**Coastal Resilience Community of Practice Meeting**

Thursday, January 25 – 1:30pm - 3:00pm

**Purpose of the COP:** Bring together diverse coastal stakeholders to focus on how ecosystem resilience can build local community resilience. We don't necessarily have to have a "thing" to work on but will take on projects as appropriate and mutually agreed on. Website: https://deq.nc.gov/coastal-resilience-cop

**In attendance:**

- Abby Williams, NC Coastal Reserve
- Amanda Merrill, Moffatt & Nichol
- Amanda Mueller, KIETS Climate Leaders Program, NC State
- Brian Byfield, NC Office of Recovery & Resilience
- Cameron Braddy, Mid East Commission
- Cat Bowler, NC Audubon
- Cayla Cothron, NC Sea Grant
- Cindy Camacho, Moffatt & Nichol
- Claire Rapp, NC Coastal Federation
- Dawn York, Moffatt & Nichol
- Eryn Futral, NC Emergency Management
- Forest Shepherd, NC Division of Water Resources
- Jeff West, Cape Lookout National Seashore
- Joe Heard, Town of Duck
- Kiera O'Donnell, Duke University
- Leda Cunningham, Lighthouse Environment Partners
- Marae West, Cape Fear Bird Observatory
- Michael Christenbury, NC Division of Coastal Management
- Michelle Lovejoy, Environmental Defense Fund
- Riley Lewis, Coastal Carolina Riverwatch
- Robin Hoffman, NC Division of Water Resources
- Sarah Spiegler, NC Sea Grant
- Stacey Feken, Albemarle-Pamlico National Estuary Partnership
- Whitney Jenkins, NC Coastal Reserve

**Notes**

**Updates on the NC Salt Marsh Plan** – Claire Rapp, North Carolina Coastal Federation (NCCF) – **see slides**

- NC Salt Marsh Action Plan Updates / work with partners coast-wide to create plan, part of regional plan by South Atlantic Salt Marsh Initiative (SASMI), applies to NC SC, GA, and FL
- The importance of salt marshes / irreplaceable habitat / recreation tourism/ impacts, rising sea level, what do to our marshes
- Marsh response to sea level rise: two options horizontal migration or vertical accretion.
- Carolyn Currin (ret. NOAA) work – Beaufort saw 7.5 mm of sea level rise/year for 2004-2018. Salt marshes can only keep up with ~8mm/year of sea level rise. Hope to have an average sediment accretion rate of 5mm. Marshes will need help so that they don't drown in place.

- This spurred launch of SASMI, a non-regulatory voluntary partnership, which is now more than 300 members strong. The SASMI Salt Marsh plan was released last year, https://marshforward.org/. Each state is working towards state-specific work under guidance of regional efforts.
- NCCF recently released a five-year action plan, informed by Carolyn Currin and Katie Warnell's (Duke University) work: https://dukeuniv.maps.arcgis.com/apps/instant/portfolio/index.html?appid=416a01c29cfd4a77af998d225478ba63n
- Difficult to apply coast-wide recommendations, taking a regional approach to create conservation planning units
- Updating existing steering committees to tackle the salt marsh plan's objectives; welcome new folks to join help move actions forward. Please reach out if you're interested in joining our steering committee: clairer@nccoast.org
- Q&A:
    - Cindy: FEMA Community Disaster Resilience Zones designated in every state; AP Sound designated; 90% federal match instead of usual 80% / federal grants, nature-based solutions, including Bipartisan Infrastructure Law / aligned with areas projected to grow. You mentioned protective stormwater, what is that?
        - Focus on enforcing existing water quality sedimentation standards, prevent scouring, filing, encourage stormwater controls to keep pollution and over wash out of marshes.
    - Brian: Have you thought through marsh protection in relation to existing land use, population? I'm interested in being part of this process.
        - The overall distribution of salt marsh is not equitable, will lose marsh, and gain marsh as we lose other habitat types, such as agricultural working lands, forests. Will need to work with farmer, develop easements, help to transition working lands, determine options to best suit needs. SASMI is helping all four states work with underserved communities, determine areas in need of coastal resilience, work with communtieis that might need assistance with adjust their lands.

**Overwinter marsh sparrows and sea level rise & new Motus Tower Grant**– Marae Lindquist West, Cape Fear Bird Observatory – **see slides**

- Impacts of sea level rise on three syntopic marsh sparrows, some occur in same place at same time. In 2019-2022, monitored these species at the Rachel Carson Reserve, Hammock Beach State Park, Masonboro Island Reserve, Bald Head Island, and Bird Island Reserve. The purpose was to survey bird abundance, density, and movement and determine sea level rise impacts on their habitat.
- Tag birds: banding, radio telemetry
- Used the Sea Level Affecting Marshes Model (SLAMM) at these sites to determine habitat changes. It is a mathematical model used to simulate land cover change over time in response to sea level rise.
- Looked at the winter space used by the three marsh sparrows. The species were not evenly distributed across the marsh landscape. Very specific location preferences in winter. Helped us refine our understanding of winter habitat needs.
- All species show the same pattern of movement with tidal cycles, but site-specific differences in daily movements. All species maintained home ranges throughout winter stationary period, not significantly different between species.
- Their populations have been declining since the 1990s and this work may help get them listed as threatened or endangered.

- Winter habitat use, our novel results indicate they require variety of marsh habitat, management should seek to conserve a habitat range, not just one habitat type along elevation gradient.
- SLAMM results show large losses in salt marsh habitat at the five sites by 2100. To conserve marsh habitat, adaptive management strategies are needed. Models used site specific parameters to provide detailed predictions.
- New project funded by the National Estuarine Research Reserve System's Science Collaborative: synthesize Motus tower data across the NERR System. It is an international network that uses radio telemetry to track migratory animals. There are major gaps in towers in NC and the NERRS. Over half the NERRs have Motus towers. We want to create a collaborative network across the NERRS to support research, education, and conservation. We plan to develop education resources, education experiences at the NC NERR, facilitate construction of Motus towers in four identified locations, and promote collaboration across the NERRS.
- Q&A:
    - Sarah: For the sparrows to be listed as threatened or endangered, what are management implications?
        - Hopefully at least provide funding. If not listed, it is estimated that they will go extinct by 2060. When black rail was listed, funding helped with marsh mitigation strategies including research on thin layer deposition. The black rail serves as umbrella species for marsh sparrows, which are not yet listed. There are several species that are in decline that live in the same areas of marsh.
- **Discuss ideas for implementation of APNEP BIL strategy** – Stacey Feken, Albemarle Pamlico National Estuary Partnership (APNEP)
    - https://apnep.nc.gov/documents/files/bipartisan-infrastructure-law-cooperative-agreement-long-term-strategy
    - https://apnep.nc.gov/documents/files/apnep-equity-strategy
- **Round robin** – members share what they are working on related to resilience
    - Sarah: Winter 2024 digital issue of NC Sea Grant's Coastwatch out. Shifting Shores article about living shorelines academy starting up at Carteret Community College. Lauren Daniel leading the effort with help from NC Coastal Federation, NC Coastal Reserve, and others. An intro class was held in November. Also a video that goes with the article: https://youtu.be/qR0TfXC9ecg
    - Leda: Lighthouse Environment Partners is an applicant for NOAA climate ready workforce grant. Opportunities to incorporate more workforce partners, working with NC Sea Grant, will know in June if funded.
    - Abby: Conducting resilience work at NC NERR; starting a resilience plan for Masonboro Island Reserve first. Rachel Carson Reserve plan is complete. Will later focus on Zeke's Island and Currituck Banks Reserves plans.
    - Joe: Good news, the Town of Duck's living shoreline project is underway. Offshore and shoreline protection done, ready to do other resilience projects. Will be complete around May or June, hope to be a good model for other communities. The project is a quarter mile stretch and visible to the public.
    - Riley: Coastal Carolina Riverwatch has multiple projects happening. Lower New River watershed restoration plan. Revitalizing the New River Roundtable in partnership with the City of Jacksonville and Pat Donovan Bradenburg. This includes looking at coastal infrastructure, capacity building, and connection project ideas to resources and funding. Research next year or so on PFAS and heavy metal oyster contamination, reestablishing an industry working group with fishers, will include quarterly

meetings, folks are welcome to join. If interested in joining the New River Roundtable or the Fisheries Industry Working Group, contact Riley at RileyL@CoastalCarolinaRiverwatch.org

- Dawn: Living with Water project at the NC battleship in Wilmington – construction moving forward after several years of planning. Washington Post article about the project. We are happy to give a tour if anyone wants to visit. Working with the Rachel Carson Reserve to construct a living shoreline at the east end of Carrot Island. Can present about at a future meeting. Work with Town of Nags Head and their estuarine shoreline management plan, seeking funding to implement the plan, but not successful yet. Actively seeking partners and collaborators, excited the Town wants to see these projects implemented.
- Brian: Riley, I'm very interested in hearing what you have learned about work on resilience in unincorporated areas. Attended a regional disaster recovery meeting in Savannah. The audience was interested in our work NC and wanted to learn more, so keep up the good work! We shared things like the Flood Resilience Blueprint, Executive Order 266 State Floodplain Policy, upcoming resilience exchange website, NCSU Design Lab Floodprints, RISE and RCCP work. Many folks interesting to learn about our work on extreme heat. We are doing cutting edge work in NC!
- Stacey: Tribal coastal resilience report release; Beth Roach presented to this group previously, getting that group back up and running. Learn more: https://apnep.nc.gov/our-work/outreach-and-engagement/building-capacity-climate-resilience-albemarle-pamlico-region-tribal-communities-project

