# Resilient Coastal Landscapes

## Goal:

Identify representative coastal sites that will be resilient to climate change

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# Climate-Resilient Sites

**Resilient Landscape**

An area with sufficient options to enable species and ecosystems to rebound in the face of great stresses without transforming into an undesirable condition

Highly Vulnerable
Disrupted function, low diversity
**Few options**
Weedy generalists

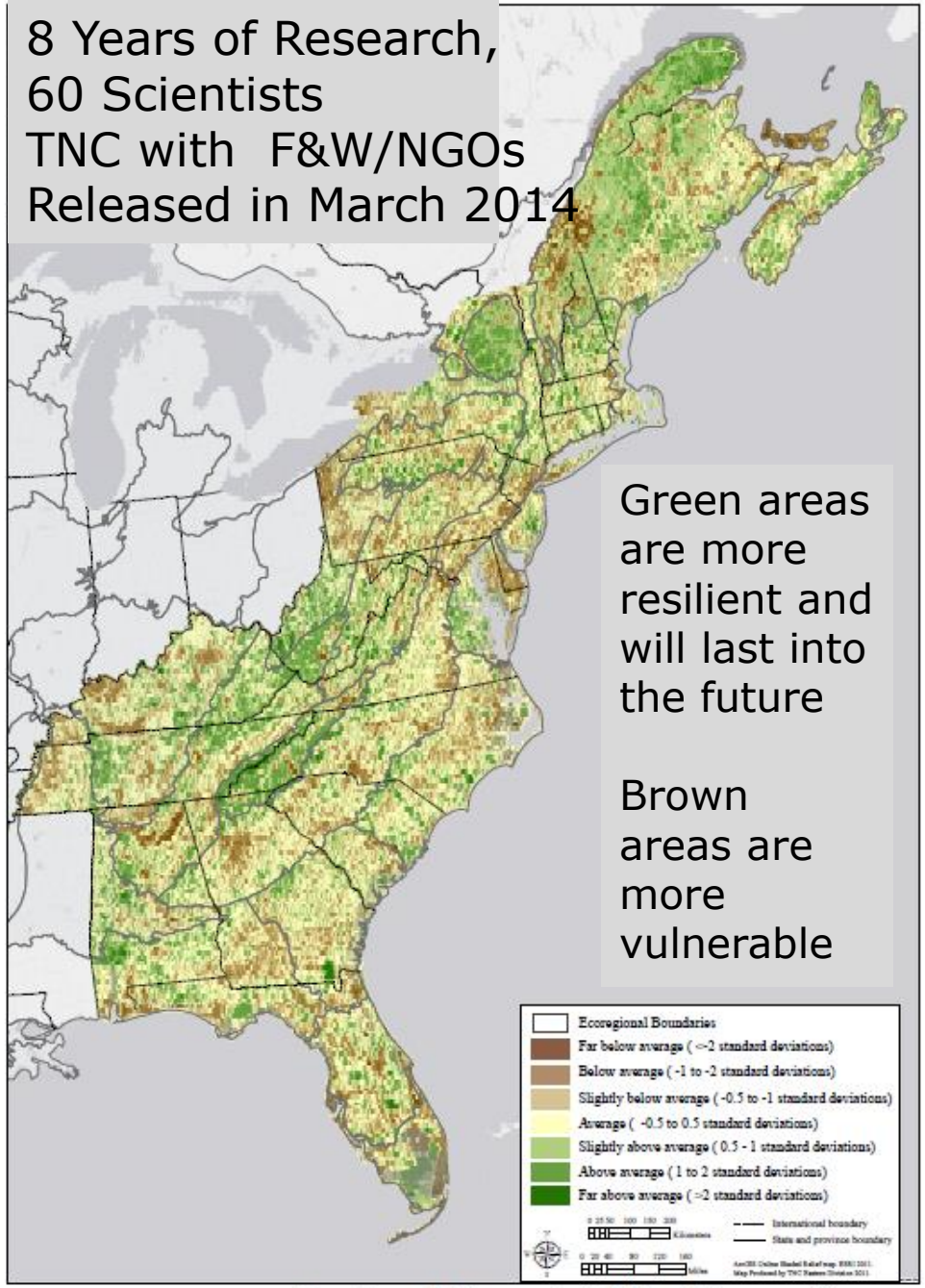
Highly Resilient
Sustain function and diversity
**Many options**
Persistence of native species

**Site Resilience** is the capacity of a site to maintain species diversity and ecological function as the climate changes.

**Resilient Site**: An intact geophysical setting that sustains a diversity of species and communities, maintains basic relationships among ecological features, and allows for adaptive change in composition and structure.

# Climate-Resilient Lands

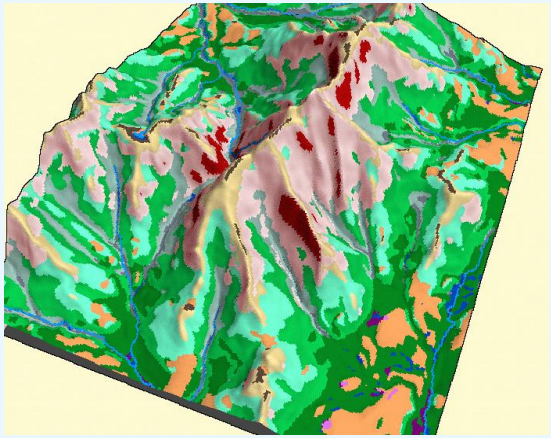
8 Years of Research,
60 Scientists
TNC with F&W/NGOs
Released in March 2014




Regional Terrestrial Resilience Score
Stratified by Setting and Ecoregion with Regional Override

