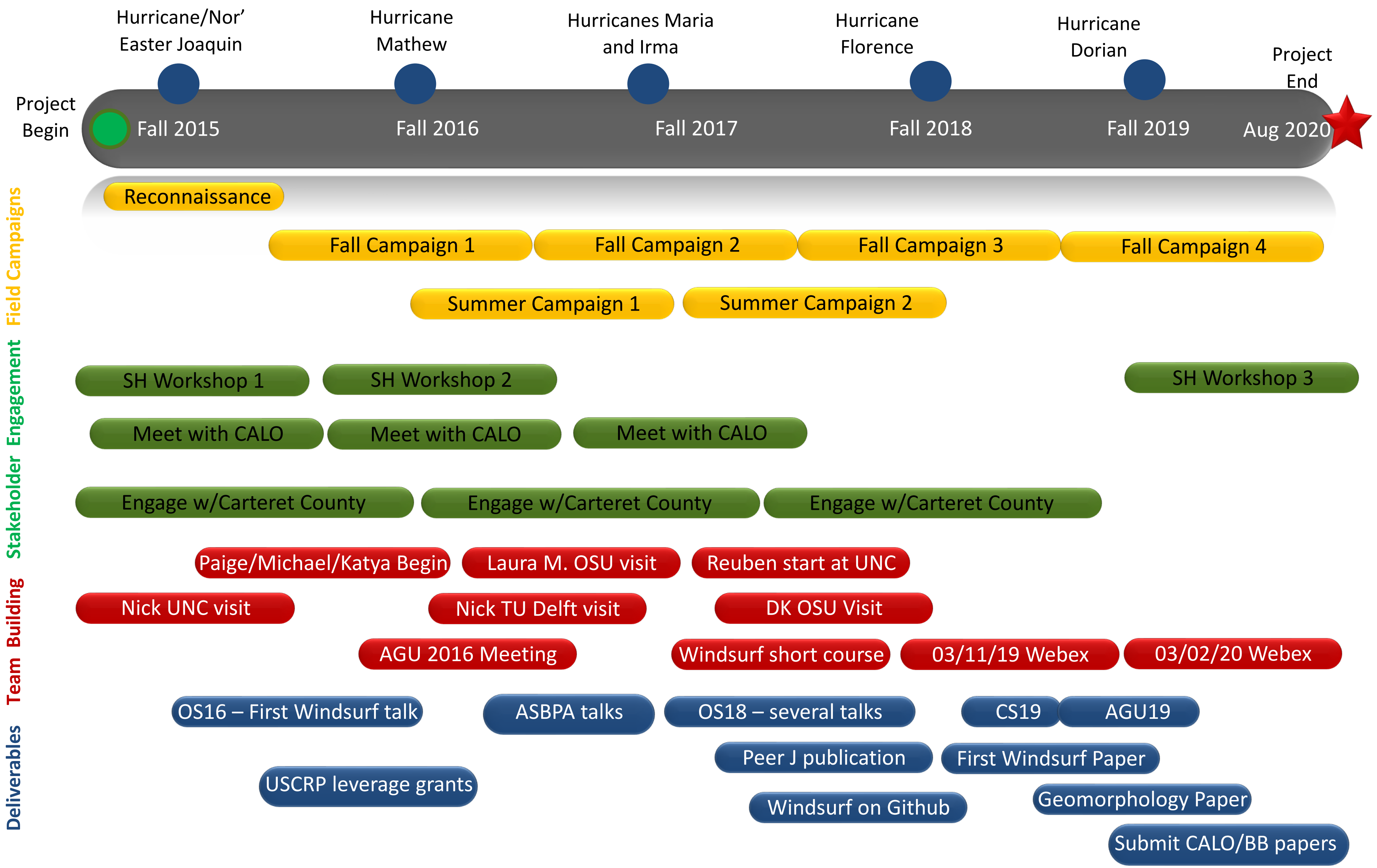
Earth Surf. Dynam., 9, 1223–1237, 2021
https://doi.org/10.5194/esurf-9-1223-2021

Earth Surface Dynamics EGU

The relative influence of dune aspect ratio and beach width on dune erosion as a function of storm duration and surge level

Michael Itzkin[1], Laura J. Moore[1], Peter Ruggiero[2], Sally D. Hacker[3], and Reuben G. Biel[1]

Project Timeline



Optimizing the ecosystem services of US Pacific Northwest coastal beaches and dunes through adaptation planning

Oregon State University

NOAA — National Oceanic and Atmospheric Administration, U.S. Department of Commerce

Project Overview November 15th, 2022

Optimizing coastal ecosystem services of beaches and dunes

Project Team

Dr. Peter Ruggiero
College of Earth, Ocean, and Atmospheric Sciences

Dr. Sally Hacker
Department of Integrative Biology

Dr. Steven Dundas
Department of Applied Economics

Mohsen Taherkhani
Civil and Construction Engineering

John Stepanek
Department of Integrative Biology

Emma Gjerdseth
Department of Applied Economics

Project Partners

Charlie Plybon, Surfrider; David Yamamoto, Tillamook County Commissioner; Sarah Absher, Tillamook County Planner; Jarod Norton, US Army Corps of Engineers; Jonathan Allan, DOGAMI; Brady Callahan, Oregon Parks and Recreation Dept., Trevor Taylor, Oregon Parks and Recreation Dept., Lisa Romano, US Forest Service; Meg Reed, Oregon Coastal Management Program

Optimizing coastal ecosystem services of beaches and dunes

Project Objectives:

- Determine the biophysical and economic value of a suite of coastal ecosystem services relevant to beaches and dunes in the Pacific Northwest.
- Integrate data and models to develop optimal policy scenarios.
- Engage with an Advisory Council and coastal communities to develop climate resilient adaptation pathways.

Optimizing coastal ecosystem services of beaches and dunes

Oregon State University

NOAA

Beaches and foredunes provide important ecosystem services

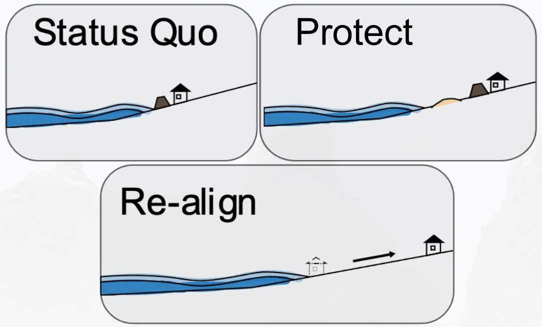
5. Carbon capture and storage

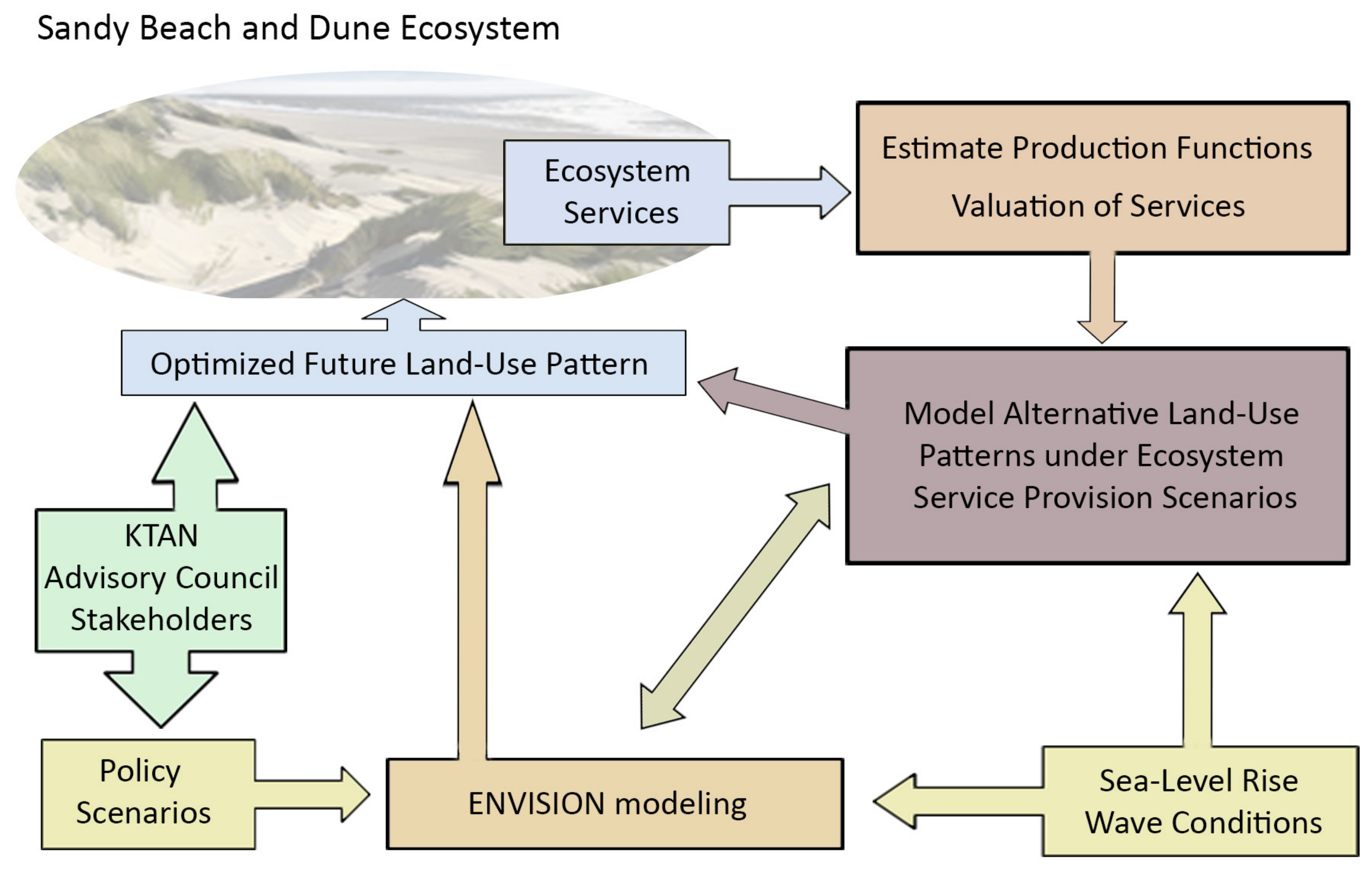
Optimizing coastal ecosystem services of beaches and dunes

Ecosystem Service	Approach for Valuation
Coastal Protection	• Value the role of coastal geomorphology using biophysical metrics • Value adaptation options revealed through housing market transactions • Quantify preferences of the general public for coastal adaptation strategies using a choice experiment survey
Recreation/Beach Access	• Value the role of coastal geomorphology using biophysical metrics • Quantify preferences of the general public for beach accessibility using a choice experiment survey • Value beach recreation using prior surveys and benefit transfer methods
Biodiversity Conservation	• Determine the number of Western snowy plovers and rare endemic plants supported by current HRAs • Value Western snowy plover recovery using a choice experiment survey on habitat restoration, other studies (benefit transfer), and biophysical value (population recovery) • Value "naturalness" of habitat using a choice experiment survey
Carbon Sequestration	• Measure carbon sequestration in PNW dunes and value of carbon storage using benefit transfer and the social cost of carbon
Viewshed	• Value of adaptation options for viewshed changes revealed through housing market analysis transactions

Optimizing coastal ecosystem services of beaches and dunes

Approach:





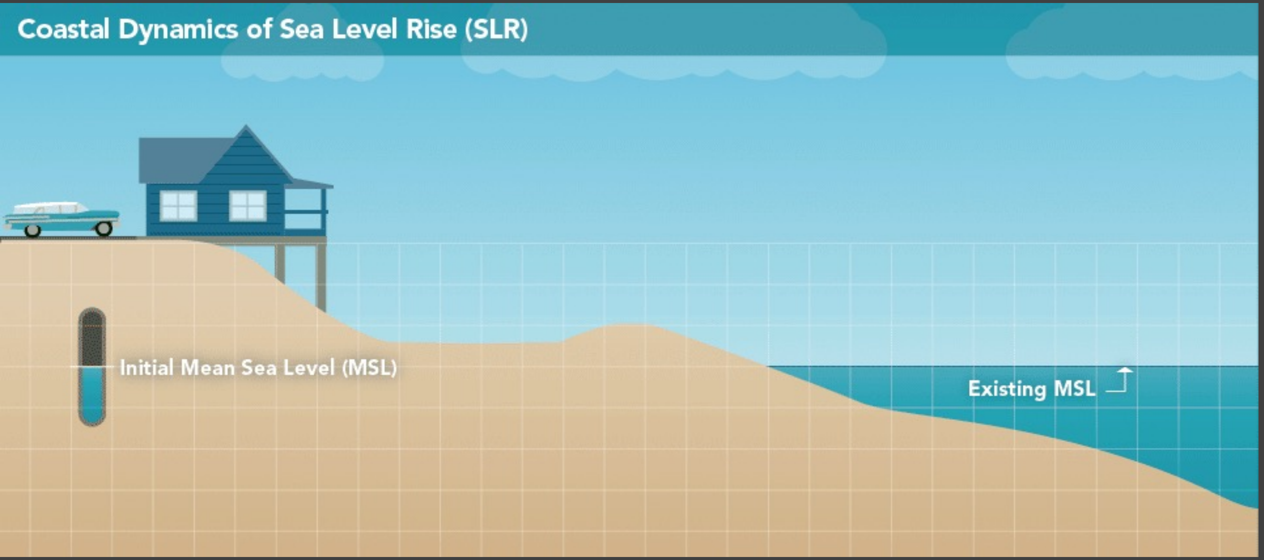
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NOAA
U.S. DEPARTMENT OF COMMERCE

A decade of ESLR funding dedicated to the Coastal Dynamics of Sea Level Rise

Davina L. Passeri, PhD
U.S. Geological Survey
St Petersburg Coastal and Marine Science Center

Establishing the Coastal Dynamics of Sea Level Rise

Sandy beaches



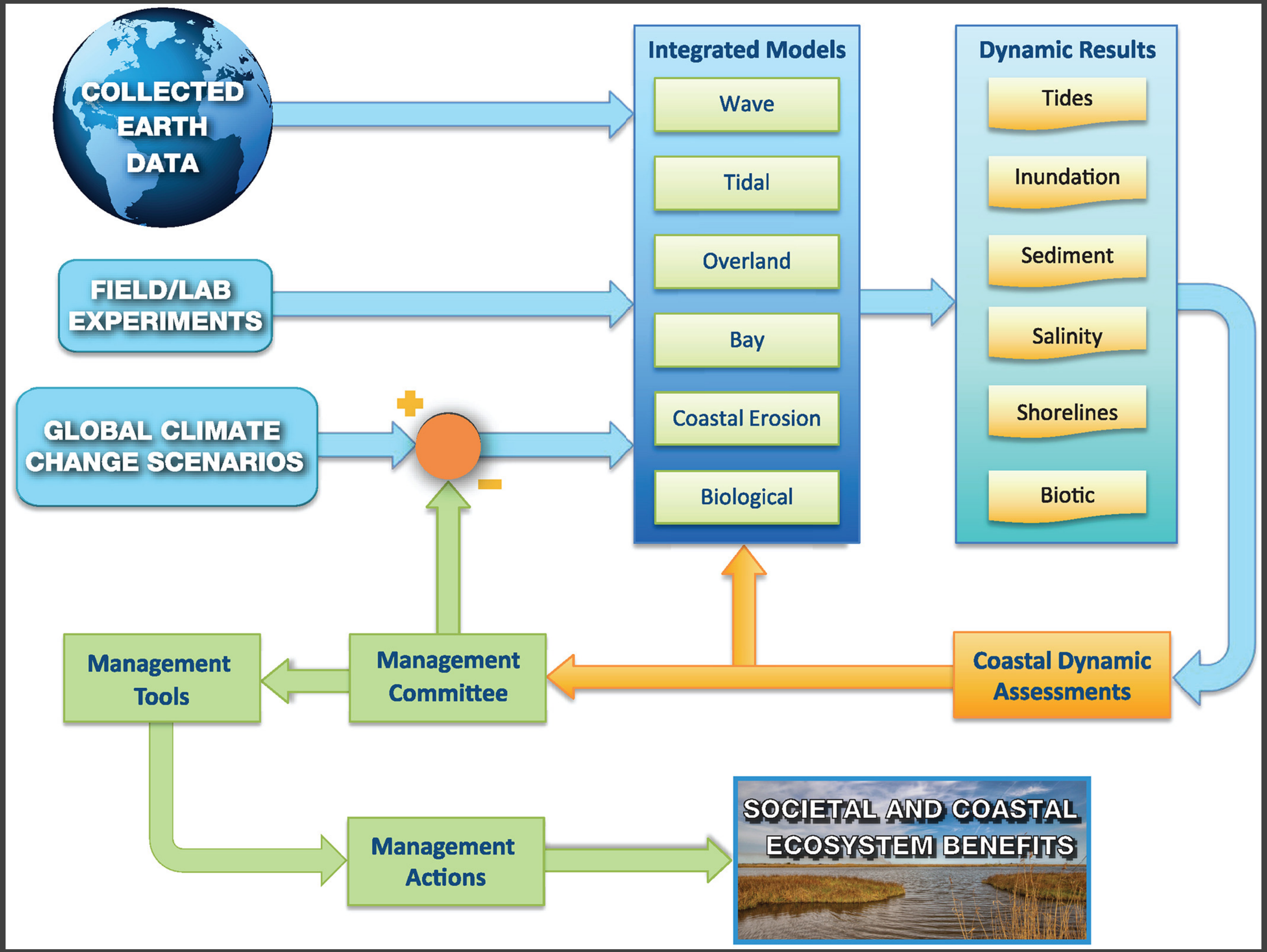
Estuaries and marshes

Passeri et al., 2015

- The coast is not a bathtub!
- SLR can result in increased inundation, beach erosion and marsh loss
- Need to incorporate the dynamic interactions and feedbacks between coastal processes into SLR assessments

USGS science for a changing world

A transdisciplinary project framework



Kidwell et al., 2017

12 years of ESLR funding to date

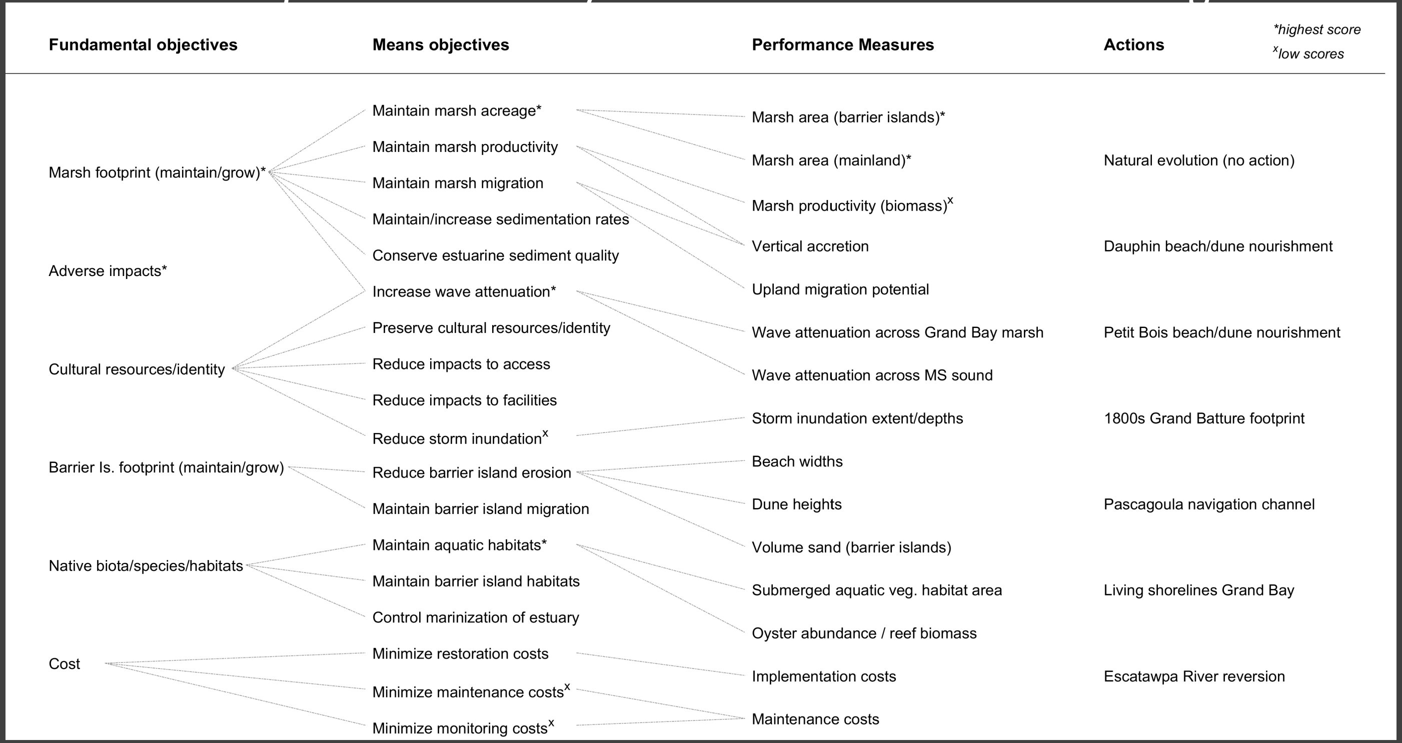
- ESLR-NGOM (2010-2016)
  - Tide, storm surge, shoreline change, marsh evolution under SLR
- ESLR-NGOM+N2E2 (2016-2021)
  - Socioeconomic impacts
  - Ecosystem services
- ESLR-EMBIR (2019-2023)
  - Barrier island evolution
  - Restoration alternatives
- ESLR-SAB (2022-2026)
  - Marsh evolution in South Atlantic Bight

USGS
science for a changing world

Engaging with stakeholders to understand management needs

- Understand local knowledge and management needs
- Gather input and feedback on the project process, research and products so they are tailored and readily applicable for improved decision support

Objective hierarchy for structured decision-making



NOAA ESLR-EMBIR project

Our partners:

ENHANCE ★ PROTECT ★ CONSERVE

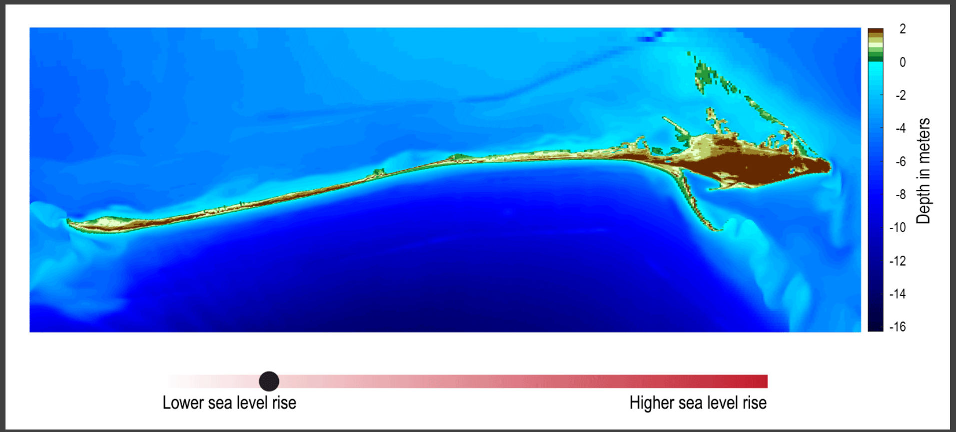
Dynamic modeling assessments

Storm surge flooding under SLR

Bilskie et al., 2019

- Higher surge depths and increased inland flooding

Barrier island evolution under SLR



Passeri et al., 2020

- More land loss and breaching with increased SLR

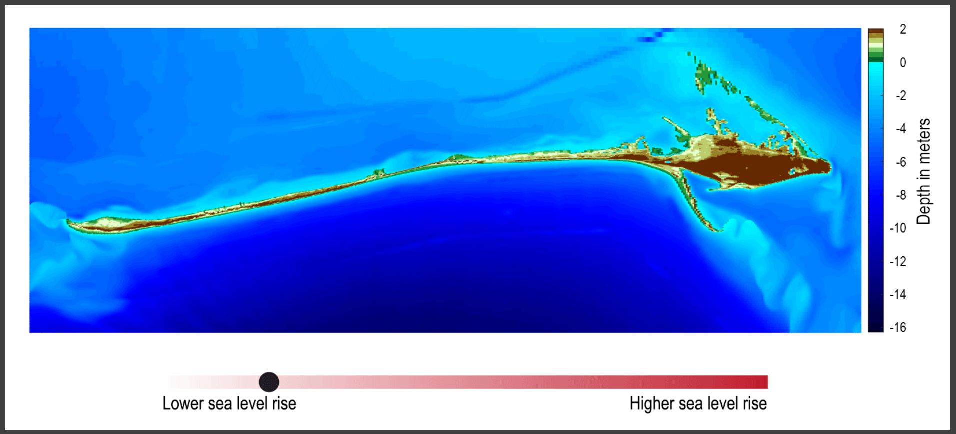
Dynamic modeling assessments

Storm surge flooding under SLR

Bilskie et al., 2019

- Higher surge depths and increased inland flooding

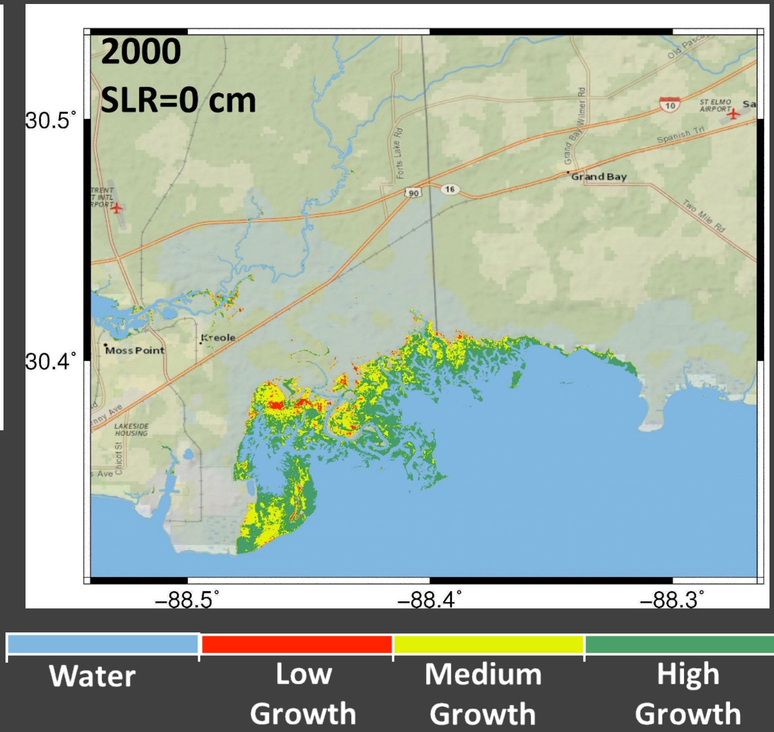
Barrier island evolution under SLR



Passeri et al., 2020

- More land loss and breaching with increased SLR

Marsh evolution under SLR



Alizad et al., 2018

- Marsh migration to upland areas and conversion to open water under high SLR

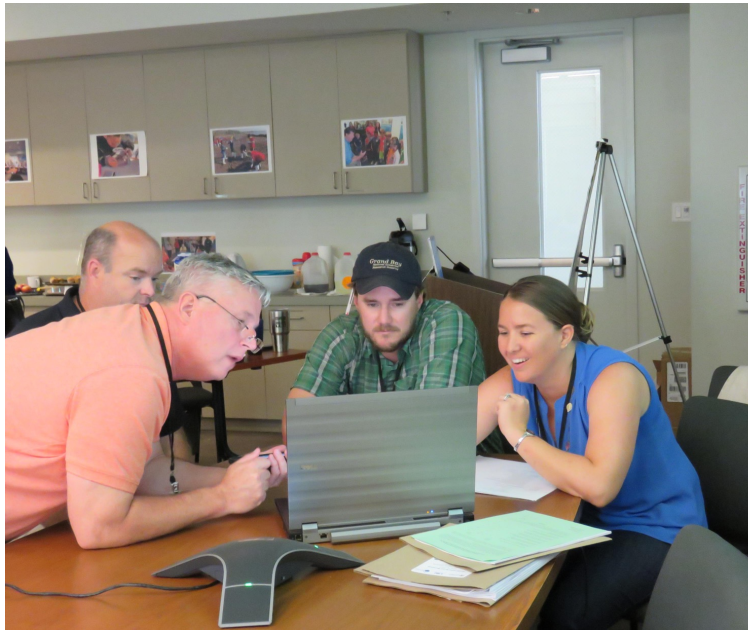
USGS
science for a changing world

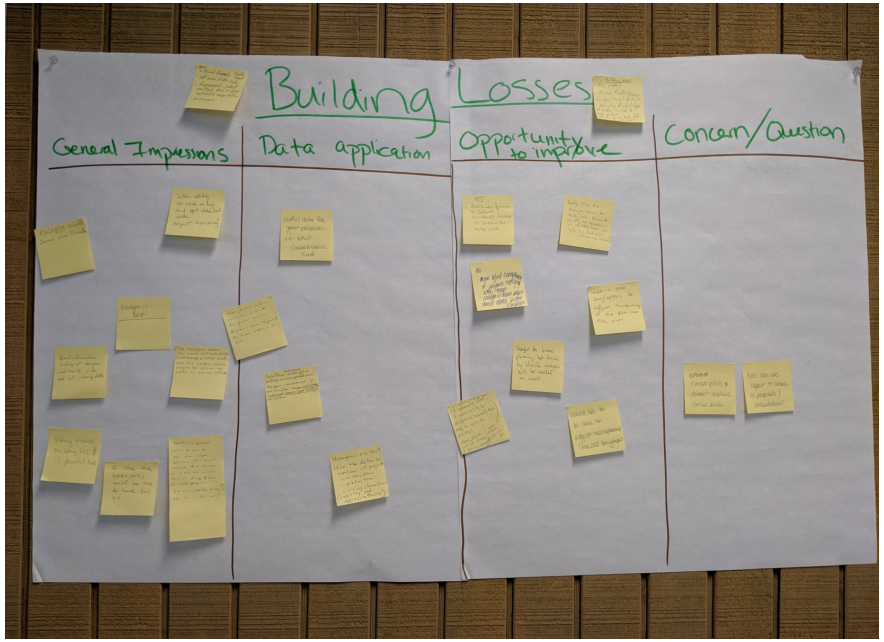
Informing management decision-making

- Translation to socioeconomic impacts
- Ecosystem services
- Dynamic assessments of a variety of management actions

Studies benefiting from ESLR-funded science

- Restoration assessments
  - NFWF Alabama Barrier Island Restoration Assessment (2015-2020)
  - NOAA RESTORE Grand Bay Restoration Feasibility Assessment (2019 – 2022)
  - NFWF Little Dauphin Restoration Assessment (2021-2023)
  - NOAA RESTORE Decision Support for Multi-species Coastal Habitat Management (2021 – 2022)
- Real-time Forecasting of Hurricane Impacts
  - DHS Development of an optimized tide and hurricane storm surge model for the west coast of FL for use in the ADCIRC Surge Guidance System (2018-2020)
  - ONR Forecasting Coastal Impacts from Tropical Cyclones along the U.S. East & Gulf Coasts using the ADCIRC Prediction System (2021-2024)





EESLR-NGOM & NGOM+N2E2

Stakeholder Engagement and Science Application Perspective

Co-Development Model Applied

Milestone Chart					
EESLR 2016 – Dynamic sea level rise assessments of the ability of natural and nature-based features to mitigate surge and nuisance flooding					
	Date	**Activities**	**Ask of MTAG:What MTAG will contribute so the science team can move forward**	**Ask of Science Team: What must be completed prior to the MTAG ask**	**Outcome**
Year 1:					
Kick off Call/ Webinar	Dec. 2016	Explain project goals & timeline	Any initial input or thoughts; Input on Apalachee field site selection	Field work site options, comprehensive presentation of project goals, objectives, and timeline	Coastal managers are aware of current research and planned outputs, begin foundations of communication
Call/ Webinar	Mar. 2017	Workshop prep, cover information on ESV	Thoughts, concerns, requests around ESV	Preliminary methods and vision for ecosystem services valuation	Coastal managers are thinking critically about how ecosystem services are quantified and valued
Workshop 1	Jun. 2017	Presentation of ESV w/ marsh model	NNBF options for Apalach	Completion of field validation of hydromarsh model in Apalachee; Completion of ESV analysis for baseline scenario (no NNBFs)	SLR researchers are aware of feasible NNBF options for Fl panhandle
Year 2:					
					Researchers and managers begin to

Co-development Model Applied

- **2016** – Build and extend partnerships with interested stakeholders
- **2017** – Understand project goals
  - Input to shape research
  - Dialogue on model capacity and limitations
- **2018** – Review preliminary economic model outputs
  - Establish common language on ESV
- **2019** – Review marsh and dune modeling outputs
  - Begin discussing data delivery in-depth
- **2020** – Pandemic Pause – research continued
- **2021** – Raise awareness of coming data products
  - Discuss disconnect: model outputs & manager perspectives
- **2022** – Refine data delivery products
  - Data product training & delivery

Concurrent social science research occurred in conjunction with engagement activities and fundings. This allowed for additional data collection and sharing of any generalizable findings.