- **Next meeting ideas:**
  - Next meeting in April, Whitney will send a meeting poll
  - Next meeting topics –
    - Salt marsh impacts/migration, marsh migration corridor mapping
    - SASMI – final conservation plan – Amanda (new coordinator), connection to NC stakeholders – state teams/action plans, get more info. Coastal Fed lead partner in NC
    - Coastal Carolina Riverwatch: community organizing in North River and the Lower New River Watershed Restoration Plan – Riley Lewis, White Oak Waterkeeper with the Coastal Carolina Riverwatch – later than April
      - Cayla: Since we have Riley here, I'd to love to learn more about the study conducted by UNC public policy students in partnership with the Riverwatch exploring wetland protection in Carteret County to see what opportunities there might be for local communities! https://coastalcarolinariverwatch.org/wetlands-protection-research/
    - Rachel Carson Reserve Living Shoreline – Dawn York & Paula Gillikin, maybe ready for April, or next quarter
    - Flood Resilience Blueprint – Michelle Lovejoy idea, Todd Kennedy is the program manager, many folks have been actively involved and bringing community perspective to the table.
    - USGS Hazard Exposure and Reporting Analytics (HERA) - pbarnard@usgs.gov

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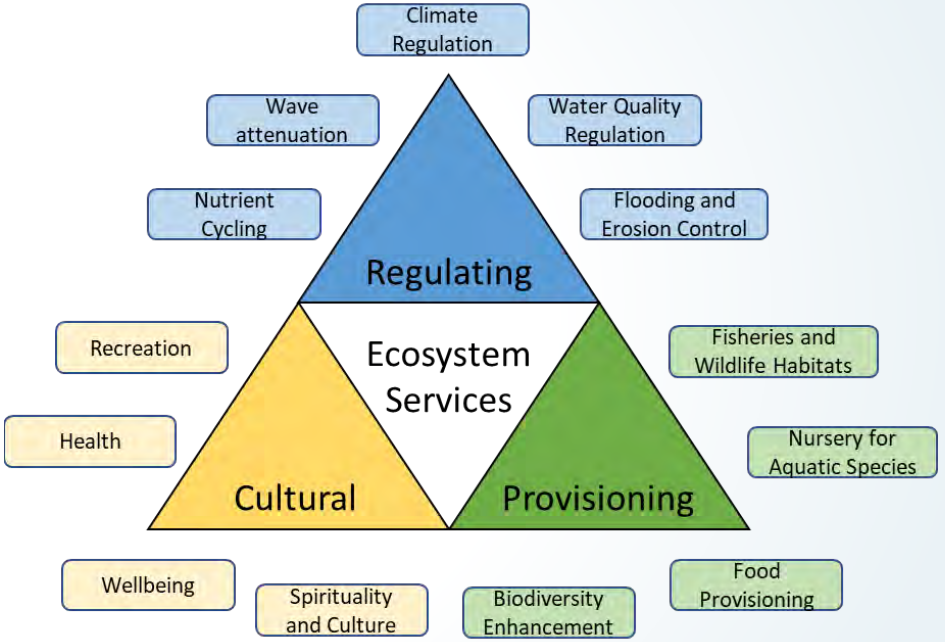
# North Carolina Salt Marsh Action Plan

*Claire Rapp*
*NC Coastal Resilience Community of Practice*
*January 25, 2024*

# The Importance of Salt Marshes


J Lee (Instagram: @growingwilder)

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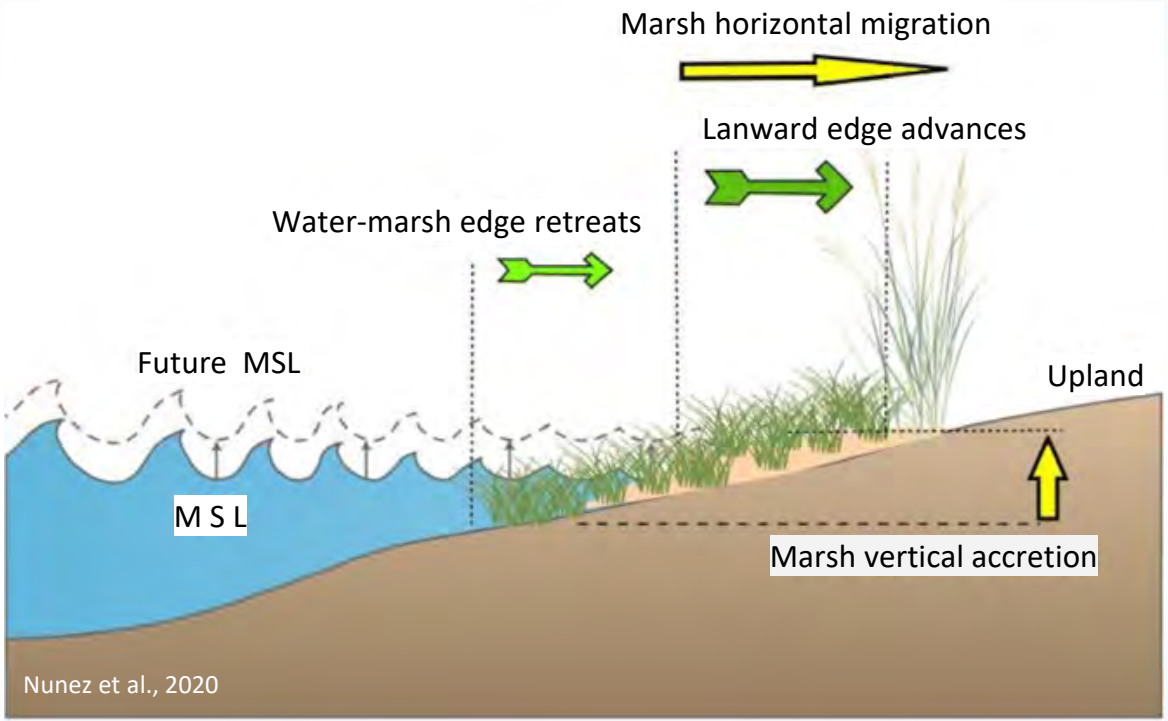
# Marsh Response to Sea Level Rise

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# South Atlantic Salt Marsh Initiative

SOUTH ATLANTIC SALT MARSH INITIATIVE

Pew


# South Atlantic Salt Marsh Initiative (SASMI)

- 350+ members consisting of leaders from SERPPAS and other local, state, and federal partners, communities, and NGOs from NC, SC, GA, and FL

- Released Regional Salt Marsh Plan May 2023
  - https://marshforward.org/

SERPPAS

Pew

SOUTH ATLANTIC SALT MARSH INITIATIVE

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# North Carolina
# Salt Marsh Action Plan

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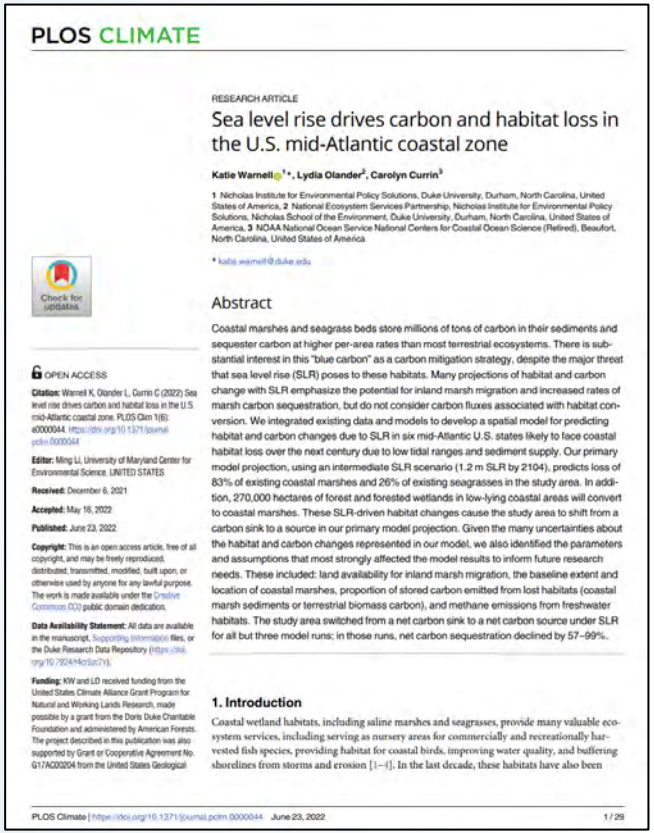
# NC Salt Marsh Projections*



PLOS CLIMATE

RESEARCH ARTICLE

## Sea level rise drives carbon and habitat loss in the U.S. mid-Atlantic coastal zone

**Katie Warnell**[1]*, **Lydia Olander**[2], **Carolyn Currin**[3]

1 Nicholas Institute for Environmental Policy Solutions, Duke University, Durham, North Carolina, United States of America, 2 National Ecosystem Services Partnership, Nicholas Institute for Environmental Policy Solutions, Nicholas School of the Environment, Duke University, Durham, North Carolina, United States of America, 3 NOAA National Ocean Service National Centers for Coastal Ocean Science (Retired), Beaufort, North Carolina, United States of America

* katie.warnell@duke.edu

### Abstract

Coastal marshes and seagrass beds store millions of tons of carbon in their sediments and sequester carbon at higher per-area rates than most terrestrial ecosystems. There is substantial interest in this "blue carbon" as a carbon mitigation strategy, despite the major threat that sea level rise (SLR) poses to these habitats. Many projections of habitat and carbon change with SLR emphasize the potential for inland marsh migration and increased rates of marsh carbon sequestration, but do not consider carbon fluxes associated with habitat conversion. We integrated existing data and models to develop a spatial model for predicting habitat and carbon changes due to SLR in six mid-Atlantic U.S. states likely to face coastal habitat loss over the next century due to low tidal ranges and sediment supply. Our primary model projection, using an intermediate SLR scenario (1.2 m SLR by 2104), predicts loss of 83% of existing coastal marshes and 26% of existing seagrasses in the study area. In addition, 270,000 hectares of forest and forested wetlands in low-lying coastal areas will convert to coastal marshes. These SLR-driven habitat changes cause the study area to shift from a carbon sink to a source in our primary model projection. Given the many uncertainties about the habitat and carbon changes represented in our model, we also identified the parameters and assumptions that most strongly affected the model results to inform future research needs. These included: land availability for inland marsh migration, the baseline extent and location of coastal marshes, proportion of stored carbon emitted from lost habitats (coastal marsh sediments or terrestrial biomass carbon), and methane emissions from freshwater habitats. The study area switched from a net carbon sink to a net carbon source under SLR for all but three model runs; in those runs, net carbon sequestration declined by 57–99%.