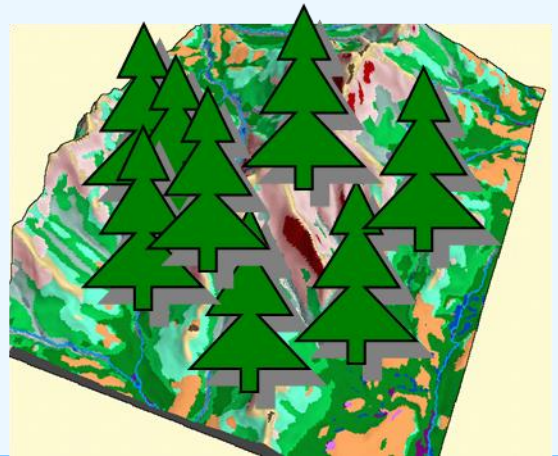
## Many Microclimates

Create climate options

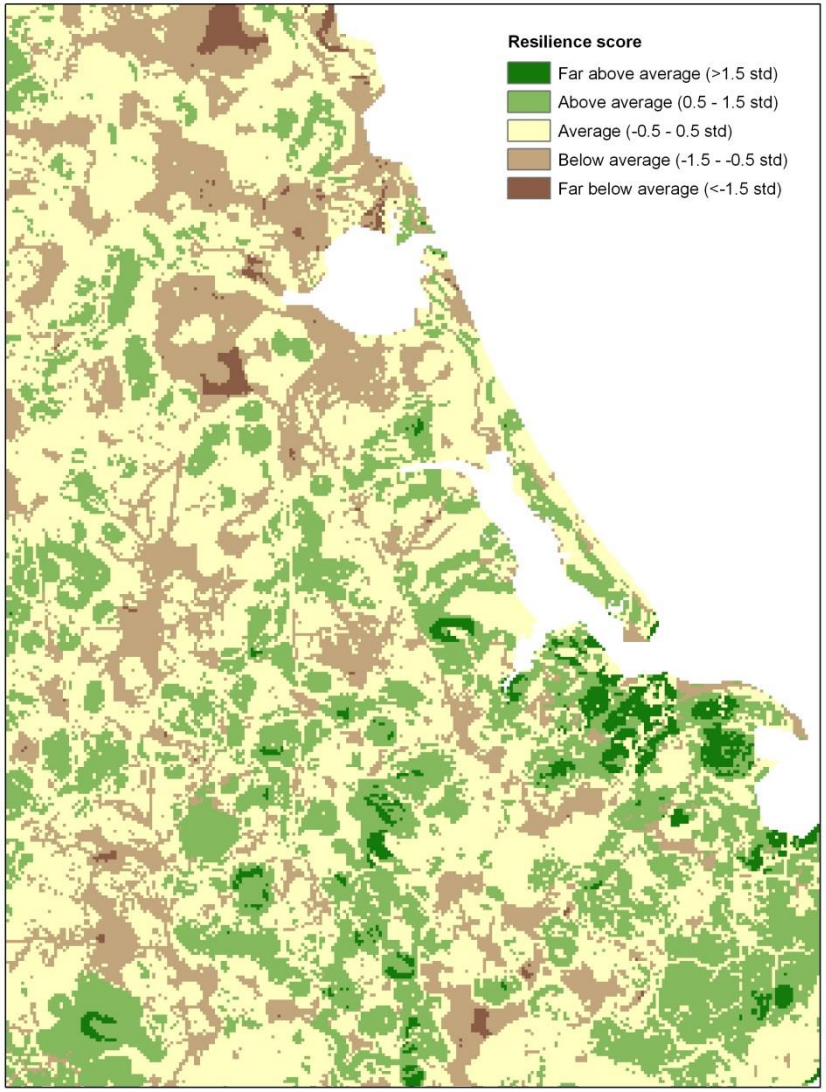


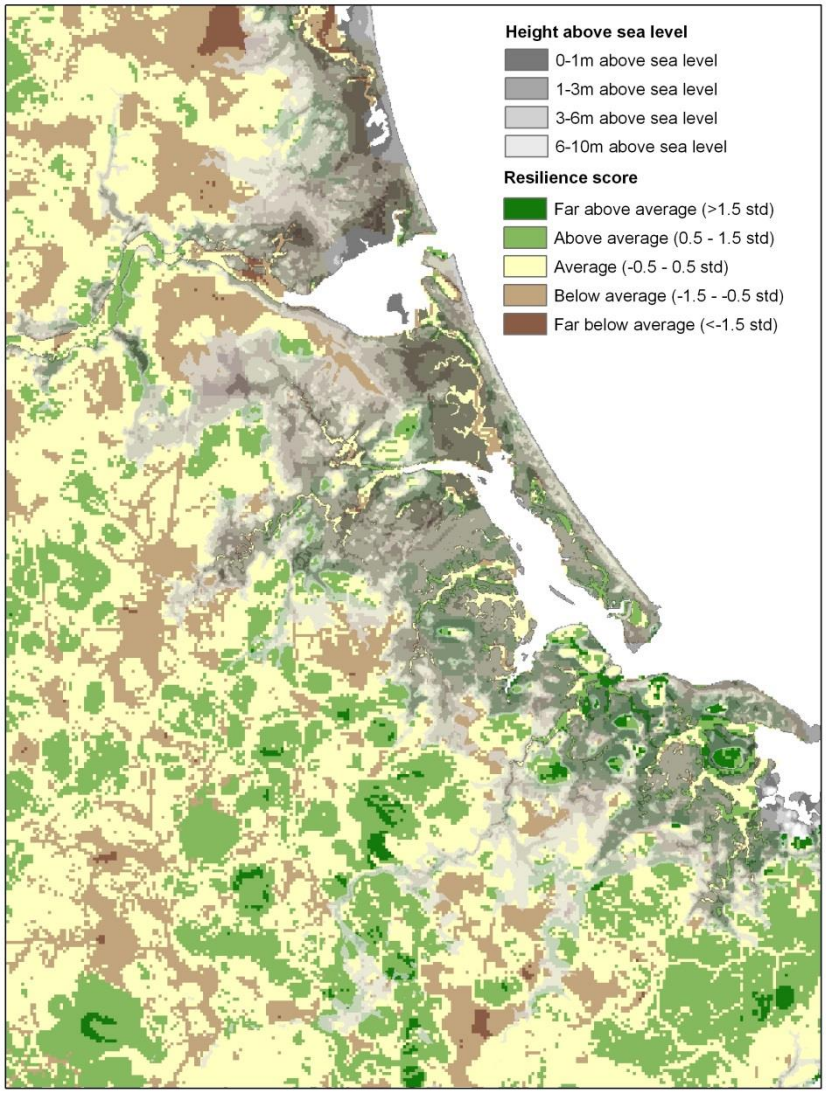
## Highly Connected

Allows species to move



# Coastal Resilience:
## NALCC grant: Jan 2015 – Jan 2017



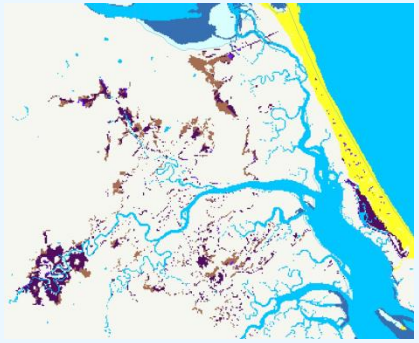



# Analysis Components

**Connectedness**

Migration space

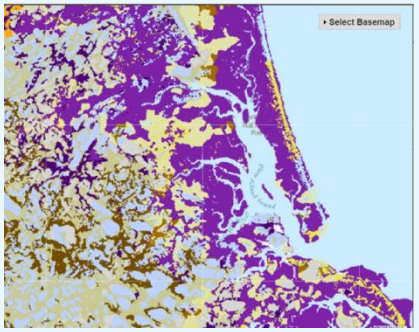
Extent of inundation



**Landscape Diversity**

Soils, bedrock, offshore sediments

topography, microclimates, elevation



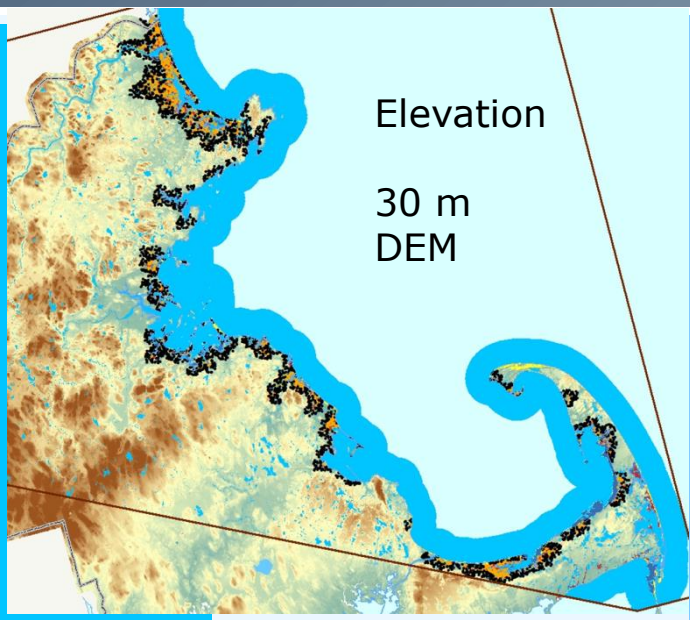

**Current Biodiversity**

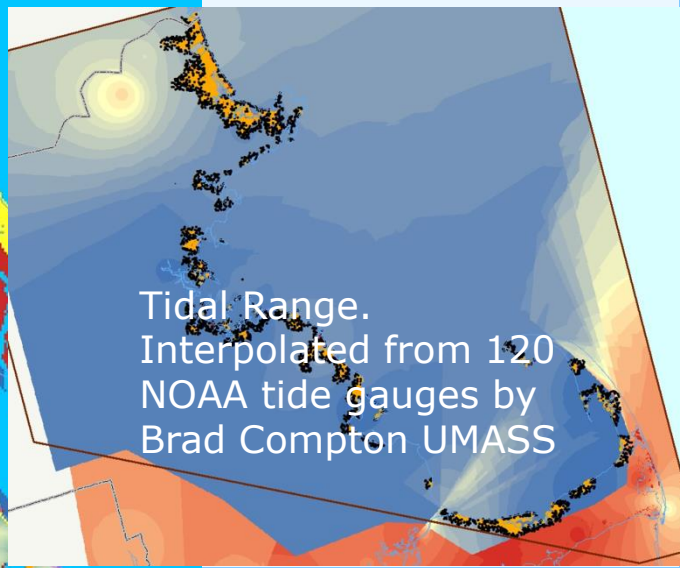
Habitats/ecosystems

Species populations

# Methods: Logistic Regression

Sample Points
**Marsh /**
**Non Marsh**




Thanks to Brad Compton

# Results

Estimated Salt Marsh

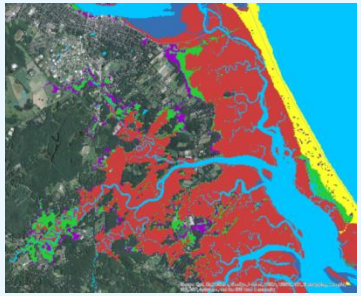
Green = Somewhat more than mapped by Mass DEP

# Scenario: 1 m Sea level Rise

Estimated Salt Marsh expansion with 1 meter Sea Level Rise

Green = Current Model

Purple = Expanded Salt Marsh

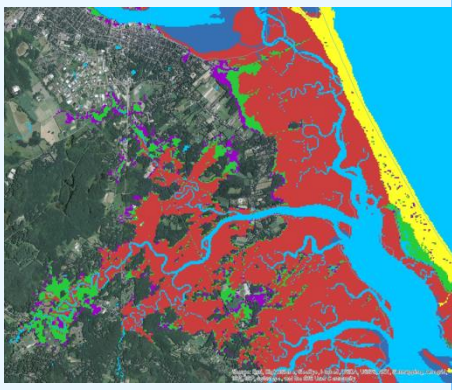


# Current Plus Expanded: 1 m SLR

Estimated Salt Marsh expansion with 1 meter Sea Level Rise

Green = Current Model

Purple = Expanded Salt Marsh

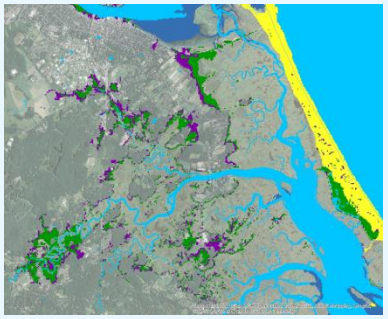


# Appropriate Land Cover Classes
## (Removed Development)

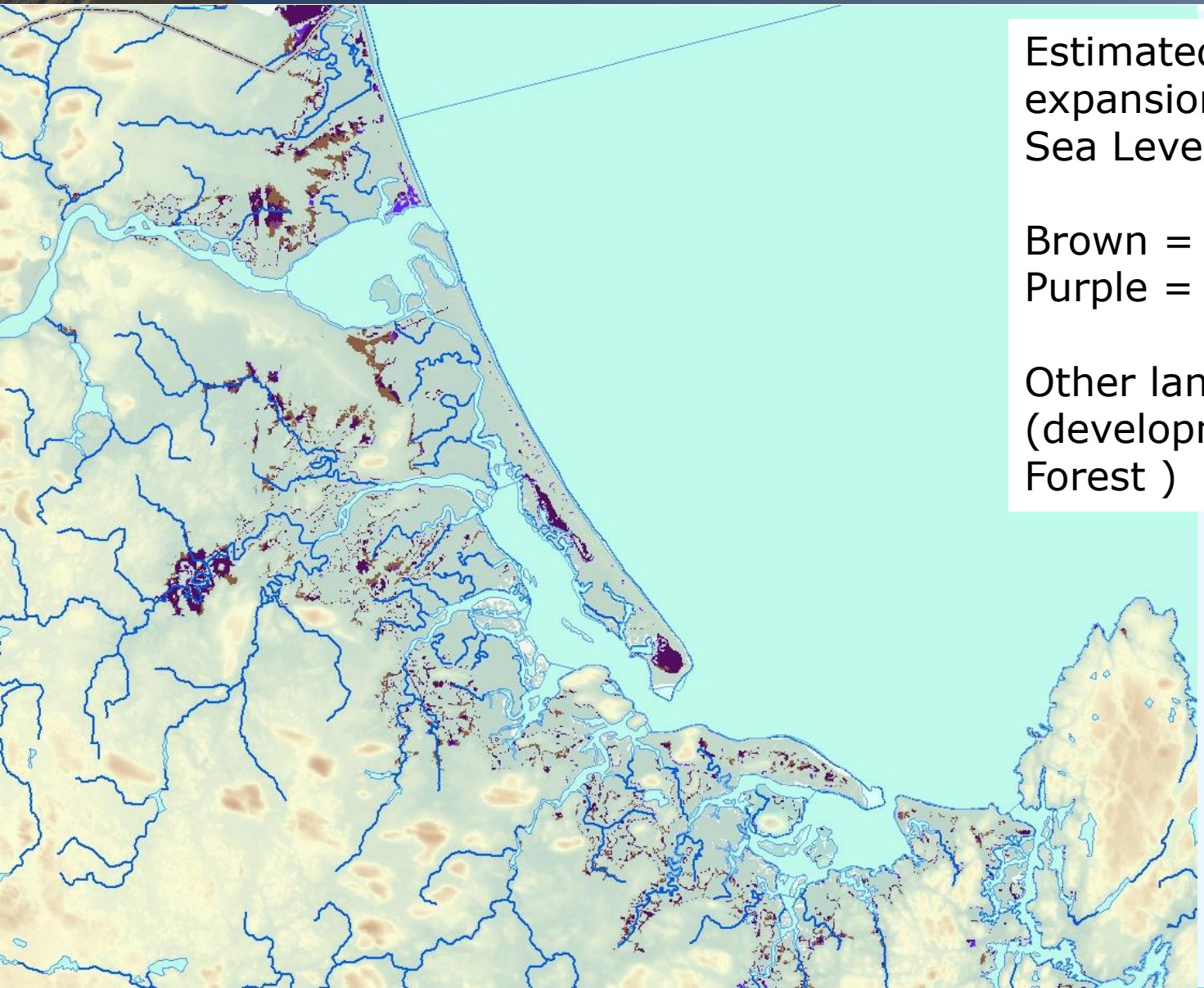
Estimated Salt Marsh expansion with 1 meter Sea Level Rise

