East Carolina University

Sea-level scenarios for Coastal Carolina

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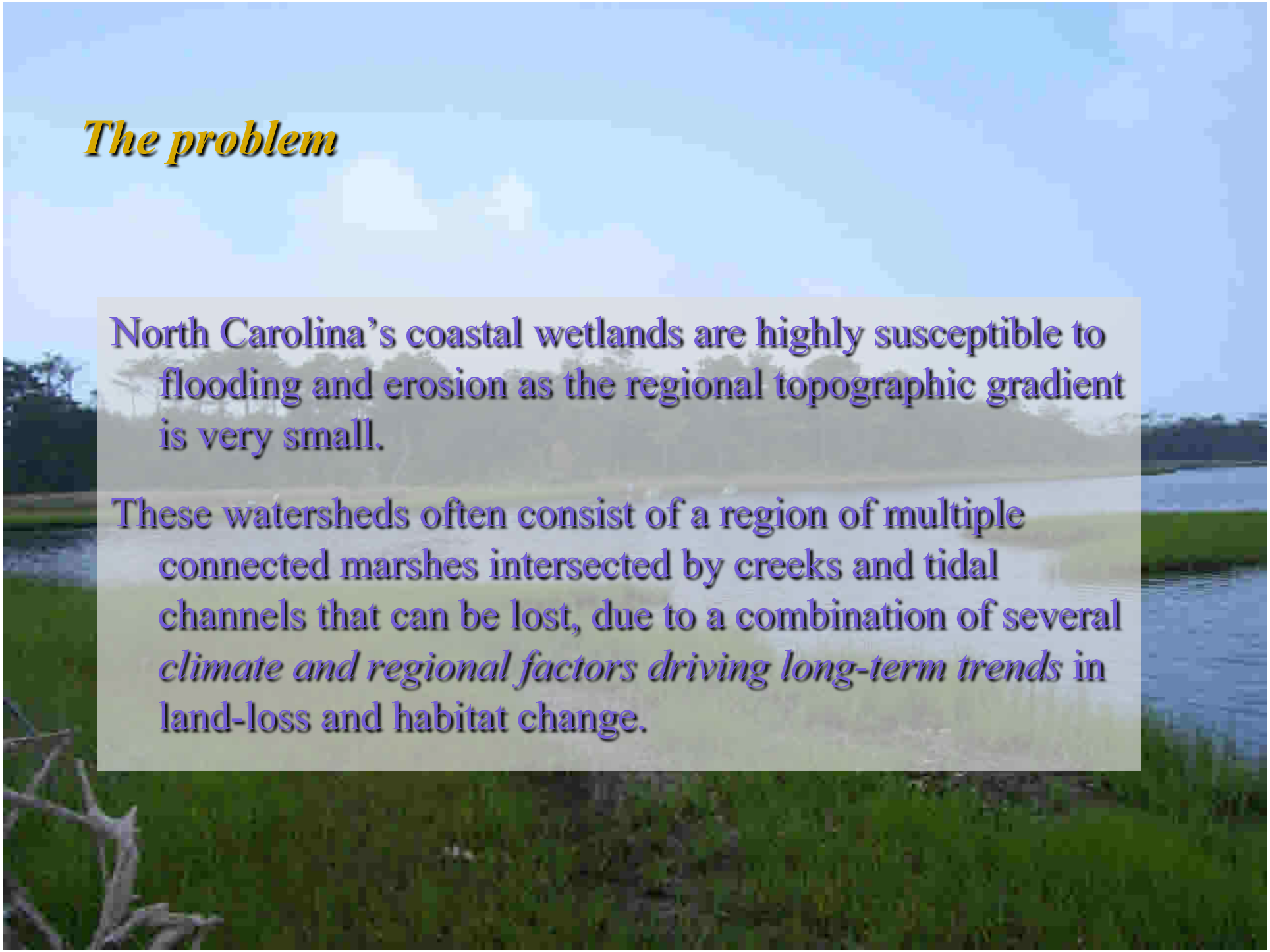


The problem

North Carolina's coastal wetlands are highly susceptible to flooding and erosion as the regional topographic gradient is very small.

These watersheds often consist of a region of multiple connected marshes intersected by creeks and tidal channels that can be lost, due to a combination of several *climate and regional factors driving long-term trends* in land-loss and habitat change.

The solution?

