NC STATE UNIVERSITY

Coastal Resilience and Sustainability Initiative

Lightning Talks: Part I

September 22, 2021

NC STATE UNIVERSITY

Climate Change & Society

Presented by Dr. Robert Mera, Program Coordinator

rjmera@ncsu.edu

https://ccs.sciences.ncsu.edu/

NC STATE UNIVERSITY

NC STATE

Highlights

1-Year Masters Program
4 Course Certificate
Multidisciplinary curriculum
Guest Speakers
Applied Climate Experience
Courses in person and online
Part-time option available
Student diversity
Jobs in multiple fields

Partner Institutions

SE Climate Adaptation Science Center
NC Sea Grant
State Climate Office
NOAA
National Park Service
Local and state governments
Non profit organizations
Department of Design
Department of Communication
Office of Sustainability

Curriculum

Core courses in climate change science, adaptation, data analysis, communication, research ethics, GIS, policy, 2 electives, capstone project

Relevant Research

Extreme rain and sea level rise impact in Nags Head waste treatment
NC Environmental Advisory Boards
SE CASC Tribal Resources Webapp
Greenhouse Gas Inventories
Engaging Local Farmers on Climate Action Plan
Comparing Crops to Solar PV in NC's Central Coastal Plain
Framing Natural Disasters
State Capacity to Implement FEMA Hazard Mitigation
Disaster Risk Reduction and Communication
Shifts in Perspectives on Biogenic Carbon Accounting
Improving Communication Strategies for Conveying Flood Risk
Daily Minimum Temperatures and Public Health
GIS Mapping of Potential Geological Sequestration Areas

A Machine Learning Approach to Natural Phenomena Data: Long term prediction of Atlantic Hurricane Activity

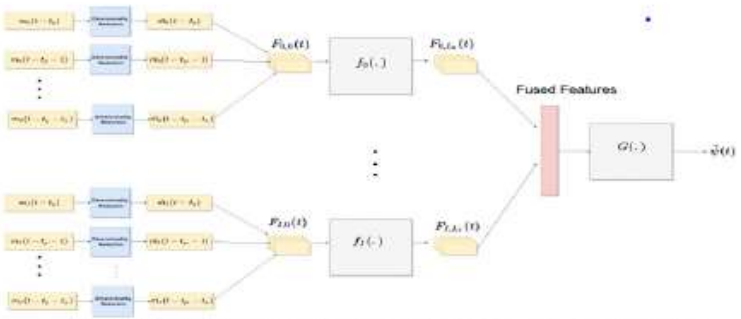
Hamid Krim
jointly with T. Asthana and L. Xie
VISSTA Lab.
ECE Dept.
NCSU, Raleigh, NC

Hurricane Impact on Coastal Ecosystems

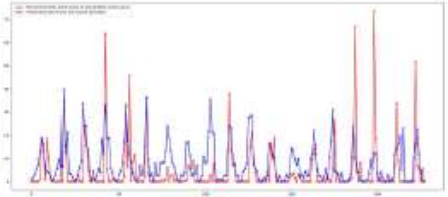
- Strong hurricane winds can cause complete defoliation of forest canopies with dramatic structural changes in wooded ecosystems,
- The changing environmental conditions in coastal habitats imply **a cascade of direct and indirect ecological responses with** immediate to long-term impact
  - Potential destruction of oyster beds and crab habitats and displacement of fish thus impacting other large marine creatures.
  - Flood waters can move sewage and untreated chemicals from land ocean waters harming marine life and impacting coastal health.
  - Hurricanes Harvey and Irma set records with their power and devastation left
  - Harvey dumped 27 trillion gallons of water over Texas and Louisiana, swelling floodwaters, (it is said that the planet's crust was pushed down by more than half an inch).
- Predicting hurricane risks can be consequential in saving lives, reducing loss and planning effective measurements and measures to protect our coastal ecosystem,

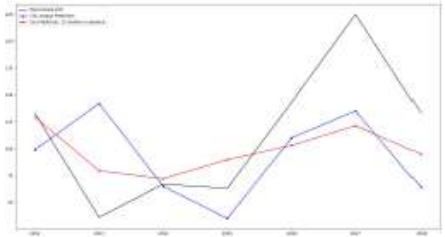
From Information Fusion to Modeling

- Multiple temporal and spatial scales captured through a multi-modal sensing mechanism provide a comprehensive but complex snapshot of the hurricane process as a dynamical system, (e.g., sea-level pressure and winds, etc.).
- The non-linear interactions may be jointly learned and judiciously interpreted in contrast to a heuristic reliance on selected climatological indices,



Model Architecture. m_i are varrios spatio-temporal features which are fused together to get final prediction $\hat{y}(t)$. t_p is the prediction lead time.





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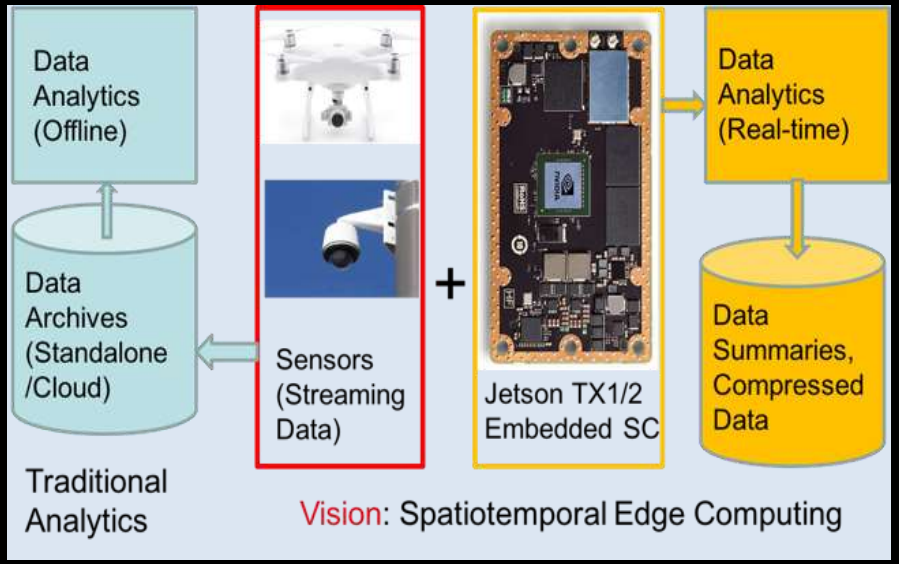
AI/ML at the Edge: Real-time Actionable Knowledge Discovery

Ranga Raju Vatsavai

Computer Science Department and Center for Geospatial Analytics

Vision: GeoEdge Platform

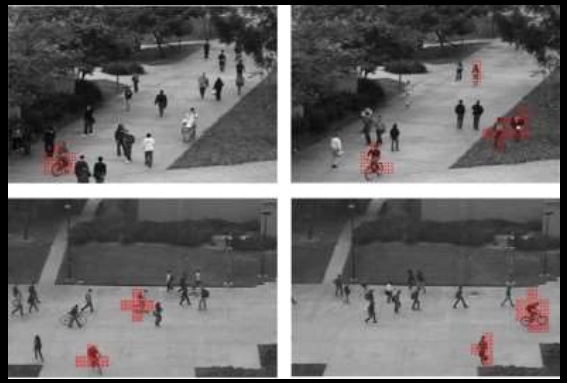
- Analyzing data as it is being acquired
- Using powerful computing devices
  - Low power, small size (embeddable), low cost
- Build a real-time analytics platform for near real-time geospatial knowledge discovery



