Shoreline Change Along the South Carolina Coast:

Implications for the Ecological Environment

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Shoreline Change Will Occur!

- On our front beaches where it is not easy to retreat

Shoreline Change Will Occur!

- On our front beaches where we can retreat

If No Retreat: Two Choices (sort of)

Beach Armoring Problems

- Good for protecting upland <u>but</u>
- No longer permitted
- Bad for beach ecosystem

  - Loss of the dune system (supports bird nesting, habitat for other fauna, more natural protection)

  - Prohibits nesting of threatened, endangered turtles

  - Altered beach fauna that live in the sands

  - Less attractive beach for human uses

Beach Nourishment Concerns

- **Changes in beach characteristics (direct)**

  Impacts to invertebrate communities

  Impacts to turtle nesting

  Impacts to bird populations?

  Duration of effects

- **Changes in borrow area characteristics (direct)**

  Impacts to bottom invertebrate communities

  Impacts to fish and invertebrate predators

  Alterations sediment characteristics affecting re-use of area

  Duration of effects

Beach Nourishment Studies

- **South Carolina DNR Monitoring Program**

  - Hilton Head Island (3)
  - Kiawah Island (1 – beach scraping only)
  - Folly Beach (3)
  - Myrtle Beach (3- one ongoing)
  - MMS Borrow Area Study (6 – physical recovery only)

- **National Research Council Review (1995)**

  - Beach and adjacent uplands for birds, plants, turtles (7)
  - Beach intertidal and nearshore subtidal (24)
  - Borrow areas (21)

- **Bergquist and Crowe (SCDNR 2009)**

  - Review of commonalities/differences among SC projects(7)

Impacts on the Beach

What have we learned?

- *Only short-term adverse effects on intertidal invertebrate communities In SC recovery within 1-<6 mo.*

- *Similar in many other areas if beach sediment type and slope not drastically altered.*

- *Largely due to use of similar types of sand*

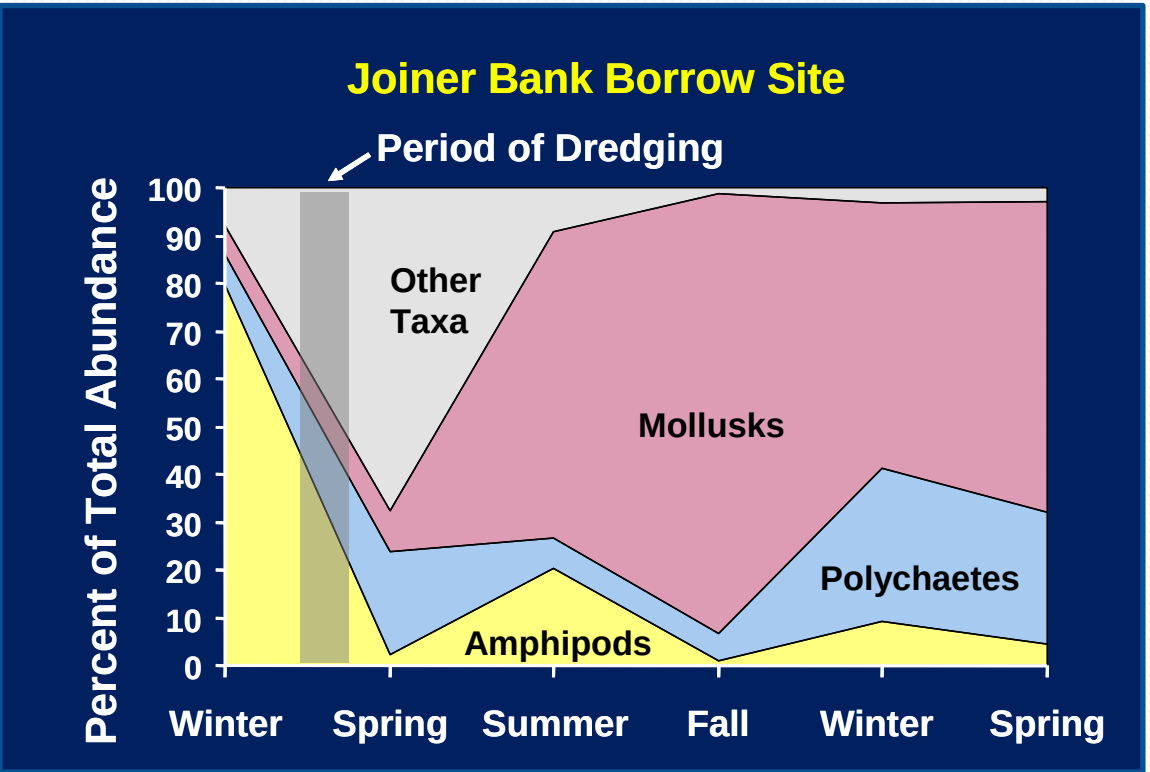
What have we learned?

- Effects on ghost crab populations significant and longer term (> 1 year in two SC studies)

- Effects on turtle populations not extensively studied in SC
  - Where examined more positive than negative effects.
  - Mixed results in other studies
  - Grading important.