Stewardship

Scientific-based decision making

Stakeholder Participation

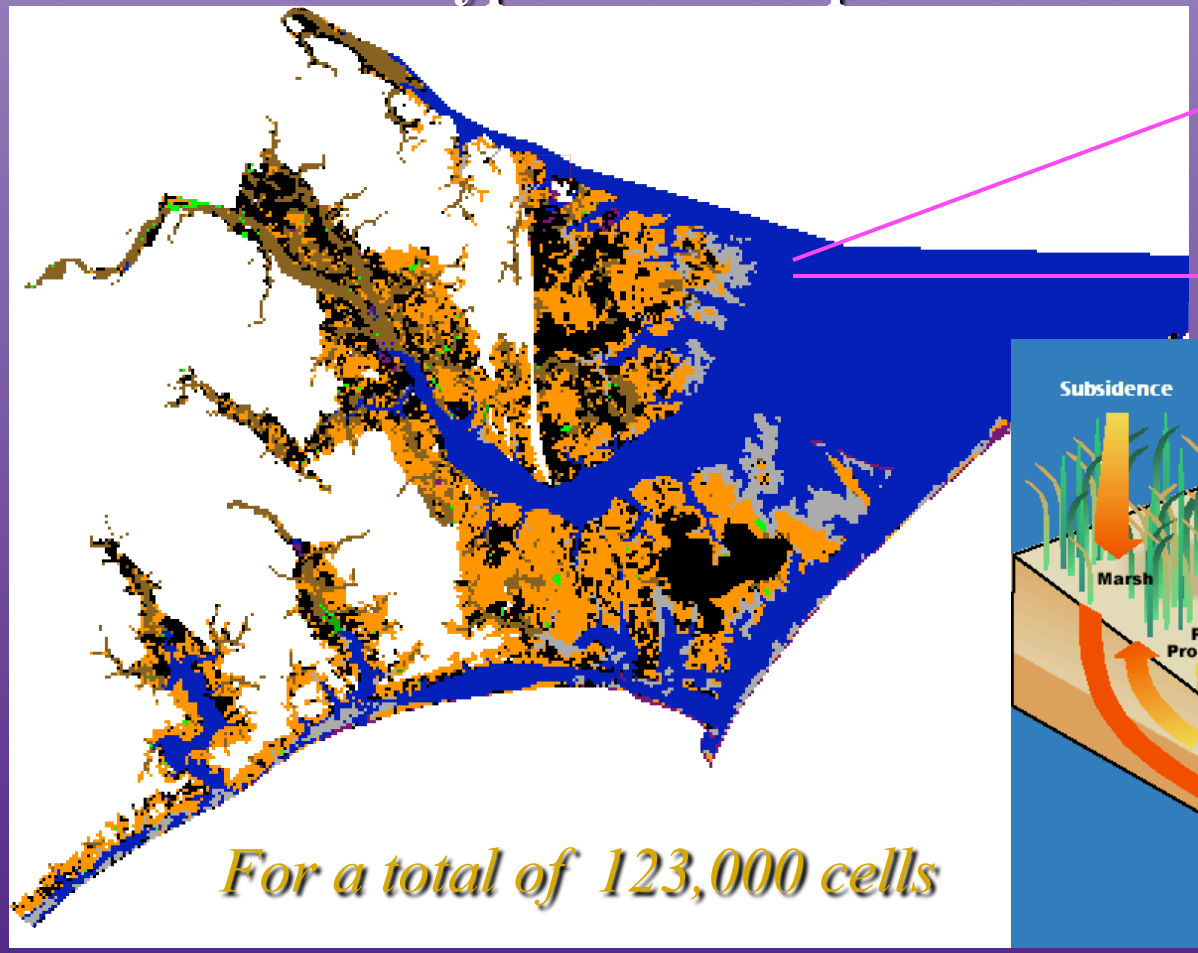
Research Objectives

Create a landscape model focused at the mid and long - range temporal / spatial scales for a landscape in eastern North Carolina that explore the near-shore hydrodynamics and the wetland interactions

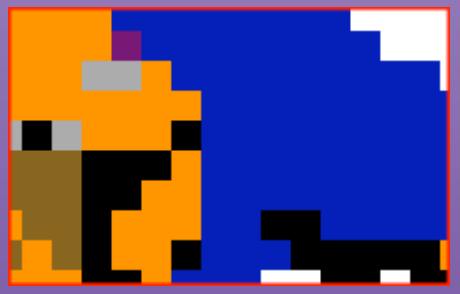
- To impose mechanistic models representing watershed functioning.
- To understand diverse time and spatial scale processes using a combination of modeling and model calibrating measurements.

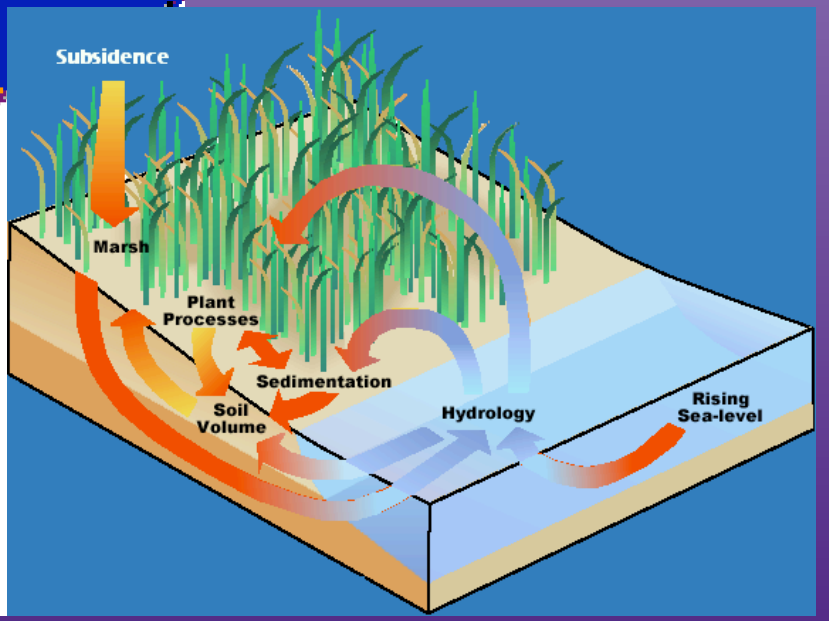
Watershed Processes

Each cell contains a *unit ecosystem model* representing a certain habitat type and incorporates location-specific algorithms.

