INTEGRATED ECOLOGICAL MODELING WITHIN THE USACE

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Integrated Ecological Modeling Team

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Integrated Ecological Modeling

Our understanding of the modern environment is becoming more and more complex. These systems require integrated approaches to capture the critical processes affecting these issues

ERDC Integrated Ecological Modeling is a state-of-the-art research program centered on developing robust quantitative models that integrate engineering and ecological approaches to better predict environmental response.

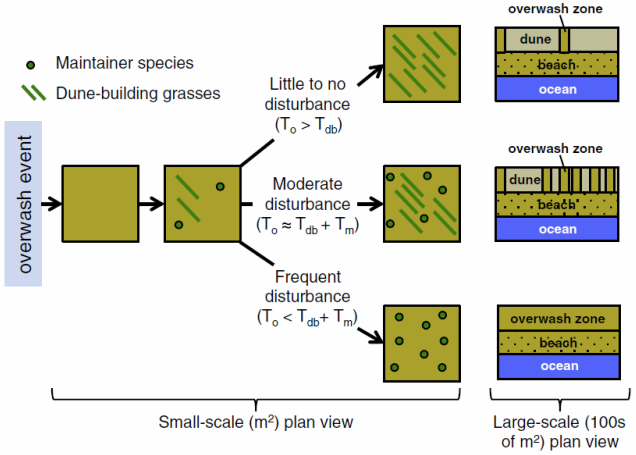
Team (5, 4 PhD)

- Two Ecologists, Three Engineers

Research Focus

- Linking spatial and temporal scales of physical and environmental processes
- Model integration

How do we model vegetation growth and dune recovery between storms?



from Wolner et al., 2013

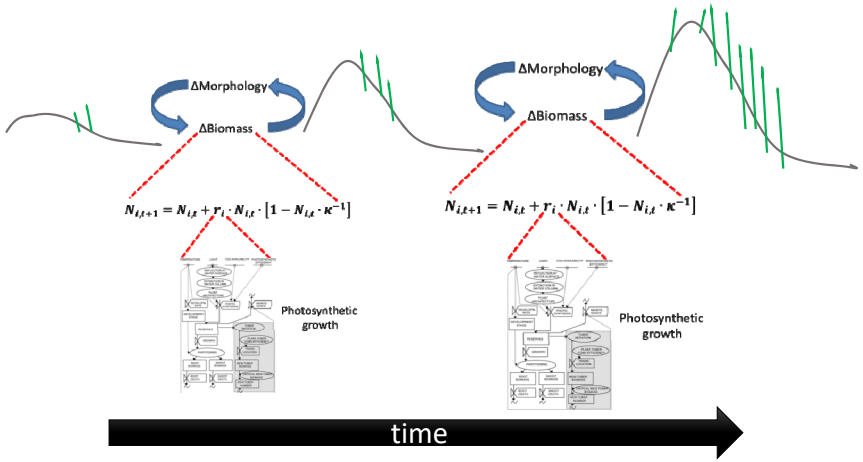
Problem: Vegetation effects are not included in coastal morphology models.

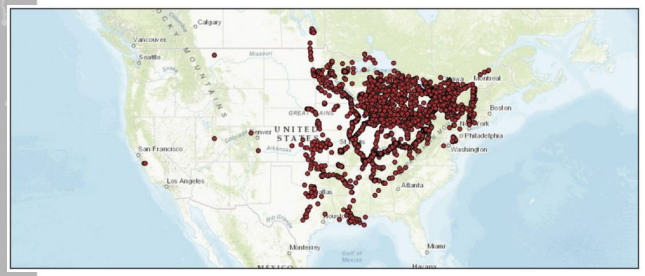
Research Question: How does this affect our model predictions, especially over multiple years?