Co-Development Model Applied: Methods

- Webinars
- In-person workshops
- Virtual workshops
- Virtual trainings
- Virtual townhalls
- One-on-One meetings

- Participatory mapping
- GIS story maps and online data exploration
- Voting (dots, hands, polls)
- Facilitated discussions (large & small)
- Worksheets & exploration activities
- Priority & perspectives mapping

Partners Beyond the Project

Partners that already have existing relationships with end-users:

- Improve initial engagement for shaping research and two-way dialogue
- Extend integration of science beyond individual projects

PROGRAM FOR LOCAL ADAPTATION TO CLIMATE EFFECTS: SEA LEVEL RISE
PLACE:SLR

SENTINEL SITE COOPERATIVE
NORTHERN GULF OF MEXICO

Sea Grant

NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM

Examples of Application and Lessons Learned

Local Utility Authority: Storm Protection & Septic Risks

Dauphin Island Watershed Management Plan

Educational Programming

Santa Rosa County VA

Public Outreach

Natural Resource Planning

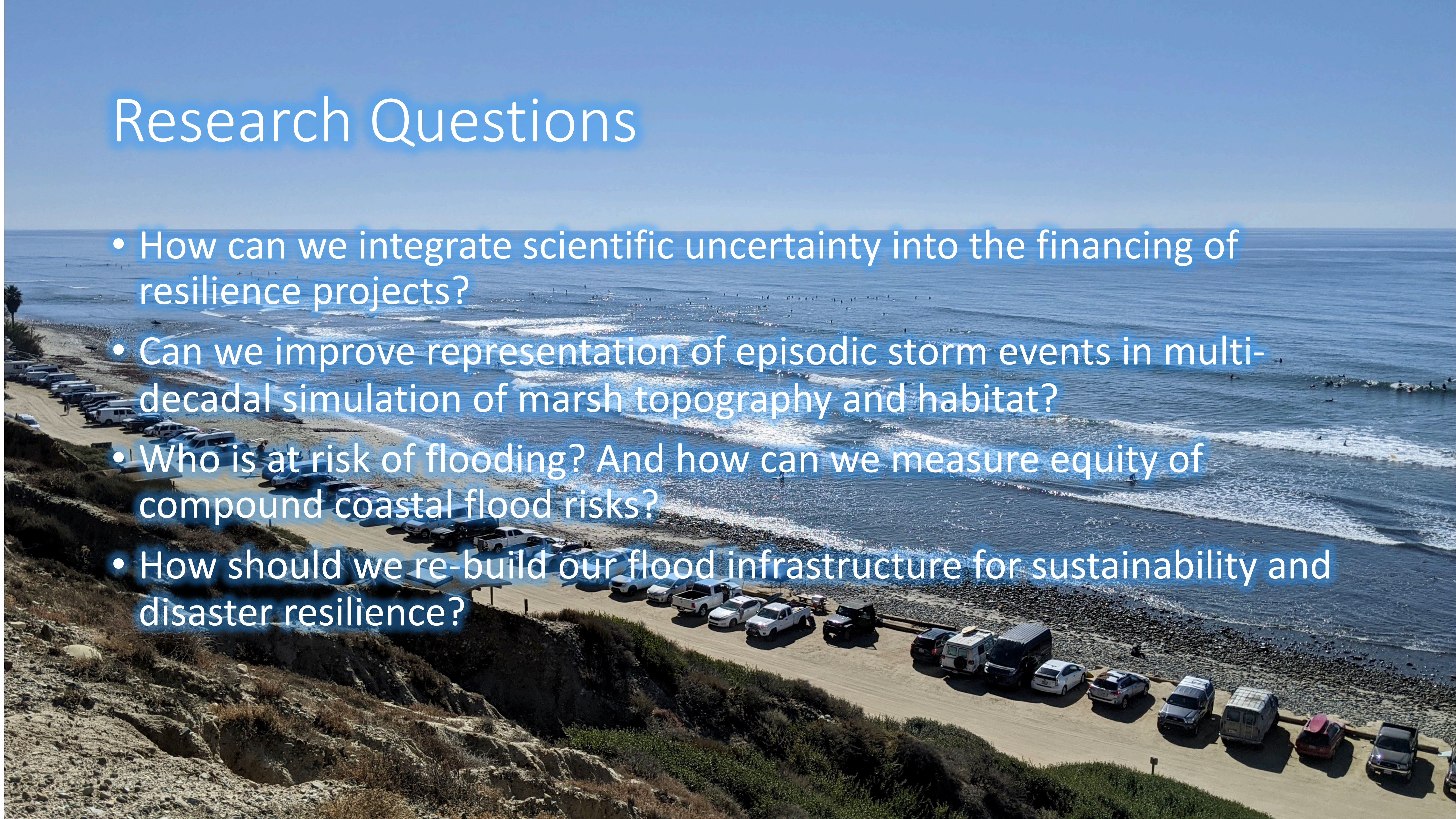
Co-development of modeling tools to manage sediment for sustainable and resilient coastal lowland habitat in Southern California
NOAA Effects of Sea level Rise (ESLR) Program.
$1,150,000.00. September 1, 2016 - August 30, 2021.

UCI Flood Lab

Brett F. Sanders, Ph.D
Department of Civil and Environmental Engineering
Department of Urban Planning and Public Policy
University of California, Irvine

San Onofre State Beach

Role of Sediment Management in Southern California Sea Level Rise Adaptation



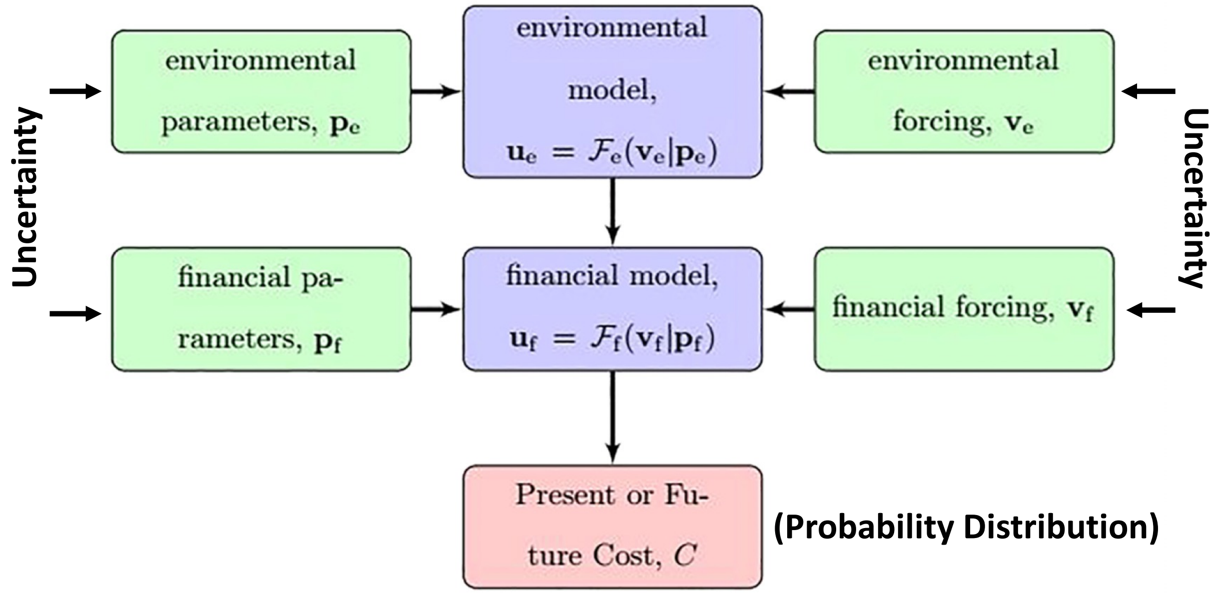
Research Questions

- How can we integrate scientific uncertainty into the financing of resilience projects?
- Can we improve representation of episodic storm events in multi-decadal simulation of marsh topography and habitat?
- Who is at risk of flooding? And how can we measure equity of compound coastal flood risks?
- How should we re-build our flood infrastructure for sustainability and disaster resilience?

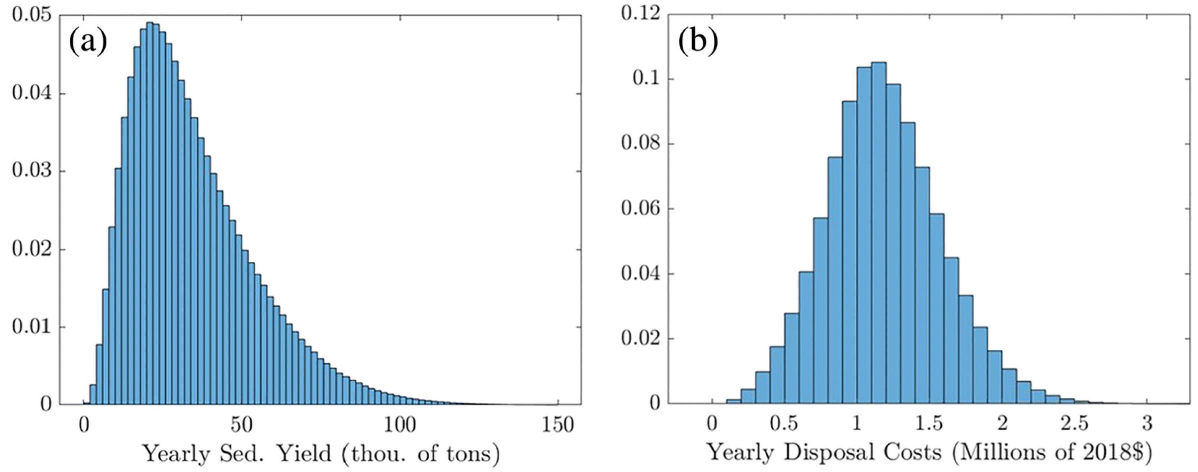
Integrating Quantitative Uncertainty into Decision-Support Tools for Coastal Management

Question: which sediment management interventions will pay for themselves (given uncertainties)?

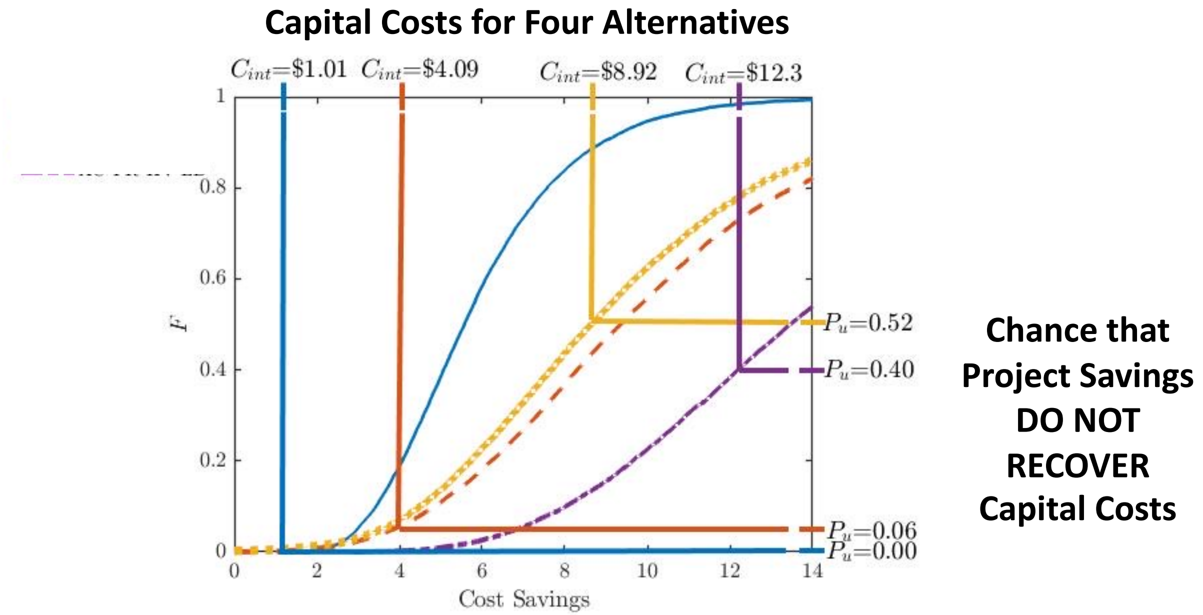
(1) Stochastic, Hydro-Financial Simulation Framework



(2) Probability Distribution for Sediment Load to Catch Basin and Disposal Cost per year



(3) Evaluation of Sediment Management Alternatives based on Capital Costs and Savings from Reduced Disposal Costs