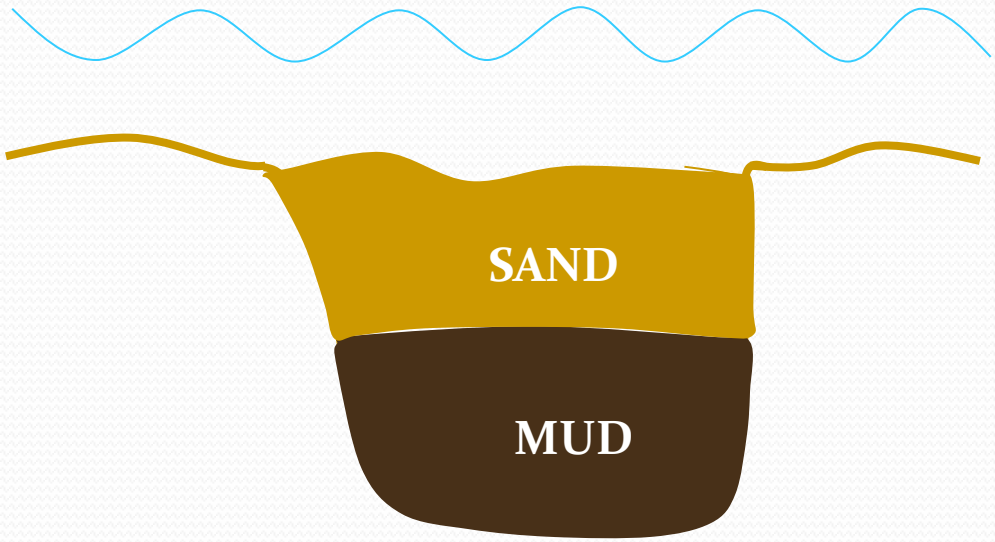
Borrow Area Impacts

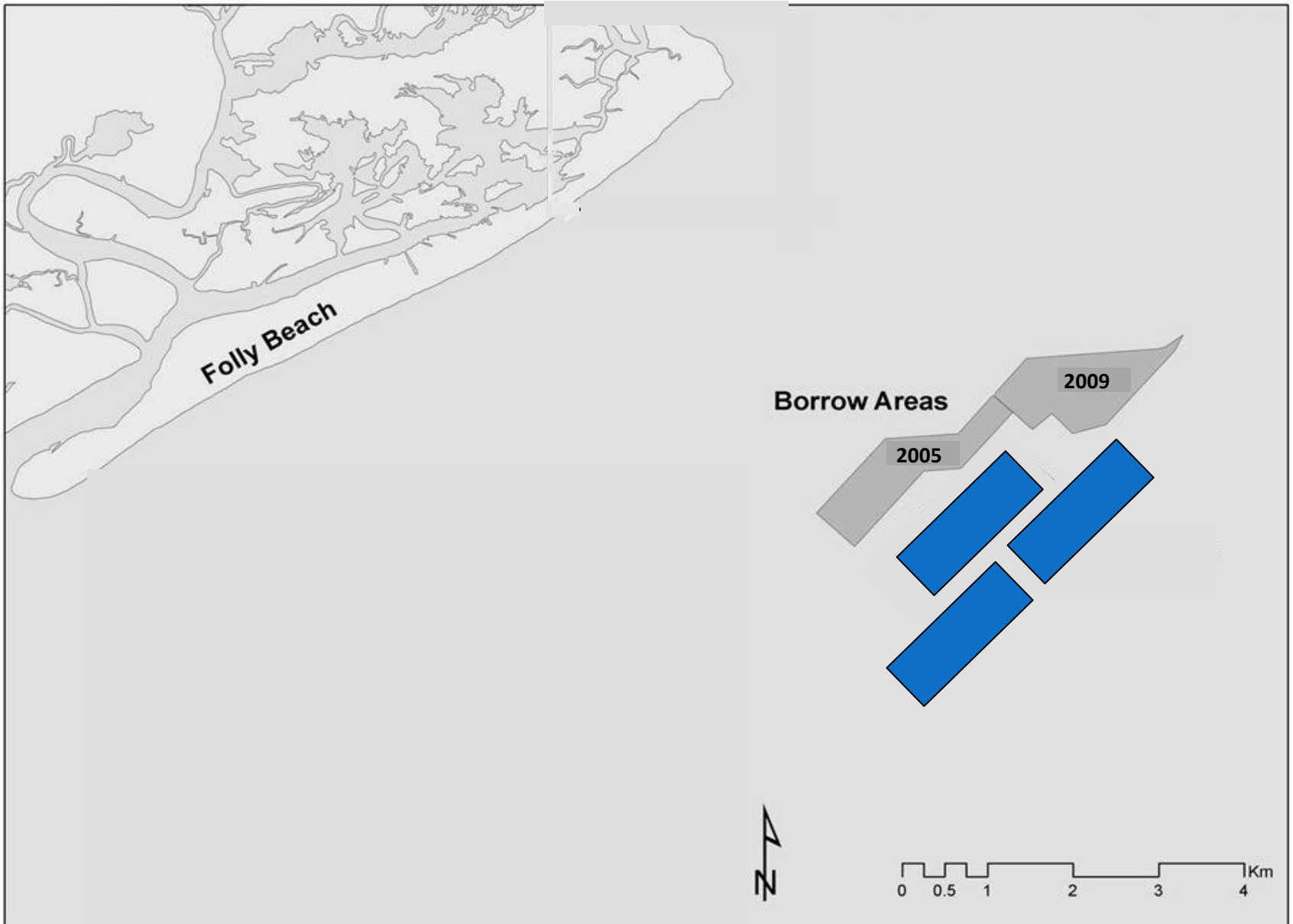
- Dredging of the "borrow site" removes all the bottom fauna
  - *Biological recovery variable and generally long term (> 1 year)*
  - *Impacts greatest when sediment composition changes*



Borrow Area Impacts

- Dredging of the “borrow site” removes all the bottom fauna
  - *Biological recovery can occur within 1 year if sediment type is similar*
  - *Rate and type of sediment refilling area*
    - *Dependent on depth of hole and location along beach*




Folly Beach
Borrow Areas
2009
2005
N
0 0.5 1 2 3 4 Km

Beach Nourishment Effects?

- **Nearshore zone impacts (indirect)**

  Limited studies – no major impacts to fauna in surf zone

  Limited studies, no obvious impacts to fish and crustaceans

  Possible burial of nearshore hard bottom habitats (Grand Strand only)

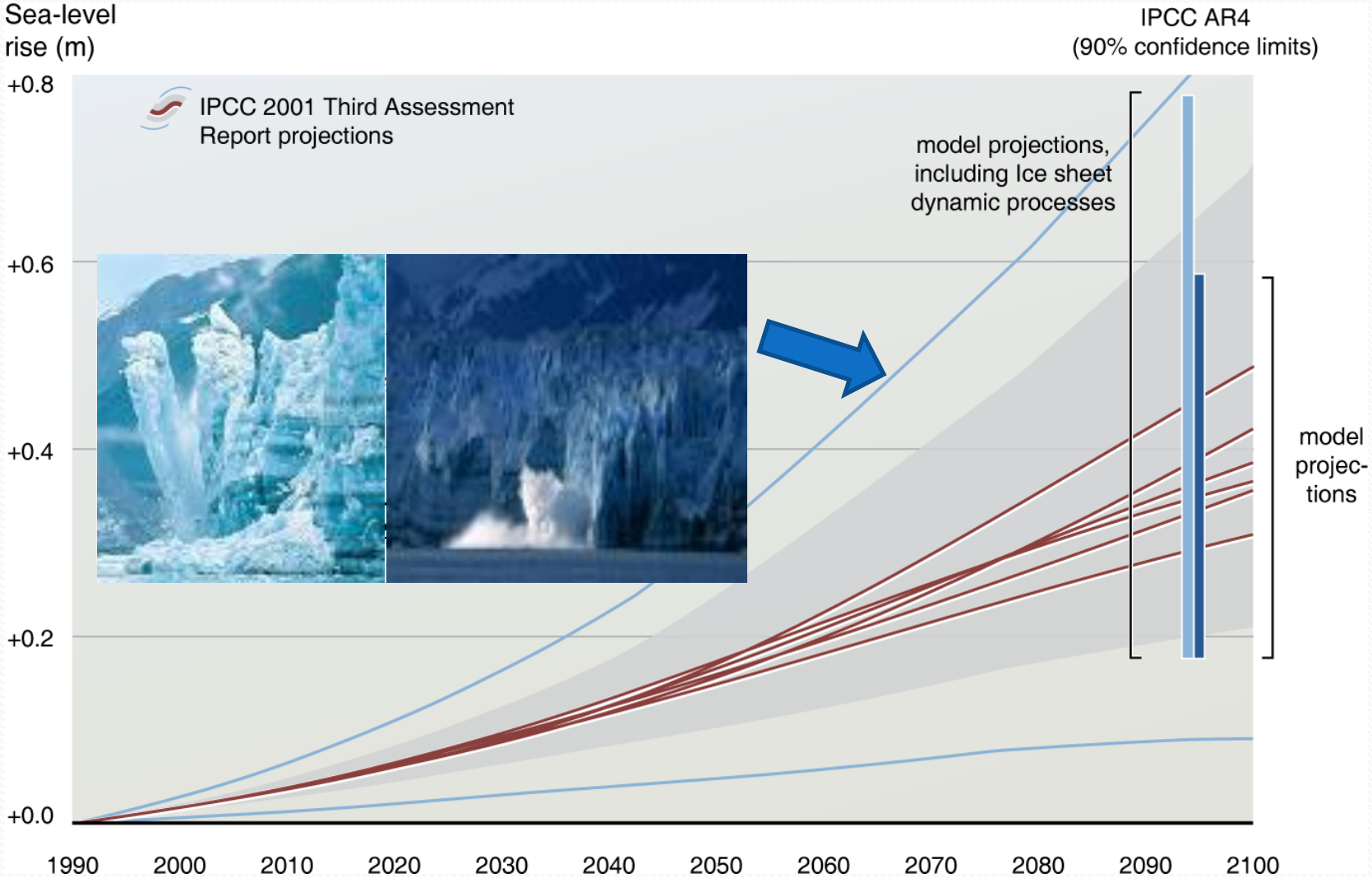
- **Effects on Inlet Dynamics (indirect)**

  Changes in inlet stability (observed at Folly and Kiawah)

  Loss or expansion of small barrier islands that serve as bird rookeries or bird feeding areas (e.g. piping plovers)