OPEN ACCESS

**Citation:** Warnell K, Olander L, Currin C (2022) Sea level rise drives carbon and habitat loss in the U.S. mid-Atlantic coastal zone. PLOS Clim 1(6): e0000044. https://doi.org/10.1371/journal.pclm.0000044

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**Data Availability Statement:** All data are available in the manuscript, Supporting Information(s) files, or the Duke Research Data Repository (https://doi.org/10.7924/r4cr3zc2v).

**Funding:** KW and LO received funding from the United States Climate Alliance Grant Program for Natural and Working Lands Research, made possible by a grant from the Doris Duke Charitable Foundation and administered by American Forests. The project described in this publication was also supported by Grant or Cooperative Agreement No. G17AC00204 from the United States Geological

### 1. Introduction

Coastal wetland habitats, including saline marshes and seagrasses, provide many valuable ecosystem services, including serving as nursery areas for commercially and recreationally harvested fish species, providing habitat for coastal birds, improving water quality, and buffering shorelines from storms and erosion [1–4]. In the last decade, these habitats have also been



Nearly 220,000 acres of salt marsh currently

More than 92,000 acres lost by 2050

Approximately 270,000 acres gained by 2050

Net gain of about 180,000 acres by 2050

About 400,000 acres of salt marsh by 2050

*data used are not scaled for parcel level decision making and should be used as regional estimates only

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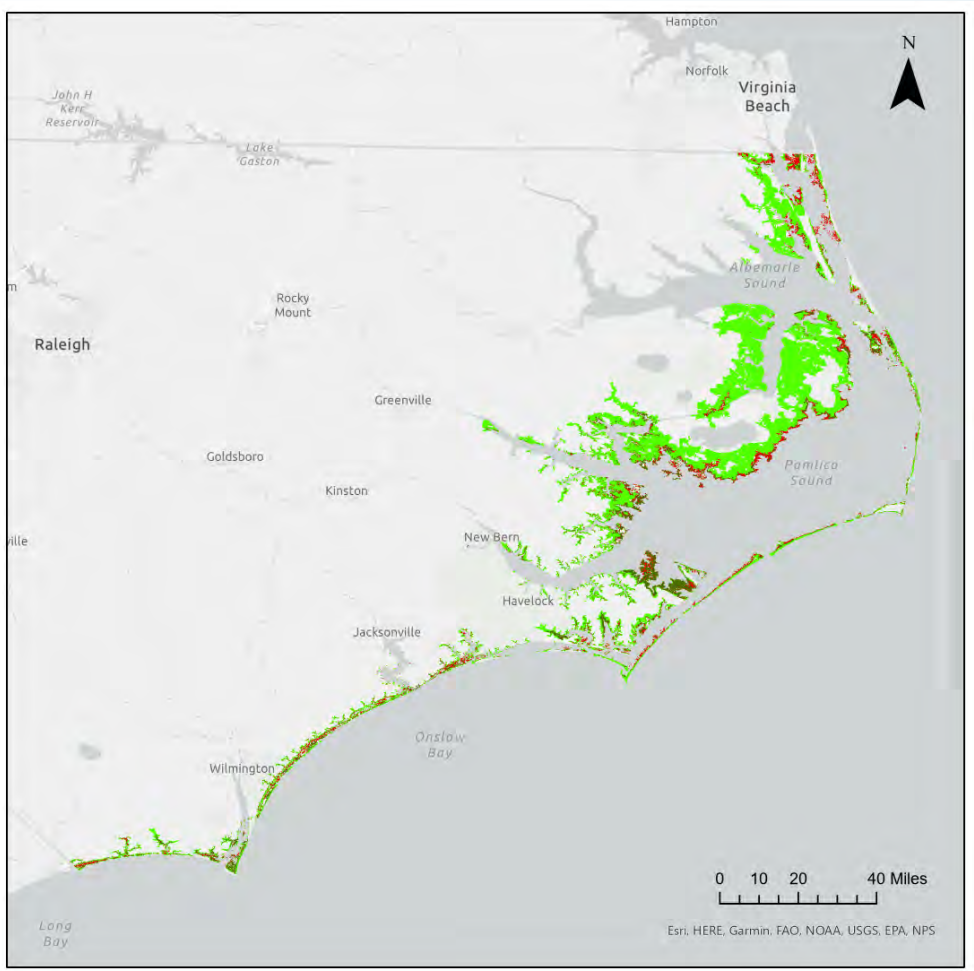
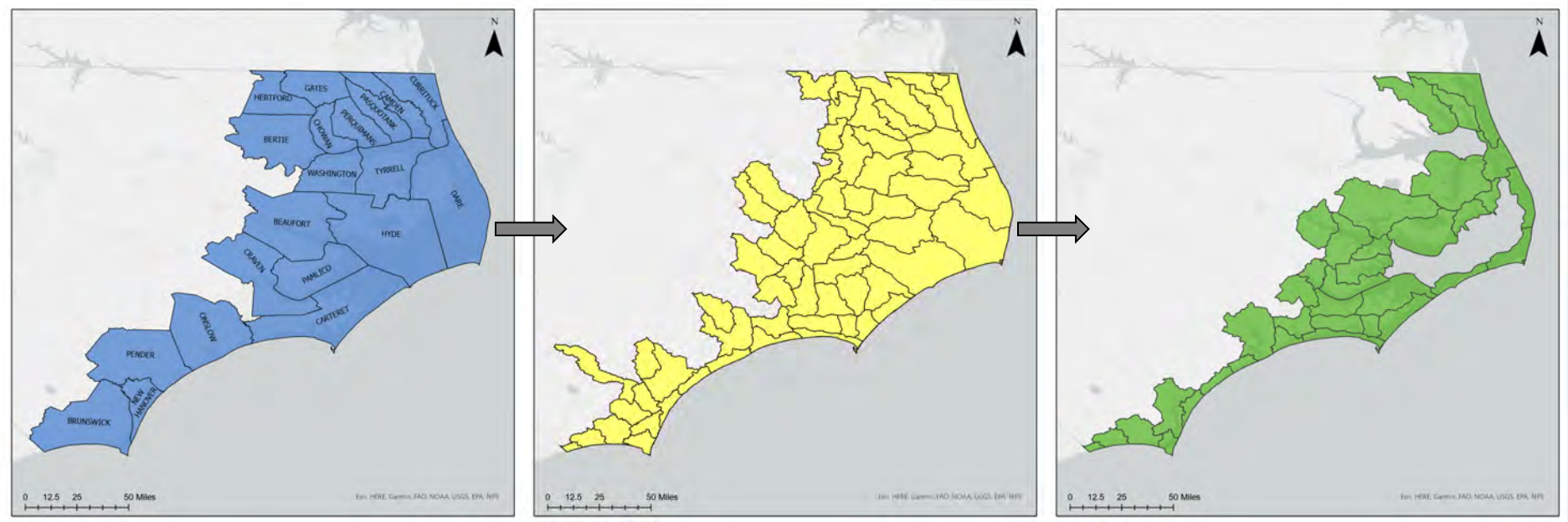
# Salt Marsh Gain and Loss by 2050




**Legend**

- Lost Original Coastal Marsh
- Persisting Original Marsh
- Converting to Marsh

# Creating Conservation Planning Units




CAMA Counties

HUC-10

CPUs

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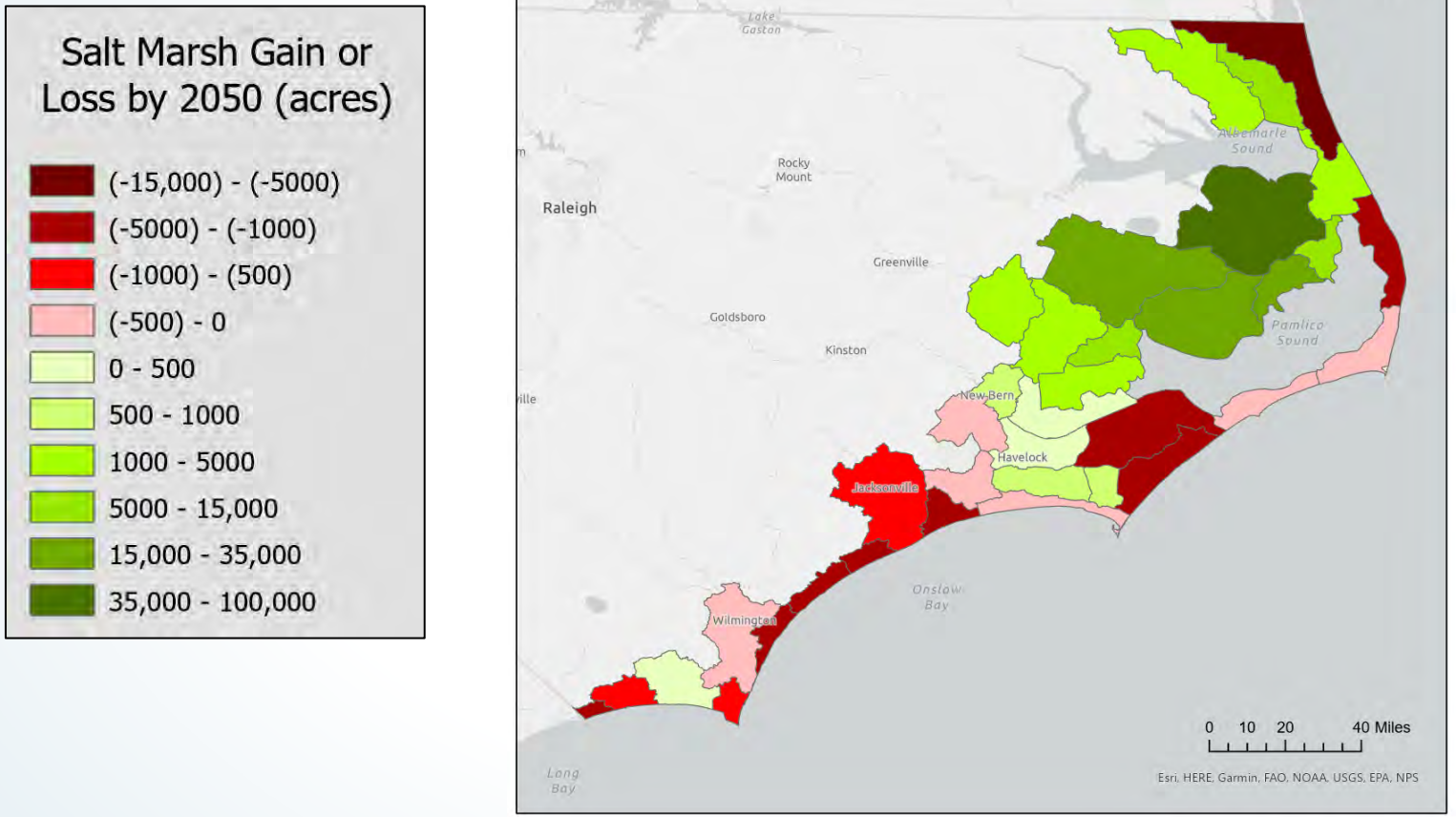
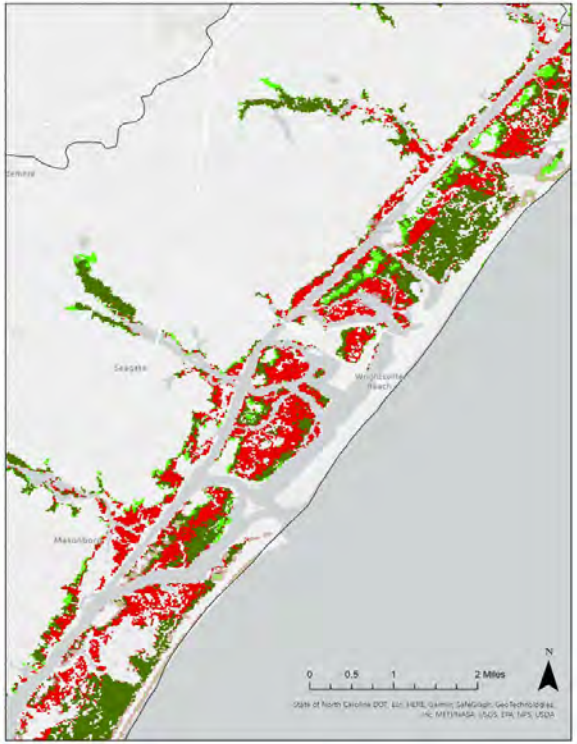