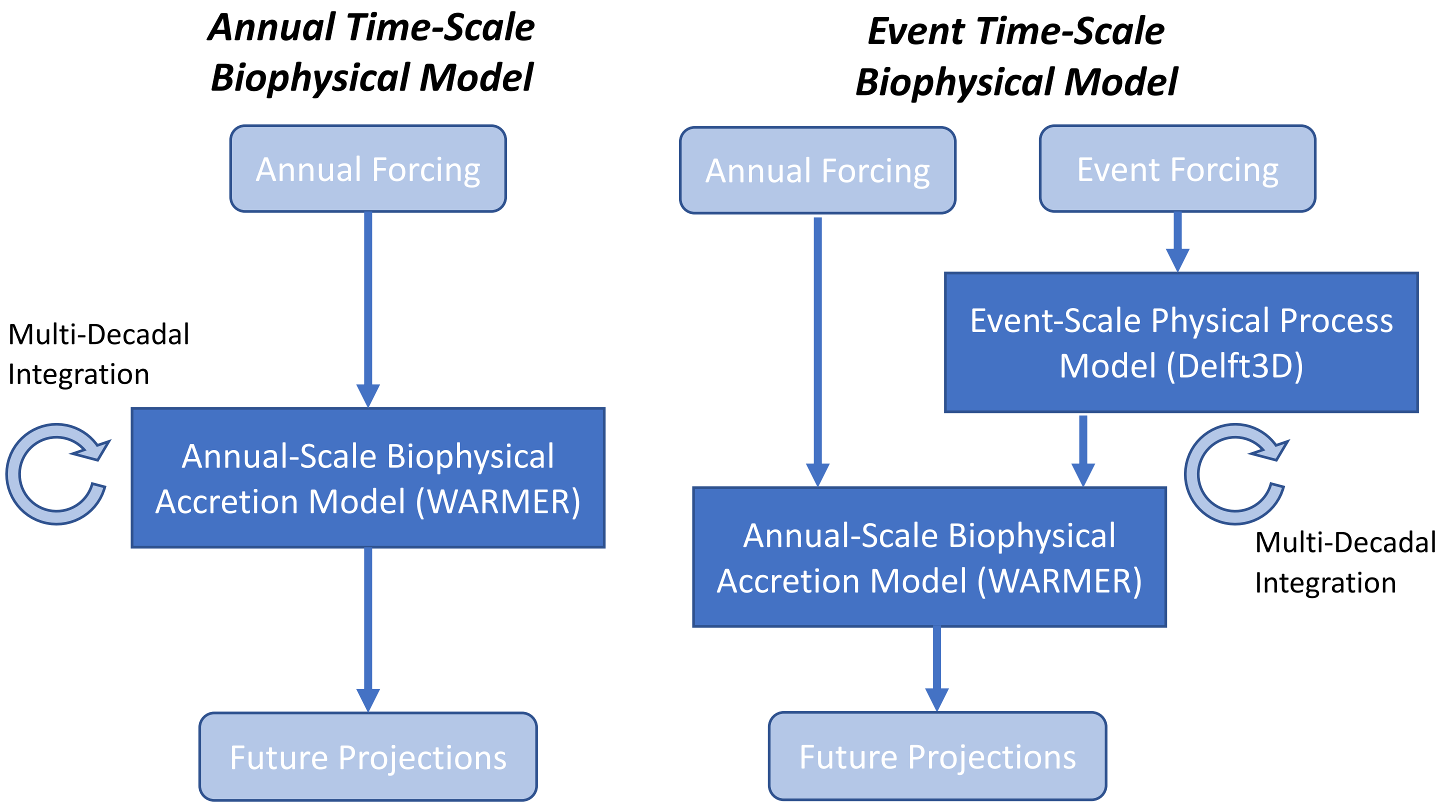


Brand et al., *Water Resources Research* (2020)

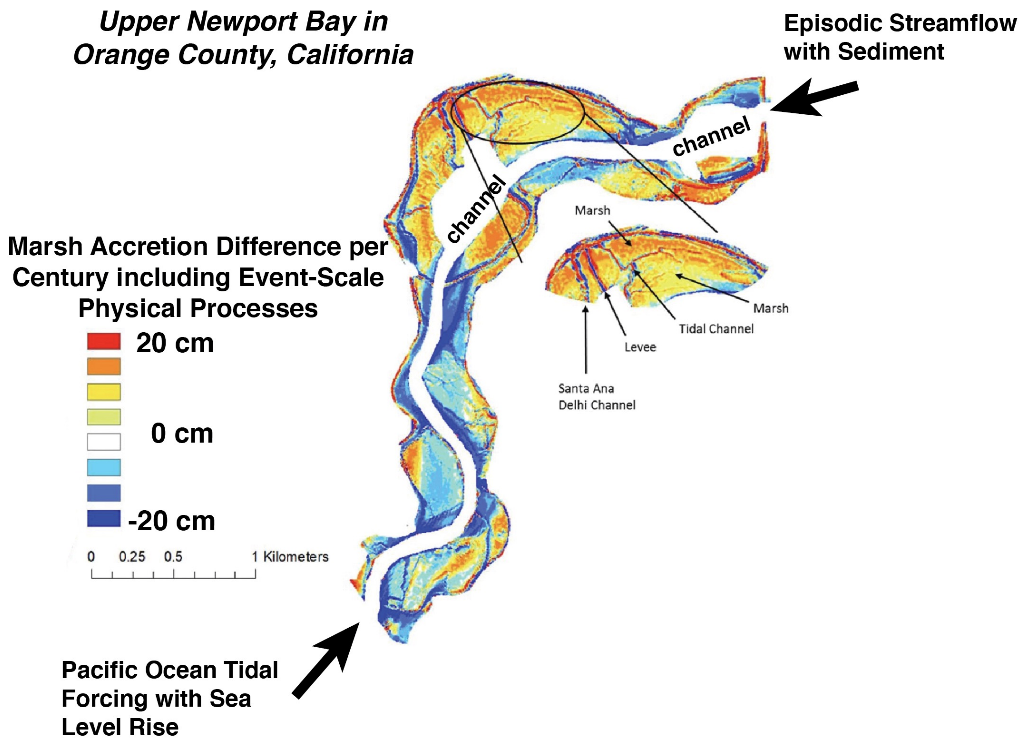
Simulating Future Coastal Marsh Habitat: A Multi-Scale Approach

Question: can we simulate marsh habitat decades into future despite highly stochastic and episodic watershed influences?

(1) Comparison of Two Multi-Decadal Marsh Simulation Frameworks



(2) Evaluating Differences in Spatial Structure of Marsh Topography Across the Two Methods

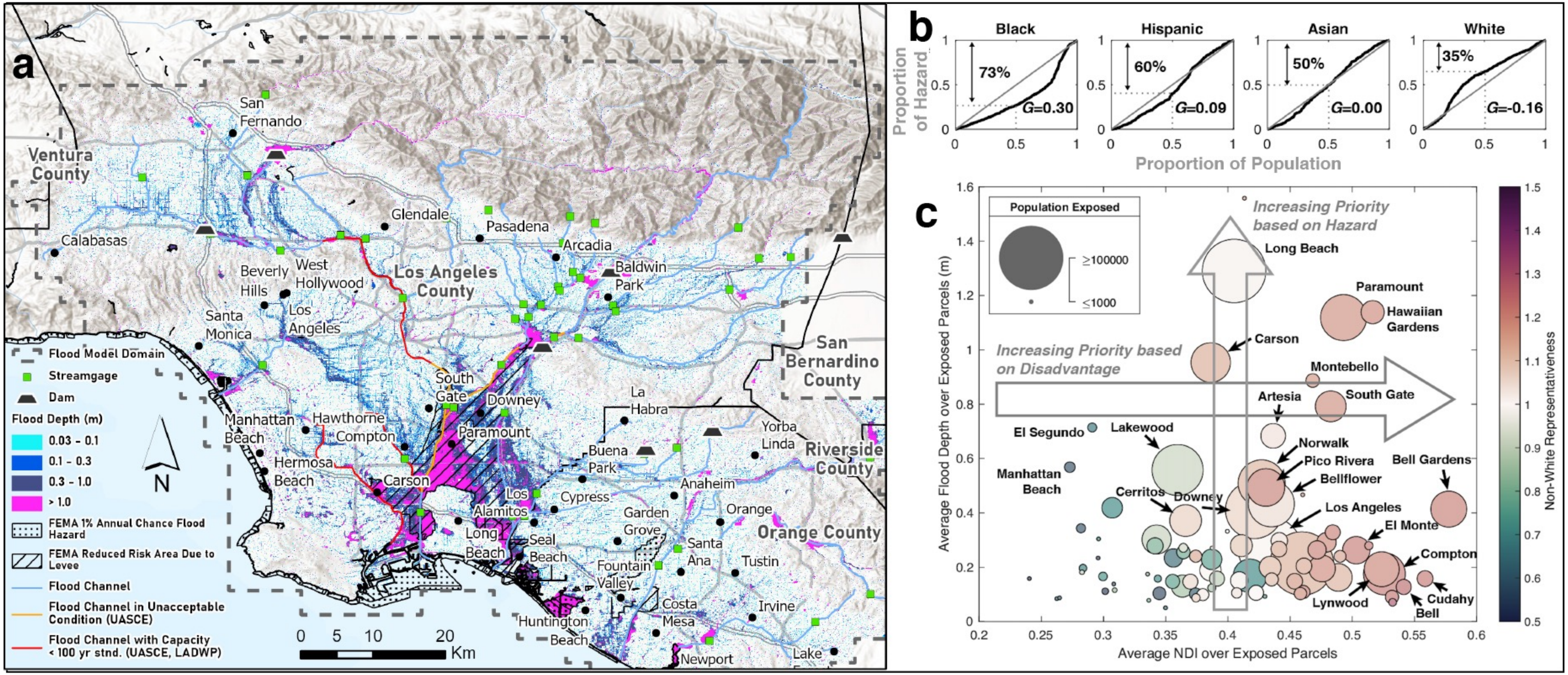


40 cm differences per century over less than 100 m horizontal distances

Brand et al., *JGR – Earth Surface* (2022)

Identifying and Responding to Compound Urban Flood Risks

The 100-year flood zone 197 - 874 thousand people (median=425K), and between $36 and $108 billion but these impacts are not equitable. Non-Hispanic Black populations are disproportionately over-exposed to flood risk.