Applications – Disease monitoring to Damage Assessments

Agriculture Monitoring

Security Applications



Coastal monitoring for erosion, pollution, damages, …

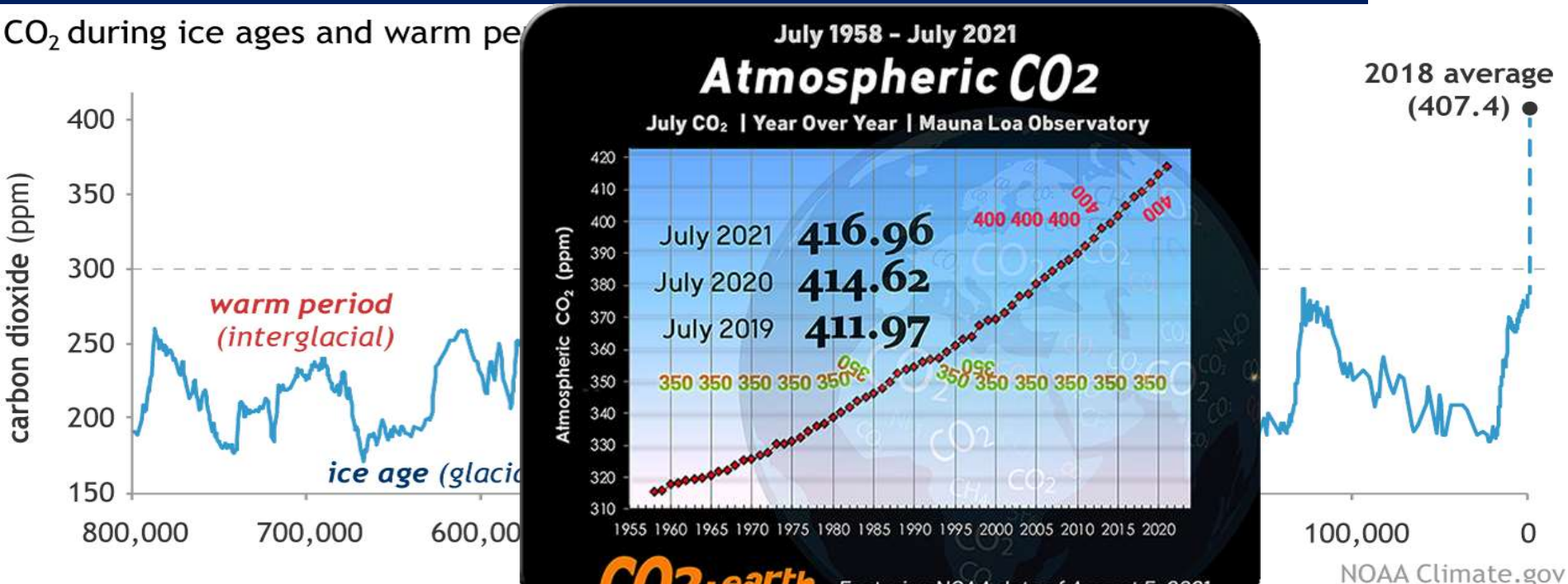
Understand the Past, Present and Future Sea-Level Changes

Paul Liu

jpliu@ncsu.edu

Paul Liu, prof. and coastal geologist at
Dept. of Marine, Earth and Atmospheric Sciences, NC State jpliu@ncsu,edu

In the past 800,000 years, the CO2 fluctuated between 180-280ppm, even many glacial vs interglacial cycles。 But.....

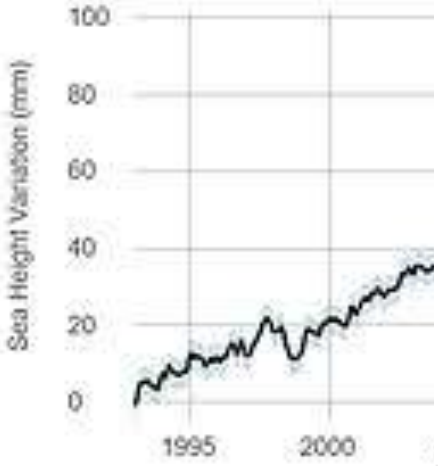


In 2019 alone, the Greenland lost 600 billon tons of ice

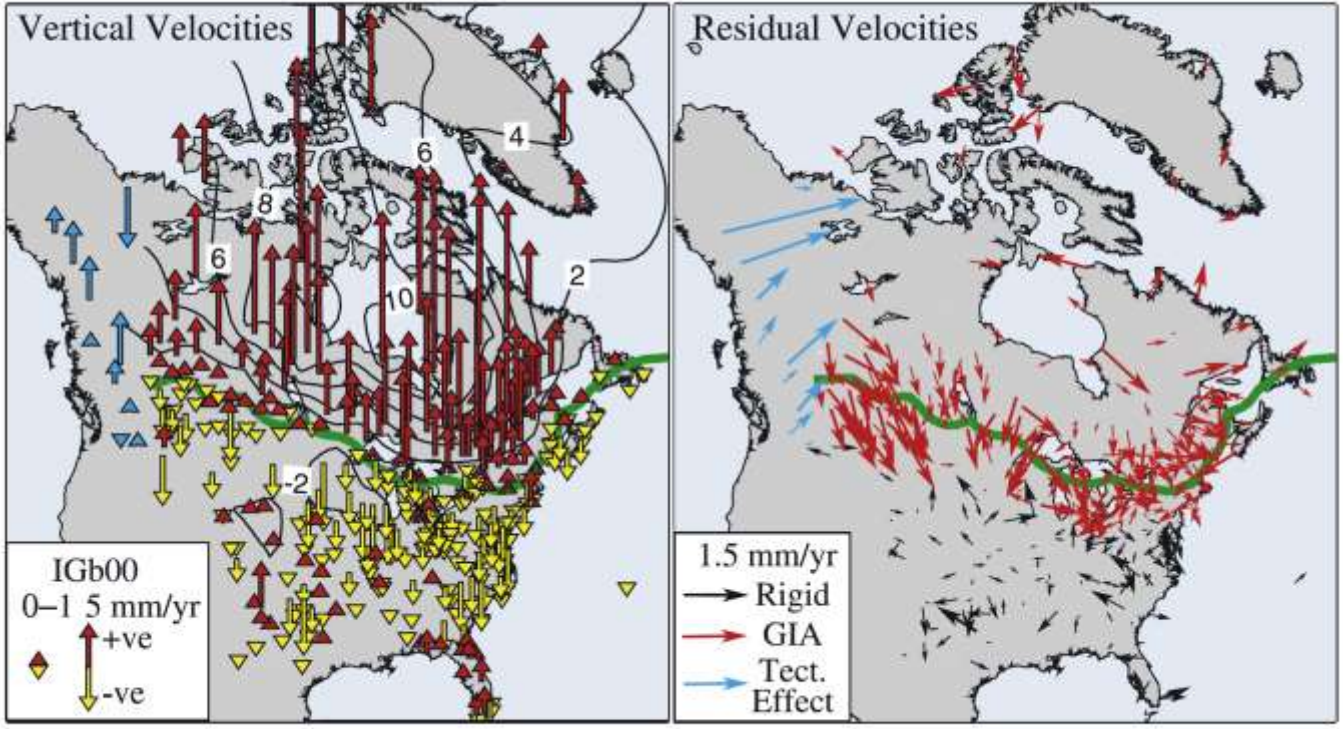
During the exceptionally warm Arctic summer of 2019
Greenland lost 600 billion
global sea levels by near
millimeters) in just two m

SATELLITE DATA: 1993-PRE

Data source: Satellite sea level obse
Credit: NASA's Goddard Space Flig



SELLA ET AL.: OBSERVATION OF GLACIAL ISOSTATIC ADJUSTMENT



(left) Vertical GPS site motions with respect to IGb00. Note large uplift rates around Hud

Observing and Predicting Historical, Current and Future Coastal Environmental Conditions

Roy He

rhe@ncsu.edu

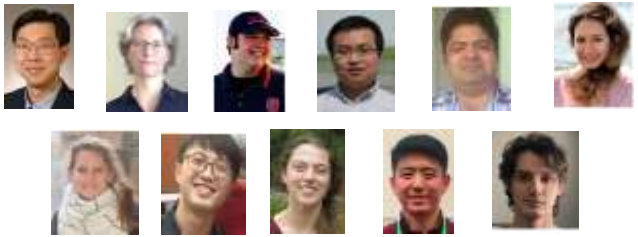
NC STATE UNIVERSITY

OOMG

Observing and Predicting Historical, Current, and Future Coastal Conditions

Roy He, Goodnight Innovation Distinguished Professor, Dept. of Marine, Earth, and Atmospheric Sciences (rhe@ncsu.edu)