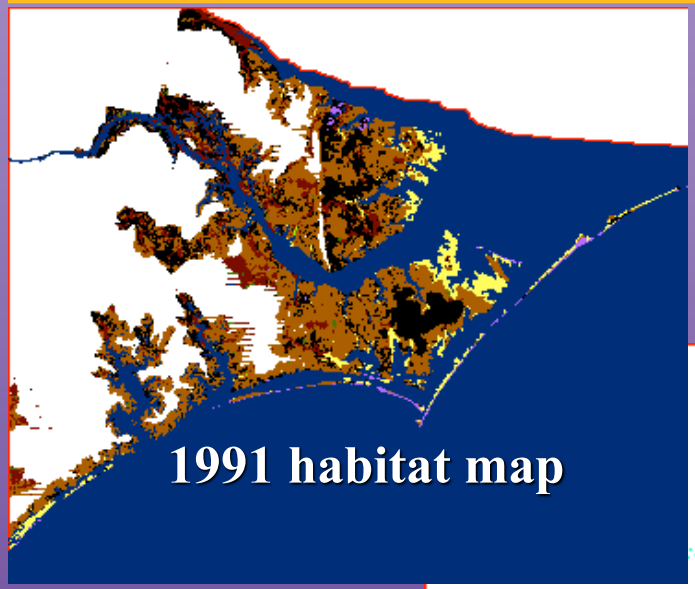


For a total of 123,000 cells



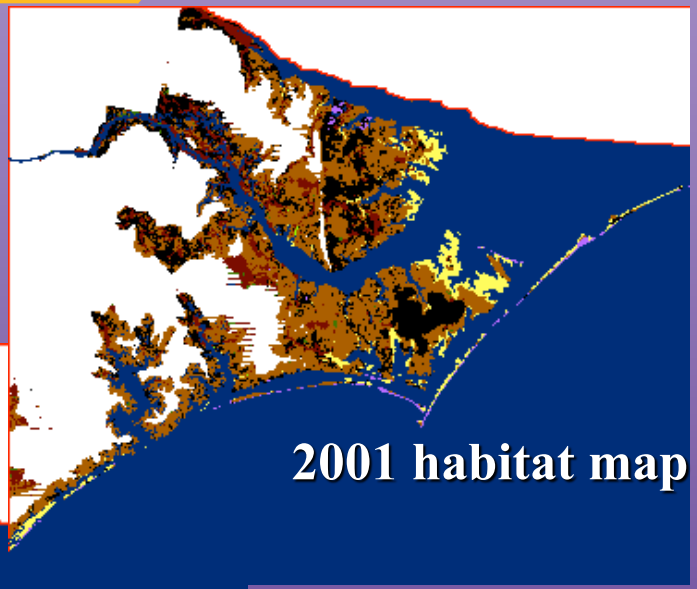


Inputs: 1991 habitat map vs. 2001 habitat map



1991 habitat map

"Difference" map

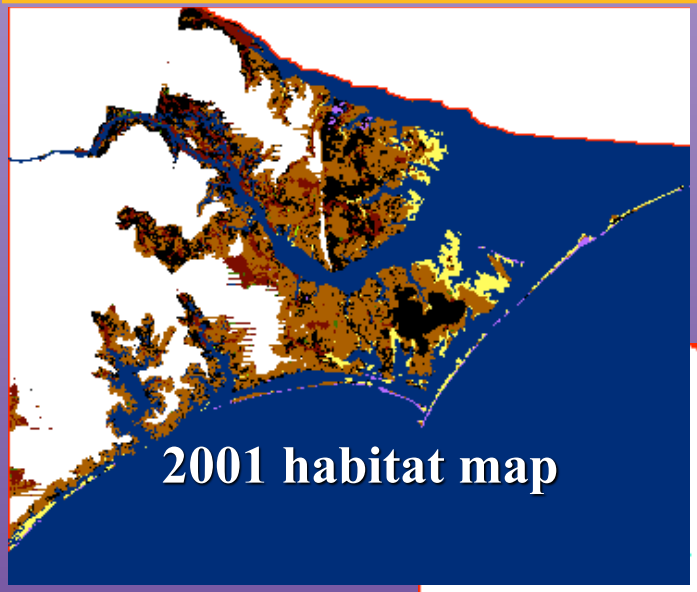


2001 habitat map

Fit Index 85.56

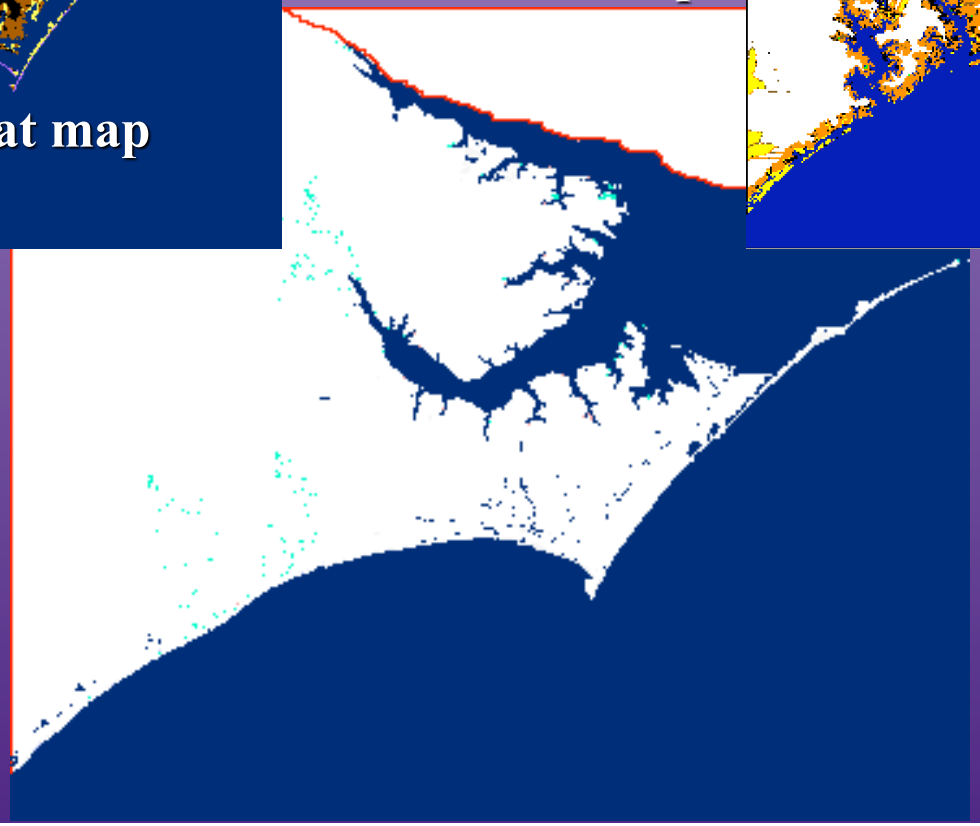
SIMULATION RESULTS

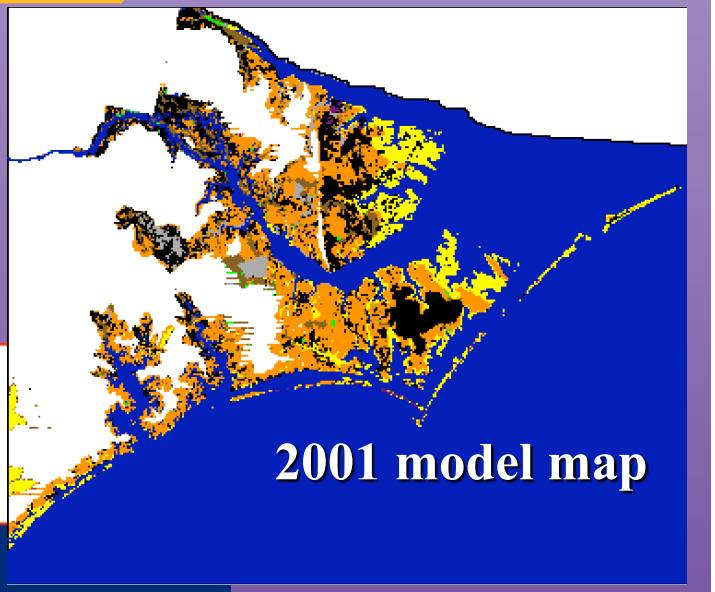
Calibration: 2001 habitat map vs. 2001 model map