Bird Key and Folly Beach

Intergovernmental Panel on Climate Change – Report 4, 2007



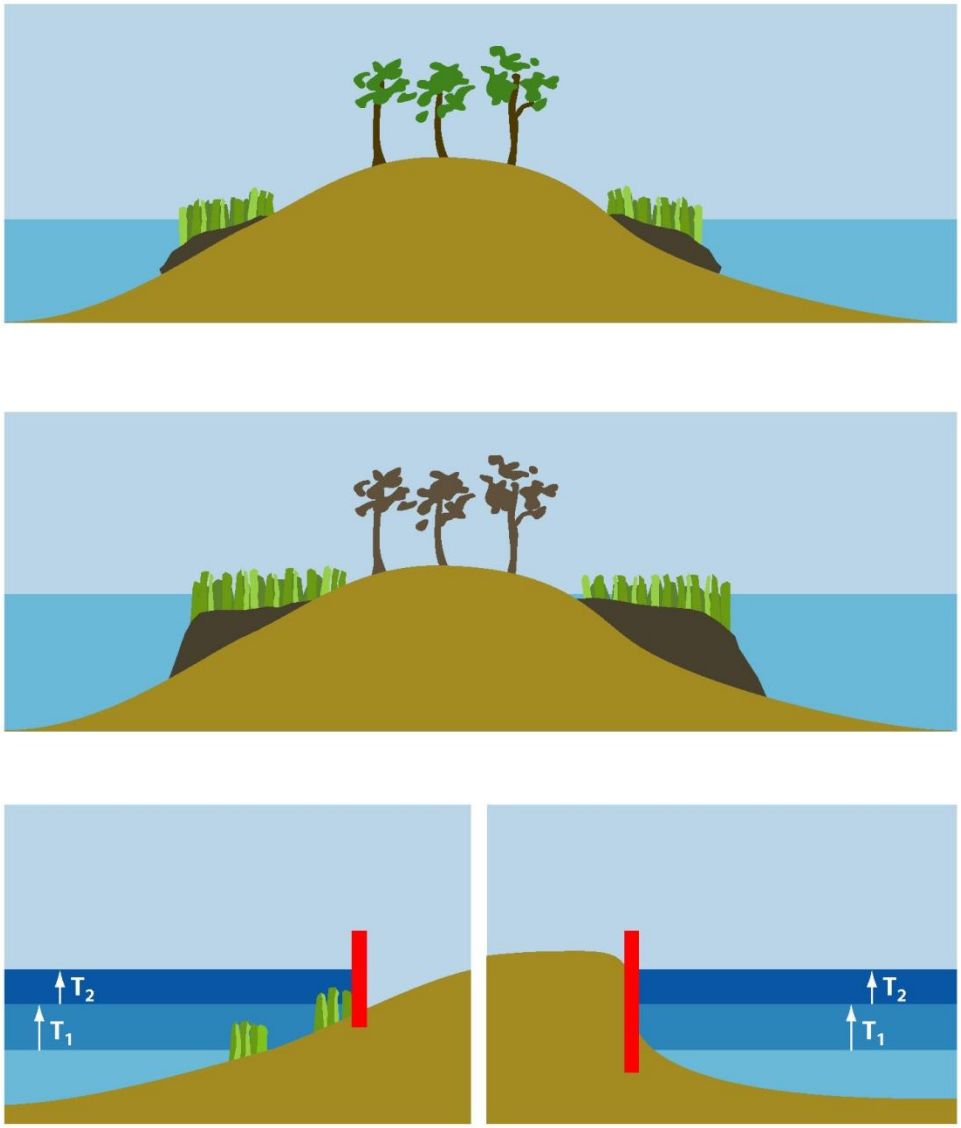
Slide Provided by Clark Alexander

More Projects!!
Greater Frequency!!
Risk of Significant Proportion of Time in Recovery

Sea Level Rise Effects on Estuarine Shorelines

Potential Impacts on several resources

- Marsh wetlands
- Threatened and endangered species
- Oyster populations

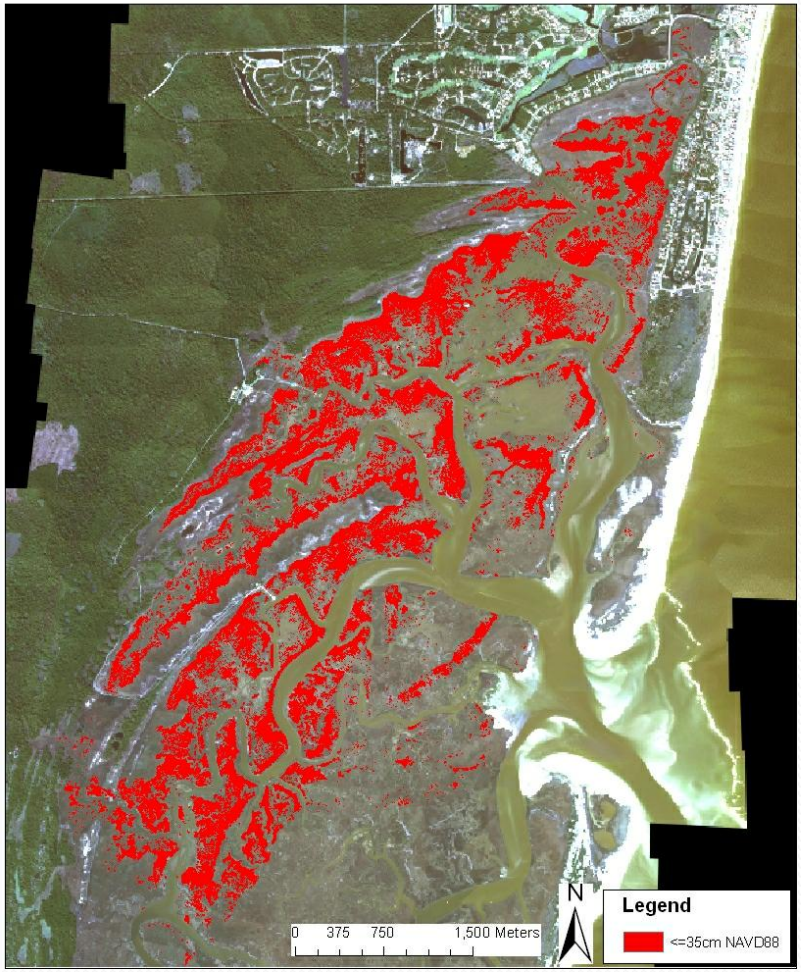


Provided by Dr. Clark Alexander
Skidaway Institute of Oceanography

Fertilized plots (high biomass) had rates of sediment accretion that were significantly greater than controls***, but in no case was the rate of accretion as great as the rate of sea-level rise***

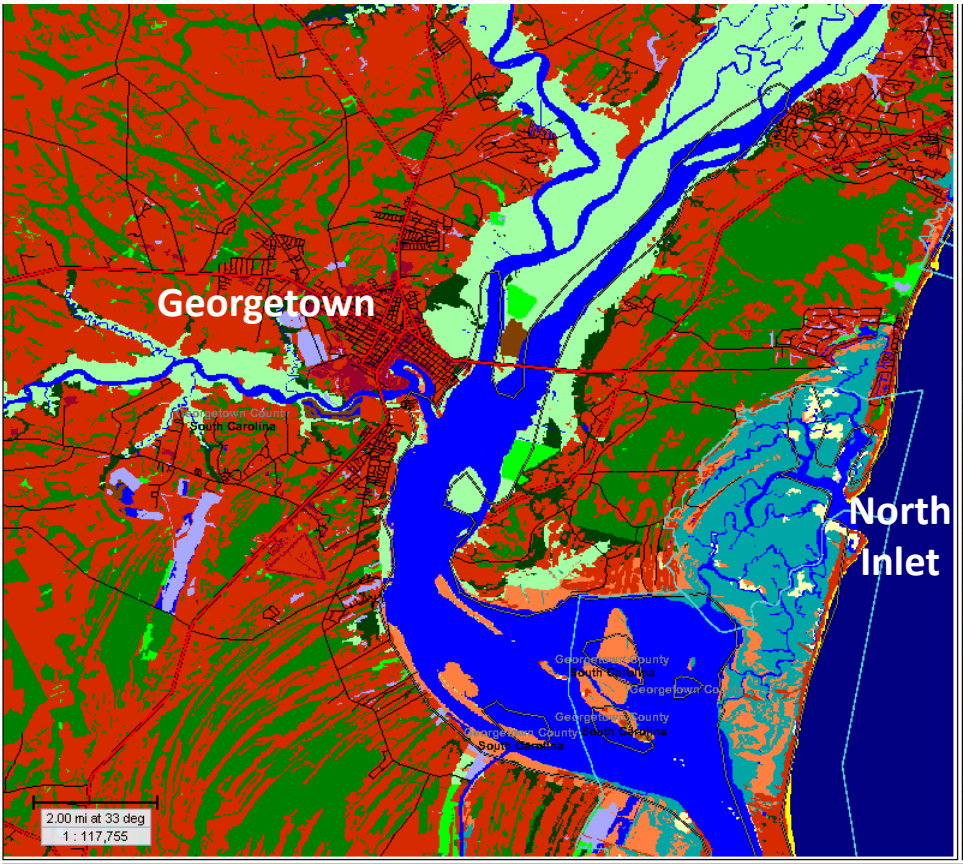
Slides courtesy of James Morris, Baruch Institute, USC