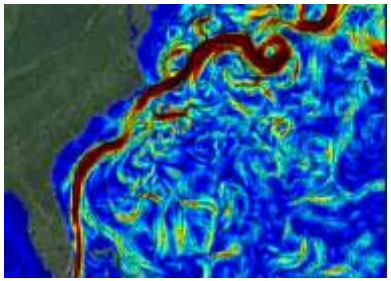
Ocean Observing and Modeling Group
http://go.ncsu.edu/oomg



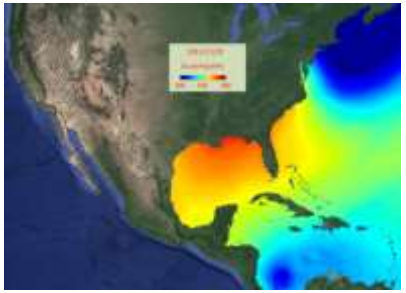
Research Expertise

Ocean Circulation Dynamics
Marine Physical-Biogeochemical Interactions
Air-Sea interactions
Satellite Oceanography
Data Analytics and Numerical Modeling
Data Assimilation
Coastal Ocean Observing System

Climate Downscaling; Gulf Stream Circulation Dynamics and Sea level Prediction

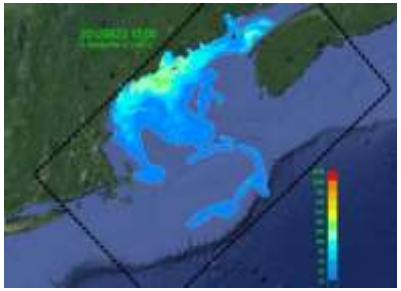


Coupled (air-sea-wave) Northwest Atlantic Prediction System (CNAPS)

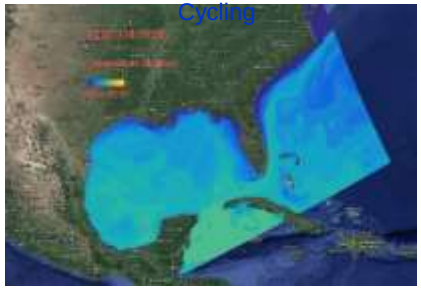


http://go.ncsu.edu/cnaps

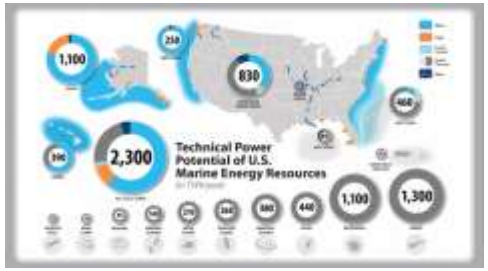
Harmful Algal Bloom Population Dynamics Prediction



Land-Sea Coupled Ecosystem Dynamics; Nutrient and Carbon Cycling



Marine Renewable Energy Resource (current, wave, wind) Assessment



(Image credit: DOE)

powered by

NSF NOAA NASA USGS BOEM The National Academies of SCIENCES ENGINEERING MEDICINE GULF RESEARCH PROGRAM ONR NOPP Sea Grant Coastal Studies Institute KENAN INSTITUTE

NC STATE UNIVERSITY

Observing and Predicting Historical, Current, and Future Coastal Conditions

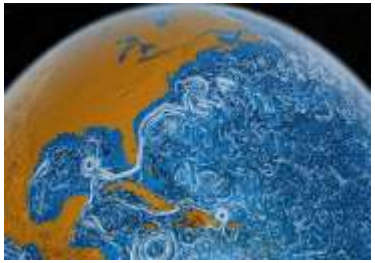
Roy He, Goodnight Innovation Distinguished Professor, Dept. of Marine, Earth, and Atmospheric Sciences (rhe@ncsu.edu)

NSF AI institute AI²ES: Artificial Intelligence for Weather, Climate and Coastal Oceanography

(2020-2025)

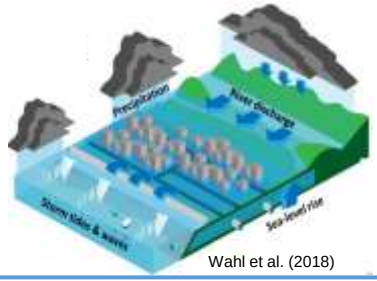
NCSU team will develop trustworthy AI/ML augmented predictions for:

i) Ocean currents and eddies



(Image credit: NASA)

ii) Compound flooding



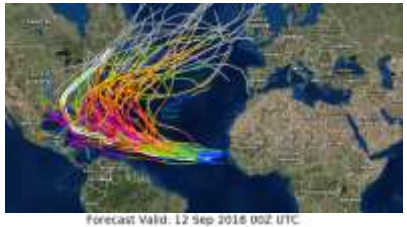
Wahl et al. (2018)

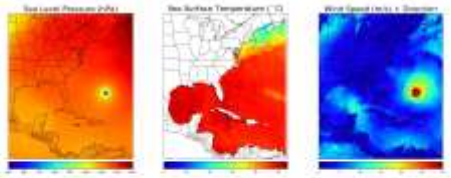
IOOS | Integrated Ocean Observing System

SECOORA

- Marine Operations
- Coastal Hazards and Climate Variability
- Water Quality and Living Marine Resource

Delivering actionable coastal and ocean information from high quality science and observations for the Southeast (2021-2026)





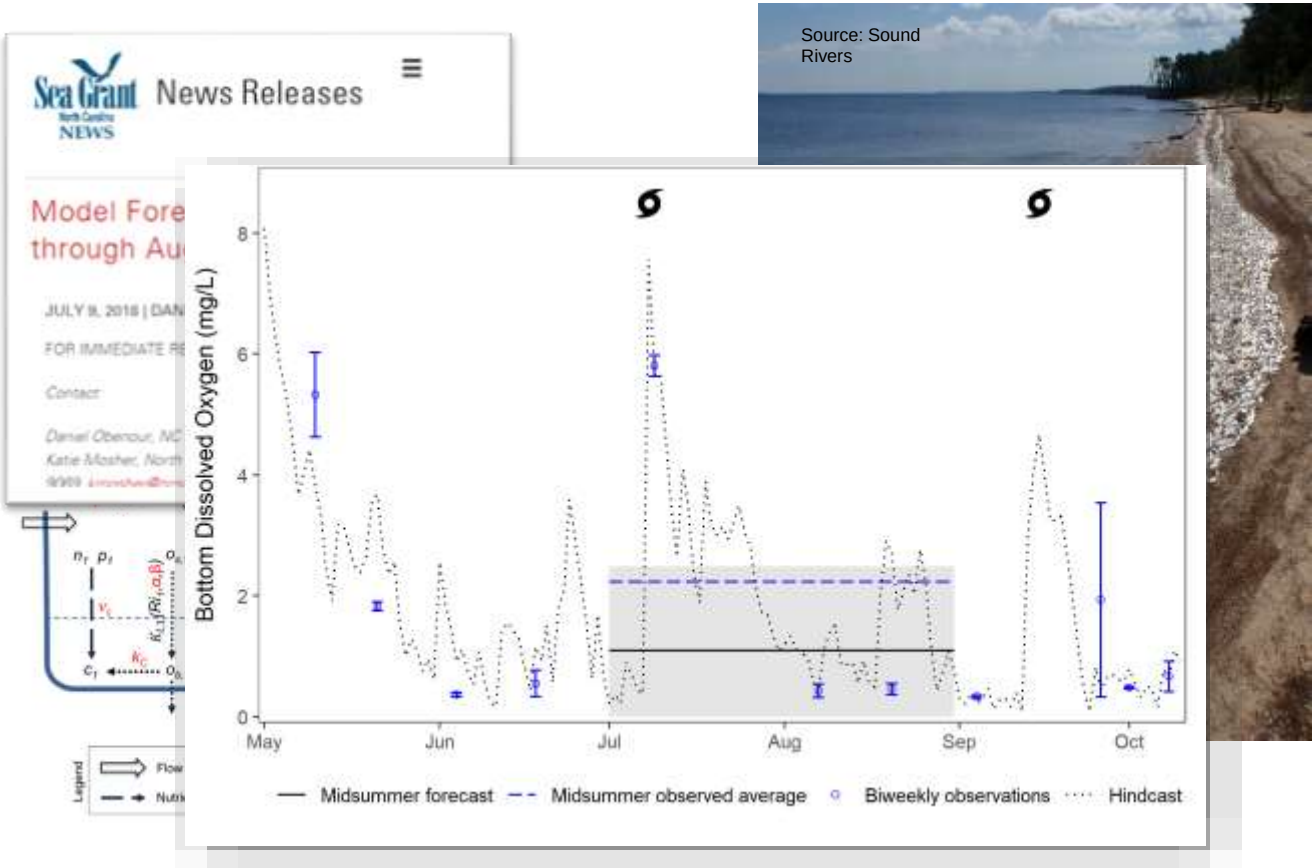
Forecasting Water Quality in Coastal Systems