2001 habitat map

"Difference" map

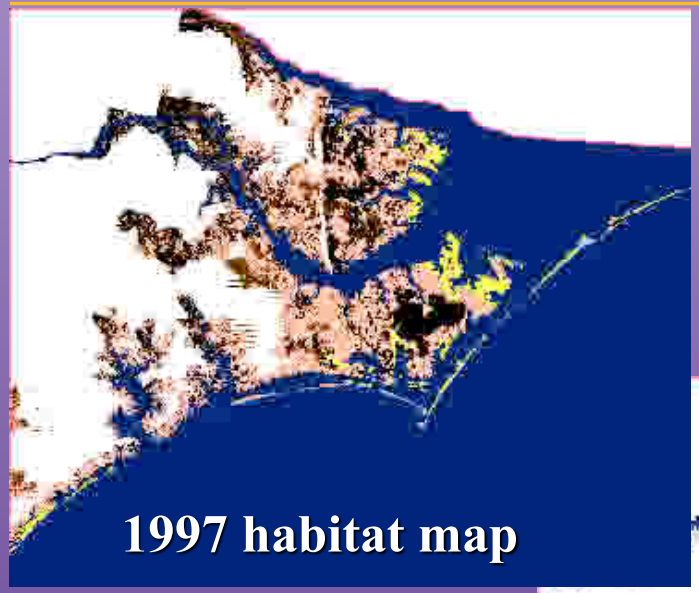




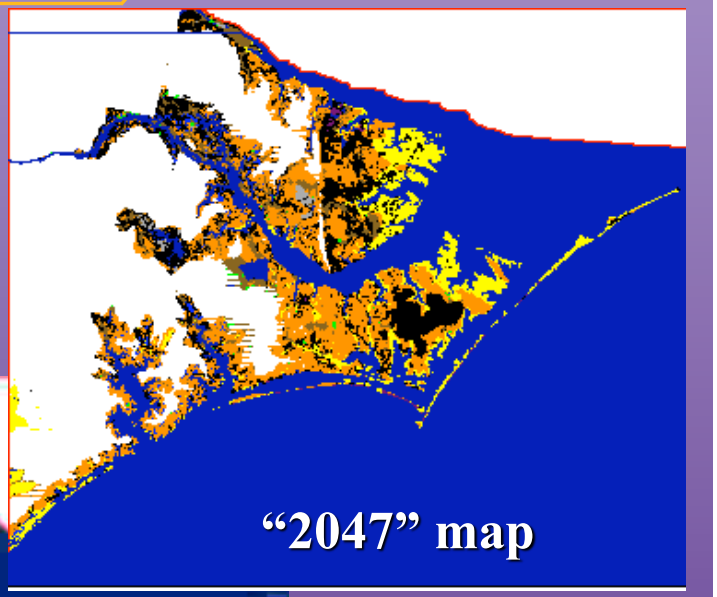
2001 model map

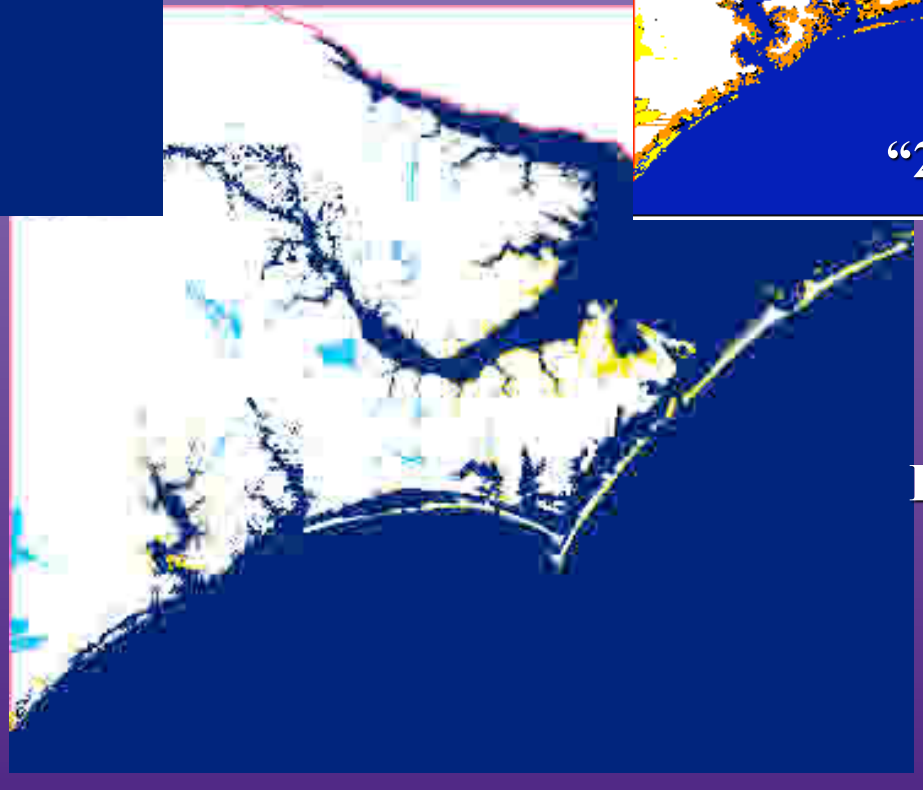
Fit Index 84.9

Present SLR (3.8 mm/yr): 1997 habitat map vs. 50 yr model



"Difference" map





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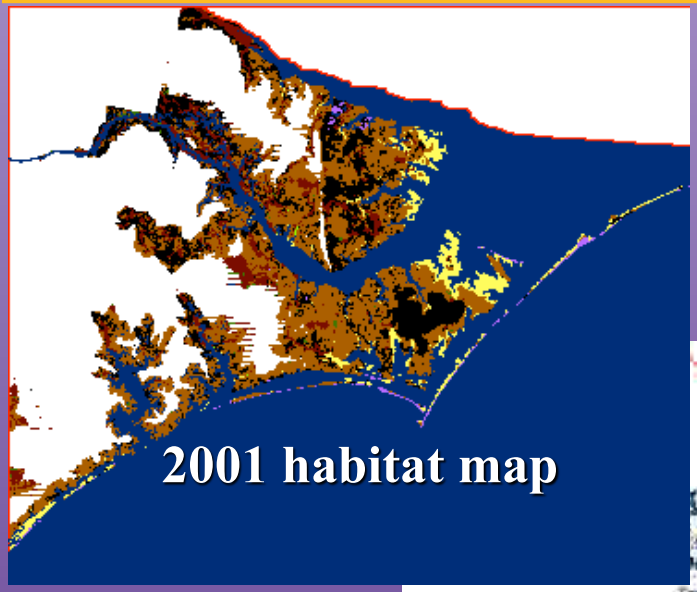
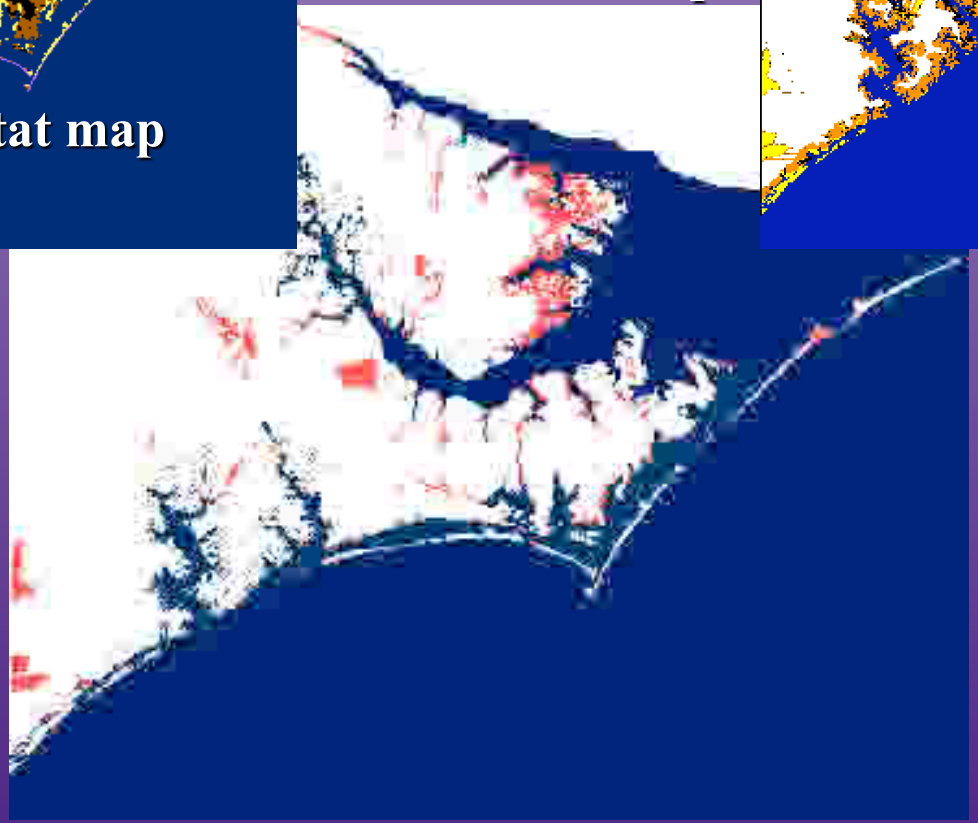
Habitat comparison