Salt Marsh Gain or Loss by 2050 (acres)
(-15,000) - (-5000)
(-5000) - (-1000)
(-1000) - (500)
(-500) - 0
0 - 500
500 - 1000
1000 - 5000
5000 - 15,000
15,000 - 35,000
35,000 - 100,000
Hampton
Norfolk
Virginia Beach
N
John H Kerr Reservoir
Lake Gaston
Albemarle Sound
Rocky Mount
Raleigh
Greenville
Goldsboro
Kinston
Pamlico Sound
New Bern
Havelock
Jacksonville
Onslow Bay
Wilmington
Lang Bay
0 10 20 40 Miles
Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS

# Protection and Restoration


**Legend**

- Lost Original Marsh
- Persisting Original Marsh
- Converting Marsh
- Converting Protected

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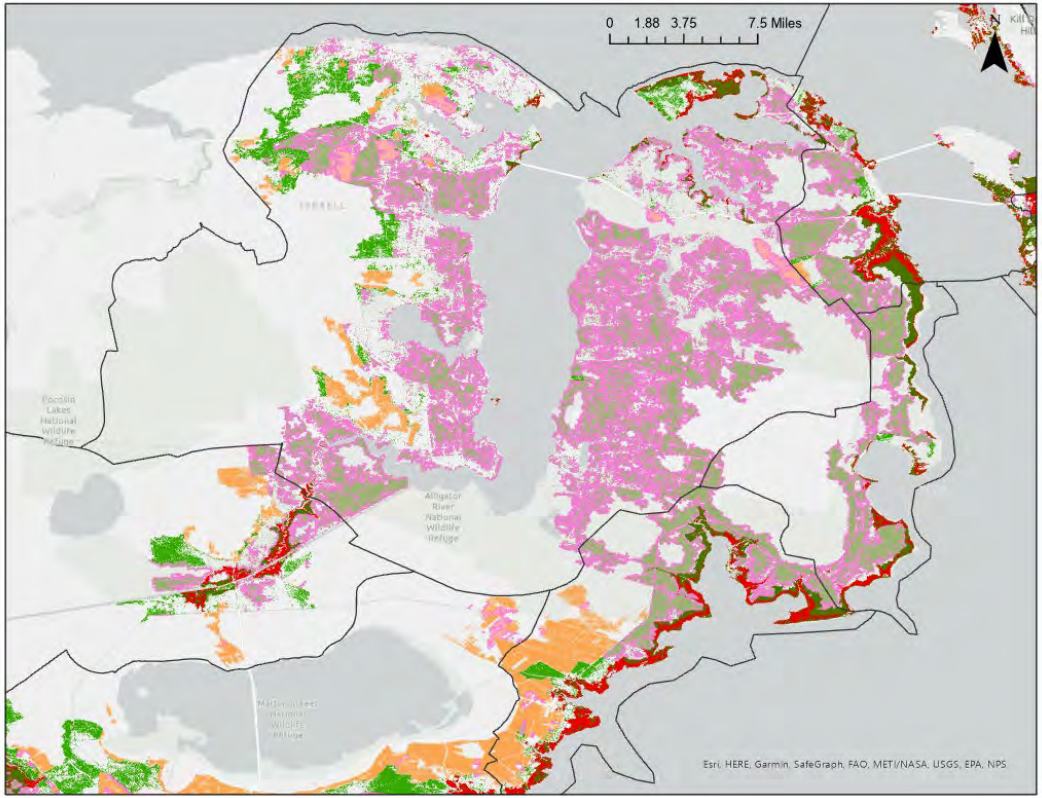
# Migration Facilitation


**Legend**

- CPUs
- Lost Original Marsh
- Persisting Original Marsh
- Forest Converting to Marsh
- Ag Converting to Marsh
- Converting Protected

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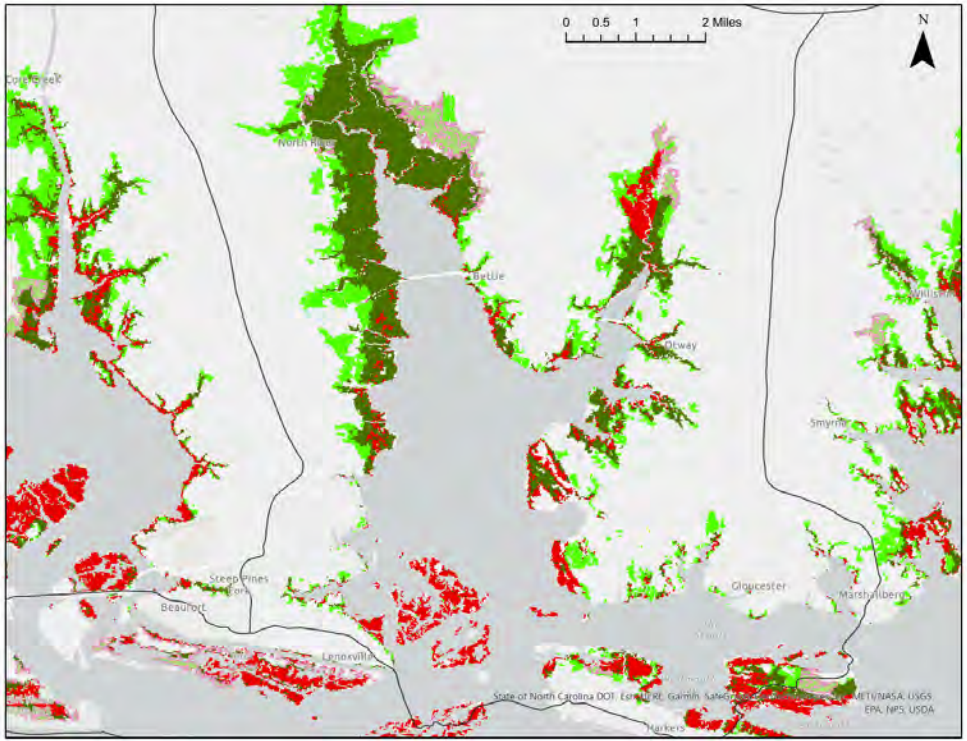
# Both Restoration and Migration Facilitation



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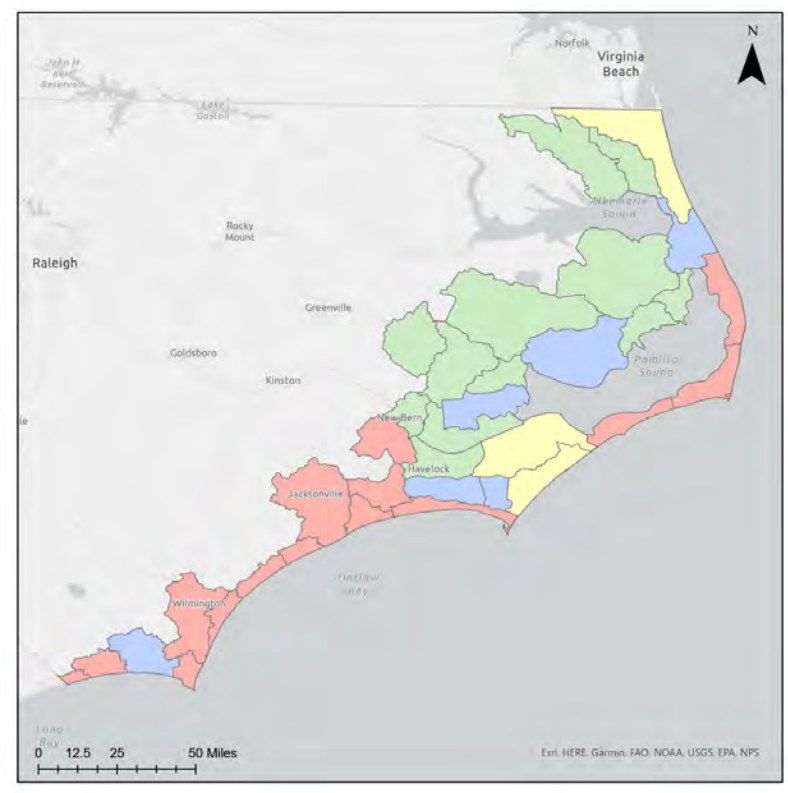
# Priority Action Suggested for each CPU




| Cluster | *Net Gain or Loss | Suggested Priority Action for Salt Marsh Protection | |
|---|---|---|---|
| | | Protection/ Restoration | Facilitate Migration |
| Red | Loss | X | |
| Yellow | Loss | X | X |
| Blue | Gain | X | X |
| Green | Gain | | X |

*Net loss or gain refers to the difference in salt marsh acreage per CPU between now and 2050 under intermediate SLR scenario (1.5ft) - assuming current levels of development. Developed from data by Warnell, Olander, and Currin (2022).