Daniel Obenour

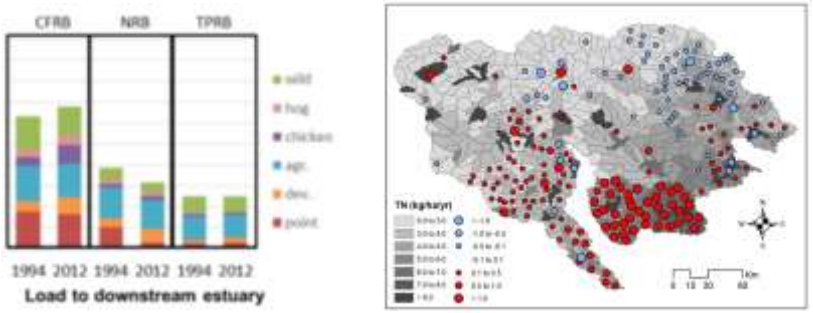
drobenou@ncsu.edu

Forecasting Water Quality in Coastal Systems – Dan Obenour

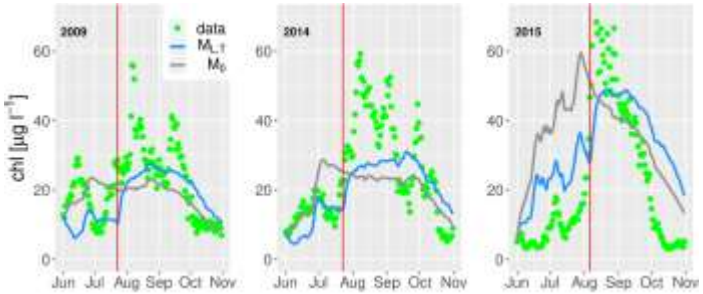
A. Neuse River Estuary



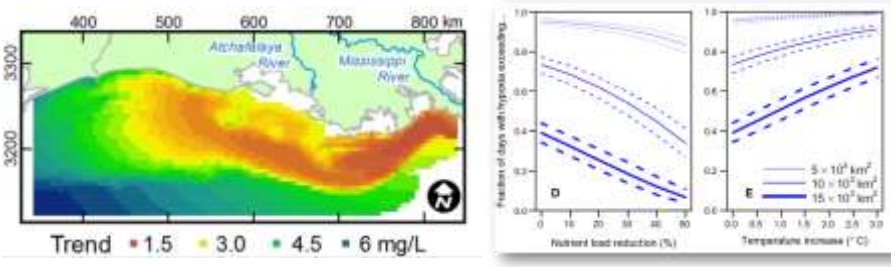
B. Nutrient load modeling



C. Algal bloom prediction



D. Gulf hypoxia and fisheries forecasting



Novel methods for microplastics collection and removal using active particle microcleaners

Orlin D. Velev

Department of Chemical and Biomolecular Engineering
North Carolina State University

odvelev@ncsu.edu

NSF EFRI: Engineering the elimination of end-of-life plastics

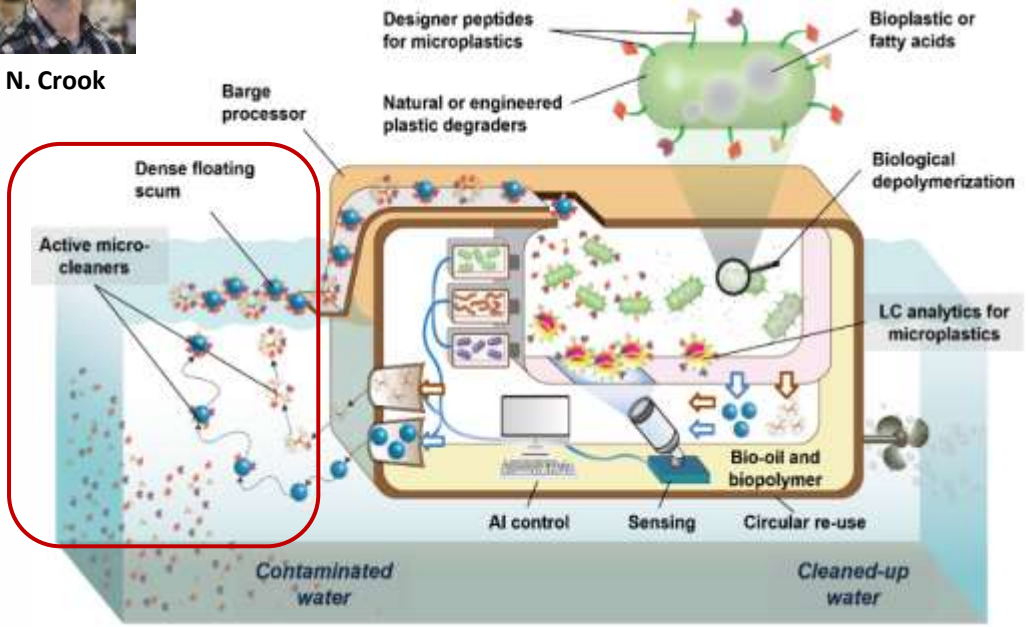
C. Hall

O. Velev

N. Crook

F. You

N. Abbott



Issue must be tackled from multiple directions with expertise in various specialties

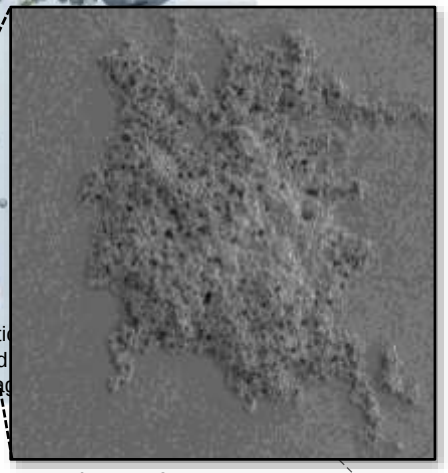
Velev group results: Active SDCs microcleaners as “mini-Roombas” of the sea

Dry condensed SDCs introduced to water

Lateral movement along surface of water to aid in collection

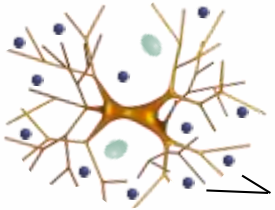
Microplastic “scum” collected for next step in processing

SDCs sink and expand when hydrated



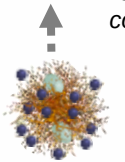
Microplastic fibers and

Soft dendricolloid

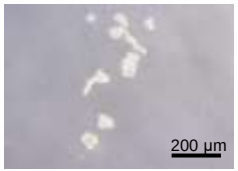


Microplastic capture by van der Waals forces

Condense after bead capture



Float up for collection



The Economics of Coastal Wastewater Management

Stay Tuned

Eric Edwards

eric.edwards@ncsu.edu

Oceans and Human Health

22 September 2021

Ayse Ercumen

Department of Forestry and Environmental Resources

Global WaSH Cluster

https://www.13newsnow.com/article/tech/science/environment/north-community-beach-swimming-advisory/291-5579ef50-940c-4df5-96dc-bc8f231ddb34