Brown = Swamp
Purple = Emergent Marsh

Removed: Development,



# Comparing Sites Across MASS: New area 1 m Sea level Rise

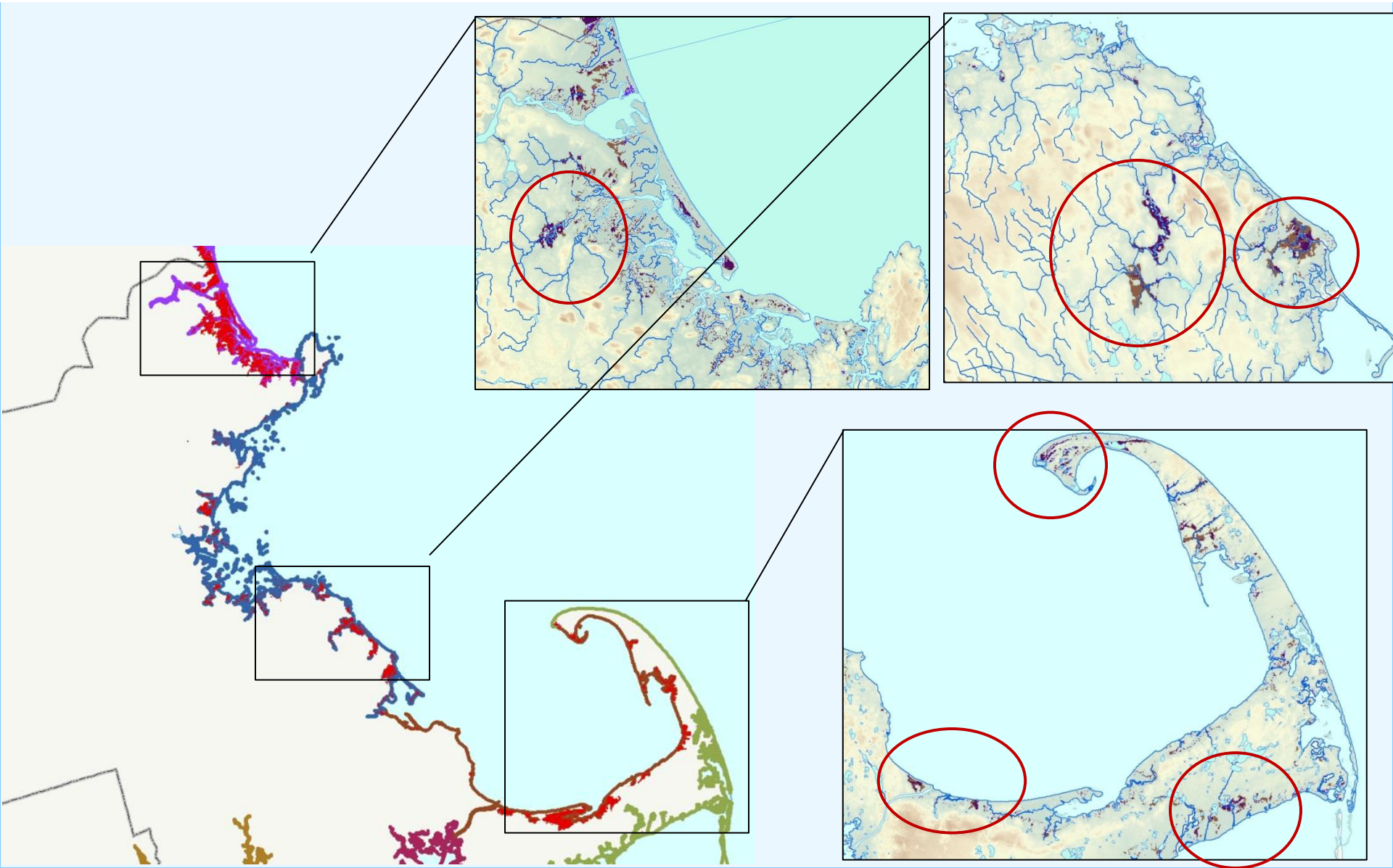


Estimated Salt Marsh expansion with 1 meter Sea Level Rise

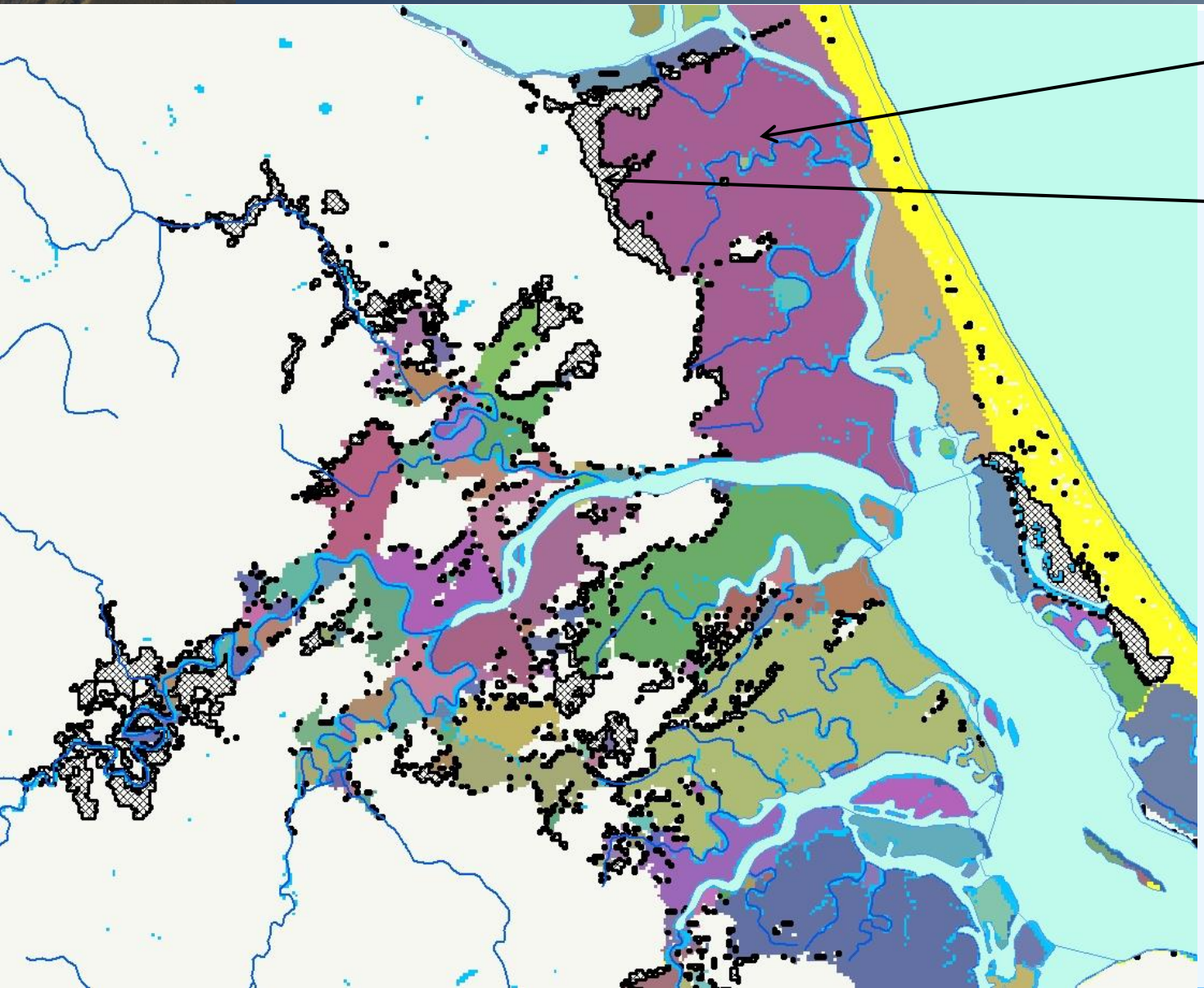
Brown = Swamp
Purple = Emergent Marsh

Other landcover removed (development, Upland Forest )

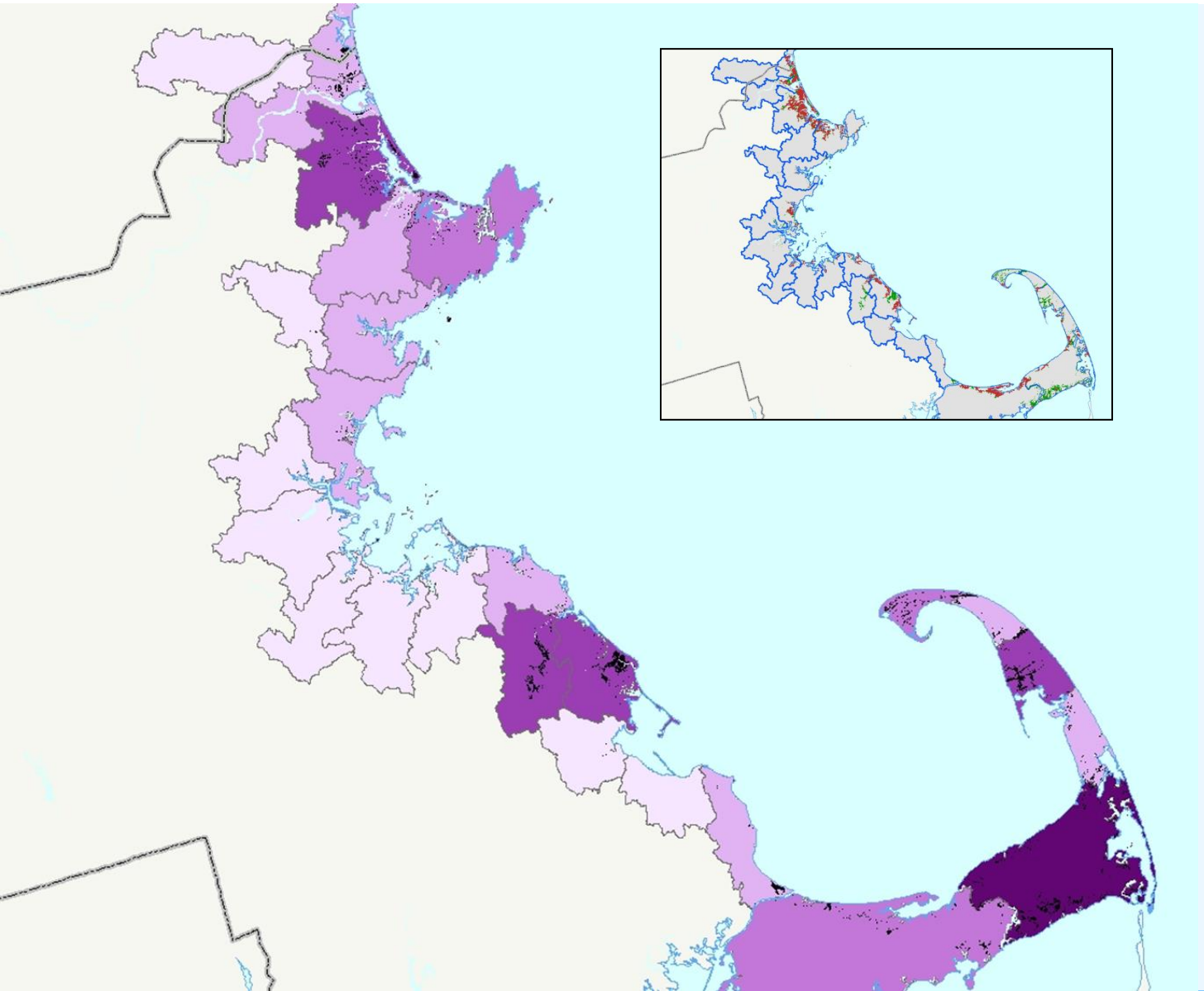
# Some place jump out at the 30,000 foot scale