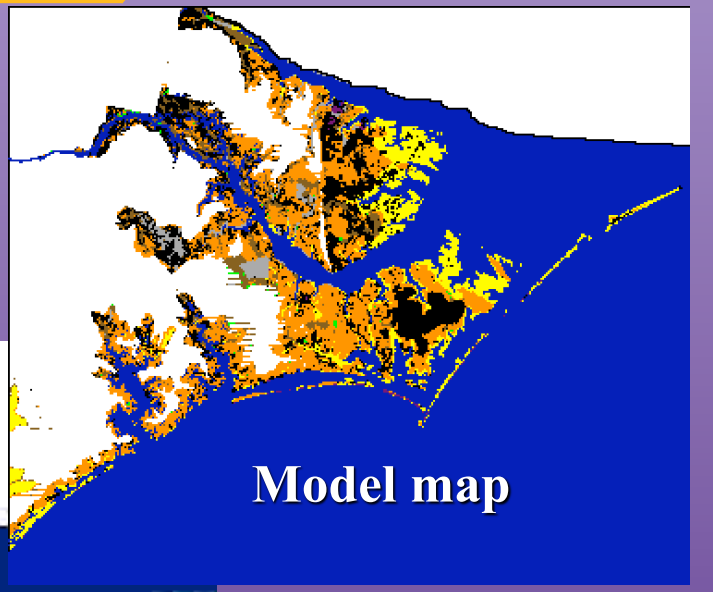
Zone Description	1997 cells	2047 cells
intermediate	96	97
fresh	8	4
swamp	2103	1607
brackish		162
saline marsh	1362	3119
forest	9871	8184
barren land (sand)	244	107
water	53668	54072