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# Strategy 1:
# Advance the NC Salt Marsh Action Plan

**Obj. A:** Establish the NC Salt Marsh Steering Committee

**Obj. B:** Research, monitor, and adapt management

**Obj. C:** Educate and Engage with Target Audiences

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# Strategy 2:
# Advance Salt Marsh Conservation and Restoration

**Obj. A:** Conserve and Restore Existing Salt Marshes

**Obj. B:** Facilitate the use of living shorelines

**Obj. C:** Promote compatible shoreline development

**Obj. D:** Provide for protective stormwater management

**Obj. E:** Promote and restore natural vegetation

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# Strategy 3:
# Facilitate Salt Marsh Migration

**Obj. A:** Promote marsh migration on private lands

**Obj. B:** Promote marsh migration on lands acquired with public funds

**Obj. C:** Design public infrastructure to be compatible with marsh migration needs

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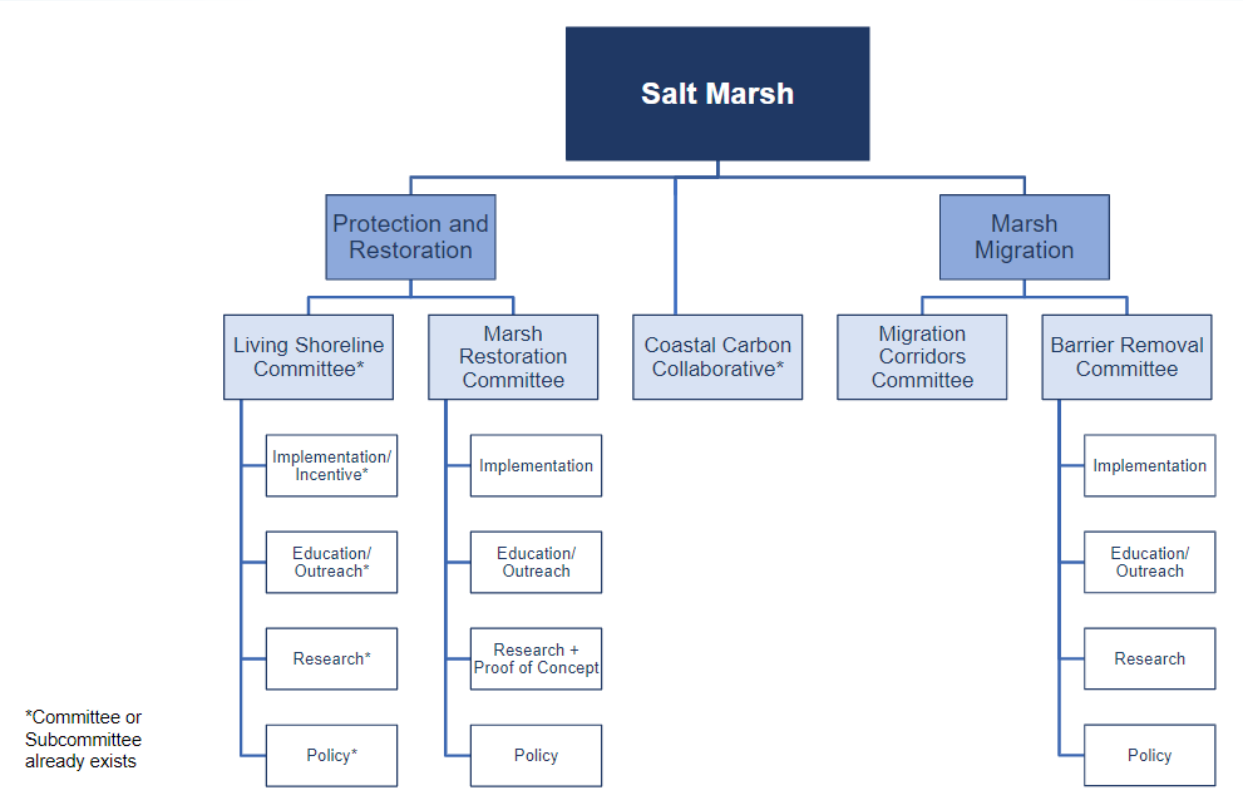
# Salt Marsh Steering Committee

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# Thank You!


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**Jacob Boyd**
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**Braxton Davis**
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**Ana Zivanovic-Nenadovic**
*Chief Program Director*
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# Overwinter marsh sparrows and sea level rise & Motus Tower Grant

Marae West, PhD

Cape Fear Bird Observatory

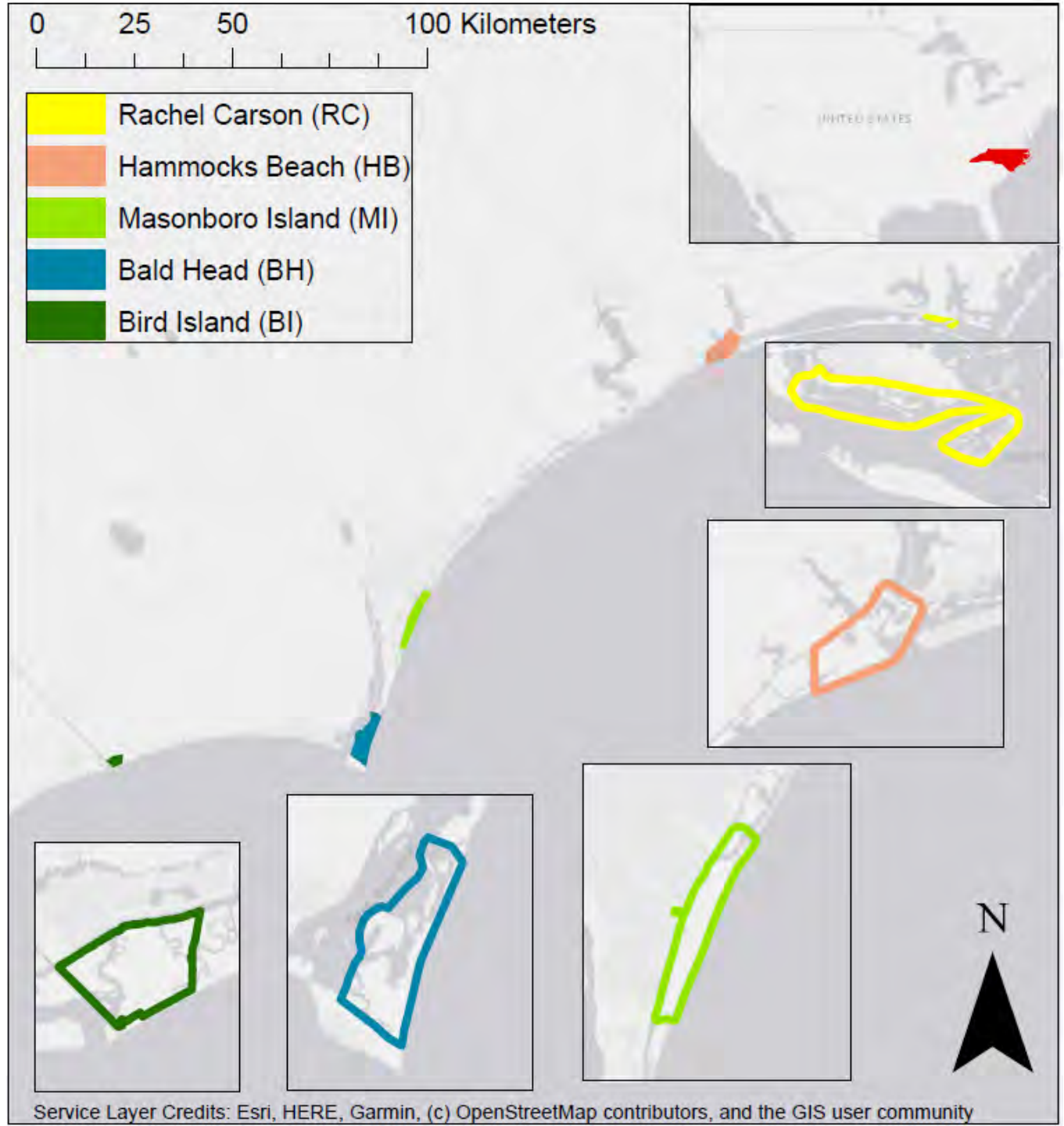
# WINTER POPULATION BIOLOGY AND IMPACTS OF SEA LEVEL RISE ON THREE SYNTOPIC COASTAL MARSH SPARROWS

In some places in the SE USA three species of New World Sparrows (Passerellidae) occur syntopically:

Nelson's Sparrows (*Ammospiza nelsoni*)