# UNITS – Individual Marshes

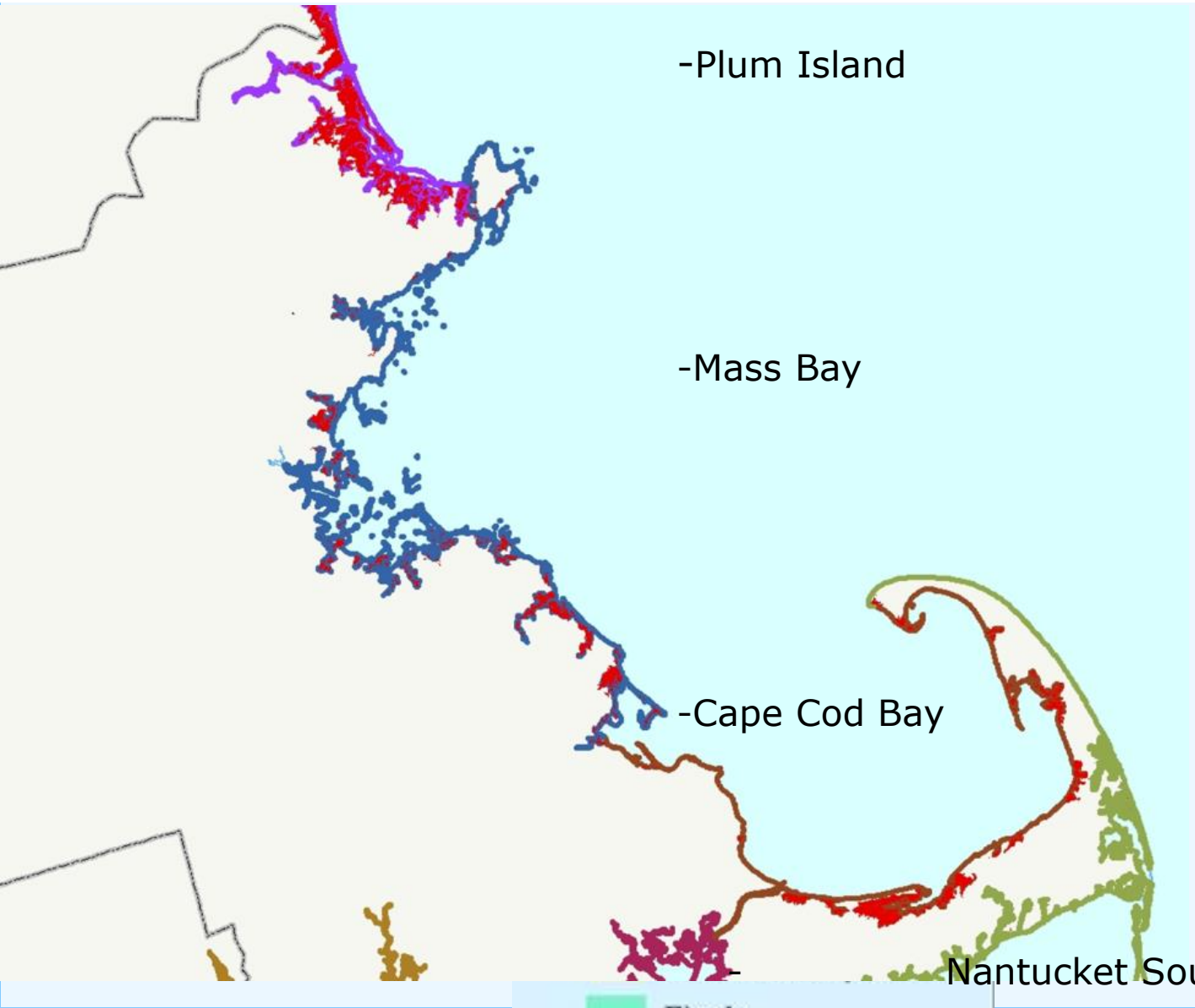


# UNITS – HUC 12



HUC 12's Prioritized by acres of Migration Space.

# Units - Coastal Shorelines



# Units and Stratification

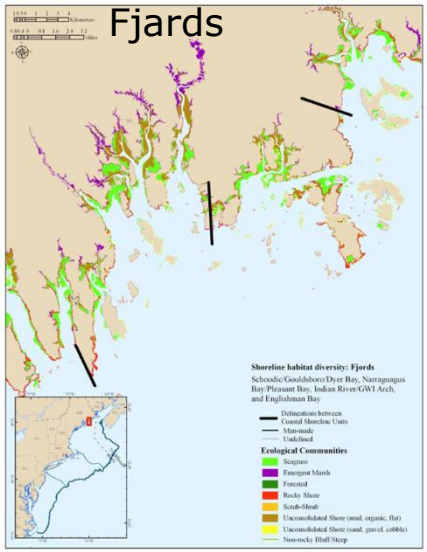
62 Coastal Shoreline Units (CSUs)

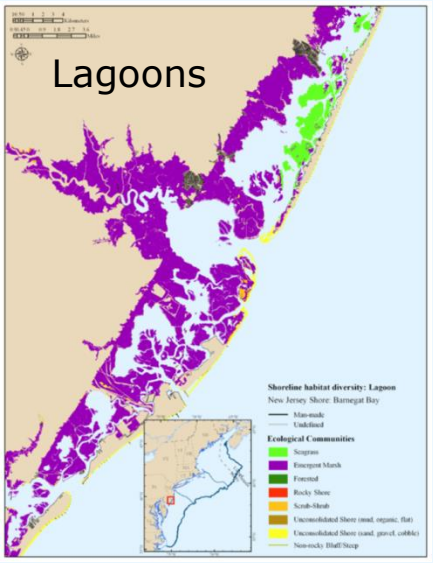
Pleasant Bay/Narraguagus Bay
Bay of Fundy
Chignecto Bay
Schoodic/Gouldsboro/Dyer Bay
St. John
Quoddy
Bagaduce
Penobscot
Muscongus Bay
Cobscook Bay
Minas Basin
Digby Harbour
St. Mary's Bay
Kennebec/Sheepscot
Bold Coast
Machias Bay
Englishman Bay
Casco Bay
Indian River/GWI Arch
Frenchman Bay
Bluehill Bay
East Penobscot Bay/Jericho Bay
Gulf of Maine
Great Bay
Muscle Ridge Channel
Damariscotta River
Saco/Scarborough River
Bigelow Bight
Plum Island/Hampton
Massachusetts Bay
Cape Cod Bay
Nantucket Sound
Buzzard's Bay
Hudson River
Connecticut River
Long Island Sound
Hudson/Raritan River
DE Bay: Upper Estuary
DE Bay: Lower Estuary
Narragansett
Block Island Sound
Gardiners Basin
Long Island South Shore
Southern New England
Chesapeake Bay Inner
Patuxent River
Long Island Sound - Central Basin
New Jersey Shore
Delaware Bay
Rehoboth & Indian River Bays
Assawoman & Sinepuxent Bays
Chesapeake Bay Eastern
Potomac River
Ketotank Bay to Smith Island Inlet
Rappahannock River
York River
James River
Mid-Atlantic Bight
Currituck & Albemarle Sounds
Tar - Pamlico
Pamlico Sound
Neuse River

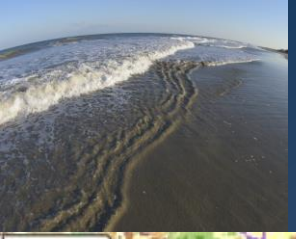
**Coastal Shoreline Units**
Depicted by colored shorelines

**CMECS Class**

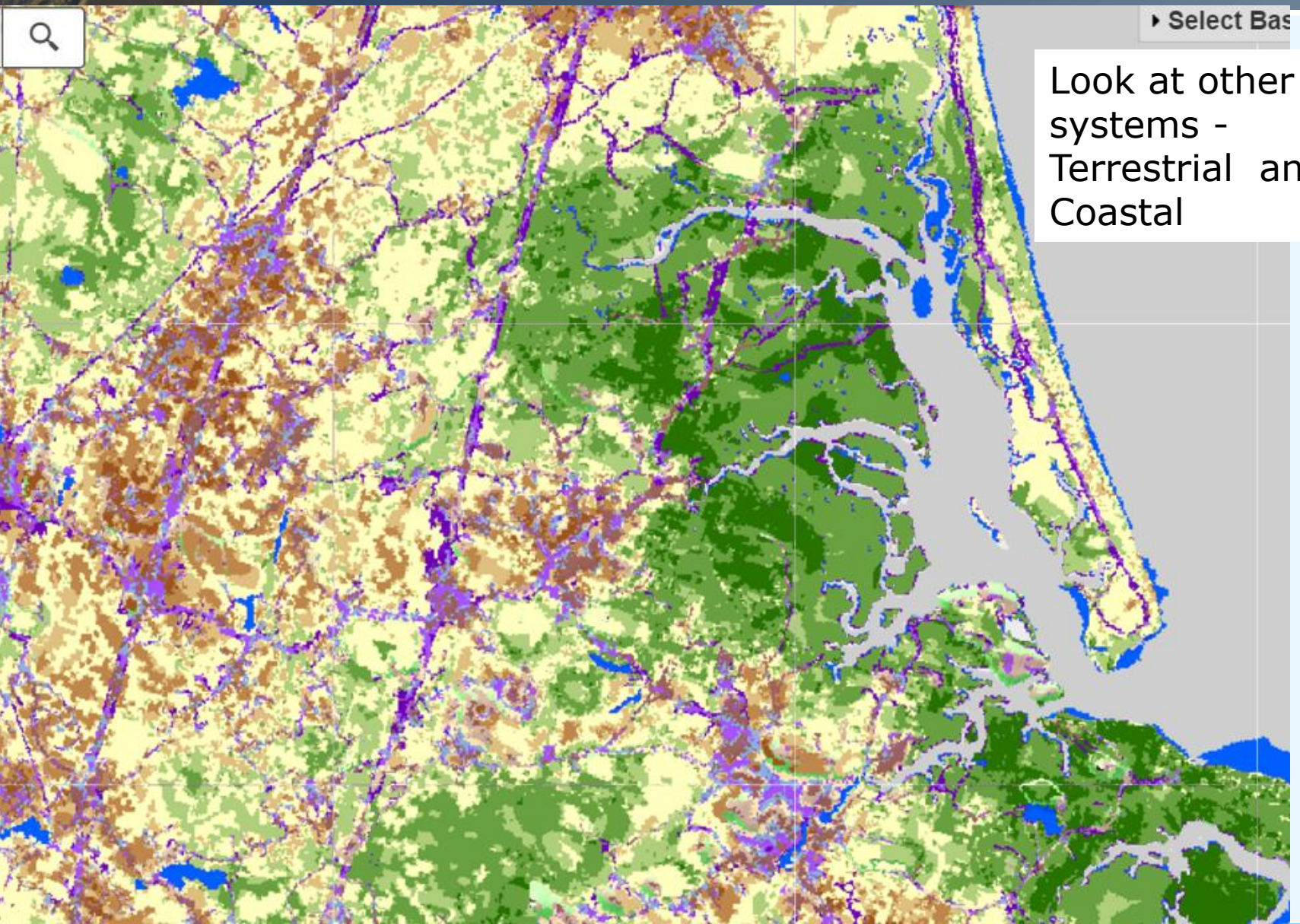
- River Dominated
- Lagoons
- Coastal Embayments