Holocene SLR (15mm/yr): 2001 habitat map vs. model



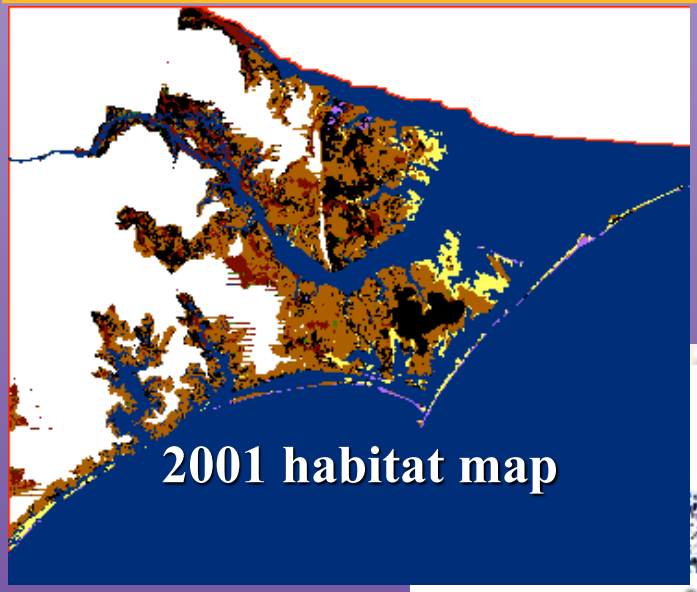
“Difference” map



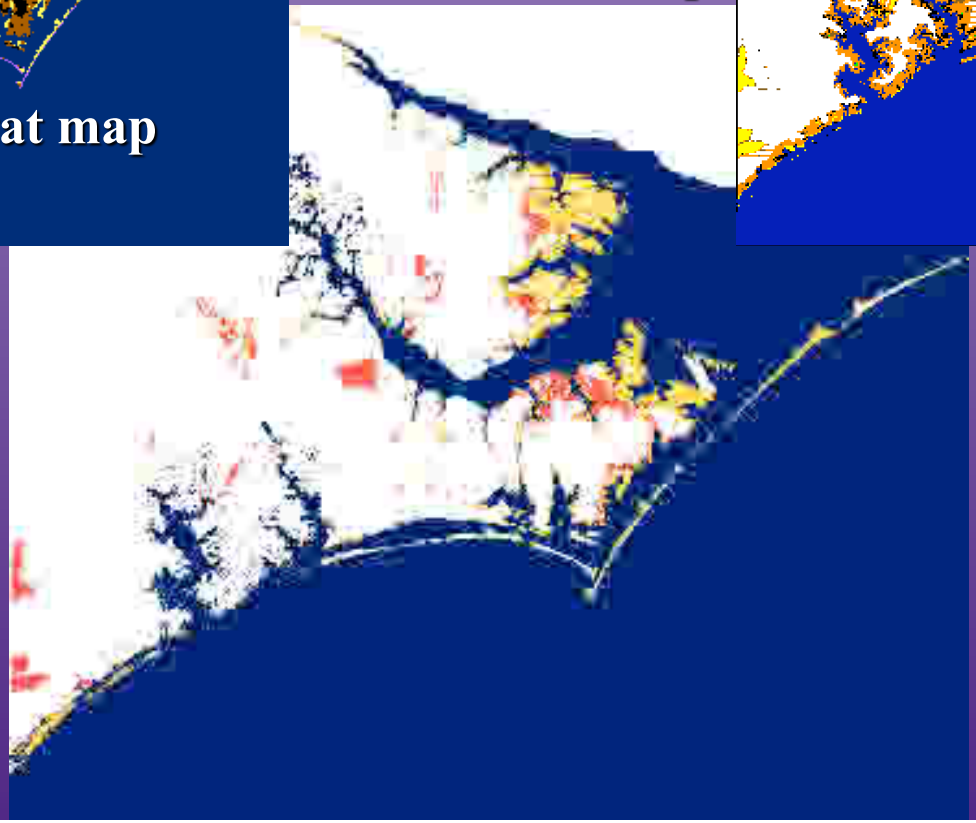


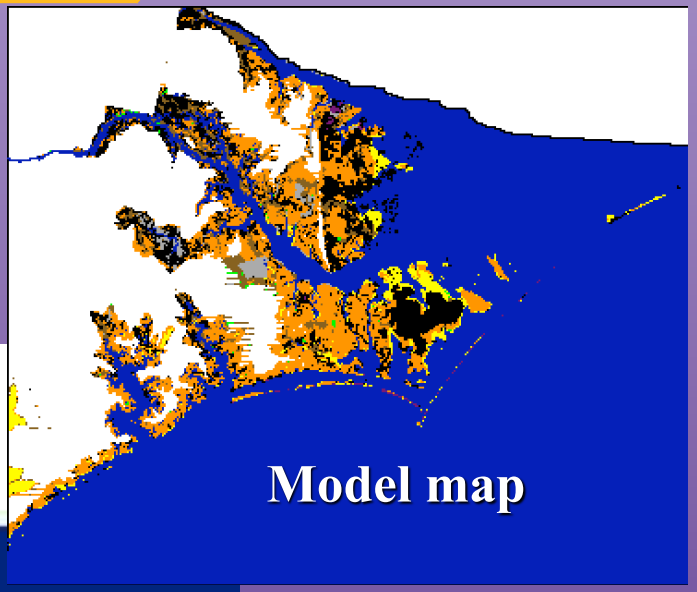
Fit Index 61.35