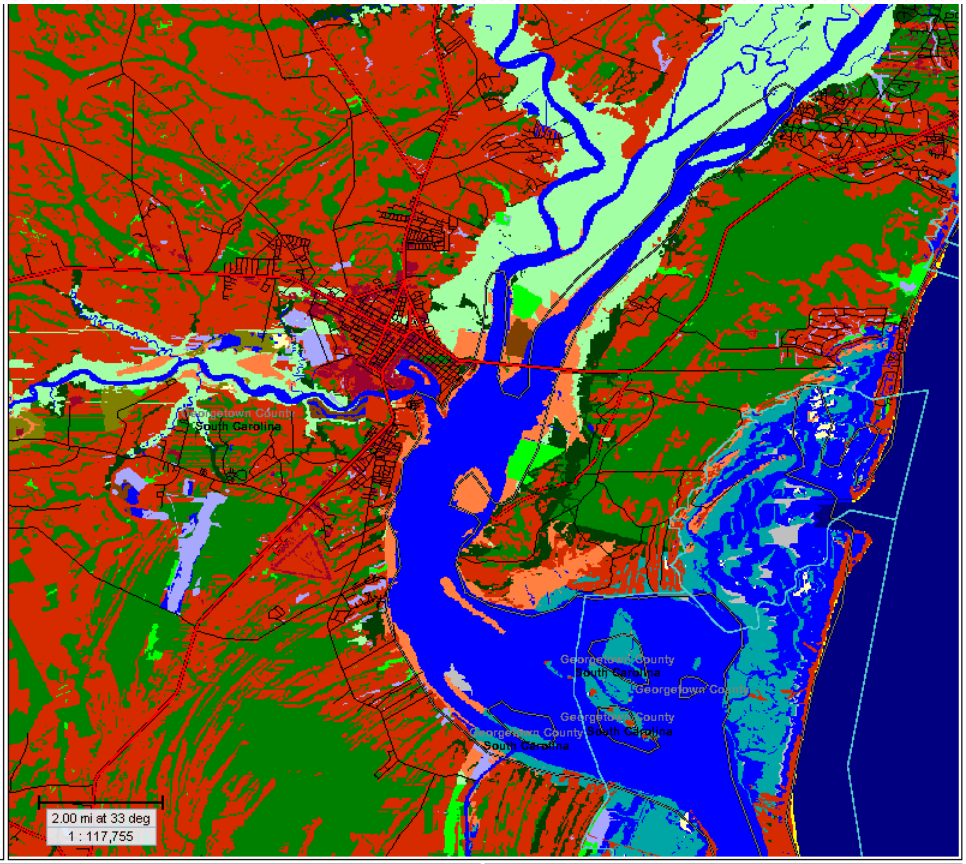
Below Critical Elevations in North Inlet, SC



About ½ of the marsh area at North Inlet is below the critical depth of 35 cm. At depths greater than the critical depth, the marsh cannot keep up with rising sea level.

Folly Beach and James Island Area
Projected Change in Marsh versus water Base versus 2100
(IPCC Mean of 39 cm)





http://www.slammview.org/

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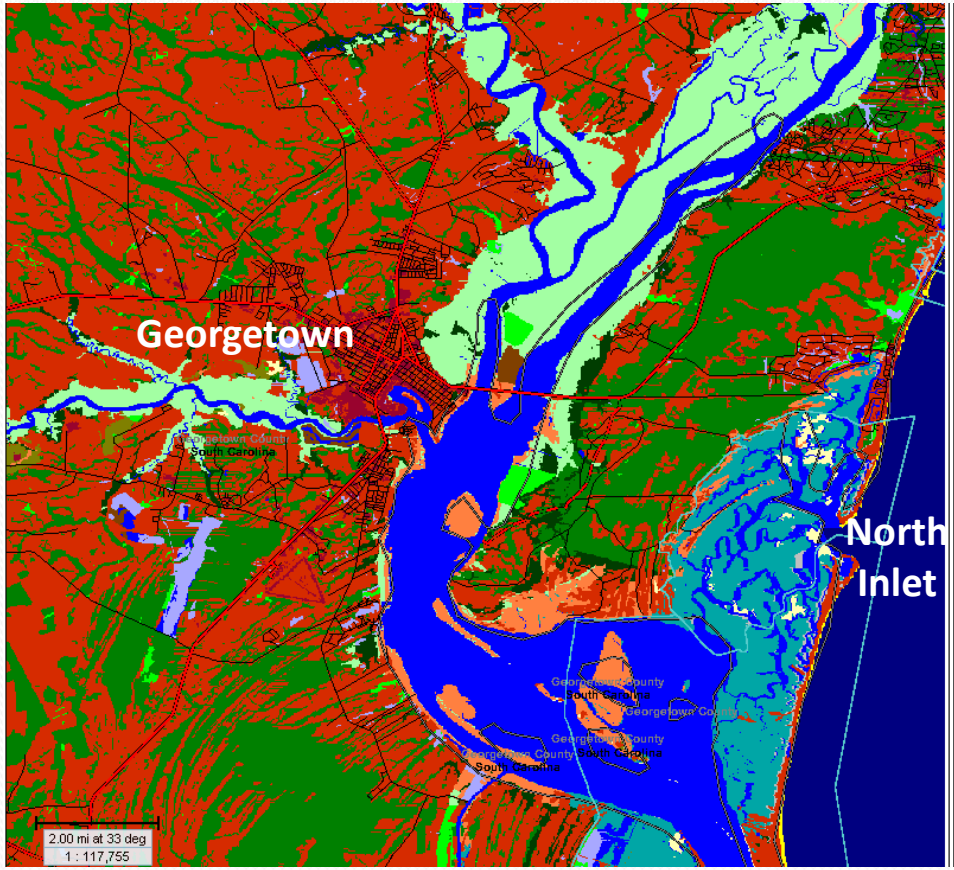