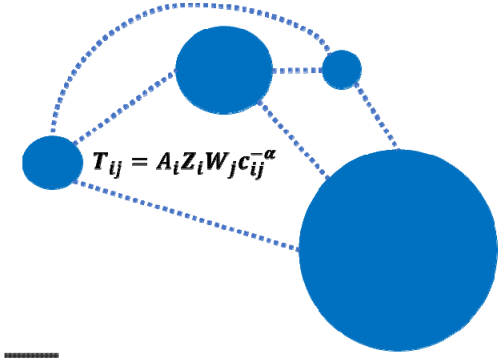
Methods: Couple vegetation growth model with a coastal morphology model to account for vegetation effects

Next Steps: Validate model at various sites eastern and Gulf coasts

Vegetation biomass enhances dune growth







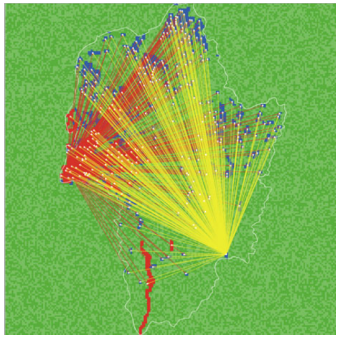
Invasive Species

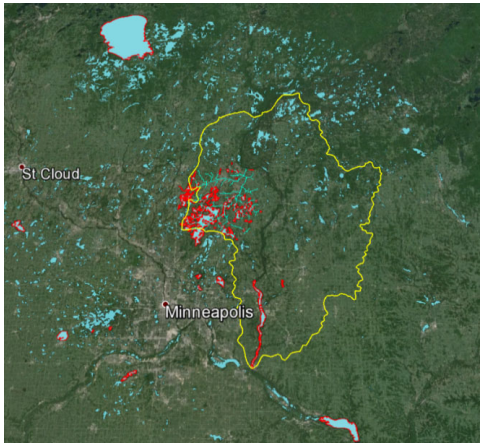
Problem: Dreissenid mussels invasion expected to cost $3.1B over next decade

Research Question: Can colonization be predicted across large scales (e.g., Western US)

Methods: Linked hydrodynamic, human behavior and ecological models to predict areas with highest likelihood of colonization

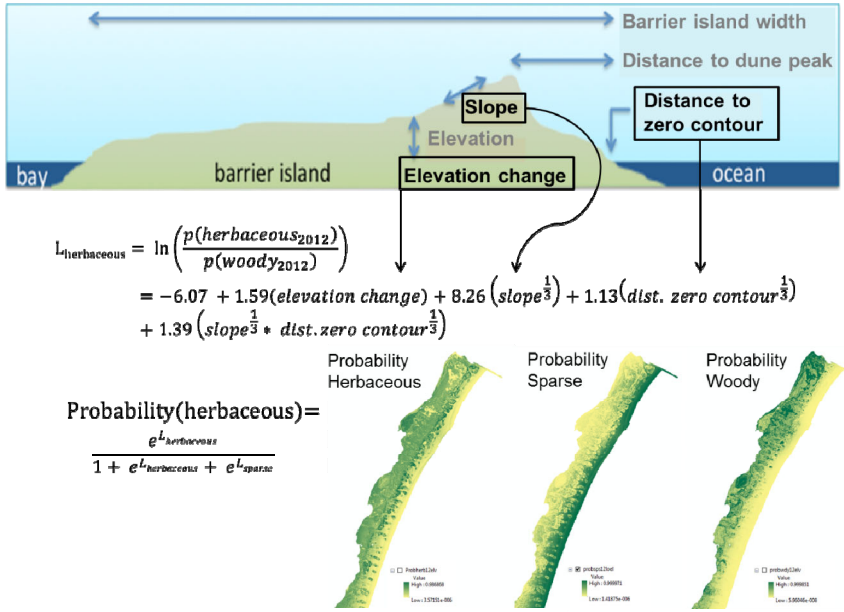
Next Steps: Collaborating with Texas State University and US Bureau of Reclamation to forecast spread across entire western US