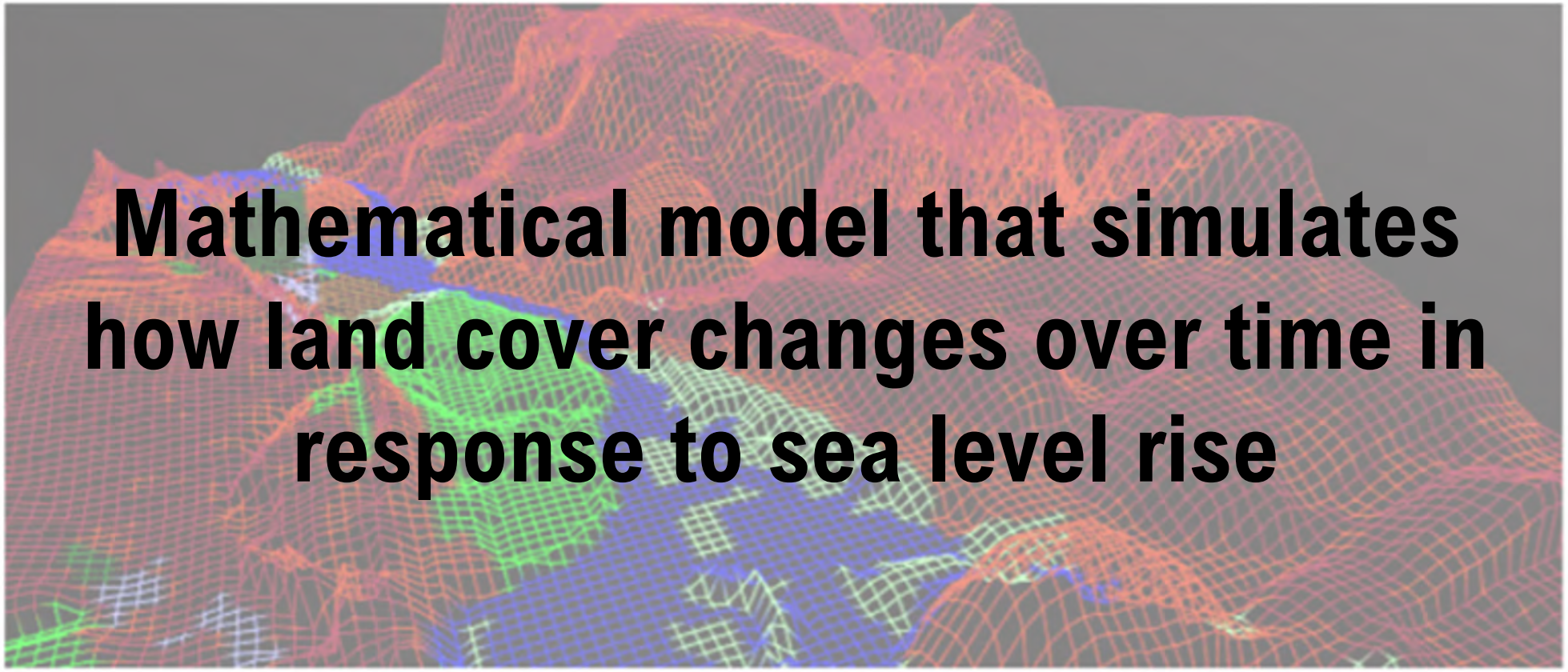
Saltmarsh Sparrows (*Ammospiza caudacuta*)

Seaside Sparrows (*Ammospiza maritima*)


0 25 50 100 Kilometers
Rachel Carson (RC)
Hammocks Beach (HB)
Masonboro Island (MI)
Bald Head (BH)
Bird Island (BI)
N
Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community








Sea Level Affecting Marshes Model, Version 6.7 beta

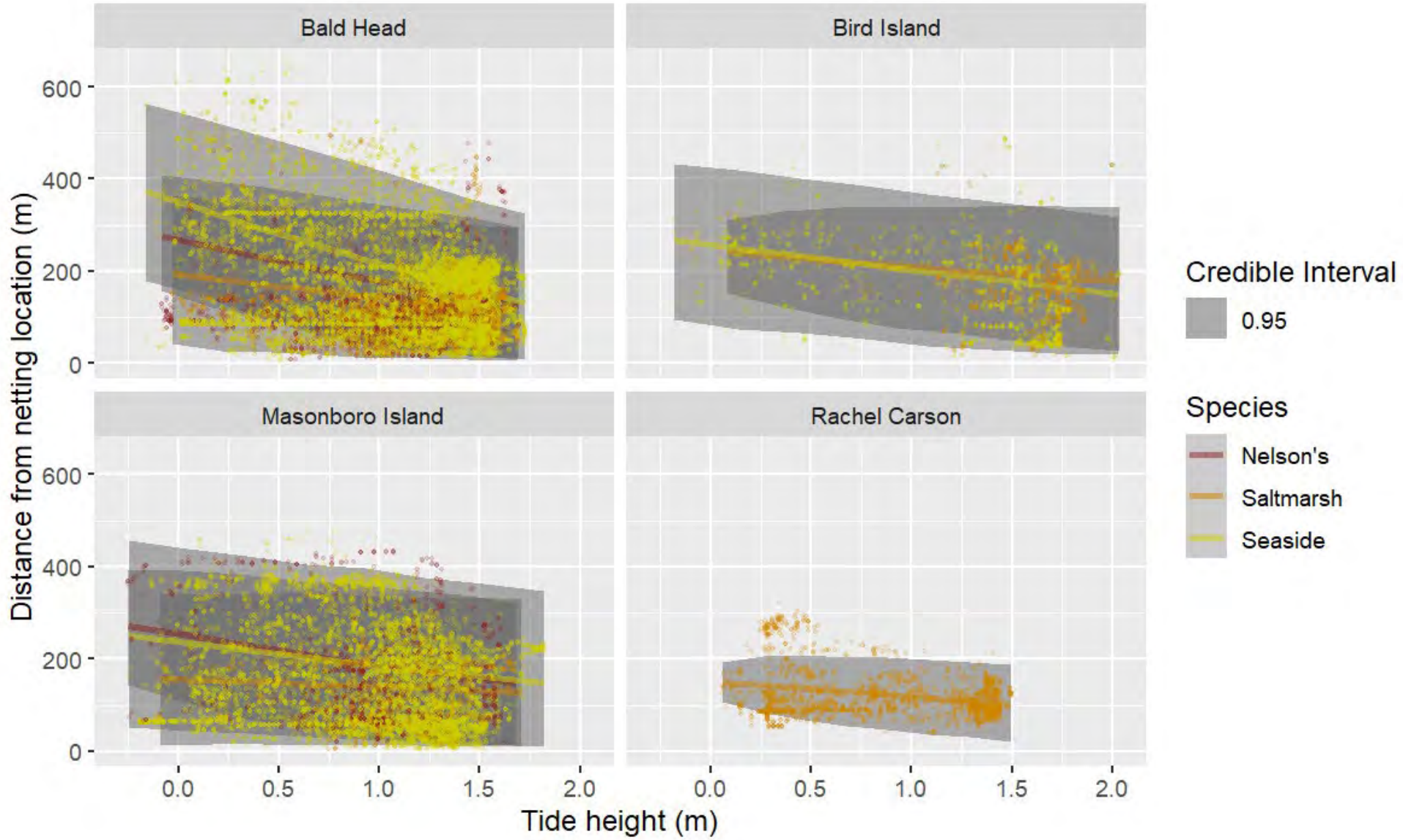
(Clough et al. 2016)

# CHAPTER 1: WINTER SPACE USE OF THREE SYNTOPIC COASTAL MARSH SPARROWS IN EASTERN NORTH AMERICA

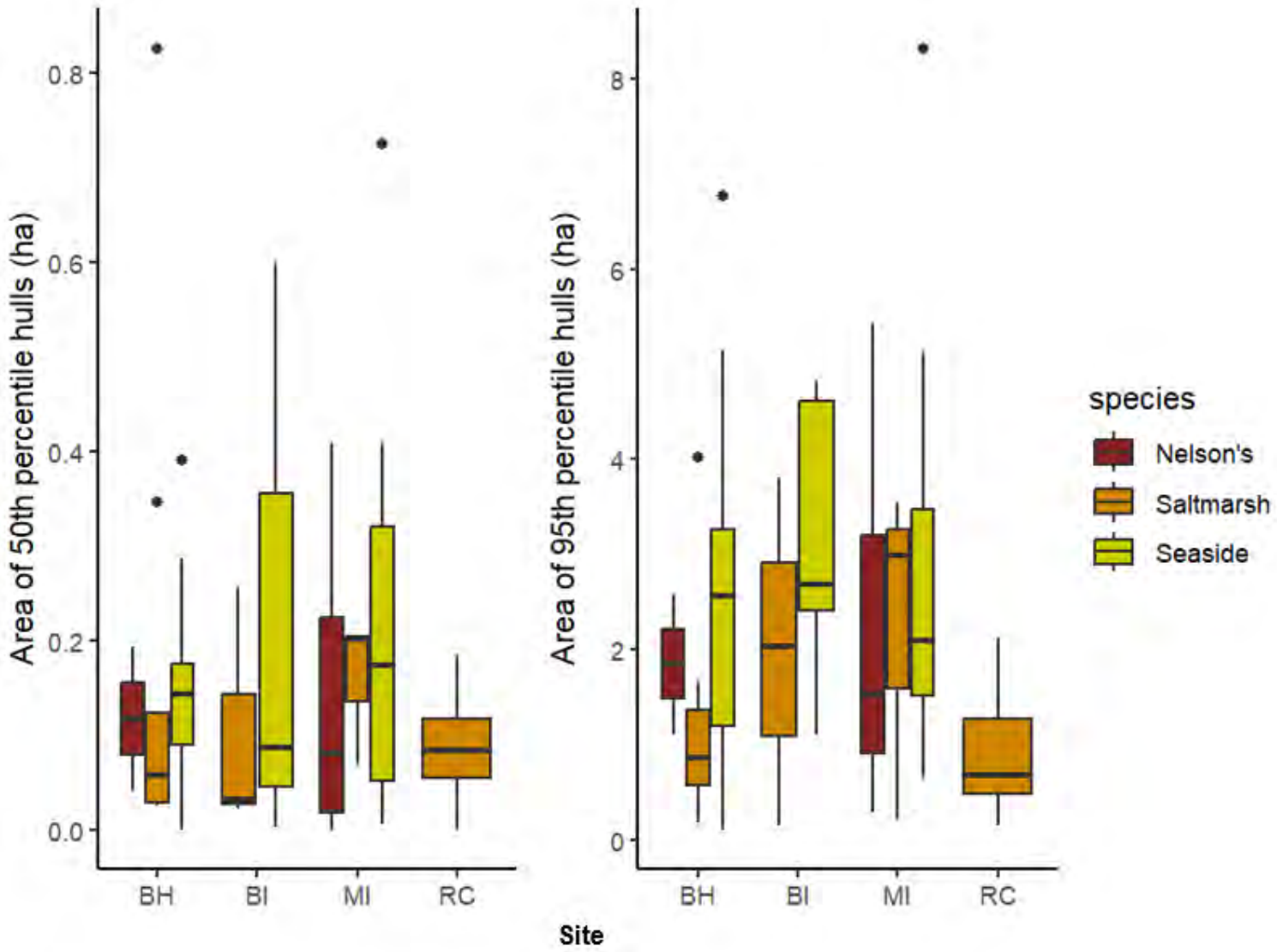
Species are not evenly distributed across the marsh landscape