Coastal waters receive fecal waste from:

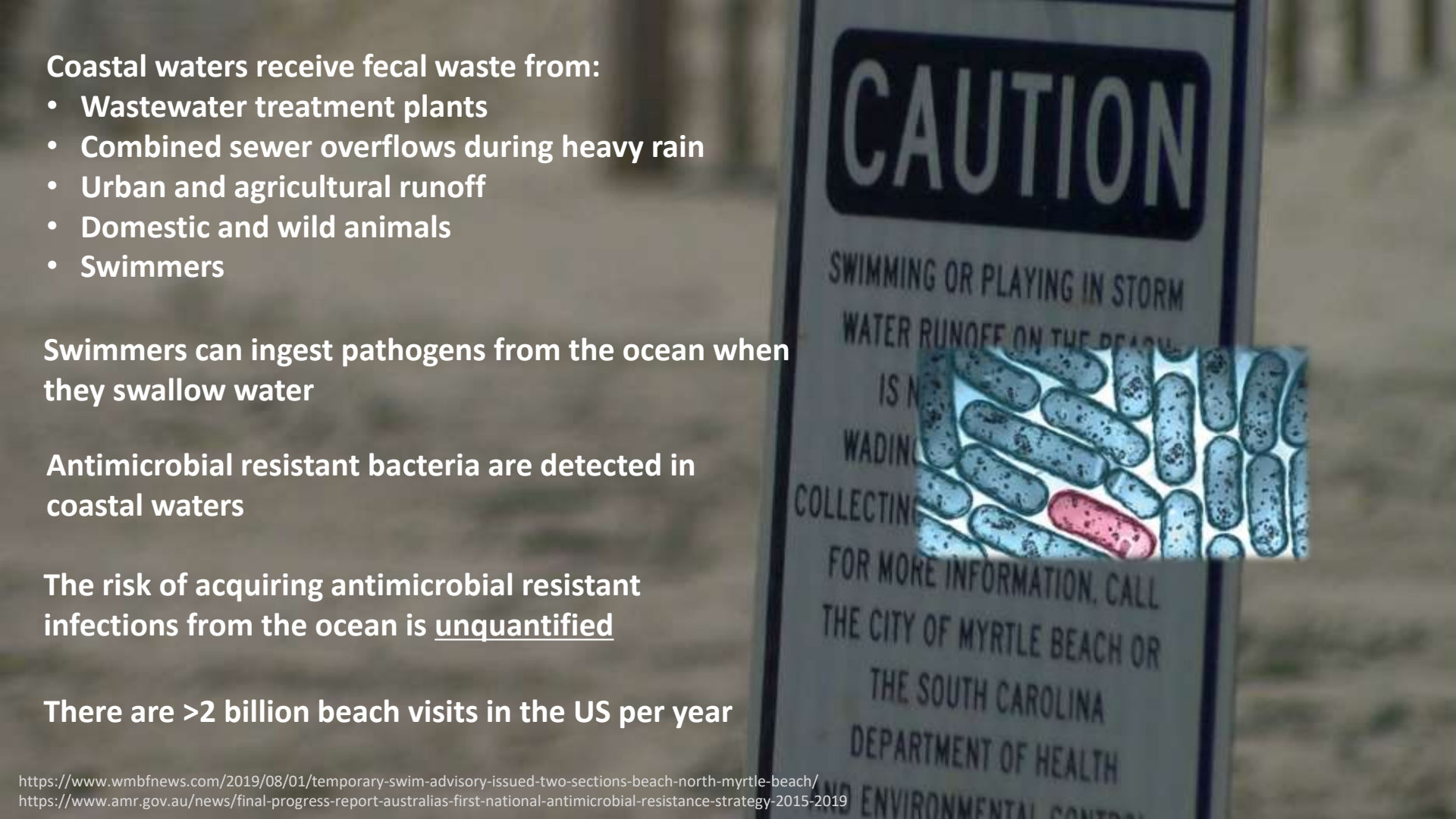
- Wastewater treatment plants
- Combined sewer overflows during heavy rain
- Urban and agricultural runoff
- Domestic and wild animals
- Swimmers

Swimmers can ingest pathogens from the ocean when they swallow water

Antimicrobial resistant bacteria are detected in coastal waters

The risk of acquiring antimicrobial resistant infections from the ocean is <u>unquantified</u>

There are >2 billion beach visits in the US per year



https://www.wmbfnews.com/2019/08/01/temporary-swim-advisory-issued-two-sections-beach-north-myrtle-beach/
https://www.amr.gov.au/news/final-progress-report-australias-first-national-antimicrobial-resistance-strategy-2015-2019

Children spend more time in the water, swallow water more frequently and in larger amounts – 4 times as much as adults

Children experience the highest burden of enteric infections from water recreation

There are fewer antibiotics approved for children's use

Children have higher risk of fatality from antimicrobial resistant infections

What is the risk of acquiring antimicrobial resistant bacteria among swimmers at North Carolina beaches, including vulnerable populations such as children?

https://www.outsideonline.com/culture/active-families/ocean-beach-safety-tips-kids/

The Southeast Climate Adaptation Science Center

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NCSU Coastal Resilience Working Group

September 22, 2021

SOUTHEAST Climate Adaptation Science Center

NC STATE UNIVERSITY

Aranzazu Lascurain • alascur@ncsu.edu

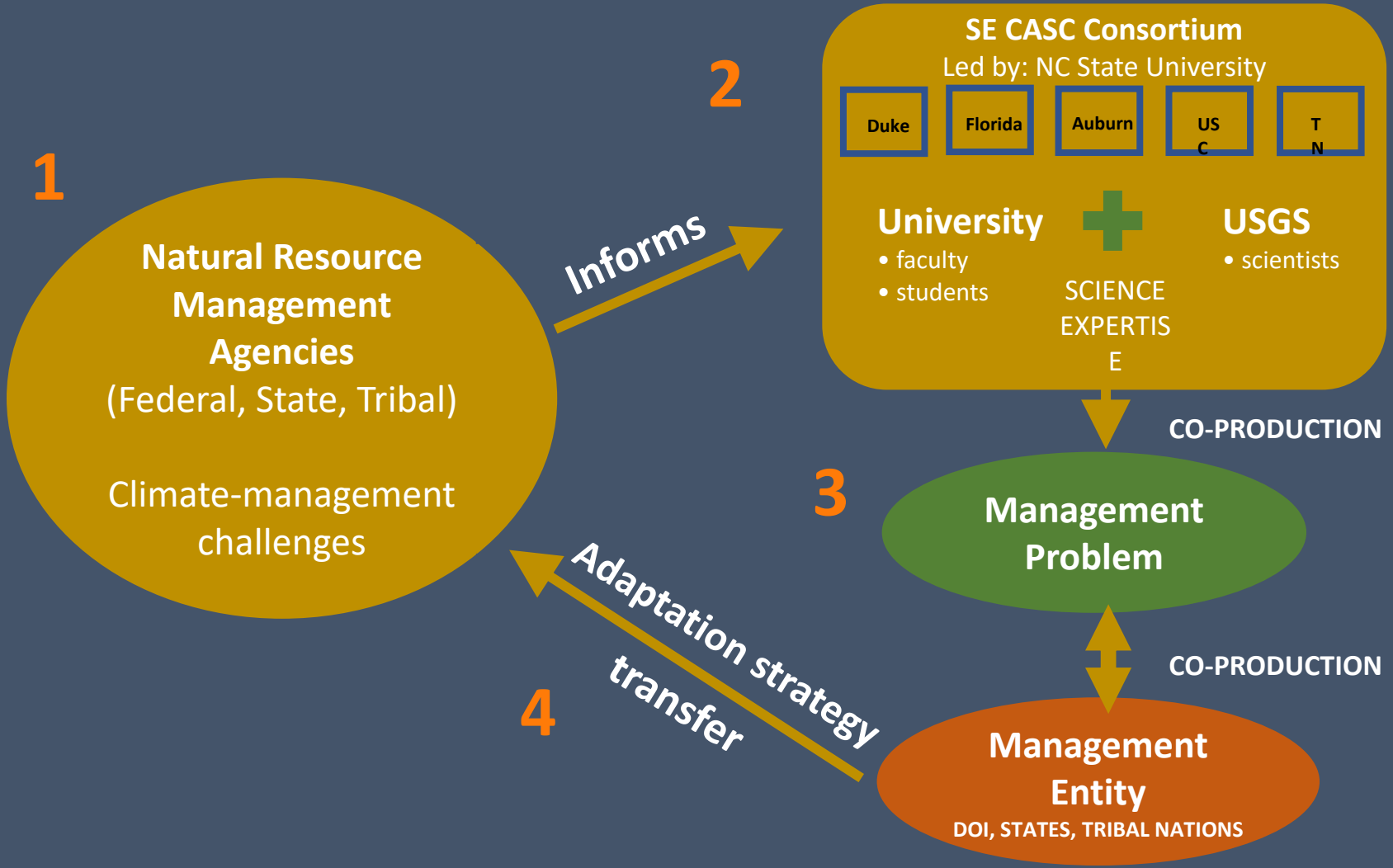
A New Paradigm for Climate Adaptation for Ecosystems