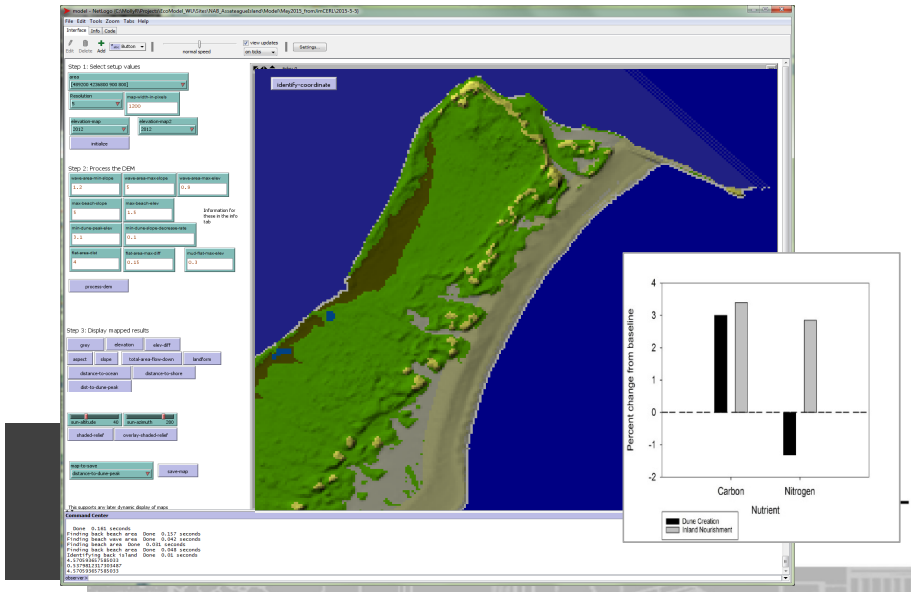




Linking landscape change to ecosystem services

Research Question: How does the spatial configuration of a landscape impact ecosystem services?
Methods: Developed models to predict landscape composition based on metrics derived from remotely sensed imagery. Integrated those models with ecosystem service models predict nutrient sequestration across entire landscape
Next Steps: Can dredge material be placed in such a way that it optimizes ecosystem services?