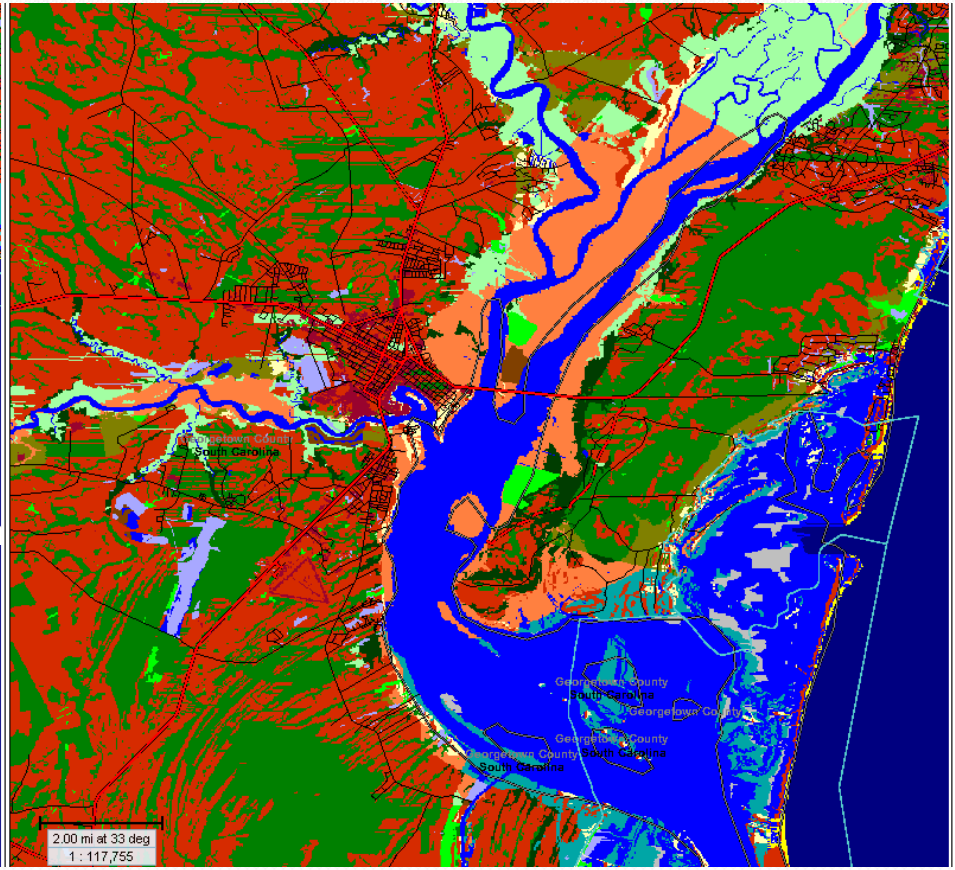

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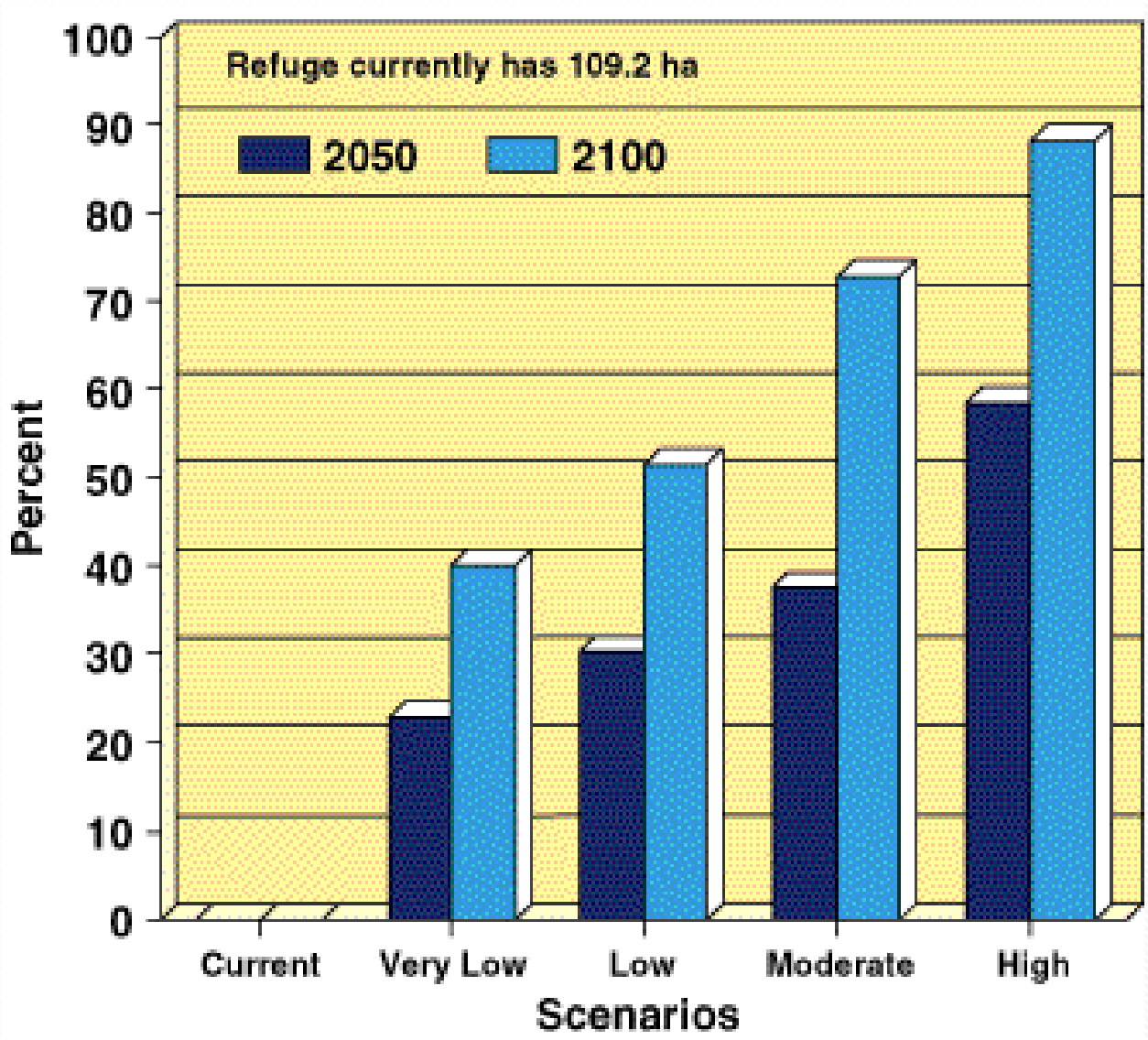
Cape Romain National Wildlife Refuge

> 75% of the Refuge is < 10 ft above MSL

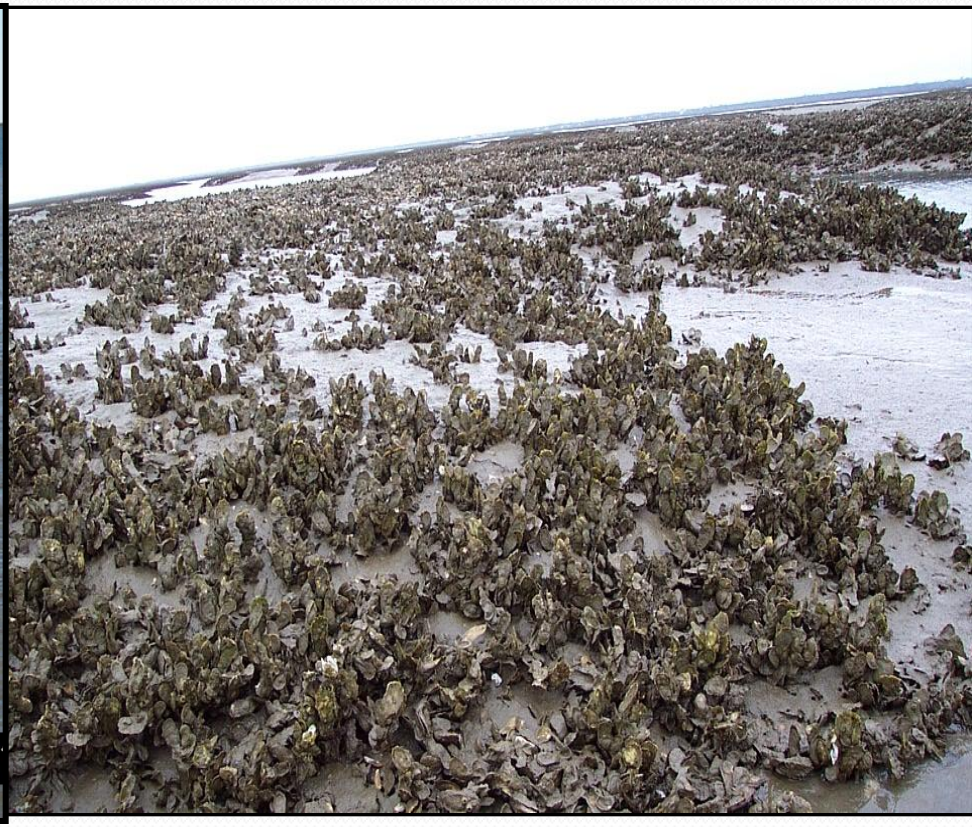
Percent of Refuge lost under different sea level rise scenarios