# Evaluate Terrestrial Connectedness




Look at other systems - Terrestrial and Coastal

# Next Steps

Run Model at 10 meters

Assembled 10 m DEM **

Compare results to NOAA model

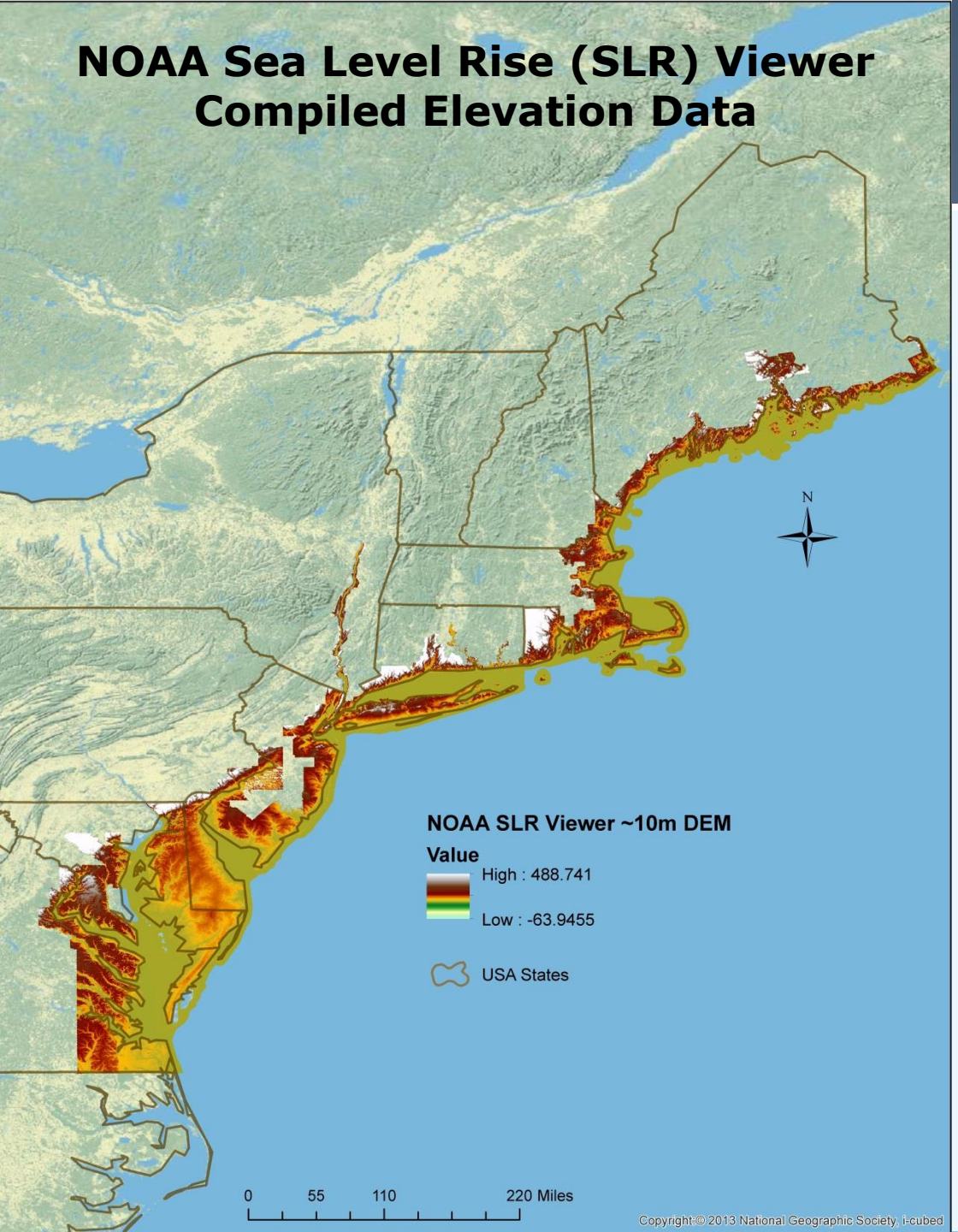
Preliminary results**

Settle on Units

Incorporate other ecological data

- Estimate space for other habitats
- Integrate geophysical data
- Integrate biodiversity data

Analie Barnett




# Compiled 10 m DEM

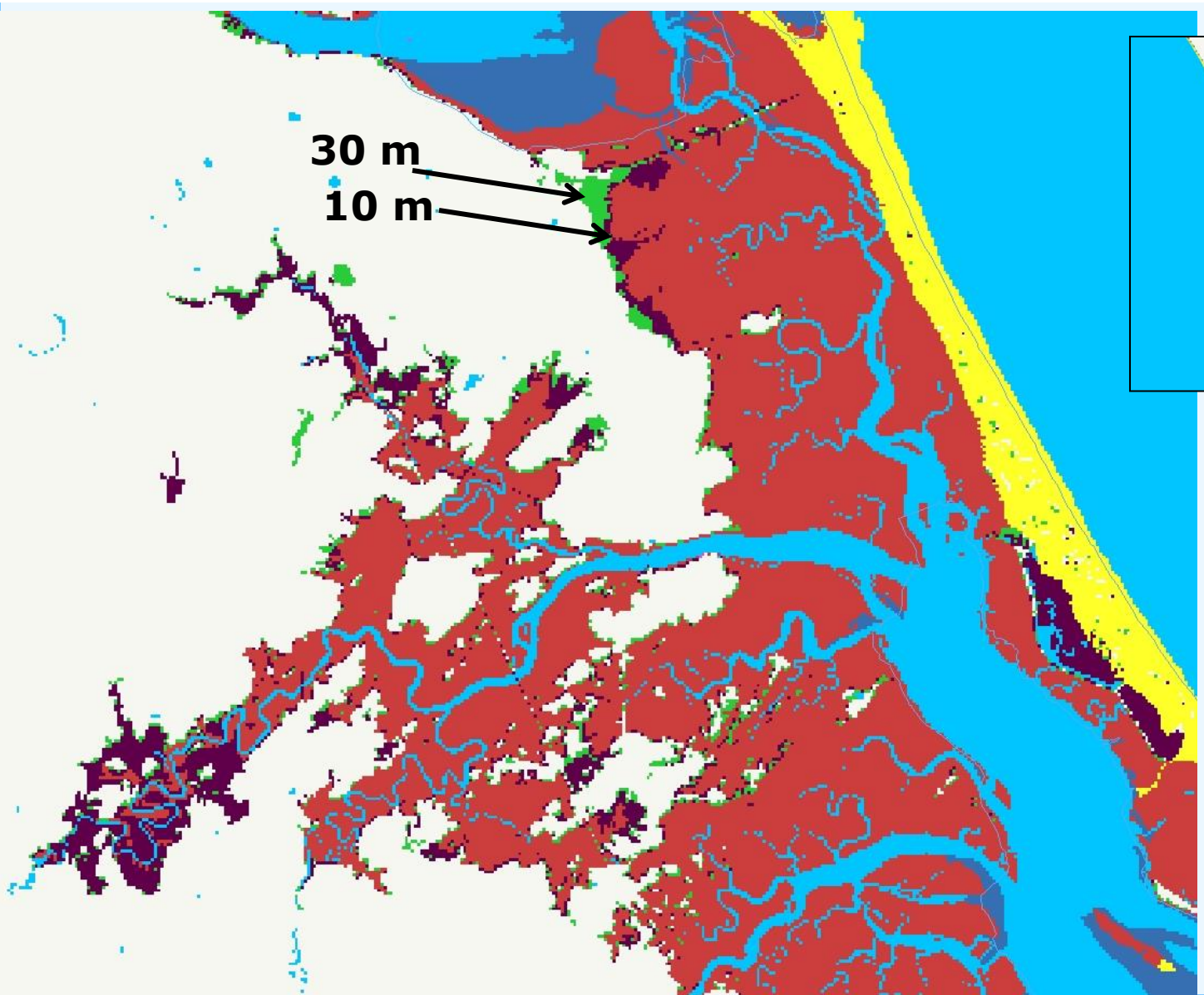
**NOAA processing steps:**

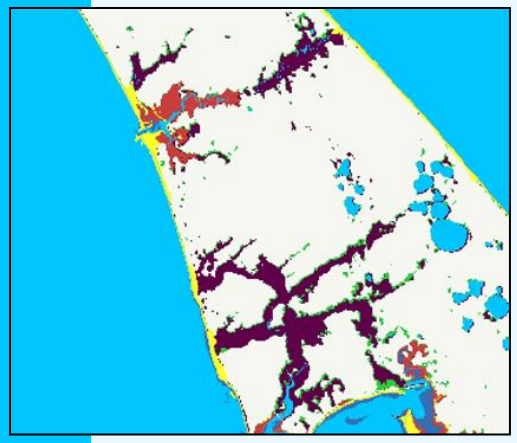
- Compiled best available Lidar-based elevation data
- condition elevation data to include hydrologic features and breaklines (i.e., bridges are removed so water bodies are not separated)
- DEMs were created for SLR mapping