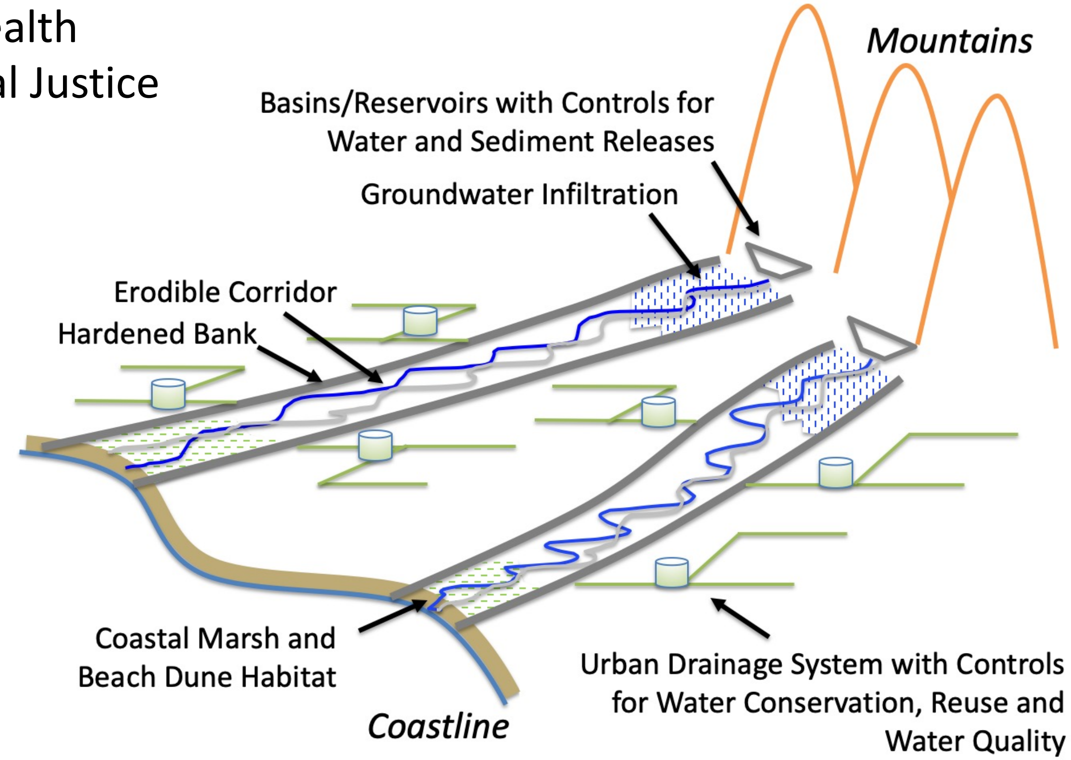


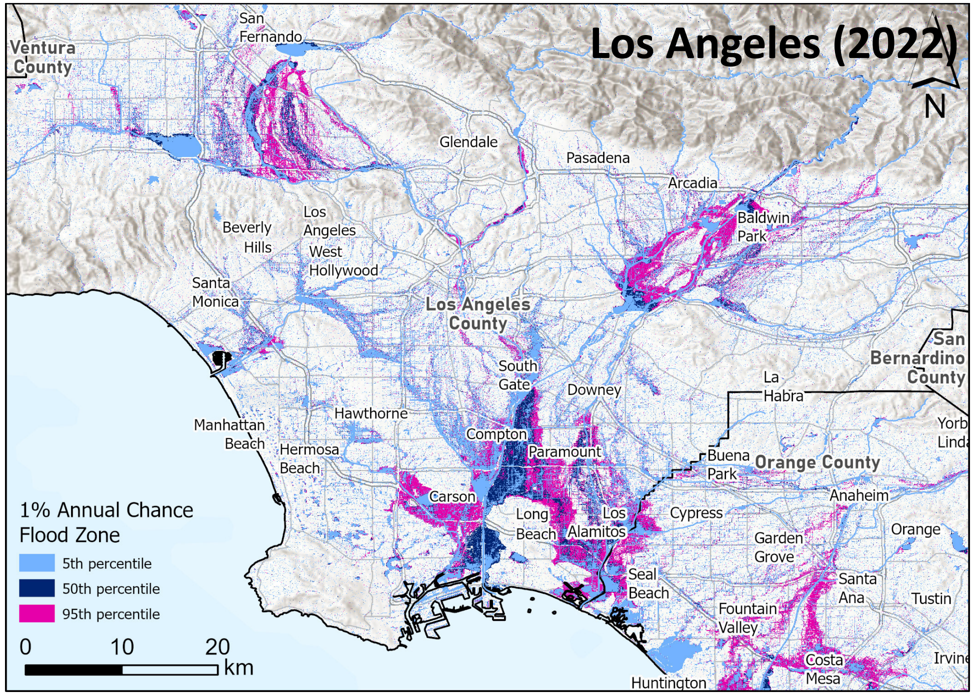
Sanders et al., *Nature Sustainability* (2022)

Re-envisioning Flood Infrastructure for High-Gradient Coastlines

Multi-Benefit Design Goals

- Urban Amenities (e.g., shade & urban cooling)
- Water Security (e.g., water conservation and water quality)
- Coastal Sediment Supply
- Flood Risk Management
- Ecosystem Health
- Environmental Justice





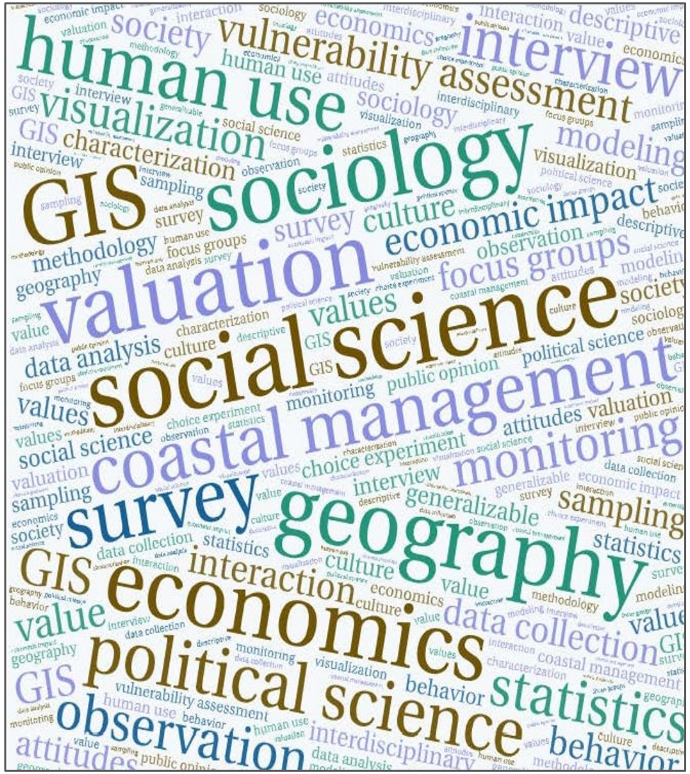
Sanders and Grant, *WIRES-Water* (2019)
Sanders et al., *Nature Sustainability* (2022)

Internal Coastal Change Science Part 2

NCCOS MSE Social Science Team

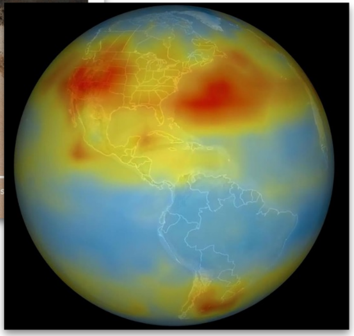
OVERVIEW

- Background
- Research priorities and goals
- Research related to coastal change

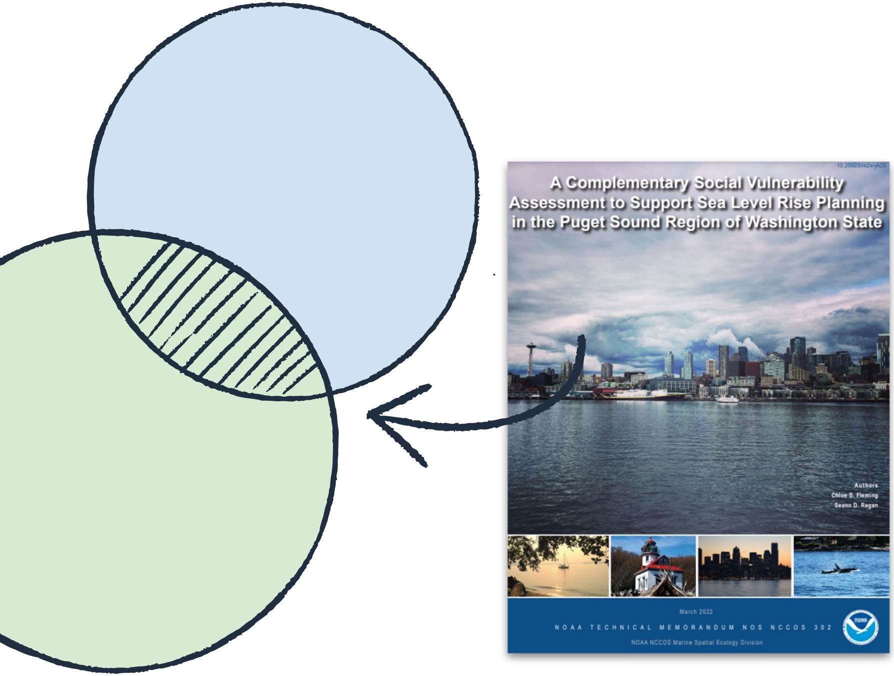


RELEVANCE OF OUR WORK

- Programmatic relevance
  - Research aligned with external and internal drivers
  - Legislative mandates and Executive Orders
  - Climate change
  - Climate- and socially-vulnerable populations



RELEVANCE OF OUR WORK



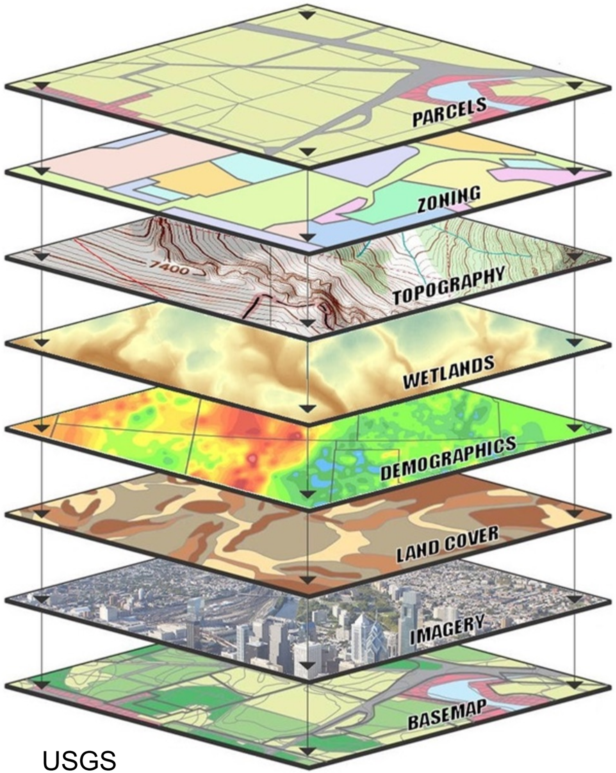
- Scientific relevance
  - Grounded in relevant theory and scholarship
  - In dialogue with peer reviewed scholarship
  - Contributed framework approach to the scientific discussion

RELEVANCE OF OUR WORK

- Application relevance
  - Identifying client communities to service
  - Engaging partners and stakeholders in co-production of science
  - Providing products that directly inform local decision-making and adaptation planning

RELIABILITY OF OUR WORK

- Research approaches
  - Descriptive
  - Explanatory
  - Preference
- General methodologies
  - Primary data collections
    - Surveys, interviews, focus groups, workshops
  - Secondary data analyses
    - Collecting data from existing sources and analyzing them in a new way



USGS

RELIABILITY OF OUR WORK

For the Vulnerability Assessment Portfolio:

- Mid-scale spatial approach
- Secondary data collection for each type of vulnerability and hazard; stakeholder prioritization
- Data reduction techniques for statistical validity
- Stakeholder and peer review of each stage of process


Index
01
Which factors most contribute
02
What are we seeking to measure
03
Best available data sources
04
How to combine into an index

TRANSITION TO APPLICATION

- Key products produced
- Primary and downstream users

TRANSITION TO APPLICATION

- Early product transition planning increases uptake
- Delivery of products
- “After delivery support”

“I am thrilled you all are moving this to a programmatic stage. Let me know when I can tell the troops about this!” -regional partner

“Super excited to work with you all and benefit from your amazing work to meet our City’s environmental goals…You all are amazing. Thank you so much!” -community official

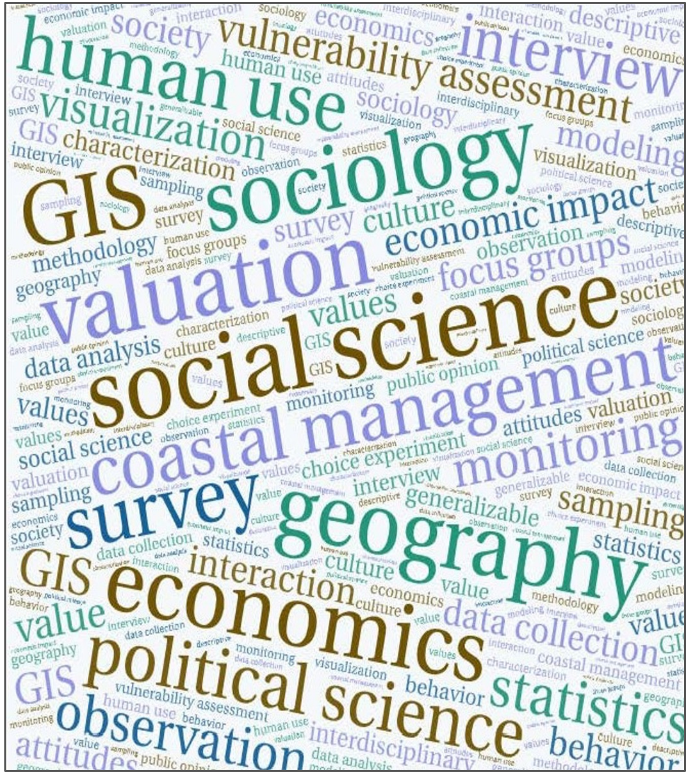
The first vulnerability analysis in Oxford, MD enabled the town to qualify for two projects funded by the Maryland DNR Coastal Grants program.