- Established under Sec. Order in Sept. 2009

- Address impacts of climate change on America's water, land, and other natural and cultural resources.

Imperative that "***scientists work in tandem with those managers who are confronting climate change impacts.***"

secasc.ncsu.edu/science


1
Natural Resource Management Agencies
(Federal, State, Tribal)
Climate-management challenges
Informs
2
SE CASC Consortium
Led by: NC State University
Duke
Florida
Auburn
US C
T N
University
• faculty
• students
SCIENCE EXPERTIS E
USGS
• scientists
CO-PRODUCTION
3
Management Problem
CO-PRODUCTION
Adaptation strategy transfer
4
Management Entity
DOI, STATES, TRIBAL NATIONS

Design for Rural Resilience

Bryan Bell

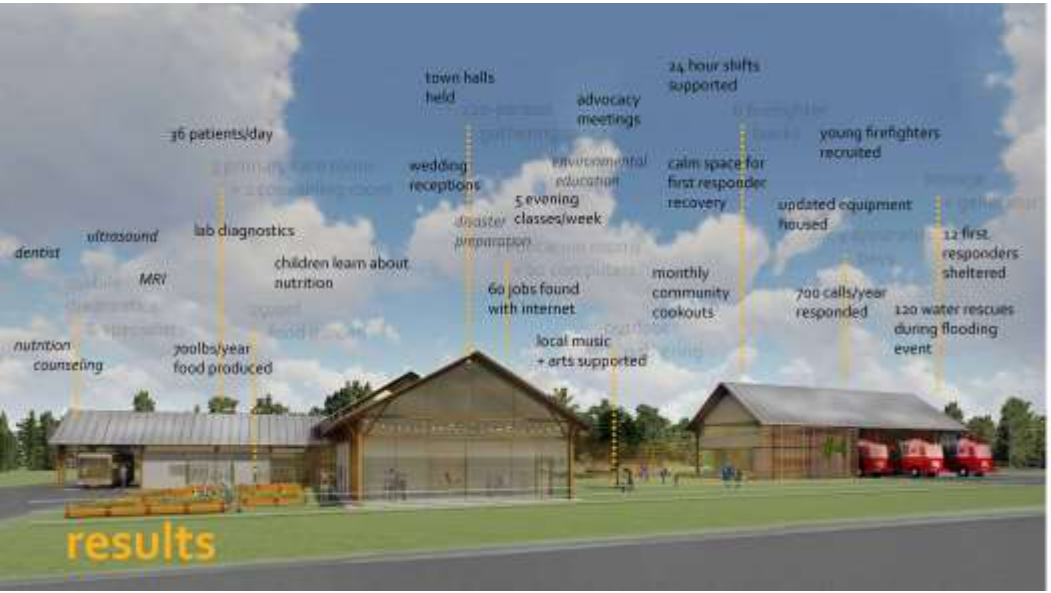
bbell@ncsu.edu

fire stations
established community trust
strategic outreach locations

health stations
clinics & community hubs at fire stations
provide outreach & preventative care

pender memorial hospital
existing underutilized hospital
central hub for network

proposal
pender health stations



pender health stations would...

... increase residents' sense of security in their **health and disaster safety**

... increase their sense of **connection to their community**

... support **first responder health & infrastructure**

Coastal Zone Soil Research

Matthew Ricker

mcricker@ncsu.edu

North Carolina Coastal Zone Soil Survey

- 2 million acres in NC need (re)classification/mapping
- Major need for updated interpretations
- **Coastal zone blue carbon storage**
  - Saltwater intrusion, tidal swamp-ghost forest-marsh transitions
  - Coastal inundation, subaerial-subaqueous soil carbon dynamics
- **Coastal septic system functionality w/ sea level rise**

First NC Subaqueous Soil Cores

Contacts

- **M.C. Ricker**, Chair, SE Region Coastal Zone and Subaqueous Soils Committee
- **Greg Taylor**, USDA-NRCS, Senior Soil Scientist for Special Projects (Raleigh, NC)
- **Visit: CZSS Website**

NCSS National Cooperative Soil Survey

Climate Adaptation through Agriculture and Soil Management (**CASM**)

- Interdisciplinary climate change initiative
- Saltwater intrusion in agricultural lands
- **Field and laboratory studies**
  - Soil salinity mapping
  - Soil health and carbon storage
  - Green house gas production
  - Risk maps/extension materials

Contacts

- **M.C. Ricker**, Saltwater Intrusion Team Lead, Twitter @MuckDragon
- **Visit:** https://casm.cals.ncsu.edu/

NC STATE UNIVERSITY
CROP AND SOIL SCIENCES

Watersheds: The Key to Resilient Landscapes

Chuck Flink, FASLA

Landscape Architect

North Carolina Watersheds

Fall Line – Piedmont/Coastal Plain

Geology Defined Settlement

Strategic tidal marsh creation contributes to coastal resiliency

Michael R. Burchell II
Biological and Agricultural Engineering

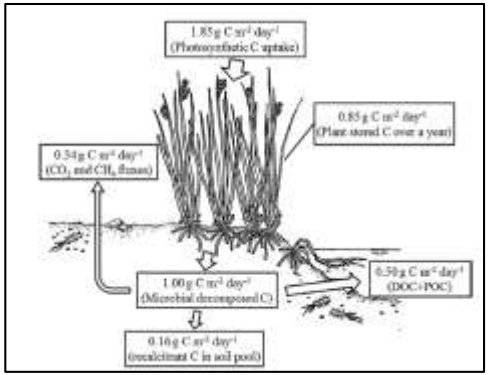
North River Farms Tidal Marsh Creation

1. Dampens and stores storm surge

2. Treats runoff to protect shellfish waters

3. Methane emissions are low

4. The marsh shows net storage of Carbon



5. Adjusting to SLR!

"FloodWise" Practices: Assessing Nature-Based Solutions (NBS) to Mitigate Flooding in Eastern, Rural North Carolina

Presented at: NCSU Coastal Resilience and Sustainability Initiative Meeting, 22 September 2021

Fred Cubbage[1], Ted Shear[1], Meredith Hovis[1], Barbara Doll[1], Jack Kurki-Fox[1], Daniel Line[1], Andy Fox[1], Madalyn Baldwin[1], Travis Klondike[1], Michelle Lovejoy[2], Amanda Sand[3], Thomas Potter[3], Bryan Evans[3]

1. NC State University

2. Environmental Defense Fund

3. NC Foundation for Soil and Water Conservation

Partial Funding from UNC NC Policy Collaboratory & NC DoJ Environmental Enhancement Grant

Preferred NBS Flood Mitigation Measures for Rural North

Categories	Best Practices and Descriptions
Agricultural	
Cover crops and no-till	(1) Including legume and non-legume cover crops on fields during winter
Hardpan breakup	(2) Breaking up compacted hardpan layers to allow for soil water infiltration
Afforestation	Planting (3) bottomland hardwood or (4) pine forest species
Agroforestry	(5) Combining mixed pine trees and pasture fields
Wetland and Stream	
Wetland restoration	Restoring natural wetlands along streams or in flat lands with (6) the use of grasses, sedges, and water control structures (flood control wetland), or (7) bottomland hardwood wetland banks on prior converted agriculture land
Stream restoration	(8) Restoring previously straightened streams to the original configuration
Structural	
Water Farming	(9) Creating small catchment areas and berms to store water during flooding also referred to as "water farming“ (e.g. rice paddies, almond groves)
Land Drainage Features	(10) Installing land drainage ditch controls, such as tiles and tiling outlets

Hovis M, Hollinger JC, Cubbage F, Shear T, Doll B, Kurki-Fox JJ, Line D, Fox A, Baldwin M, Klondike T, Lovejoy M, Evans B, West J, Potter T. Natural Infrastructure Practices as Potential Flood Storage and Reduction for Farms and Rural Communities in the North Carolina Coastal Plain. *Sustainability*. 2021; 13(16):9309.