- Areas with the specific elevational gradient and vegetation structure are important

This study refines our understanding of winter space use and helps identify specific areas and configurations of marsh that will be important to conserve




All species showed the same pattern of moving with the tidal cycle but there were site by species differences in daily movements



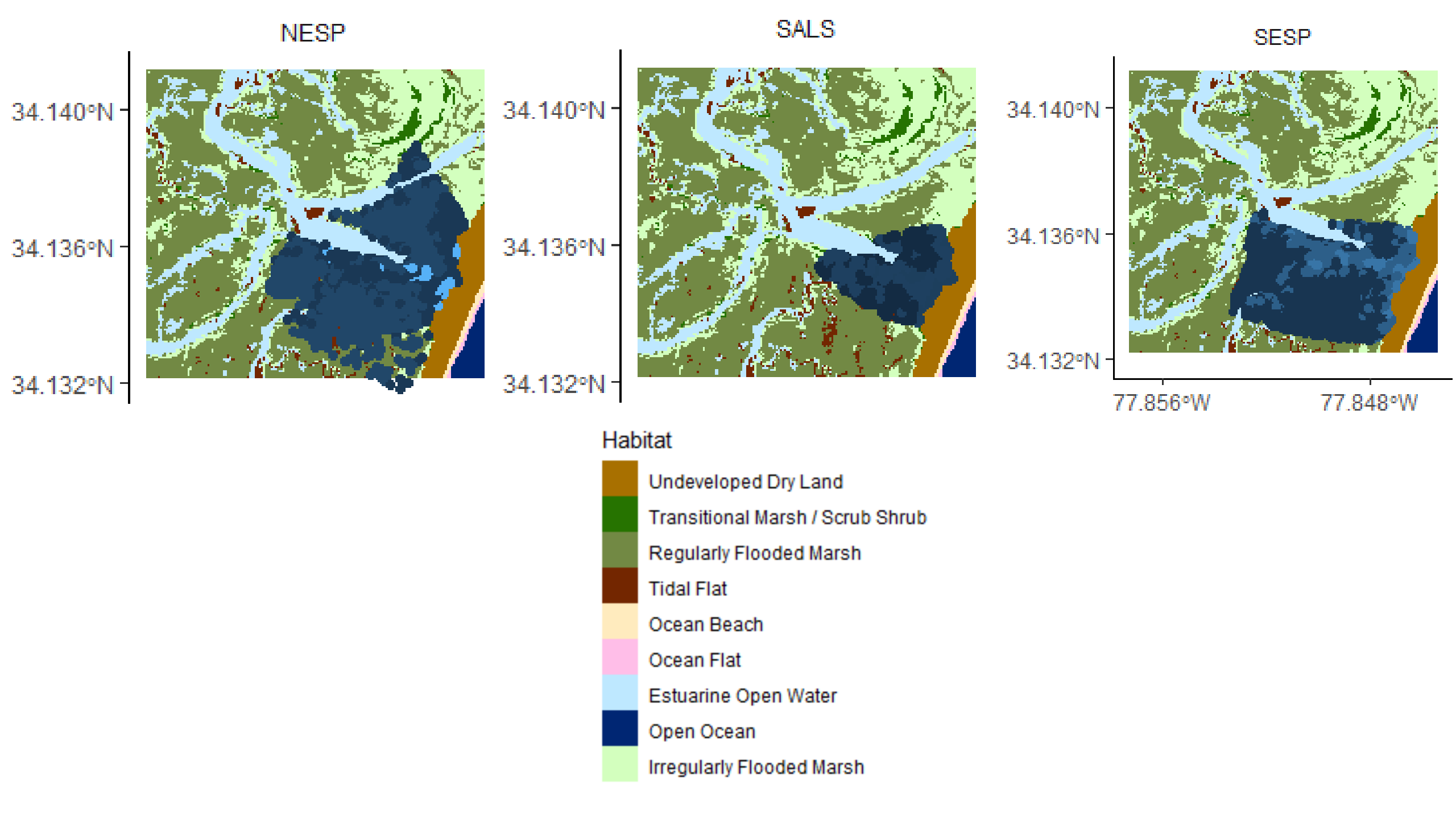

All species maintained home ranges throughout the winter stationary period, but they were not significantly different

# CHAPTER 2: WINTER HABITAT USE OF THREE SYNTOPIC COASTAL MARSH SPARROWS IN EASTERN NORTH AMERICA

These novel results indicate that the marsh sparrow populations and communities require a variety of marsh habitats

Management efforts should seek to conserve a range of habitats along the marsh elevation gradient

Future research should search for shoulders of other remnant inlets for similar habitat configurations to identify priority sites for conservation


NESP
SALS
SESP
34.140°N
34.136°N
34.132°N
77.856°W
77.848°W
Habitat
Undeveloped Dry Land
Transitional Marsh / Scrub Shrub
Regularly Flooded Marsh
Tidal Flat
Ocean Beach
Ocean Flat
Estuarine Open Water
Open Ocean
Irregularly Flooded Marsh

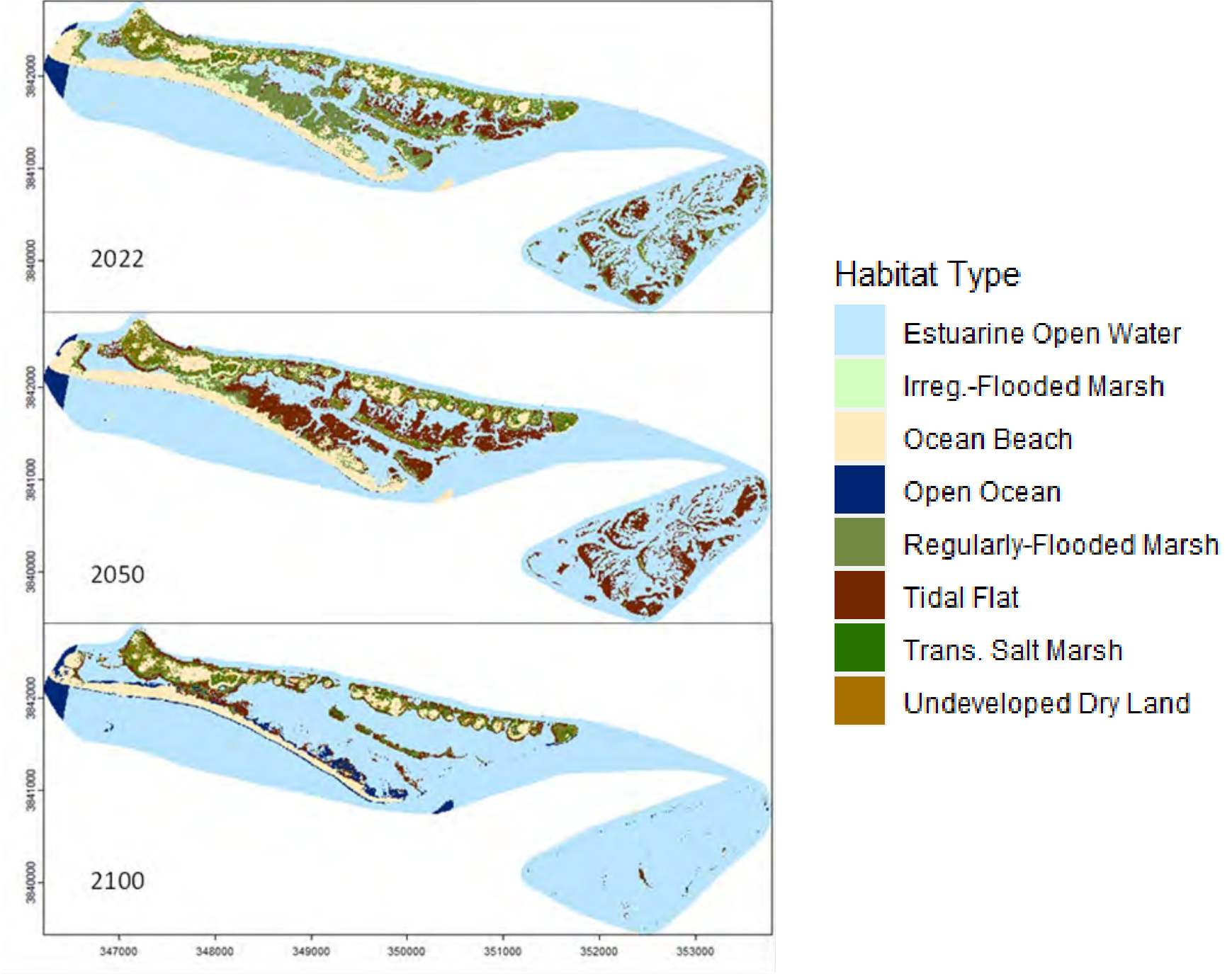
# CHAPTER 3: HIGH RESOLUTION SEA LEVEL RISE MODELS PREDIT SUBSTANTIAL LOSSES AT FIVE ECOLOGICALLY IMPORTANT MARSHES IN NORTH CAROLINA, USA

There will be large losses in salt marsh habitat at five sites in North Carolina by 2100

To conserve marsh habitat in marshes with limited area for marsh migration, adaptive management strategies should be employed

These models use site-specific parameters and provide detailed predictions for specific locations