Oyster Reefs Provide

- Food
- Filters
- Habitat for other animals
- Marsh breakwater

95% of South Carolina's oysters are located above low water

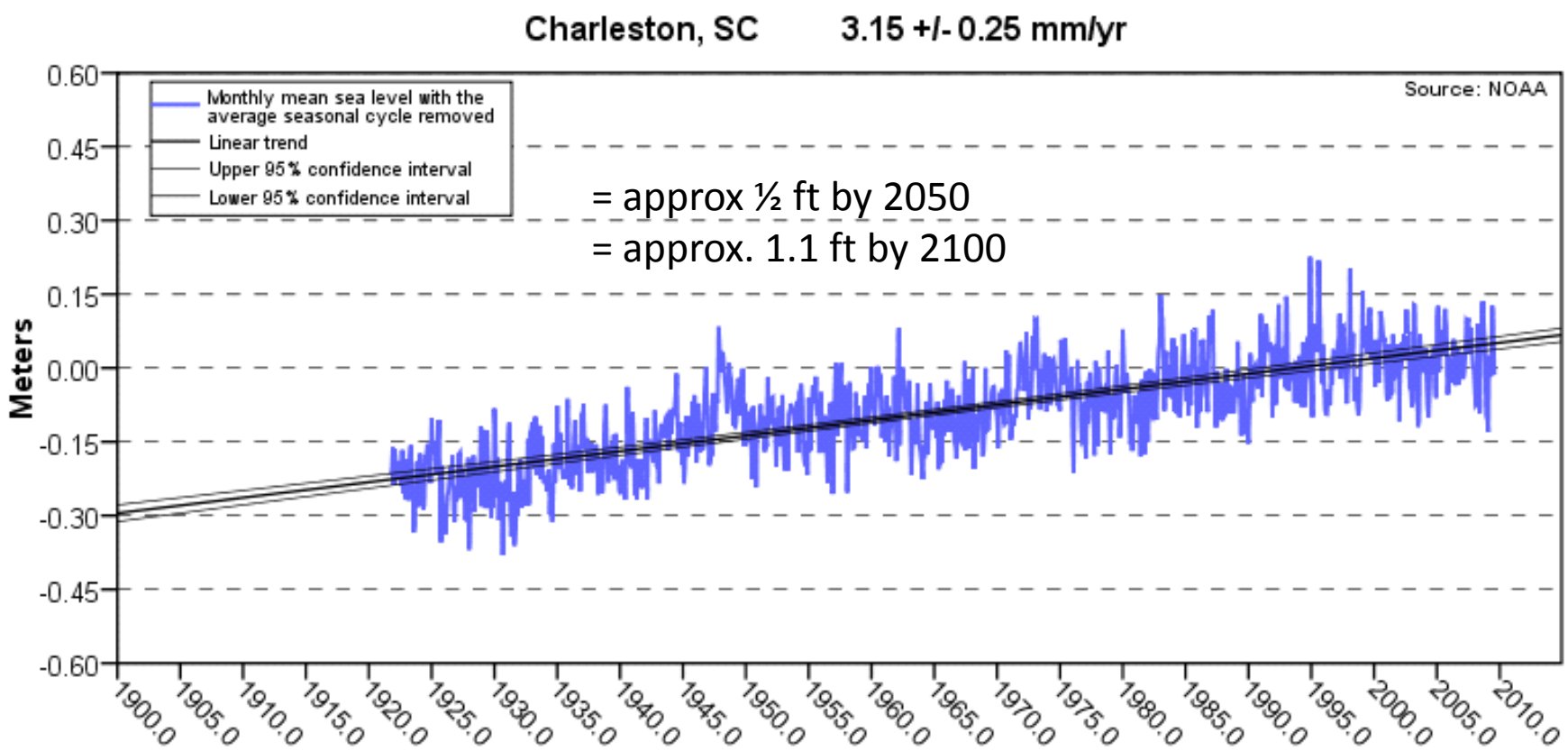


Oyster Reefs in Cape Romain Area

Conclusions

- We will have to deal with increasing coastal erosion problems on our beaches
- If retreat is not an option, nourishment needs to be done
  - In a way that minimizes long term adverse ecological effects
  - Brings new sand into the active beach system
- Effects of sea level rise on our marsh wetlands uncertain
  - Could be significant losses if sedimentation rates too low
  - Too much shoreline becomes armored
- Oyster resources should be fairly resilient
  - Unless marshes and sediment beds are destabilized
- Fate of threatened/endangered species uncertain

Projected Sea Level Rise



Beaufort and Sea Islands
Projected Change in Marsh versus water Base versus 2100
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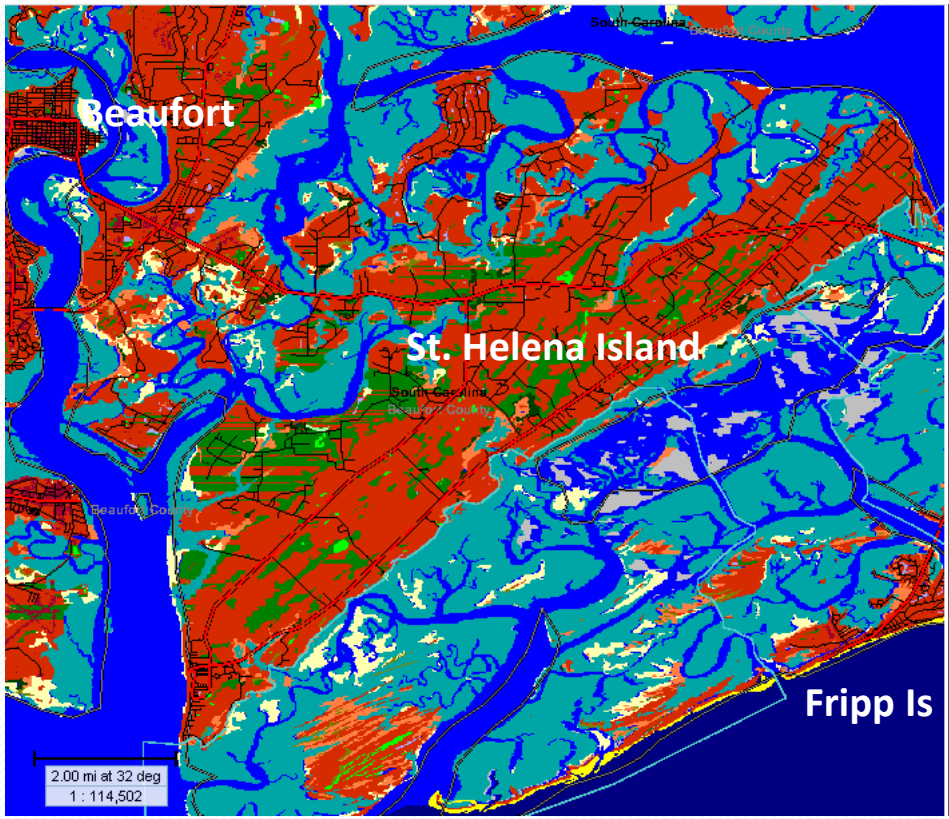