These multimillion dollar efforts included resilience infrastructure improvements such as:

1. Interior stormwater retention with the aim of reducing stormwater flooding during high tides
2. Shoreline improvement design to protect from vulnerable infrastructure from storm surge

CONCLUSION

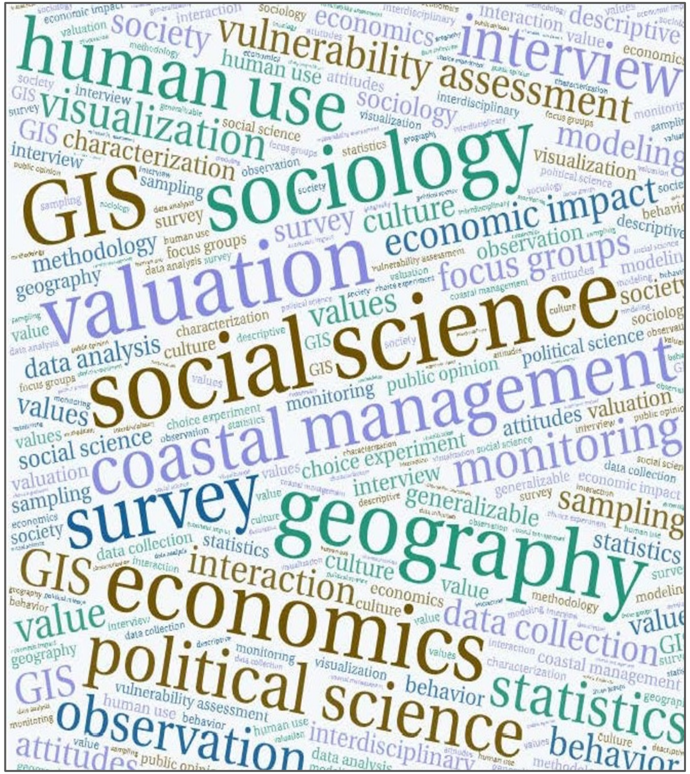
- Past accomplishments
- Future directions
- Feedback requested



CONCLUSION

Feedback requested

- How can we better connect our products and findings to local adaptation planning activities? And track local outcomes from our work?
- Is there technical guidance on how to best choose which hazard or climate models best suits a local context?
- How can we better explain complex models and analysis to our partners and stakeholders, including limitations and uncertainty?



Questions, Comments & Discussion

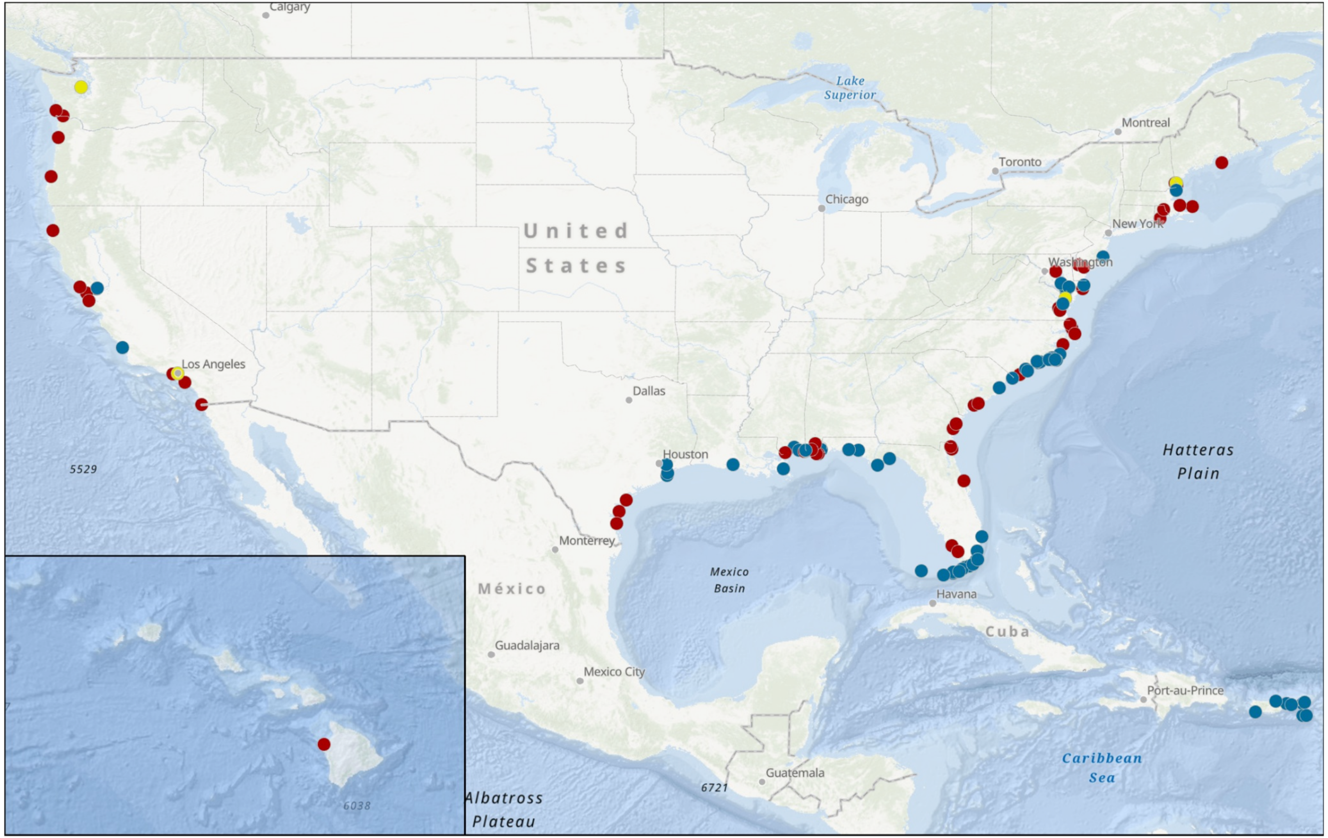
Coastal Change by the Numbers

Tomma Barnes

52 projects

Over 100 partners

118 publications



- External Science (ESLR)
- Internal Science-Resilience Team & COL
- Internal Science- Social

Full time Coastal Change Staff

Management
Hired in 2022

External Science
Competitive Research Program


David Kidwell
CRP Director
Silver Spring, MD


Trevor Meckley, Ph.D.
Program Manager
Silver Spring, MD

Internal Science
Coastal Resilience, Restoration, and Assessment (CRRA) Branch


Tomma Barnes, Ph.D.
CRRA Branch Chief
Beaufort, NC


Christine Buckel
Ecologist
Beaufort, NC


Jenny Davis, Ph.D.
Research Ecologist
Beaufort, NC


Shay Viehman, Ph.D.
Research Ecologist
Beaufort, NC


Mike Greene
Biological Science Technician
Beaufort, NC


Avery Paxton, Ph.D.
Research Marine Biologist
Beaufort, NC


Brandon Puckett, Ph.D.
Research Marine Biologist
Beaufort, NC

Partial Coastal Change Staff

Social Science Team (Biogeography Branch)

Theresa L Goedeke, Ph.D.
Social Science Team Lead
Silver Spring, MD

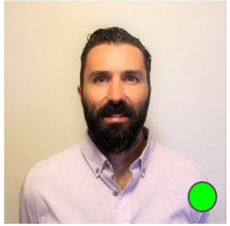
Amanda Alva
Policy Specialist
Remote

Heidi Burkart
Marine Scientist /
Spatial Analyst
Remote

Chloe Fleming
Social Scientist /
Policy Specialist
Remote

Amy Freitag, Ph.D.
Sociologist
Oxford Laboratory

Sarah Gonyo, Ph.D.
Economist
Silver Spring, MD



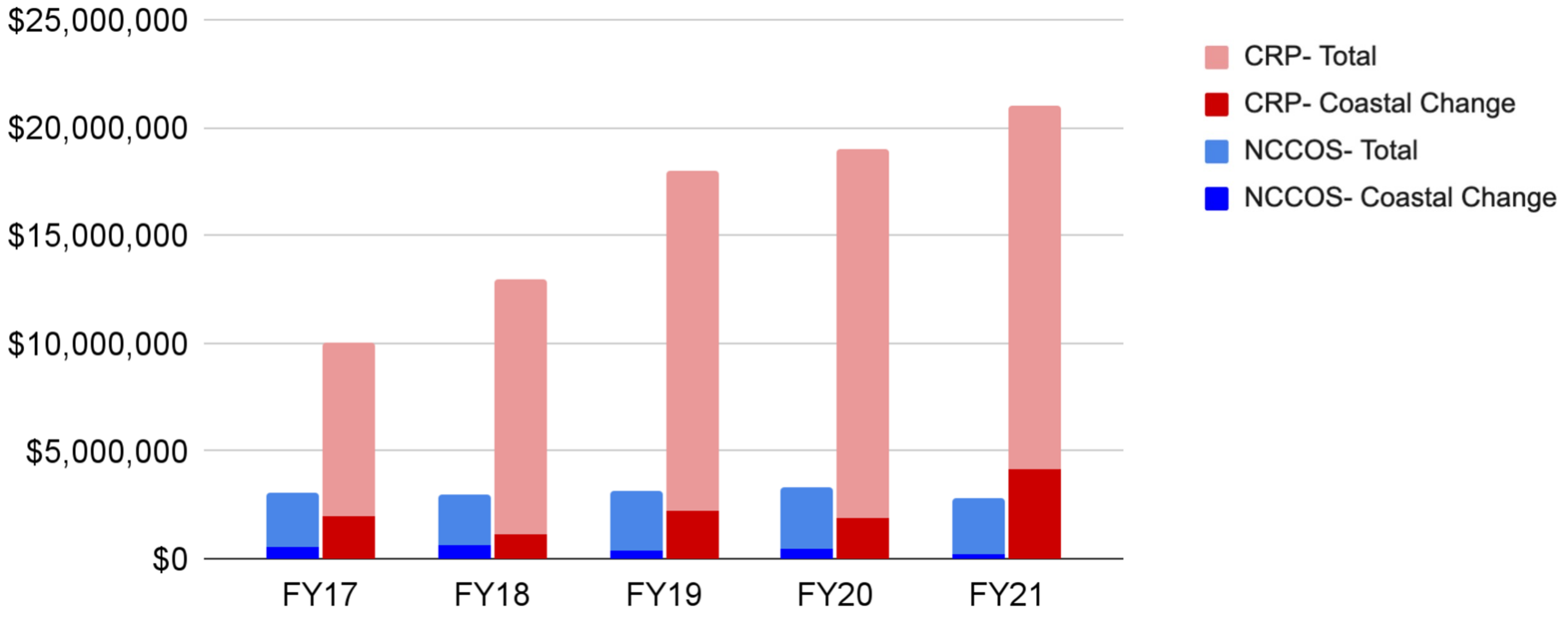
Seann Regan
Geographer / Social Scientist
Charleston, SC

