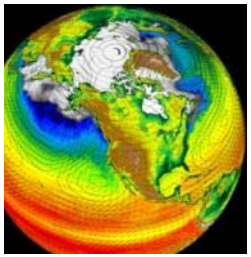
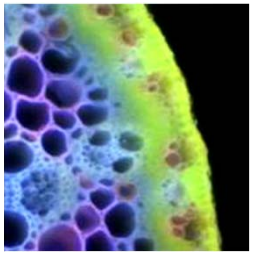
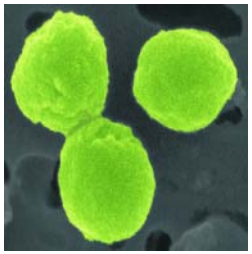


# Terrestrial-Aquatic Interfaces Workshop Update

## Research priorities to incorporate terrestrial-aquatic interfaces in Earth system models

**September 7-8, 2016 (Rockville, MD)**

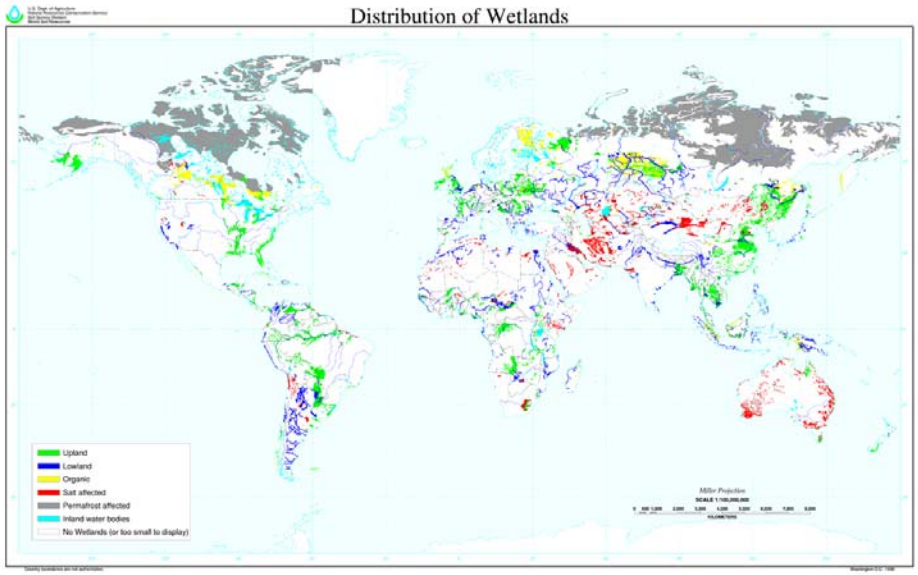
BERAC
October 27, 2016

**Jared L. DeForest, Ph.D.**
Daniel Stover, Ph.D.
Terrestrial Ecosystem Sciences

# What is a Terrestrial-Aquatic Interface (TAI)?

## General Description

- Highly dynamic ecosystems developed from a near balance between terrestrial and aquatic conditions forming unique processes and community assemblages.




## CESD-Relevant criteria for TAI

- Carbon-rich (e.g. $CO_2$ & $CH_4$ flux)
- Globally ubiquitous
- Sensitive to climate change
- Under represented in process & Earth system models

# TAI workshop, why the need?

- The unique ecosystem processes at the TAI have traditionally been excluded in Earth System Models
  - Current process level understanding of key carbon-related processes is insufficient for a reliable predictive understanding of climate change
  - Coastal areas have poor representation in ESMs, which is a critical gap
- TAI plays a critical role in biogeochemical cycling and has the potential to provide major climate forcing feedbacks
- Expected to be sensitive to shifts in moisture and disturbance regimes in response to climate change
  - Think sea-level rise, droughts, fire, etc.

# Workshop Goals and Objectives

The workshop's goal was to identify critical scientific gaps that limit our ability to represent terrestrial-aquatic interfaces in predictive models.

- Specific Objectives
  - Identify critical needs and gaps in CESD's biogeochemistry related modeling efforts to enhance the predictive capability of the Earth System as a whole;
  - Recognize the most pressing and relevant scientific questions;
  - Identify key processes, traits, existing data, and environmental characteristics;
  - Prioritize research gaps to advance the workshop goal, using experimental approaches that combine with model development and analysis.