**TNC Processing Steps**

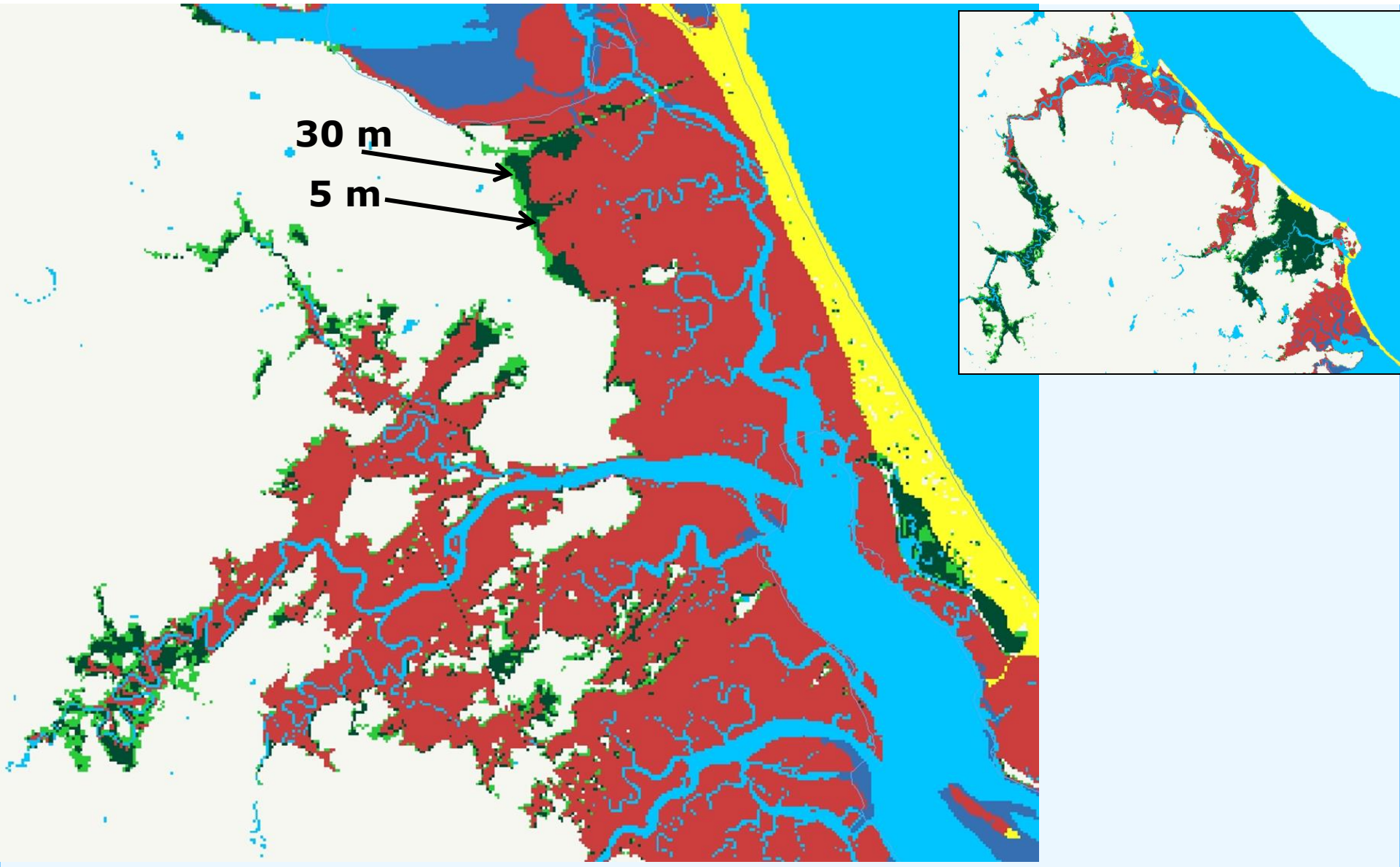
- downloaded ~10 and 5 meter DEMs from NOAA SLR Viewer
- resampled the 5m grids to 10m
- merged the resampled 5m grids (n=4) with the 10m grids (n=8)
  - averaged overlapping values
- re-projected to NAD 83 Albers

# Test Higher Resolution Data: NOAA 10 m DEM

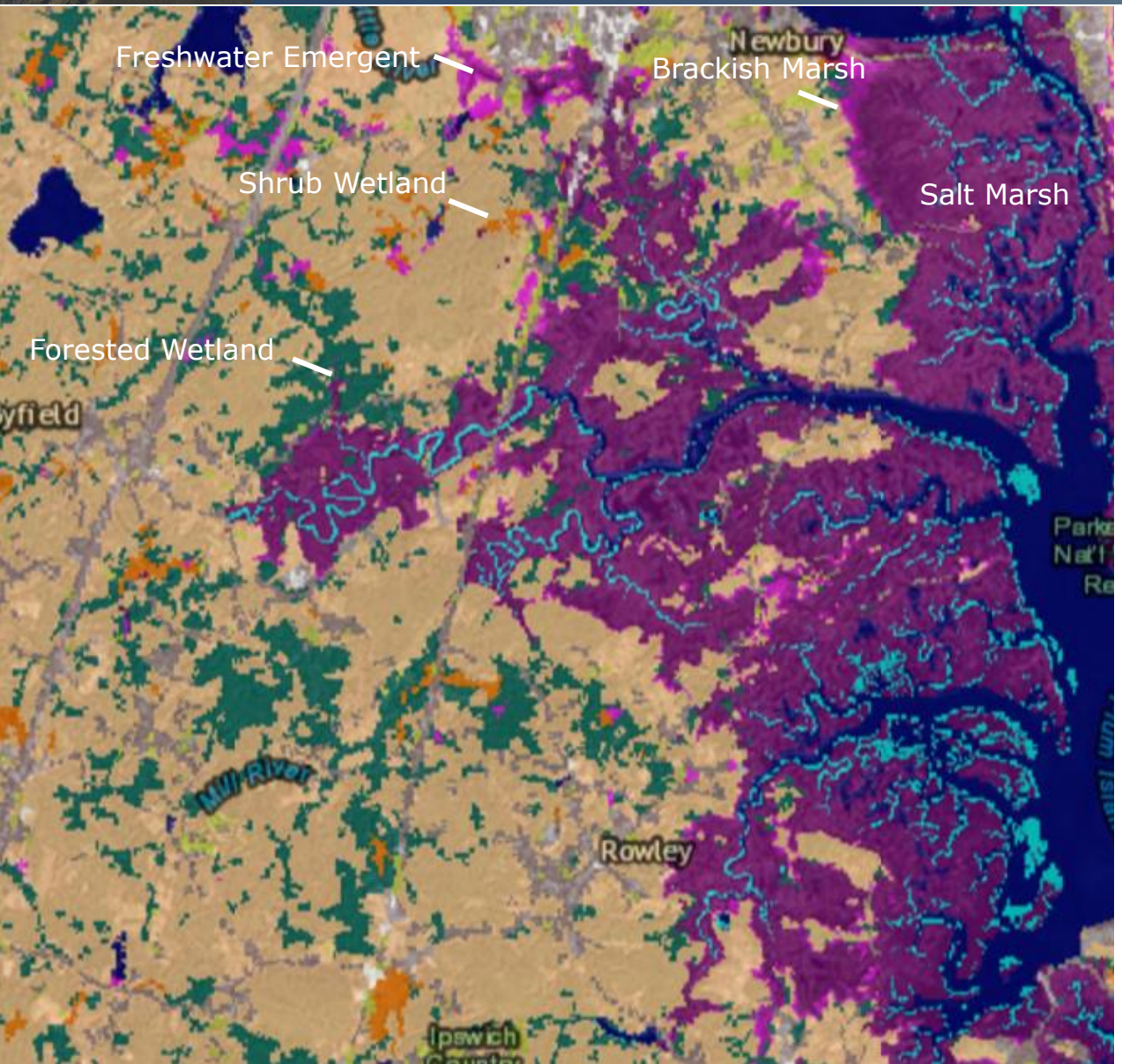


# Test Higher Resolution Data: 5 m DEM



# Comparisons:
# NOAA Marsh Migration Model

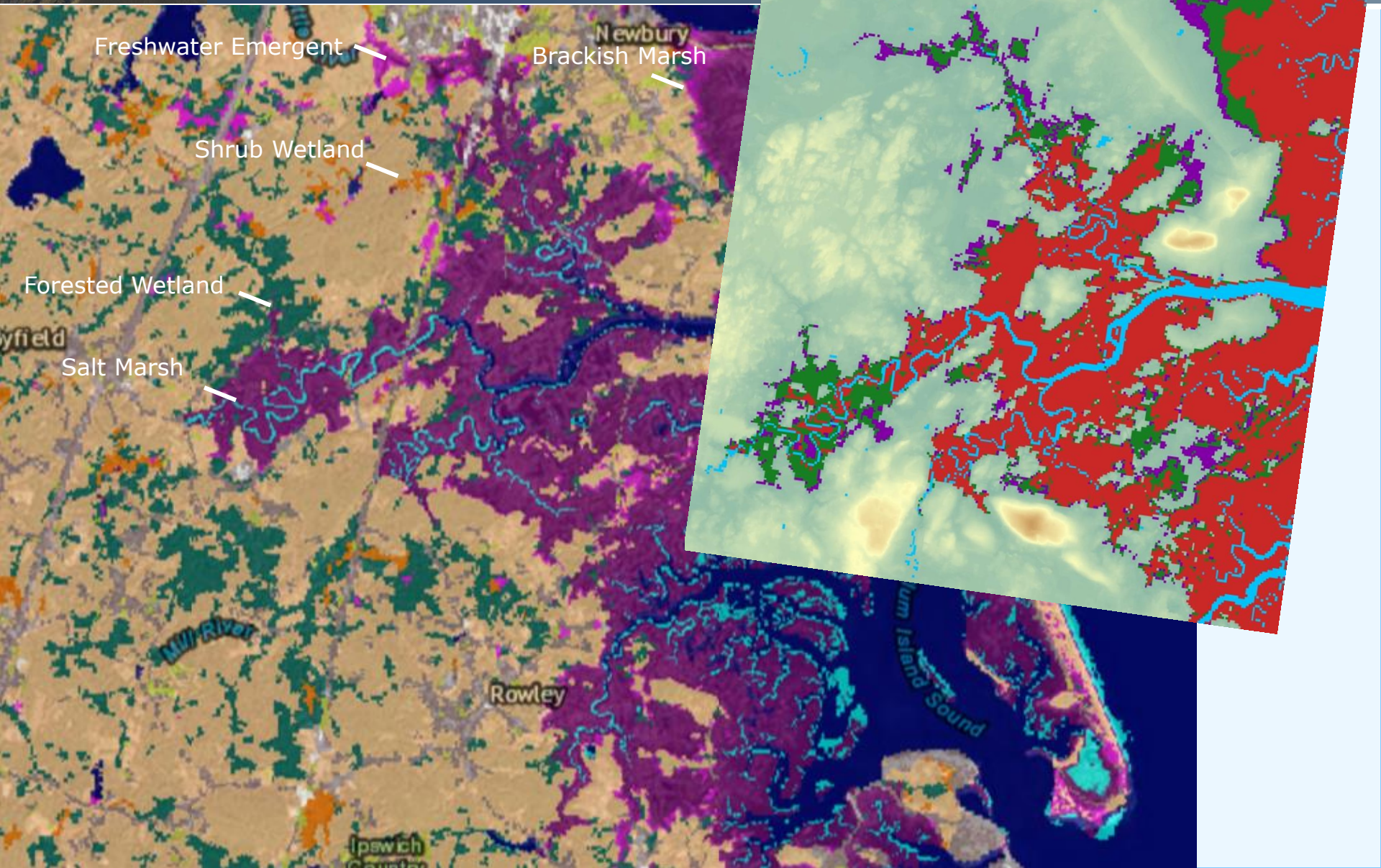



Marsh migration
(4 tidal surfaces)

- mean high water spring (MHWS),
- mean high high water MHHW,
- mean tide level (MTL),
- mean lower low water (MLLW).