Catastrophic SLR (50mm/yr): 2001 habitat map vs. model map



"Difference" map





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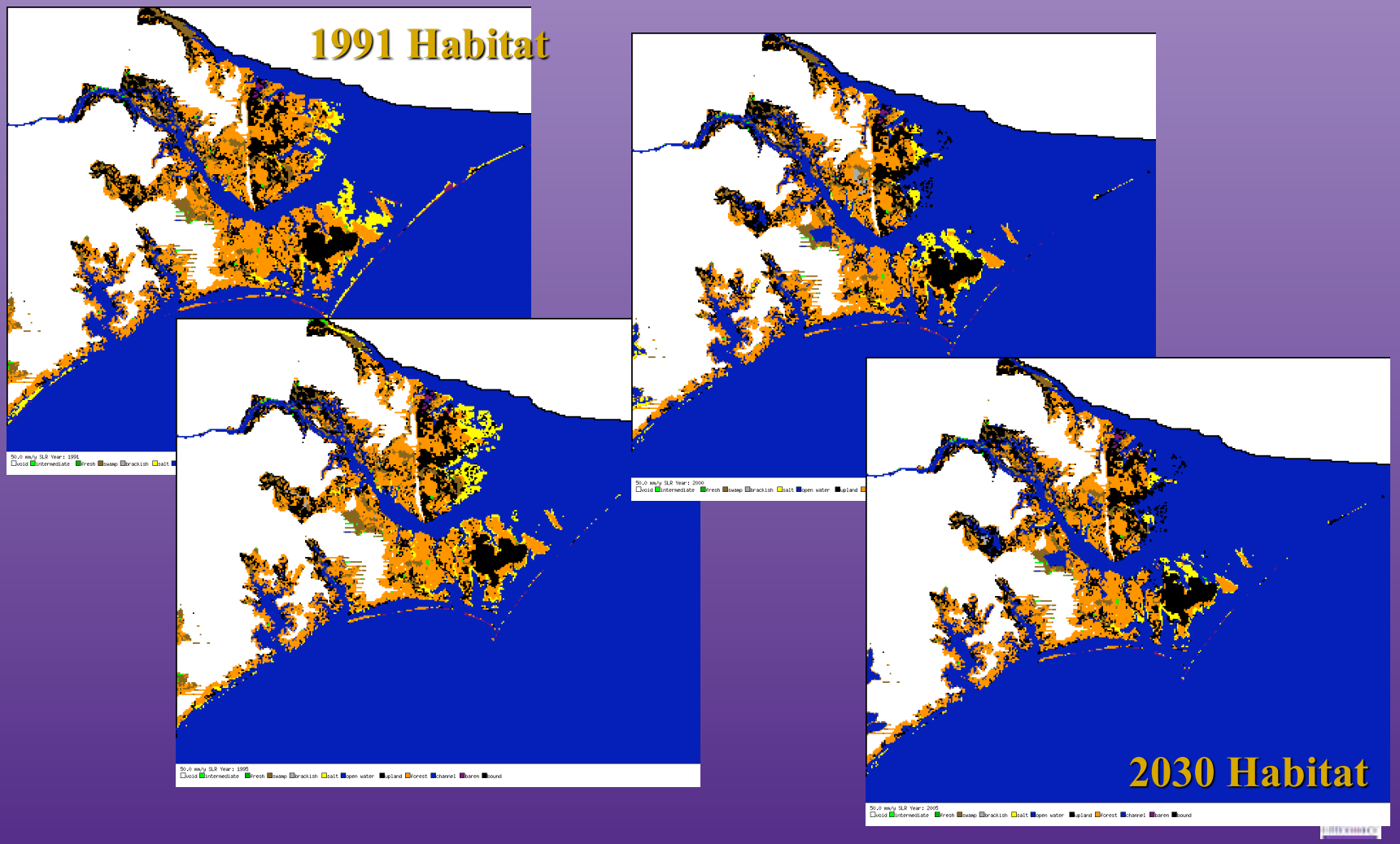
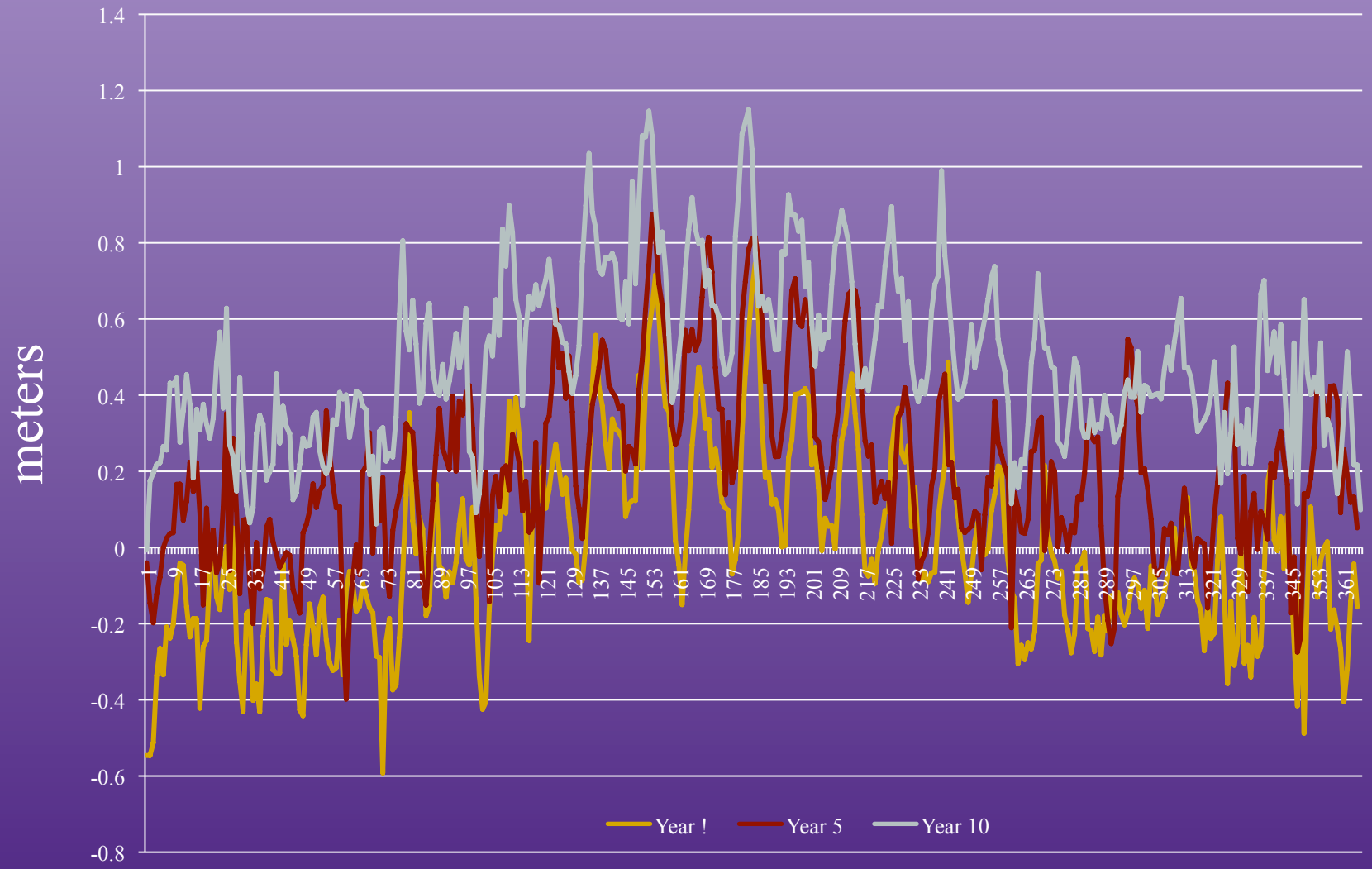
Results - preliminary run (catastrophic SLR)