Capital Budgeting Analysis Comparison, @ 6% Discount Rate

NBS Scenarios	NPV ($/acre)	LEV ($/acre)	AEI ($/acre)	IRR (%) (Only applicable to forestry practices)
Cover Crop (Soybean/Winter Wheat/No-Till BAU)	$2,799	$3,389	$203	N/A
Cover Crop (Corn/Cool Season Pasture/No-Till BAU)	$3,569	$4,321	$259	N/A
Hardpan Breakup	-$215	-$260	-$16	N/A
Afforestation (Bottomland Hardwoods)	-$749	-$772	-$46	-1.9%
Afforestation (Loblolly Pine)	$368	$480	$29	9.7%
Agroforestry (Loblolly Pine)	$71	$93	$6	9.1%
Wetland Restoration (Flood Control Wetland)	-$88,026	-$106,583	-$6,394	N/A
Wetland Restoration (Bottomland Hardwood Forest Bank)	-$11,738	-$63,043	-$3,783	N/A
Stream Restoration	-$772	-$934	-$56	N/A
Water Farming	-$3,454	-$4,182	-$251	N/A
Land Drainage Features	-$1,508	-$1,826	-$110	N/A

Climate Impacts in Animal Agriculture Productivity

Sara Shashaani

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CLIMATE IMPACTS IN ANIMAL AGRICULTURE PRODUCTIVITY

Sara Shashaani (ISE), Mahmoud Sharara (BAE), Sarah Larson (MEAS)

Climate change vulnerabilities due to

- warmer temperatures,
- excessive rainfall and altered seasonal patterns, and
- extreme weather / climate events (flooding, hurricanes)

can result in

- reduced NC animal agriculture productivity,
- degraded environmental quality through nutrient / pathogen leakage to ground / surface waters,
- negative health outcomes and wellbeing of rural communities.

Step 1: Hog lagoon spill risk

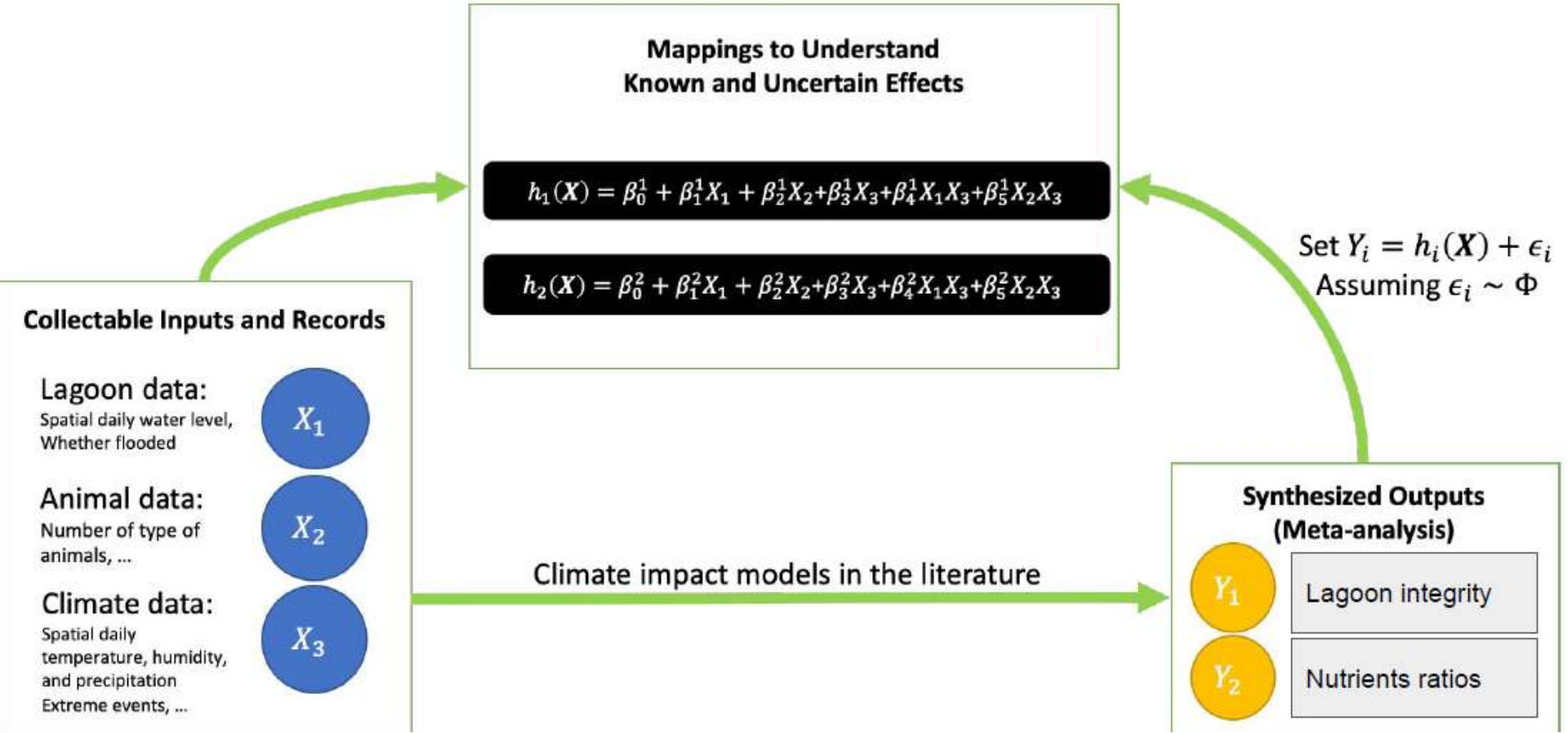
Hog lagoon spills due to increased rainfall negatively impact:

- water quality,
- farm sustainability, and
- neighboring communities wellbeing.
-

Using climate variables, can we predict

- probability of lagoon level exceeding the maximum storage capacity, and
- volumes of nutrients in the water?