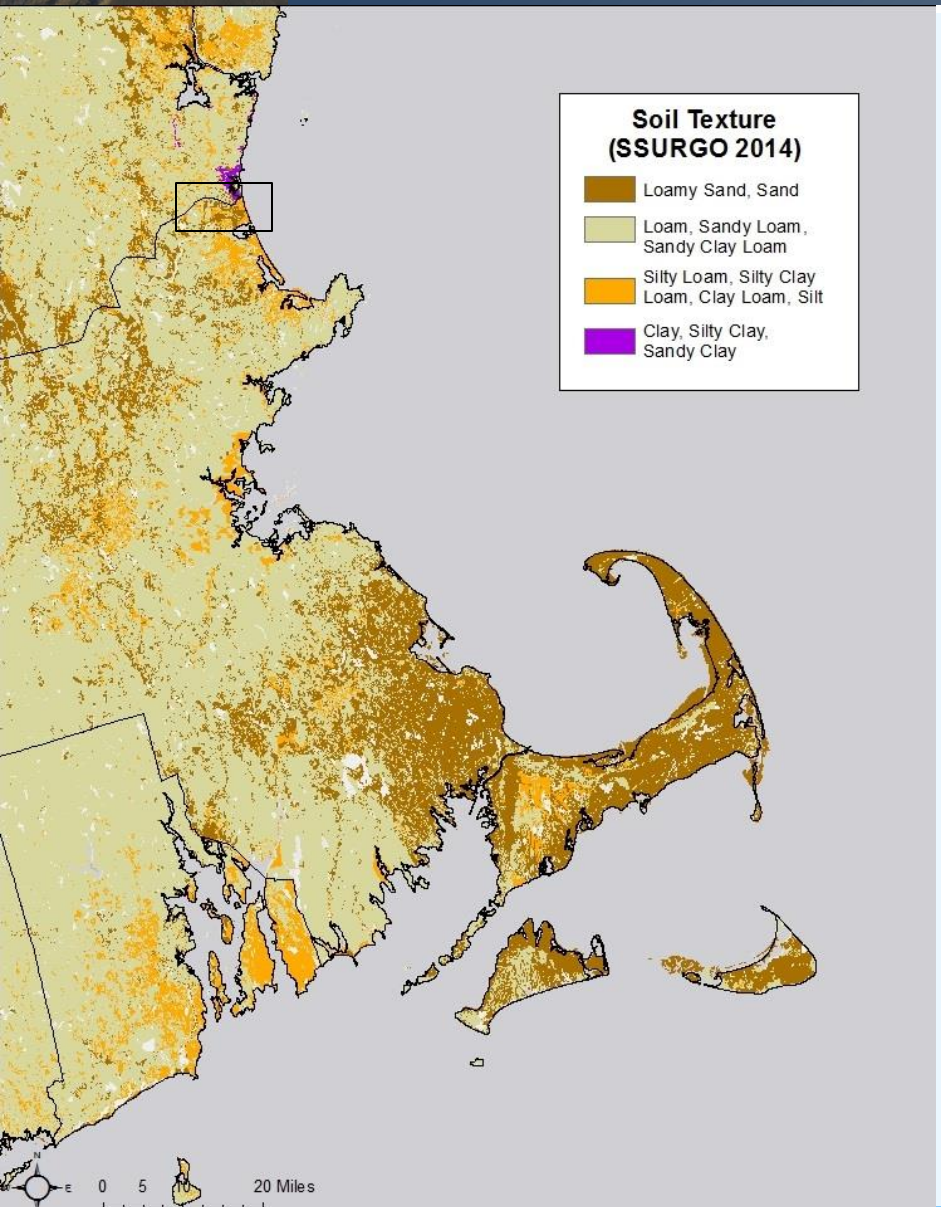
MHHW, MTL, and MLLW are interpolate a surface using the available tide stations or from NOAA's vertical datum conversion software (VDatum) , which incorporates a hydraulic model to help determine tidal elevations between stations, and has adjustments for inland interpolations.

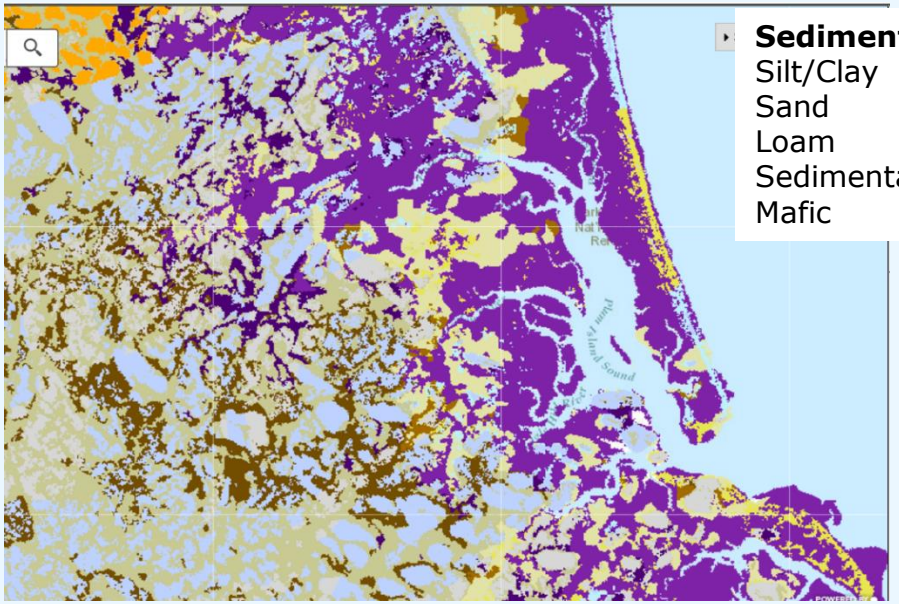
# Comparisons: NOAA Marsh Migration Model