Resulting daily tidal signal for catastrophic SLR (50mm/y)

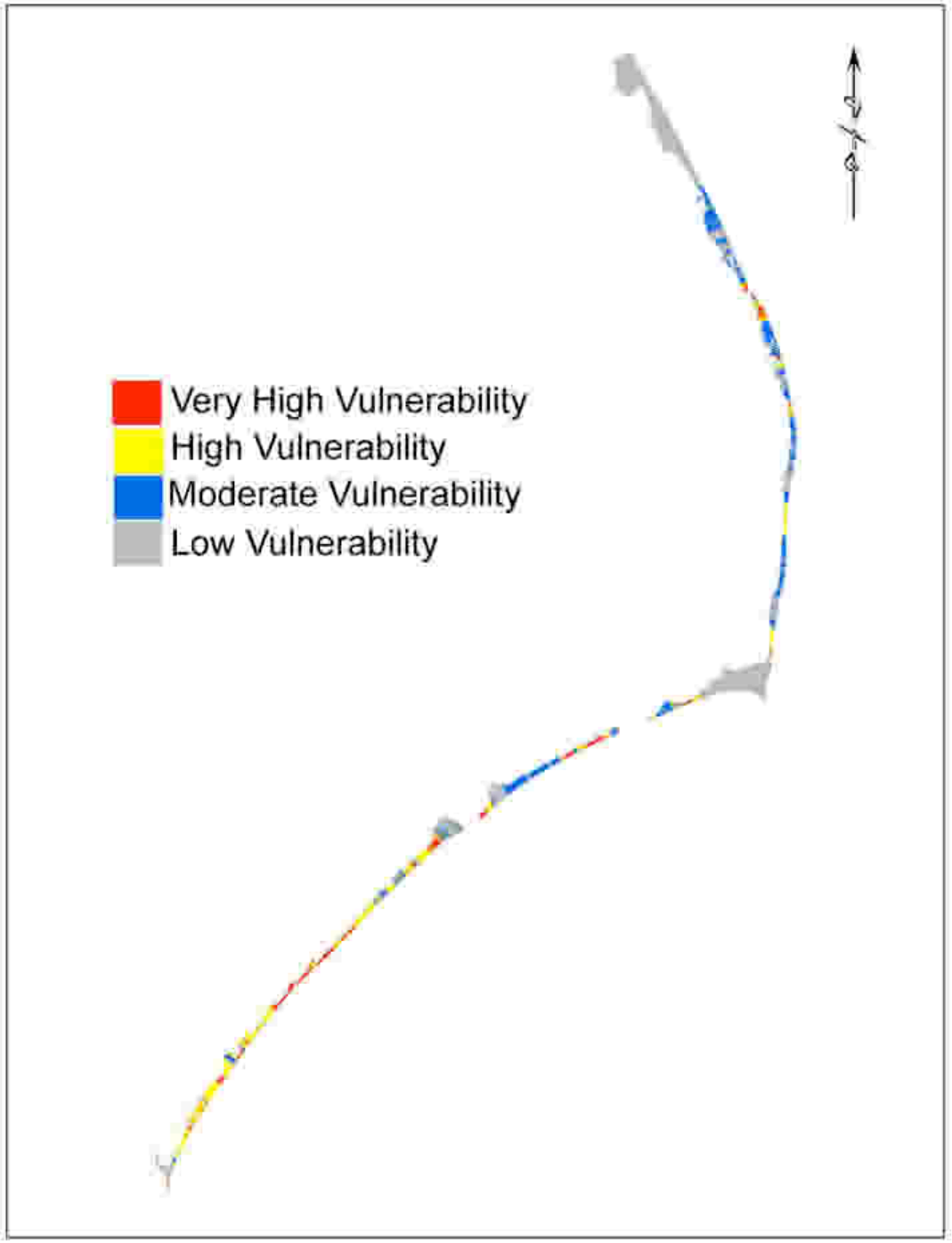


Coastal Vulnerability

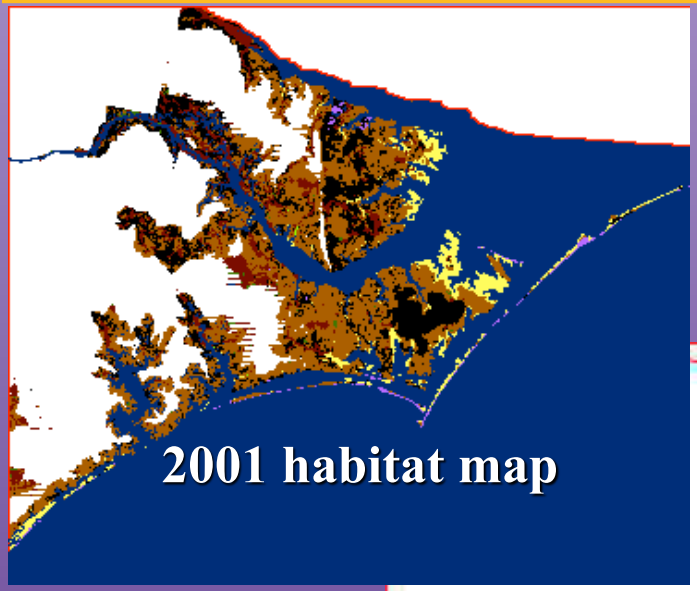
Barrier Islands in coastal Carolina are dynamic geomorphic elements susceptible to erosional forces by storms and hurricanes

Portions of the barrier island complex can disappear rapidly

Assess effects on inner banks habitats

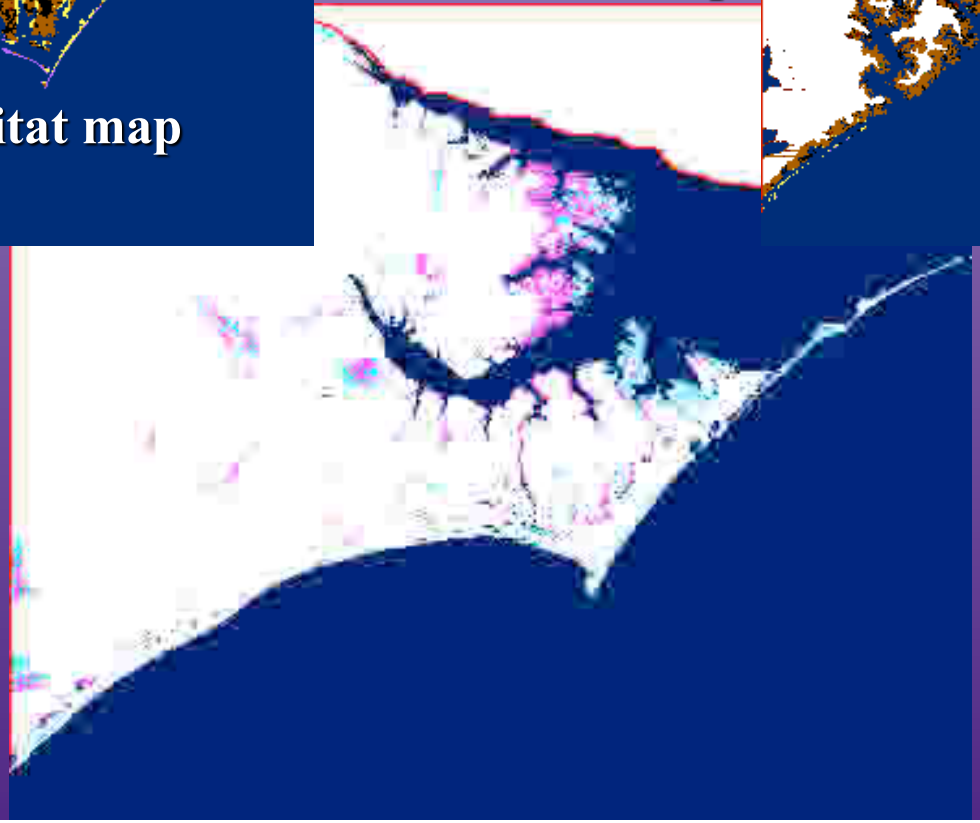


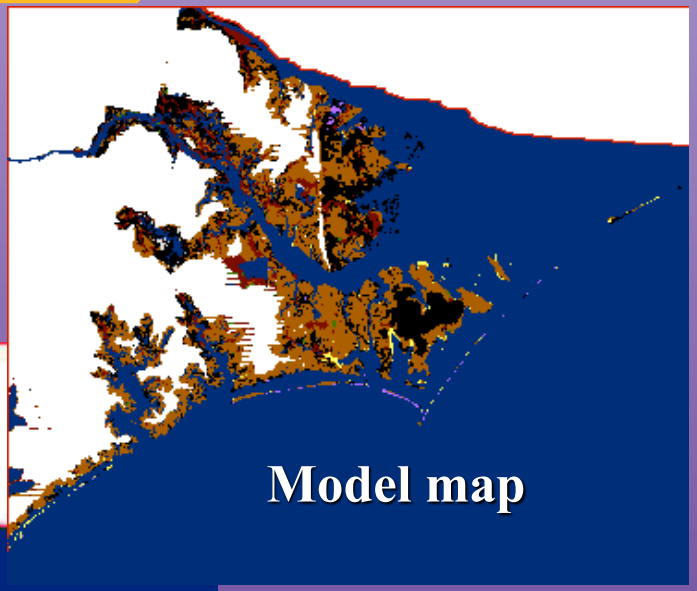
Coastal Vulnerability: 2001 habitat map vs. model map



2001 habitat map

"Difference" map





Model map

Conclusions

- Historical maps don't show a clear effect by RSLR
  - Confounding factors include: development and forestry
- "Big Squeeze" is already happening.
  - Migration options for coastal vegetative communities are being severely reduced
- Regional simulations are a useful approach to evaluate single environmental drivers
- Regional simulations show good agreement with historical maps