We study the uncertain climate impact in animal agriculture productivity through the following framework:



Economics of Saltwater Intrusion on Coastal Agricultural Lands

Roderick “Rod” M. Rejesus
Professor & Extension Specialist
Dept. of Ag. and Resource Economics
North Carolina State University

Lightning Talk for the
Coastal Resilience and Sustainability Initiative
September 22, 2021

Current Research on Saltwater Intrusion

- Objective: To examine farm-level economic impacts of saltwater intrusion in coastal agricultural lands
  - Evaluate the productivity (yield) and profitability impacts of saltwater intrusion in selected farmer fields in Hyde county
    - With the expected negative impact of saltwater intrusion, will it be better to abandon the fields versus convert to coastal wetland (to sequester carbon), and get payments from CRP?
  - Collaboration with Dr. Matt Ricker (Crop & Soil Science) and the Climate Adaptation through Agriculture & Soil Management (CASM) Initiative
- Interest in assessing economic impacts of saltwater intrusion for wider geographical scale
  - Panel county-level analysis requiring data on saltwater intrusion (perhaps remote sensing data?) and merged with yield data

Related Work & Interests

- Looking to collaborate with other scientists interested in assessing economic impacts of saltwater intrusion in coastal agricultural lands and its interactions with adaptation strategies
- Email: rmrejesu@ncsu.edu
- Previous climate change & agriculture work published in:
  - *Science*, *Am. J. of Ag. Econ.*, *Ag. Econ.*, *Field Crops Research*, *Food Policy, Euro. Rev. of Ag. Econ.*

Health and Behavior Sensors for Mussels, Fish and Plants

Alper Bozkurt

aybozkur@ncsu.edu

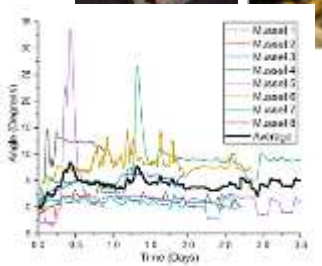
Health and Behavior Sensors for Mussels, Fish and Plants

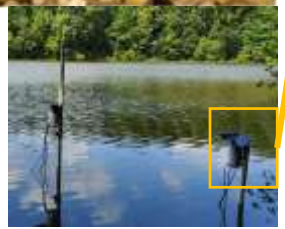
Prof. Alper Bozkurt (aybozkur@ncsu.edu)
Department of Electrical and Computer Engineering

W/ Prof M Daniele

- Internet of Bionic Systems (novel data)
  - Instrumented animals and plants
    - behavior, physiology, stress response
  - Environmental sensors
    - air, soil
  - Local recording or wireless transmission
- Pilot project (Mussel gaping behavior monitoring)
  - Co-lead by Prof. Jay Levine

    Aquatic Epidemiology and Conservation Laboratory
    Marine, Earth and Atmospheric Sciences
  - Mussel health (wild or aqua-cultured)
  - Mussels as aquatic sensors





StriperHub: Striped Bass Aquaculture

Benjamin Reading

bjreadin@ncsu.edu

Fish Physiology, Breeding, and Genomics in Aquaculture (Fish Farming)

Benjamin J. Reading, PhD bjreadin@ncsu.edu ; 206-658-5149
Applied Ecology: Associate Professor & University Faculty Scholar

PROJECT OBJECTIVES

- 9 out of 10 seafood products consumed in the US are imports and this is a $14 Billion trade annual deficit for the country (USDA + NOAA *Marine Aquaculture Initiative*)
- Development of a strong, domestic seafood industry is required for future food security in the global market
- Industry requires a consistent and reliable source of fish for growout (*Supply Chains*)
- Genetic improvement (domestication) of cultured fish species will allow the industry to expand
- Understanding genomes to phenomes using advanced analytical platforms, such as machine learning, are required for transformative progress in breeding and physiology research in this 21st Century of biology

SCIENTIFIC APPROACH

- Selective breeding of fishes and dissemination of broodstock to industry stakeholders (*Extension*)
- Congruent work with academic, industry, and government partnerships to ensure project success from science through to seafood production and retail (*Impact*)
- Discover and implement machine learning approaches that provide meaningful results with wide applications (*Apply*)

CAPABILITY (ACHIEVEMENTS)

- Research Interests:
  - ✓ Basic physiology and applied breeding (animals; fish)
  - ✓ Understanding genomes to phenomes
  - ✓ Translational science through extension and outreach
  - ✓ Artificial intelligence and machine learning informatics
- Faculty Director *Pamlico Aquaculture Field Laboratory* & *Lake Wheeler Field Laboratory Fish Barn* (NCSU)
- Co-Coordinator *National Breeding Program for the Hybrid Striped Bass Industry* (with USDA ARS)
- Aquaculture Coordinator *NRSP-8 National Animal Genome Program* (USDA NIFA)
- Member *Southern Regional Aquaculture Center* (USDA NIFA)
- Member *AquaFish Innovation* (USAID Feed the Future)
- > 50 journal articles and book chapters; > 160 presentations
- Over $10M in funding as PI, Co-PI, or Collaborator
- FFAR *New Innovator in Food and Agriculture Research*

FUTURE RESEARCH OPPORTUNITIES

- Address national and global food security grand challenges with industry stakeholders and the publics (NOAA Sea Grant *StriperHUB,* 2020-Present)
- Continue to lead advances in striped bass broodstock development ($50 million per year farm-gate value)
- Pioneer and expand striped bass farming as a new mariculture industry in the country and centered in NC
- Develop and refine novel machine learning approaches to analyzing “omics” data for widespread applications in bioinformatics (*Systems Biology*; AEC 510)
- Content expert liaison for the industry to government
  - USDA, NOAA, US House, US Senate, US WH
  - US Intelligence Community (USDHS, ODNI)
- Follow us on FaceBook: Striped Bass Genome Community
- https://www.youtube.com/watch?v=5IGNzgssxN0

New Innovators in Food & Agriculture Research 2016

December 4-6, 2017
US Senate, US House

2019 State of the Union Address

Executive Order: Promoting American Seafood Competitiveness and Economic Growth

EO 13921 Issued on: May 7, 2020

2021 PUBLIC-PRIVATE ANALYTIC EXCHANGE PROGRAM

Homeland Security

"The U.S. government needs to promote domestic aquaculture for food production"

Southeast Climate Adaptation Science Center Coastal Resilience Working Group

Cari Furiness

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Southeast Climate Adaptation Science Center

secasc.ncsu.edu Cari Furiness, cari_furiness@ncsu.edu @se_casc

Solving the wicked problems related to global change will require the scientific expertise and collaboration of university and federal researchers.

Mission: Actionable Science that meets needs of natural & cultural resource managers

Science: Exposure, Impacts, Adaptation
> USGS-funded research focused on coastal areas

Working Groups: Multi-disciplinary, multi-sector
> Identify, address regionally-relevant emerging issues.
> Develop syntheses of topics to inform science needs and improve co-production.

Federal-University Partnership

SOUTHEAST Climate Adaptation Science Center · NC STATE UNIVERSITY · AUBURN UNIVERSITY · Duke UNIVERSITY · UF UNIVERSITY of FLORIDA · UNIVERSITY OF SOUTH CAROLINA · THE UNIVERSITY OF TENNESSEE KNOXVILLE · USGS science for a changing world

Coastal Resilience to Global Change Working Group

SE CASC Working Groups bring together multi-disciplinary teams of academics, USGS staff, Tribal Nations, representatives from state agencies, other stakeholders, and students to address regionally-relevant emerging issues and to develop syntheses of topics to inform science needs and improve co-production.

Working Group Goals:

Elucidate the needs/gaps and opportunities for coastal resilience in the southeastern U.S. region through development of a network of researchers among consortium members, leveraging existing efforts and stakeholder connections.

Working Group Leads:

Karen McNeal (Auburn University), Lydia Olander (Duke University), Micheal Allen (University of Florida)

secasc.ncsu.edu/coastal-resilience-to-global-change-working-group/

Activity and Products:

> Identified key researchers at each consortium university for monthly meetings.

> Identified key areas of interest, expertise, and opportunities for SE CASC.

Southeast Coastal Resilience Database

> Editable & searchable database of organizations working on coastal resilience in SE.

SE CASC Coastal Resilience Working Group Report

> Research priority: System-based modeling of the Land-Ocean Continuum

> Watershed Modification Effects on Coastal Ecosystems: A Synthesis from Selected Gulf of Mexico Estuaries

Future: Potential workshop series with partner stakeholders and researchers.

SOUTHEAST Climate Adaptation Science Center | NC STATE UNIVERSITY | AUBURN UNIVERSITY | Duke UNIVERSITY | UF UNIVERSITY of FLORIDA | UNIVERSITY OF SOUTH CAROLINA | THE UNIVERSITY OF TENNESSEE KNOXVILLE | USGS science for a changing world

Questions about today's presentations?

Contact individual presenters for questions about their work.

Questions about the Coastal Resilience and Sustainability Initiative?

Contact Mary Watzin mwatzin@ncsu.edu or Amanda Mueller ammuell2@ncsu.edu