Cooperative Oxford Laboratory

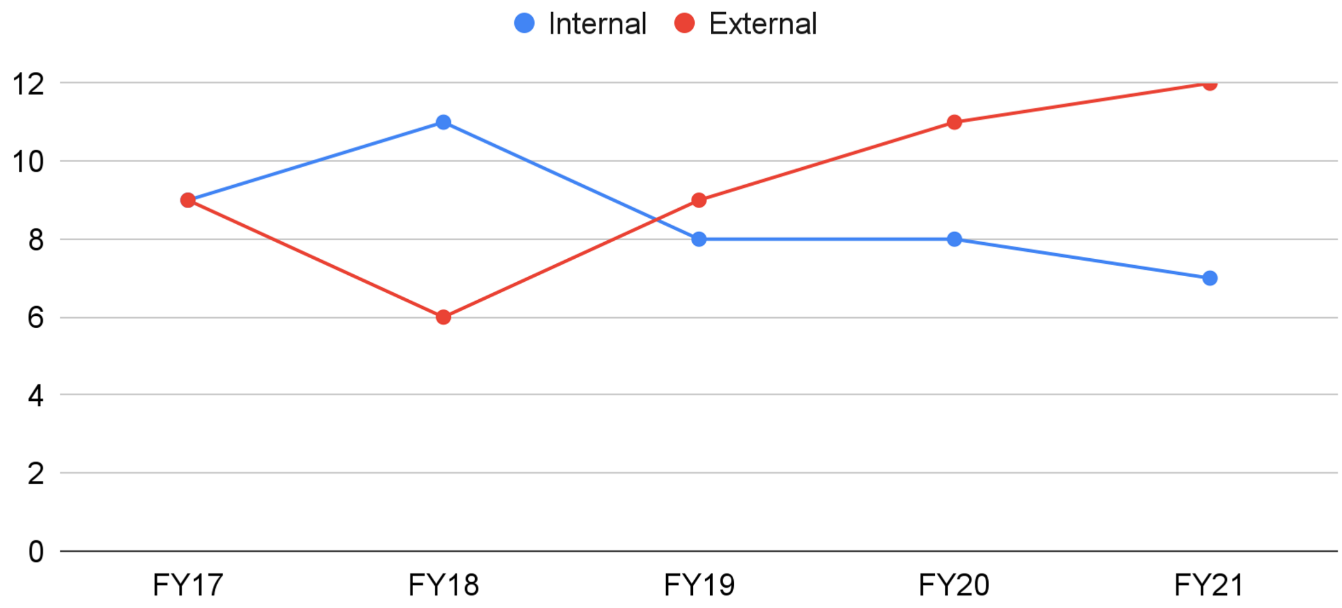
Doug Pirhalla
Research Physical Scientist
Oxford Laboratory

● Contract Staff

Funding for Coastal Change Science within NCCOS

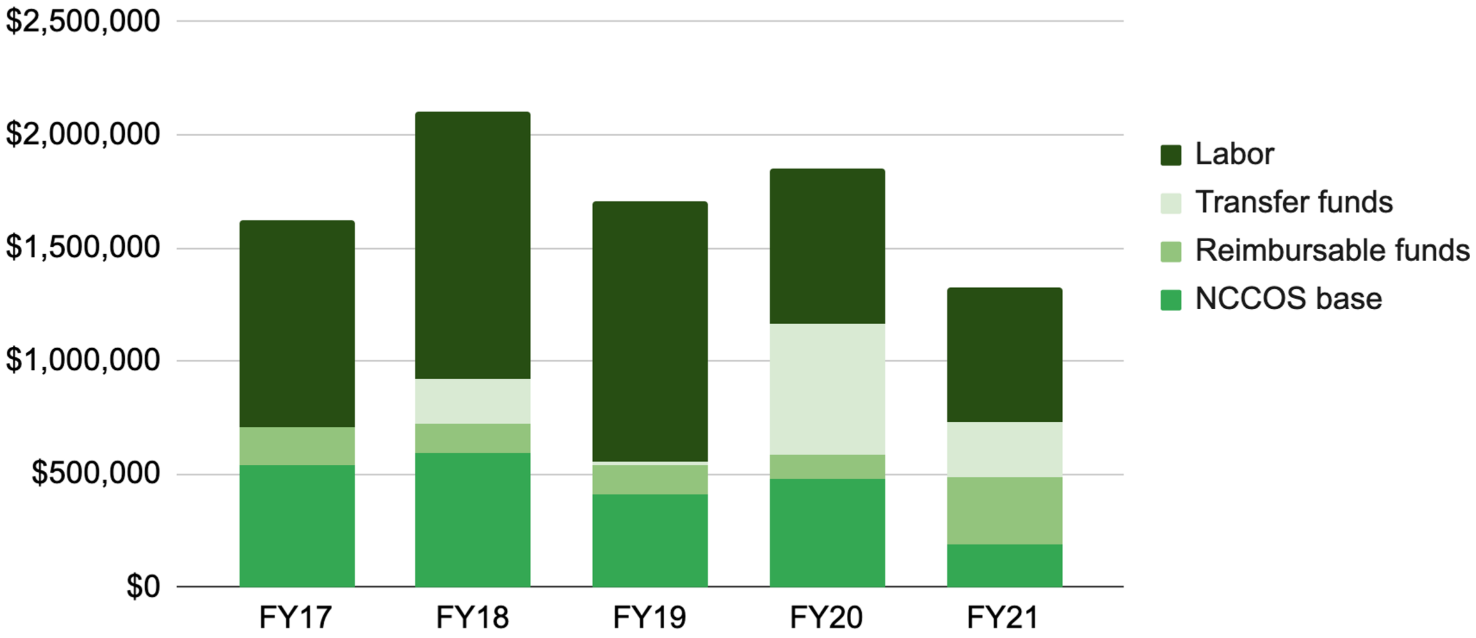


Active projects each year

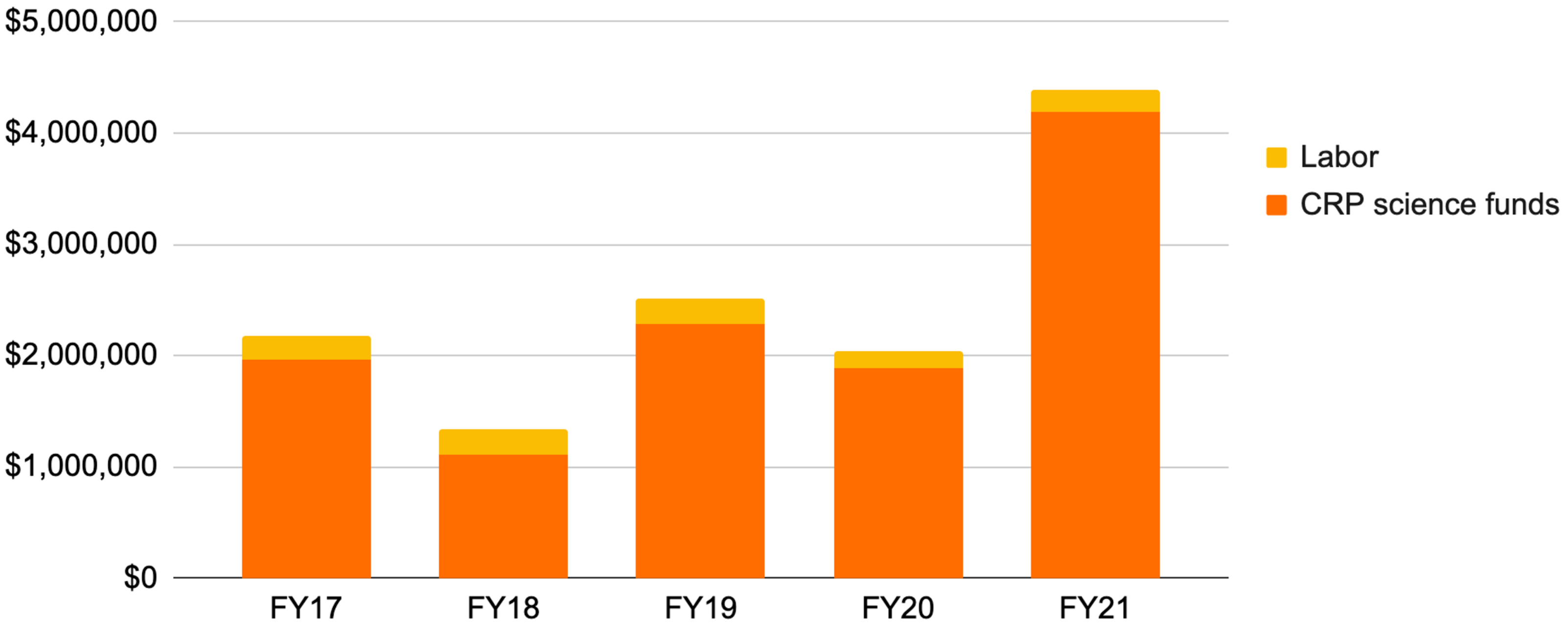


Note: projects under a no-cost extension are not included in that year

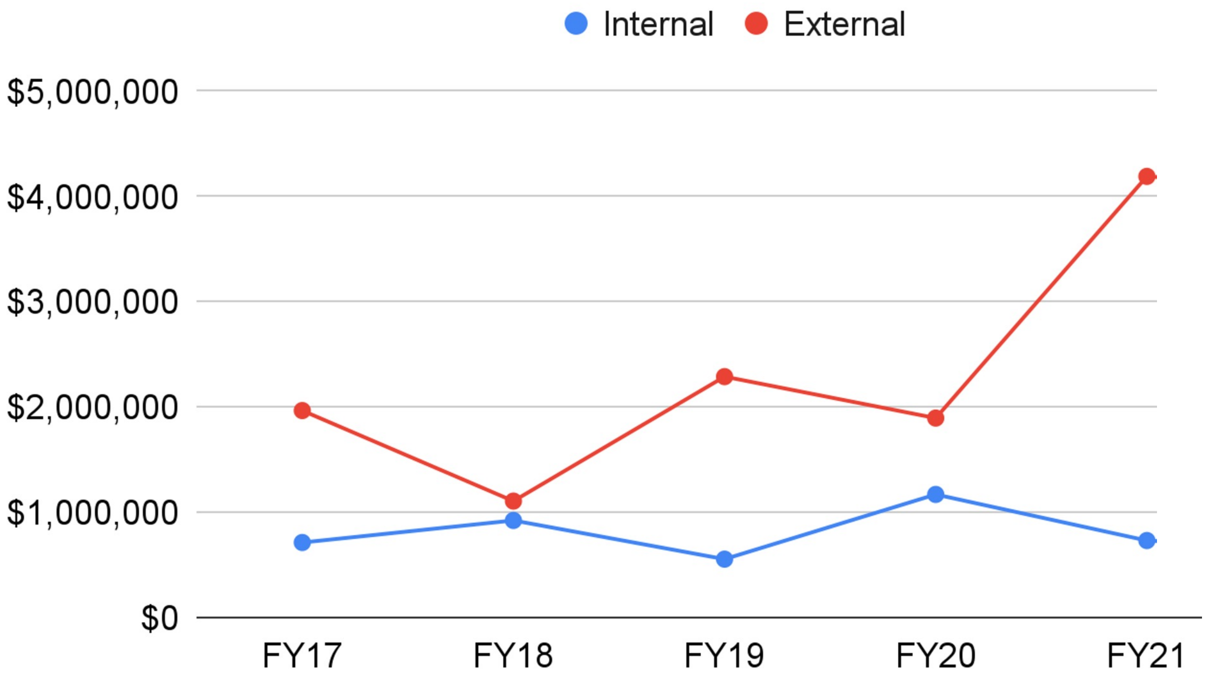
Breakdown of Internal Science Funds



Breakdown of External Science Funds



Project Funding by Year



Future Directions

- Coastal resilience is a higher priority in the Biden Administration and NOAA
- Adopting a coordinated approach to integrating the Coastal Change Portfolio to be more deliberate in the products and services NCCOS provides
- Incorporating new technologies will allow for more efficiencies
- In order to keep up with the demand for the products and services NCCOS science provides, the Coastal Change Portfolio will need more resources.