# Rachel Carson



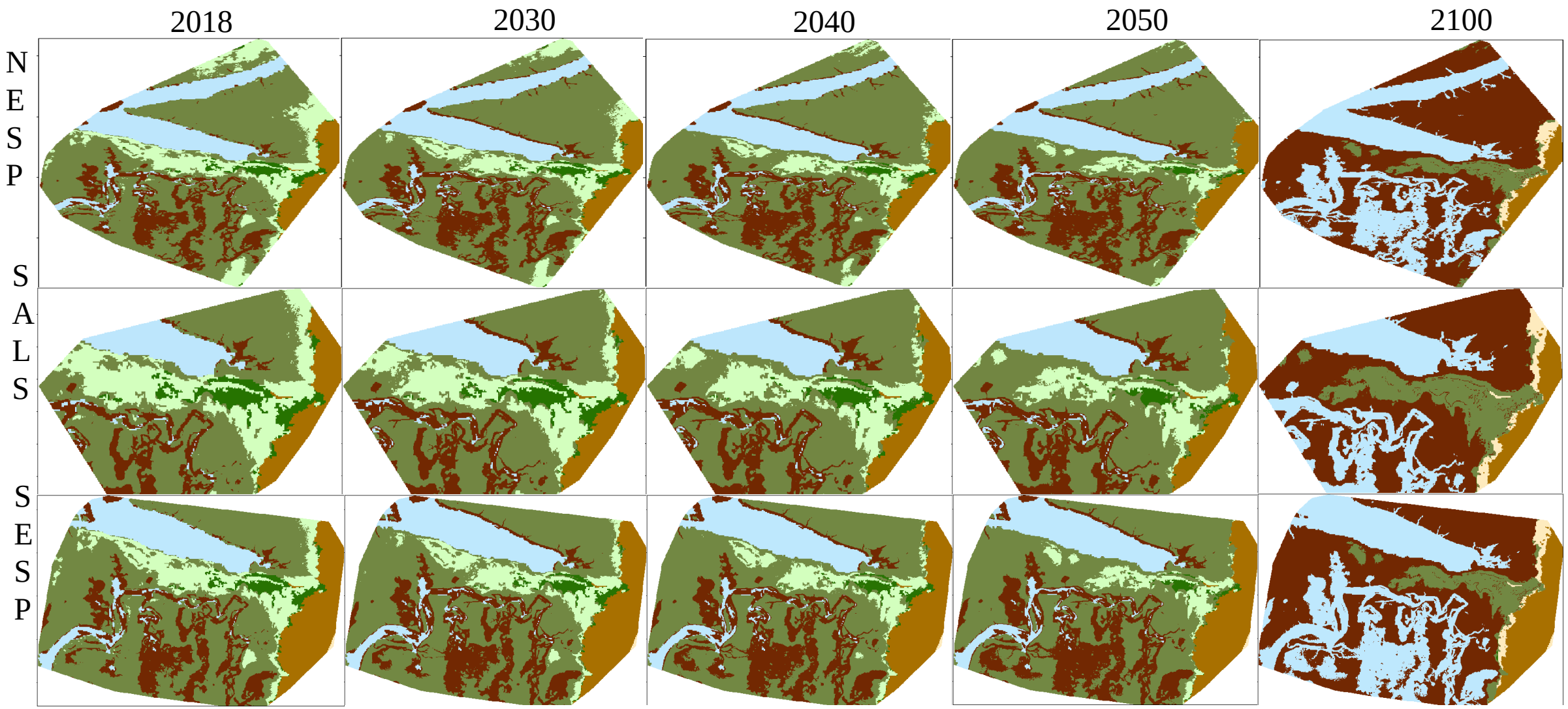
# CHAPTER 4: SEA LEVEL RISE MODELING PREDICTS DECLINES IN WINTER HABITAT FOR THREE SYNTOPIC COASTAL MARSH SPARROWS IN NORTH CAROLINA

Birds may select sites based on the presence of specific habitats

Capture rates were relatively stable, though there were some days with notably higher or lower numbers of captures

Possible that the small amount of habitat remaining in 2100 would be too small to support any individuals of our study species

**Without adaptive management, SLR will lead to loss of essential habitat for an array of marsh specialist species**




# Masonboro Island

| Species | Hectares (ha) | | | | | Percent Change | | | |
|---|---|---|---|---|---|---|---|---|---|
| | initial | 2030 | 2040 | 2050 | 2100 | 2030 | 2040 | 2050 | 2100 |
| Nelson's | 22.75 | 21.67 | 21.16 | 20.57 | 2.00 | -4.73 | -7.01 | -9.60 | -91.23 |
| Saltmarsh | 7.98 | 7.58 | 7.47 | 7.37 | 1.66 | -3.84 | -5.19 | -6.52 | -78.93 |
| Seaside | 17.09 | 16.10 | 15.62 | 15.07 | 1.91 | -5.79 | -8.62 | -11.82 | -88.84 |

# Synthesizing Motus data across the NERRS for research, education, and conservation

Marae West
Role: Project Lead
Cape Fear Bird Observatory

Evan Buckland
Role: Technical Lead
Cape Fear Bird Observatory

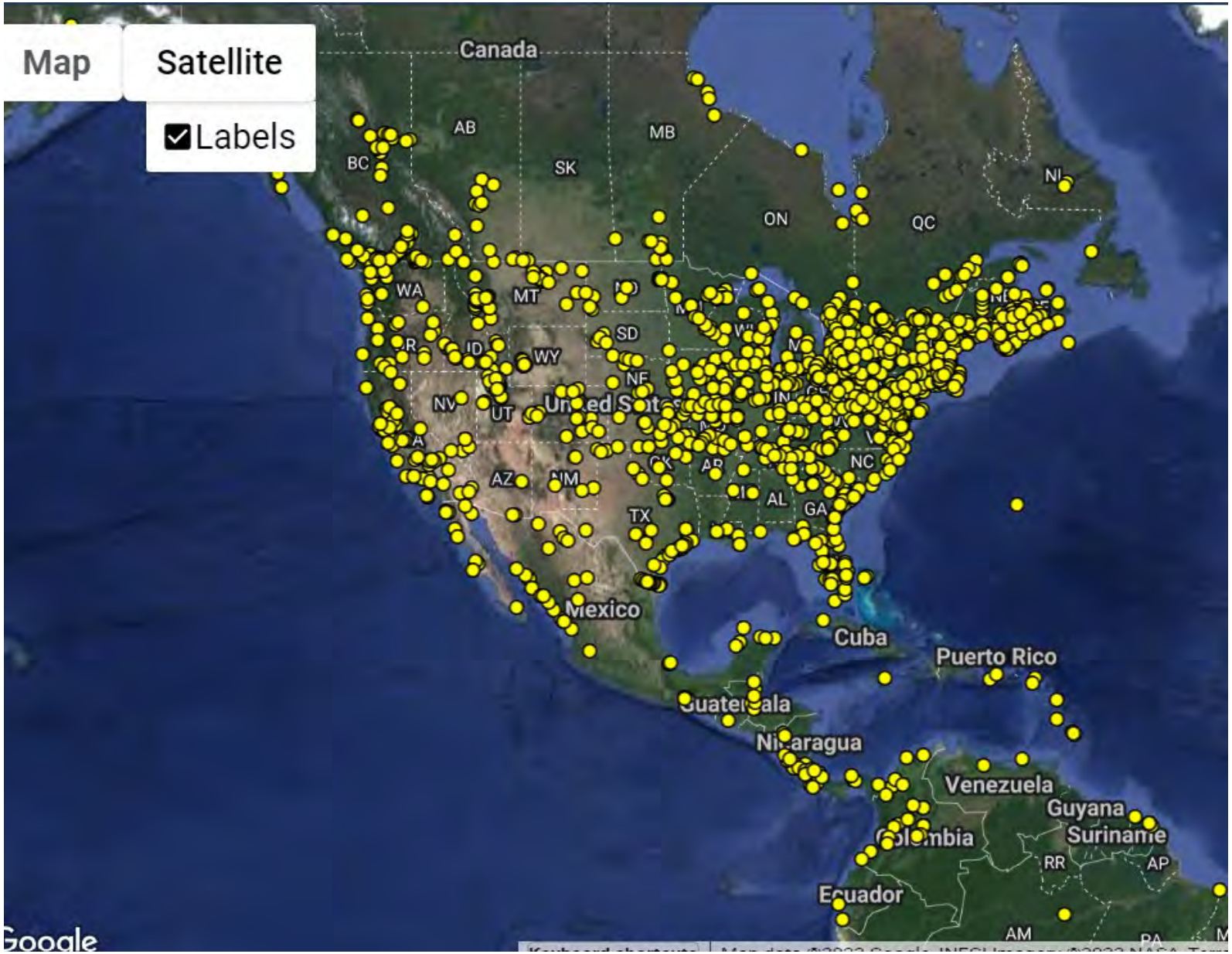
Chelsea Bullock
Role: Technical Assistant
Cape Fear Bird Observatory

Ray Danner
Role: Collaborative Lead
Althouse and Meade Inc.

Lori Davis
Role: End user specialist
NC NERR

Jill Peleuses
Role: Team Member
Cape Fear Bird Observatory

# What is Motus?




https://motus.org/

# Project Overview

Over half of the NERRs have Motus stations which provide information on the presence and movements of animals

Given NERRS' increasing number of Motus stations, growth of resulting databases, and interest in these data from within and outside of the NERRs, there is an opportunity to develop a collaborative community and supporting infrastructure within the NERRS

# Project Overview: Objectives

1) Create a website that displays Motus data from across the NERRS, which would support research, education, and conservation. The website will show locations of towers, numbers of species detected, example species detected, and connections among sites.

2) Develop freely available educational resources related to Motus data from the NERRS.
i) an online dashboard intended for students in grades 6–12 that could be used individually or in a directed lesson in the classroom
ii) digital and printable resources for visitors to the NERR sites
iii) social media content

3) Develop in-person educational experiences at NCNERR by attaching Motus transmitters to painted buntings at reserve sites

4) Facilitate construction of Motus systems at four priority locations

5) Promote communication and collaboration among the NERRS staff to ensure that shared values and goals are met.

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# Questions?

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