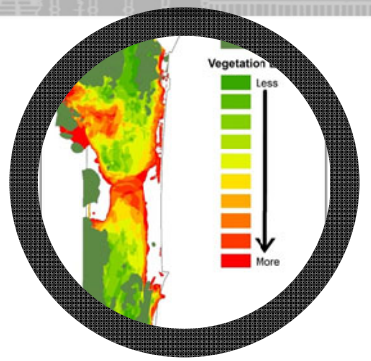


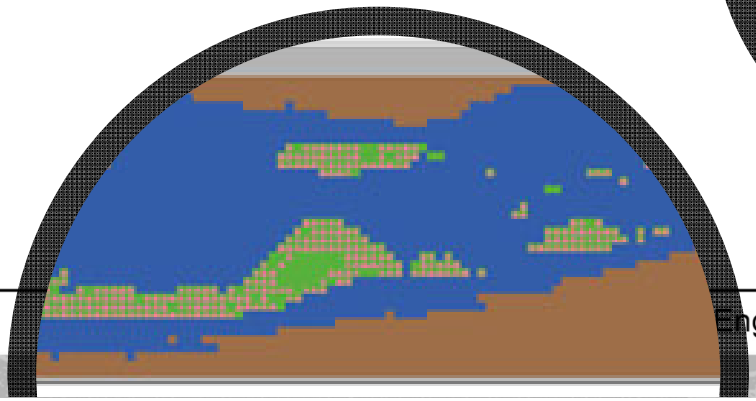
Environmental Flows

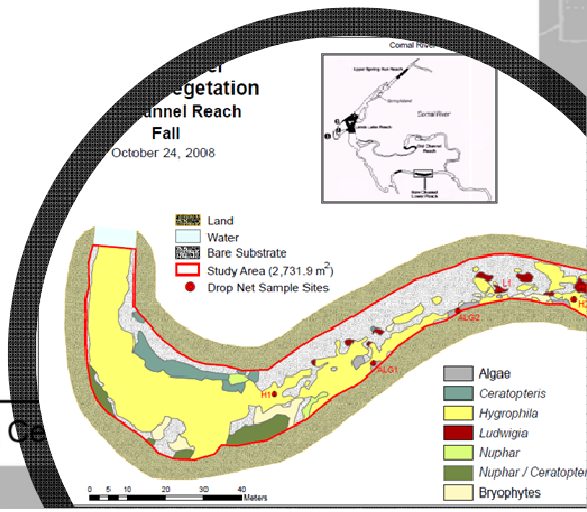
Problem: Balancing urban water use with environmental sustainability will be a major issue in the next 50 years, especially for systems with T&E species. Brought in to develop predictive framework for Edwards Aquifer Authority (water authority for San Antonio, TX). Multiple T&E species, high water use, heavily developed urban watershed

Method: integrated hydrodynamic, water quality, endangered fish and plant movement, growth and population models to determine how different water usage strategies would impact T& within rivers systems.

Next steps: Expand to other systems with similar issues







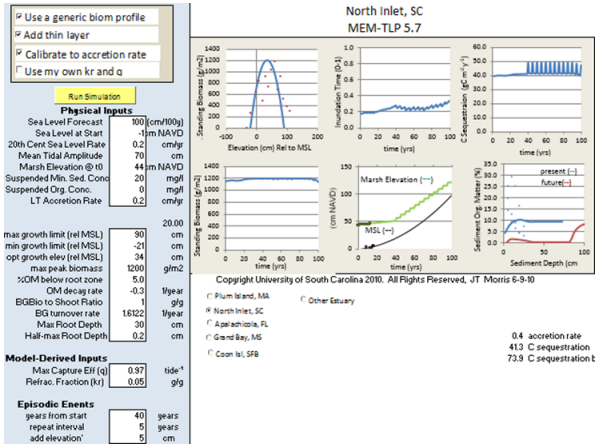
Using sediment to help marshes adapt to SLR

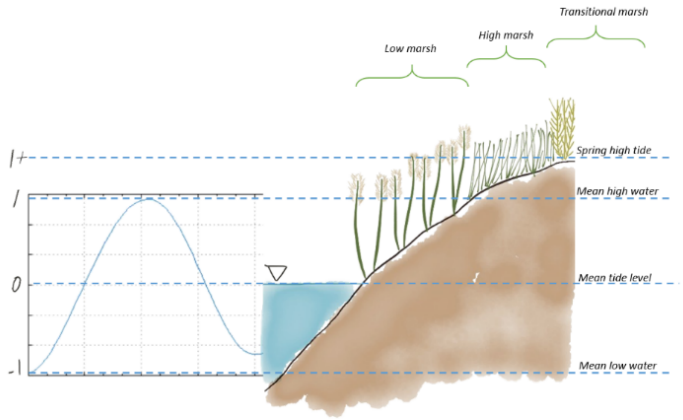
Problem: Coastal wetlands are degrading due sea level rise, sediment transport alterations, and human development

Research question: How much sediment is required for marshes to maintain elevation relative to local sea levels?

Methods: Modify the Marsh Equilibrium Model to include the effects of episodic sedimentation from thin layer placement or storms

Next steps: Field test model for planning new wetland TLP projects





Integrated Ecological Modeling

Collaboration is the key to success…

…we collaborate with hydrodynamic and morphology modelers, geographers, field scientists, mathematicians, biogeochemists, economists, statisticians, policy wonks, anyone!

We work on high profile topics and opportunities exist for many systems…

…any aquatic ecosystem across multiple spatial and temporal scales at multiple levels of complexity

Our program is diverse and would love to collaborate with University of Oklahoma faculty and students.

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GoTeamEcoMod