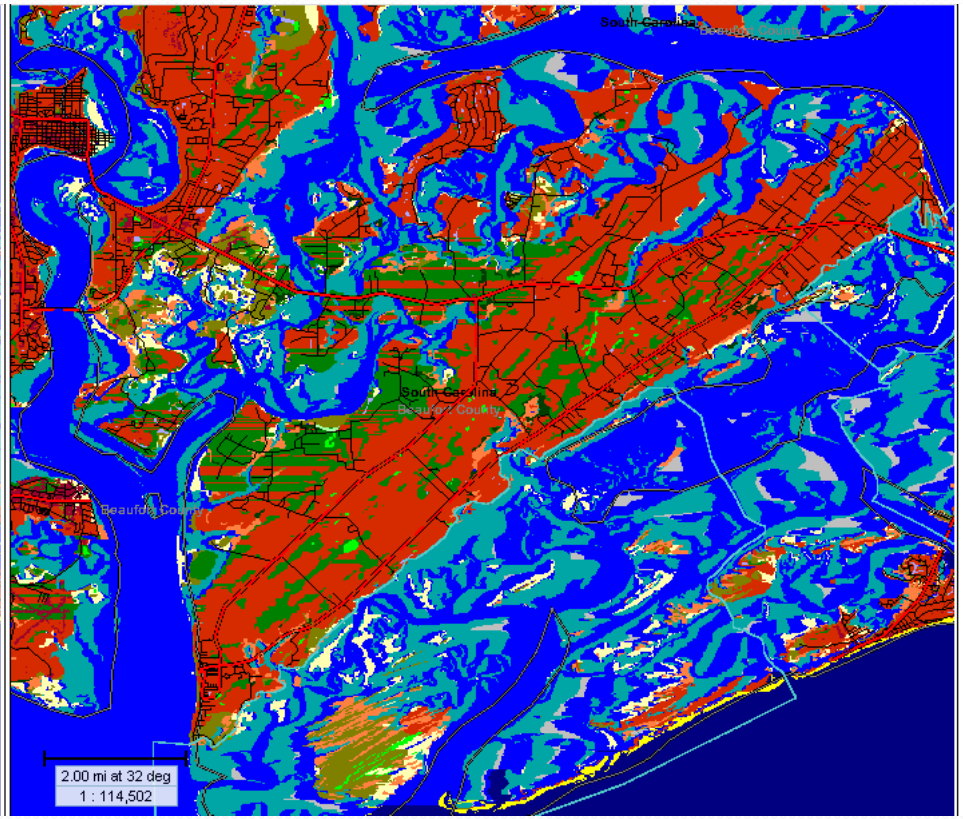

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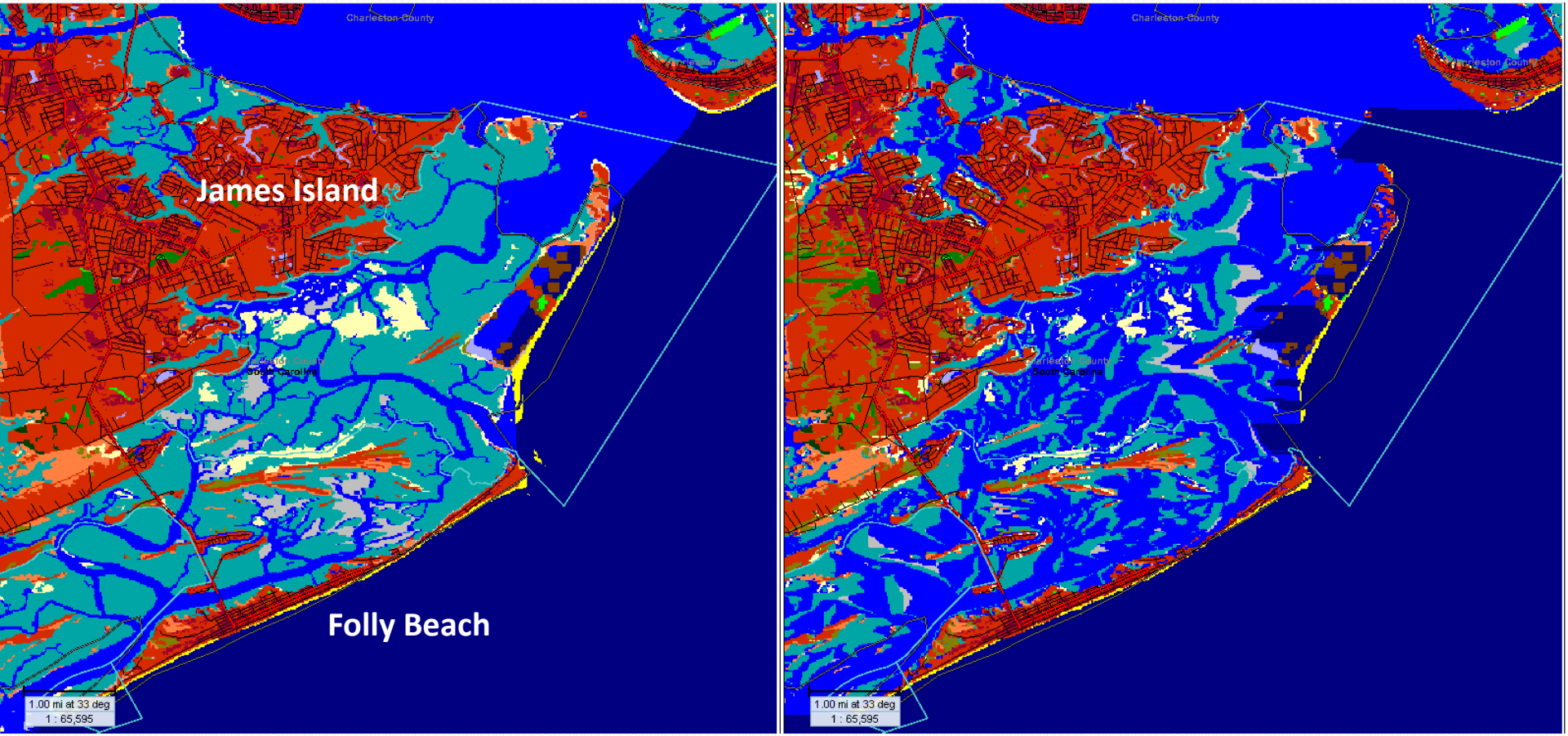

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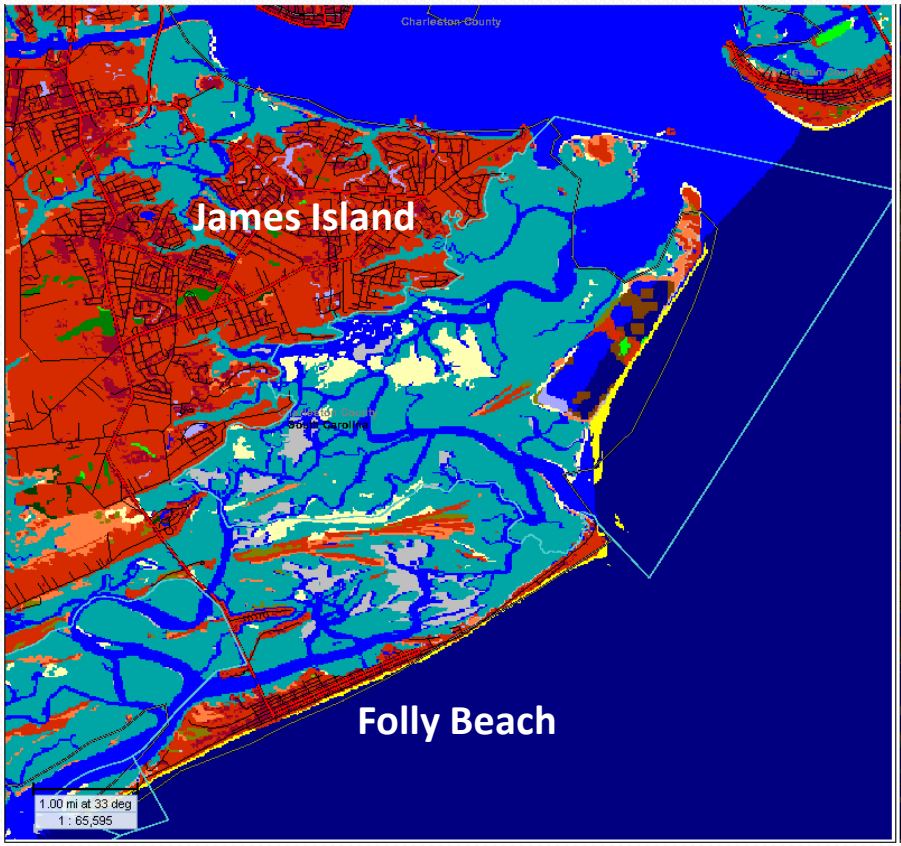