# Workshop planning and process

- Workshop organizing committee


Vanessa Baily
(PNNL)


Pat Megonigal
(Smithsonian)

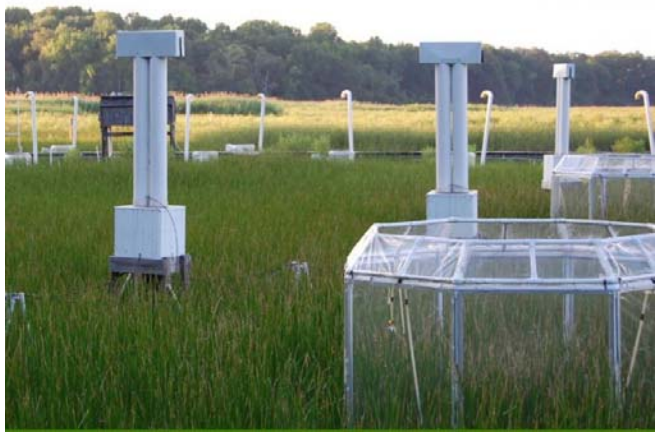

Joel Rowland
(LANL)

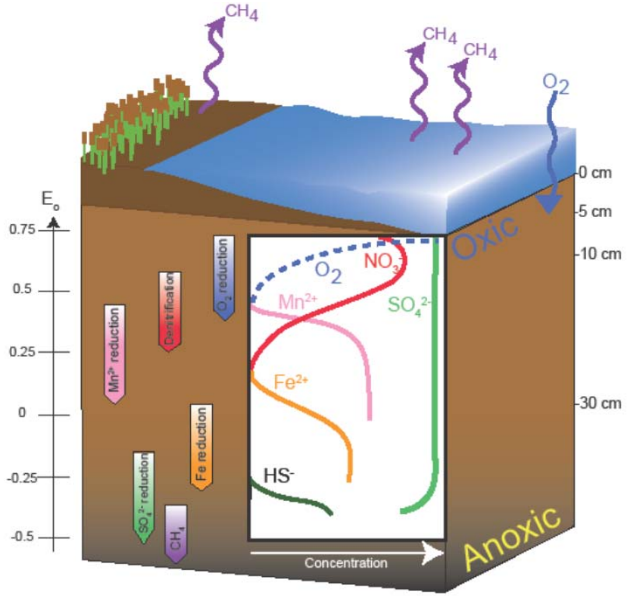

Tiffany Troxler
(Florida International Univ.)

- Invited participants (40)
  - Selected by the organizing committee with great care to represent a diversity of fields within and outside the DOE research community.
  - A subgroup (10) was selected to serve on the writing team to draft the workshop report, all participants will be able to comment and provide suggestions.
- Pre-workshop participation
  - An online questionnaire was utilized to gather ideas from invited participants.
  - Questionnaire helped the organizing committee develop the breakout questions.

# Workshop activities and initial outcomes

- Major Themes
  - Physical Processes
  - Spatial and Temporal Heterogeneity
  - Biogeochemical and Ecological Processes
  - Grand Challenges & Future Directions
- Reoccurring keywords
  - Thresholds, drivers, coupled, feedbacks, relevant spatial-temporal scales, multi-scaled models, human influences, perturbations
- Workshop report is expected to be published early 2017
  - Leads just finished sending comments to the writing team on the first order draft





# Major Research Uncertainties or Questions

## Initial outcomes that popped out of the breakout sessions

- Physical Processes
  - Lateral exchange, bidirectional movement of carbon/sediment into streams & exchange between coast and wetlands.
- Spatial and Temporal Heterogeneity
  - The scale (space & time) that is most relevant in characterizing the influence of perturbations or extreme disturbances on important TAI process and state changes.
  - The degree to which the fine scale processes scape up to influence large scale fluxes.
- Biogeochemical and Ecological Processes
  - Recognizing relevant microbial/plant traits that drive TAI specific processes and are sensitive to perturbations.
  - A process understanding of what generates resistance/resilience in TAI.

# Major Research Uncertainties or Questions

## Initial outcomes that popped out of the breakout sessions

- Better estimates on carbon pools and fluxes, but also need mechanisms and identify how generalizable they are across different TAI ecosystem.
- All TAIs are influenced by human activities, making it difficult to model socio-economic drivers that impact TAI.
- Hydrology is the master variable for understanding TAI; without that, it would be difficult to improve our predictive understanding.
- Due to the complexity of multi spatio-temporal scales, modeling resolution is most relevant to capture driving TAI processes in response to extremes?

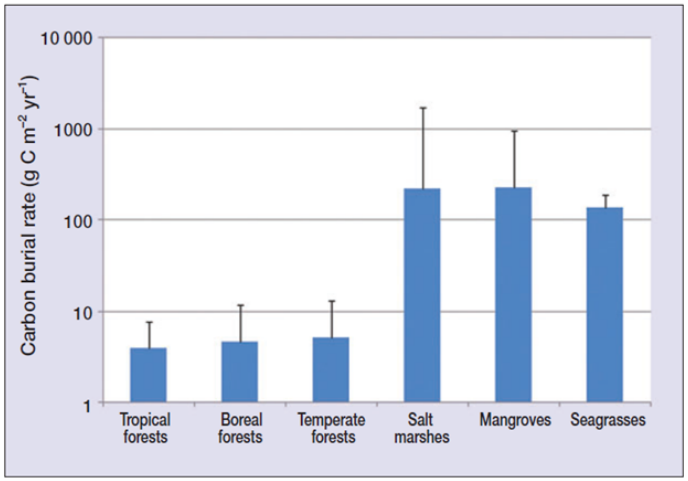



*Figure 5. Mean long-term rates of C sequestration (g C m$^{-2}$ yr$^{-1}$) in soils in terrestrial forests and sediments in vegetated coastal ecosystems. Error bars indicate maximum rates of accumulation. Note the logarithmic scale of the y axis. Data sources are included in Tables 1 and 2.*