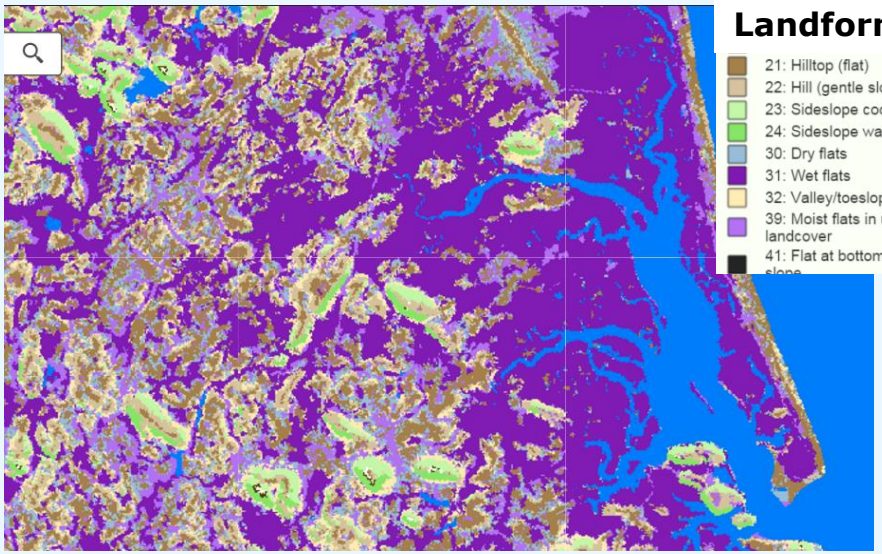


# Evaluate Landscape Diversity

## Soils, Surficial Sediments, Landforms, Wetland, Elevation

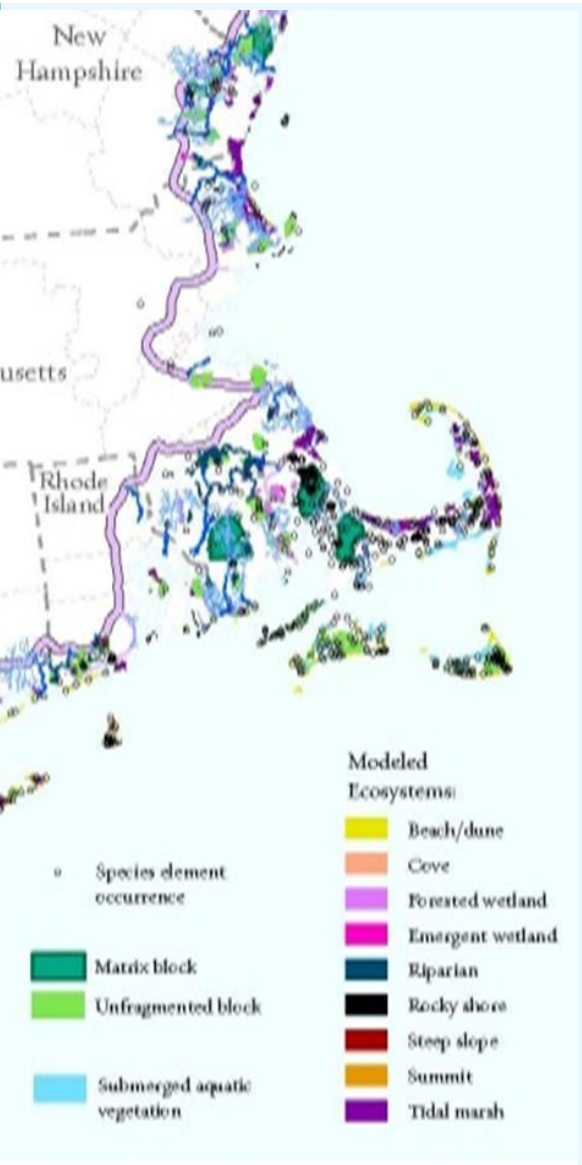


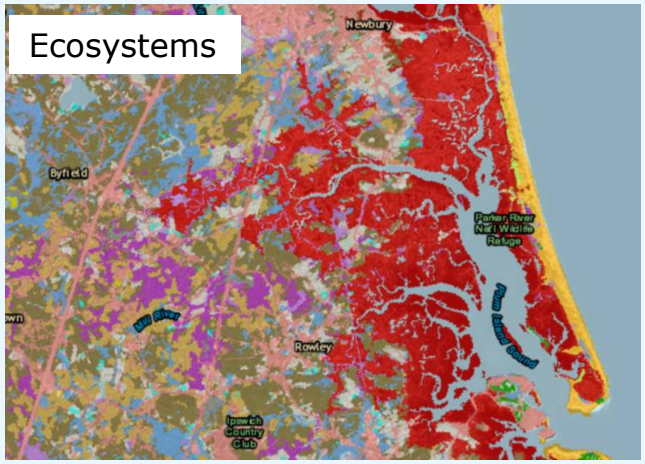



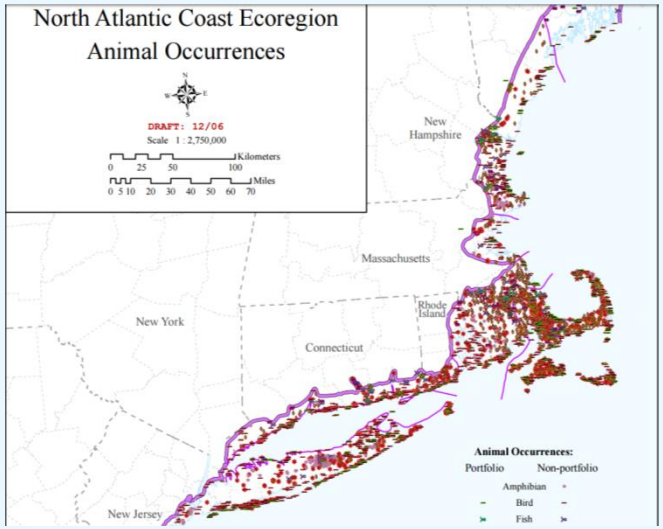
# Evaluate Biodiversity

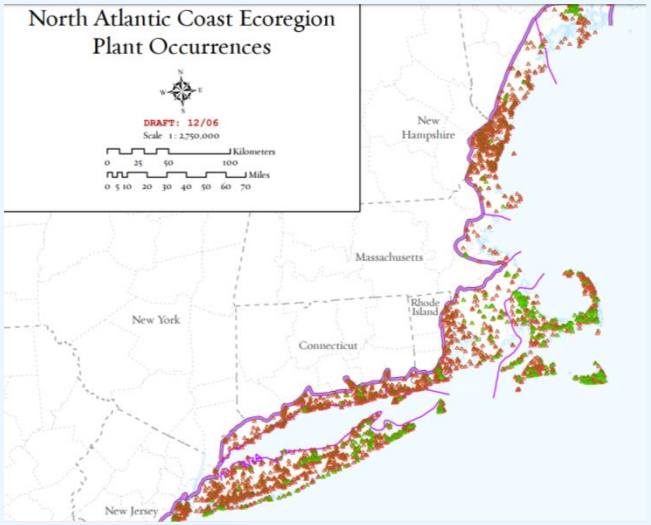
## rare species, terrestrial and aquatic ecosystems



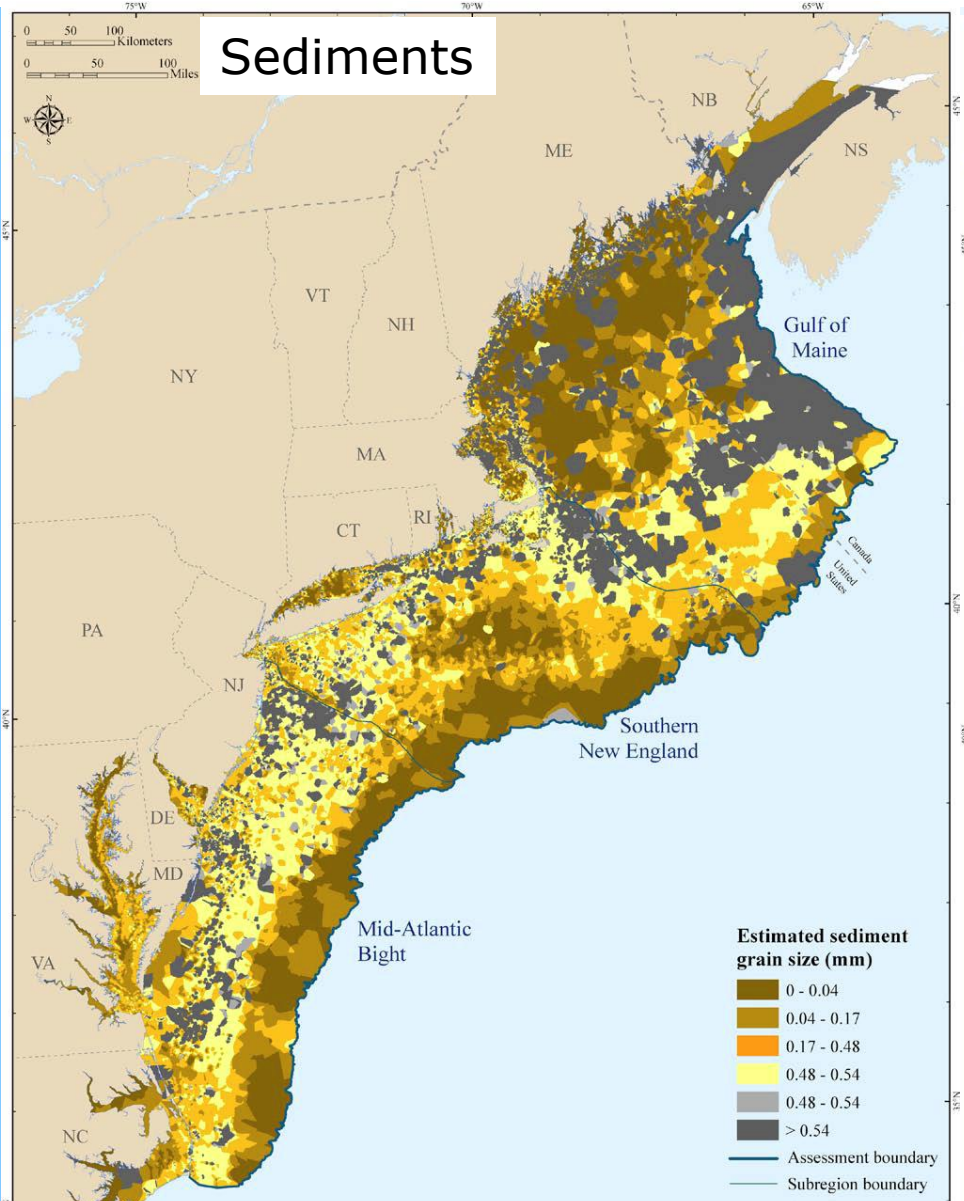



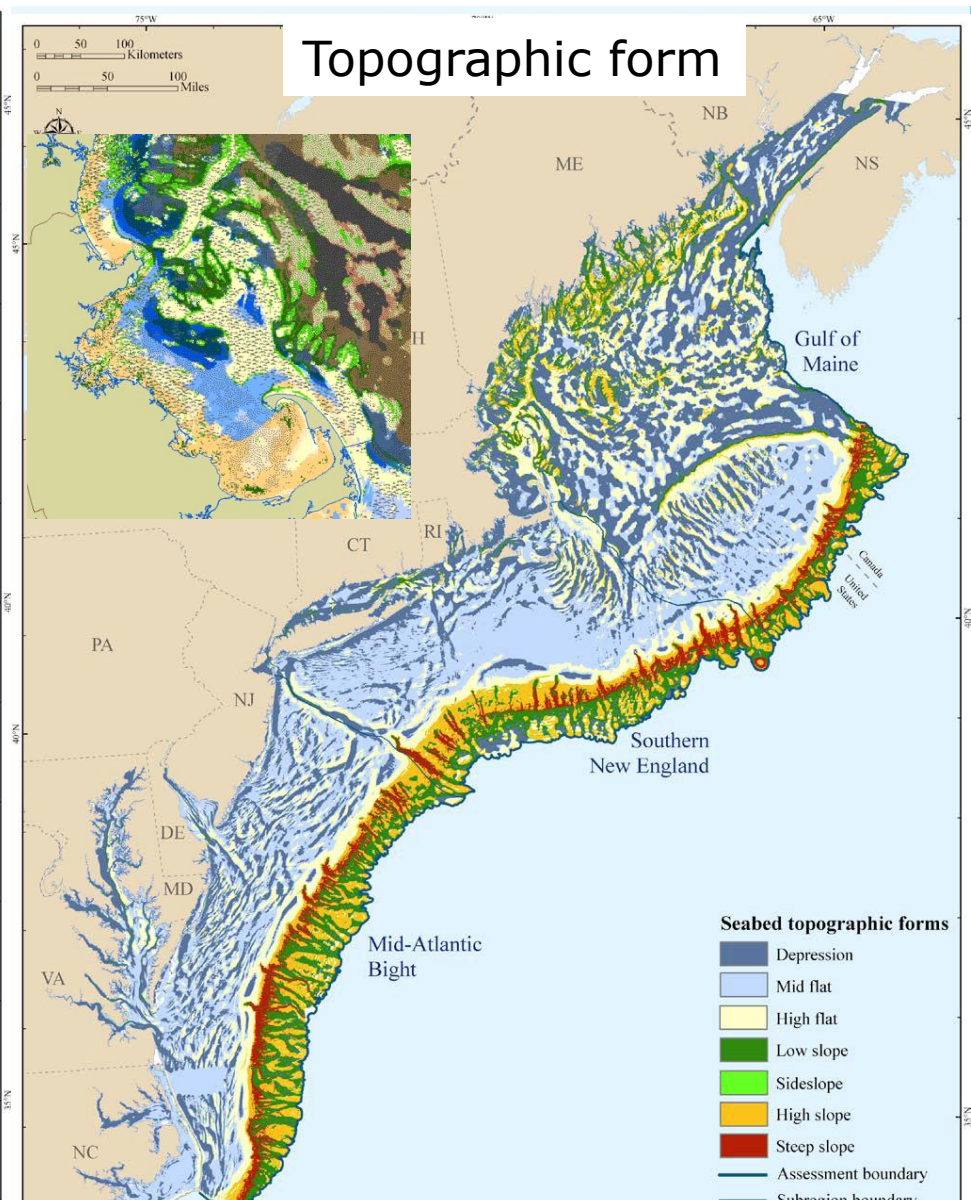




# Incorporate Offshore Data?



# THANK YOU

Funding from USFW's North Atlantic Landscape Conservation Cooperative and The Nature Conservancy

# Outline

**Overall approach**

- Climate resilience and focus on the stage (complement)
- Prioritization / Options

**Components**

Connectedness

Migration space, Extent of inundation

Landscape Diversity

Soils, Bedrock, Offshore sediments

Topography, microclimates, elevation

Current Biodiversity

Habitats/ecosystems

Species populations

**Progress**

Connectedness: Salt marsh model –

Salt marsh polygons, 30 m DEM, Tidal range, **

Points and Logistic model, **

Estimates and evaluation of Migration space**

Comparisons across marshes

By marsh unit** By CSU ** By marsh within CSU type **

By marsh within CSU wih Biodiversity data? **