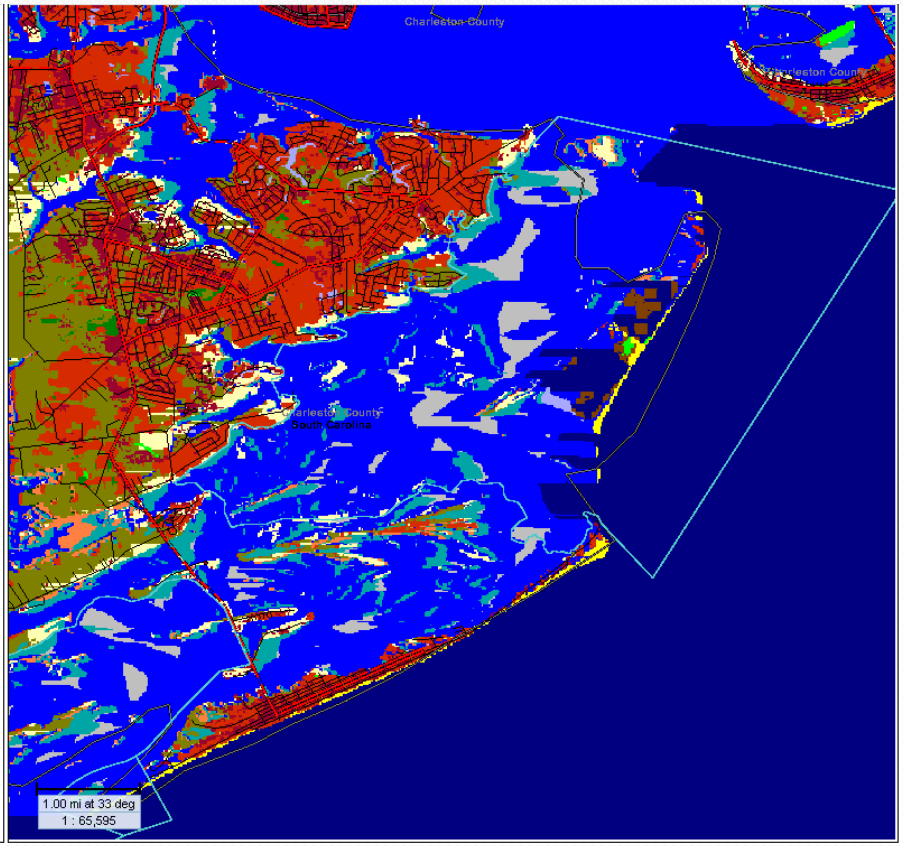

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Oyster Reefs in May River Area

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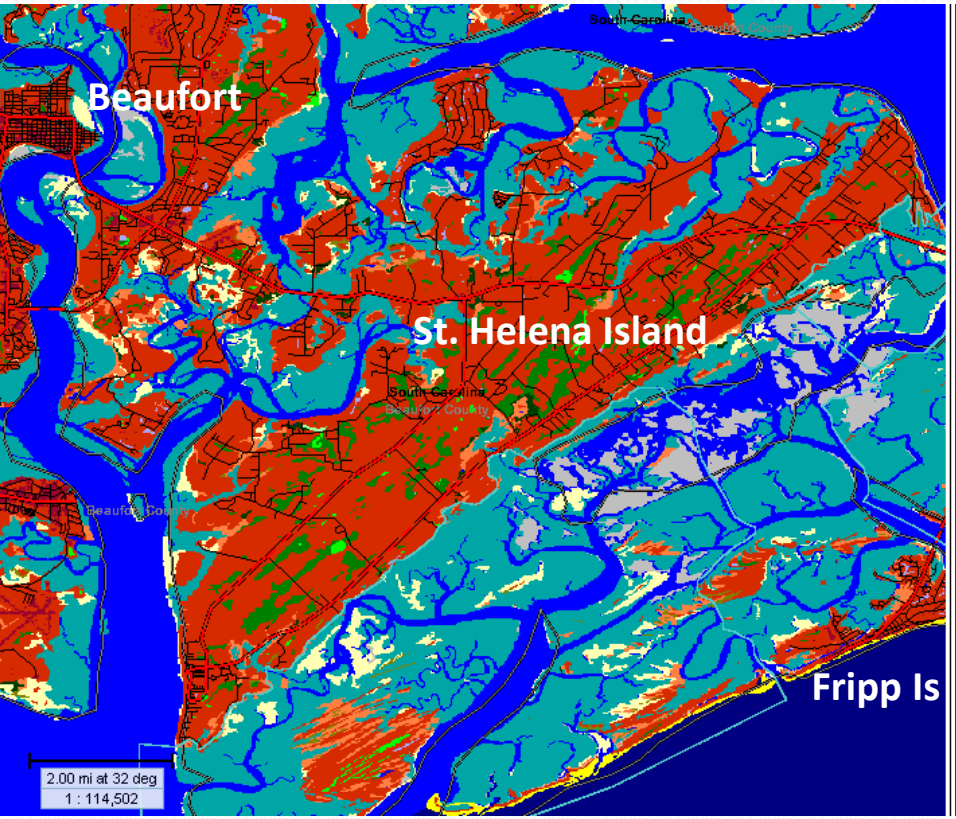

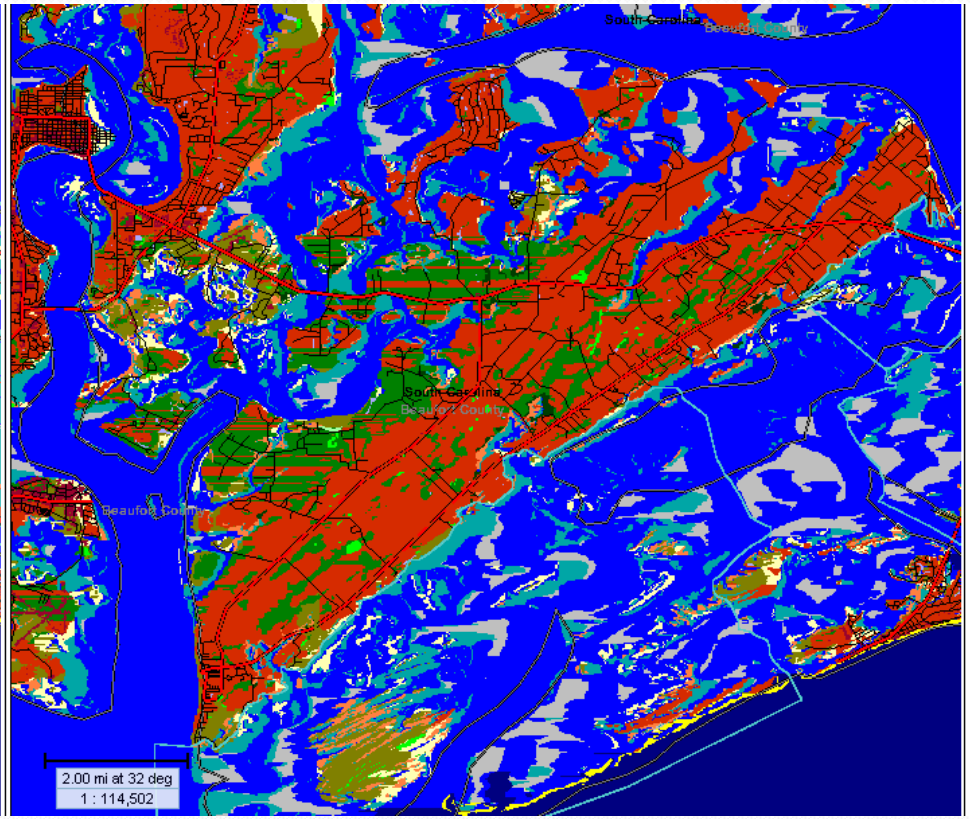

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