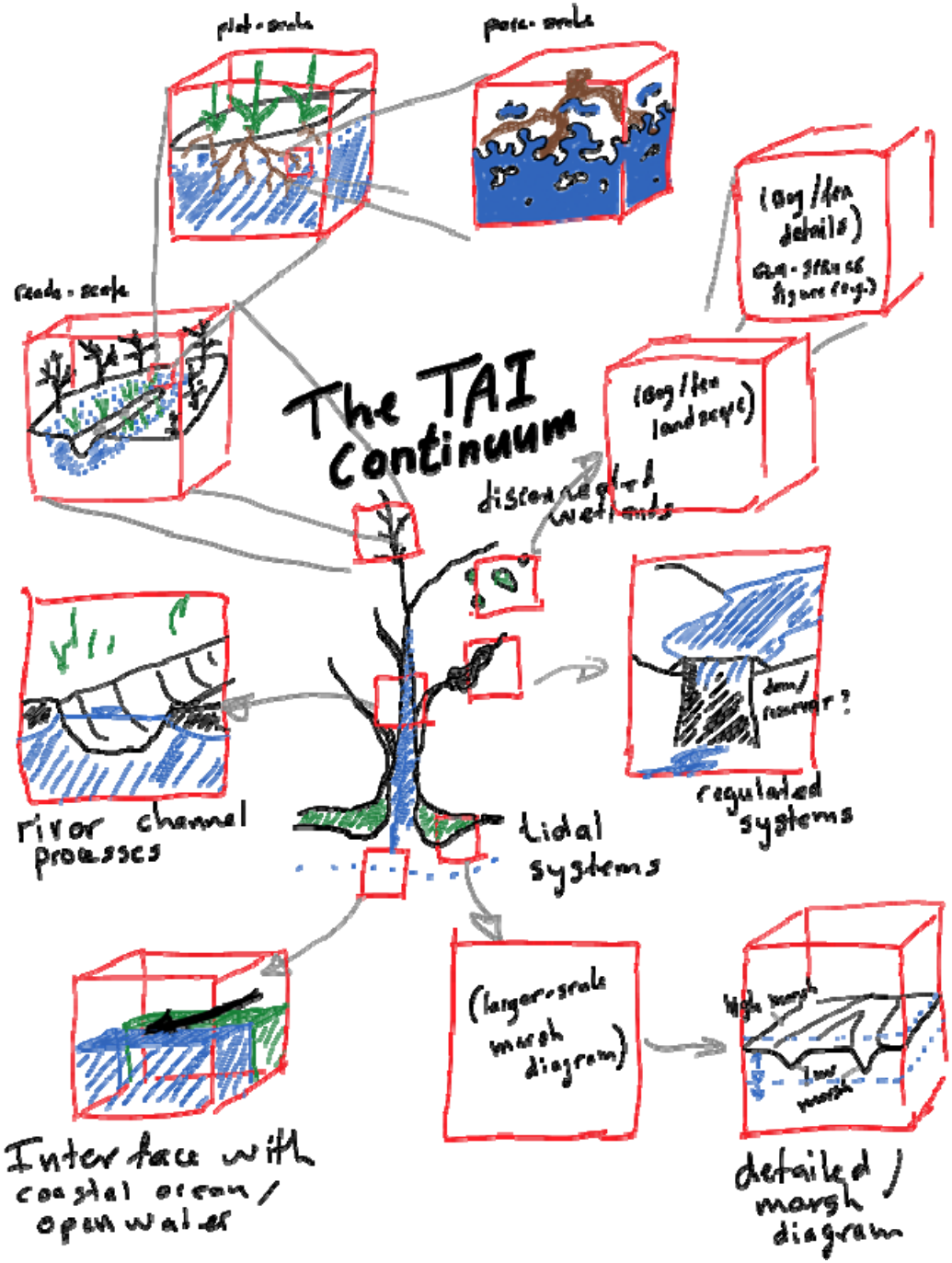
Figure from: Mcleod, E, G Chmura, S Bouillon, R Salm, M Björk, CM Duarte, CE Lovelock, WH Schlesinger, and BR Silliman. "A blueprint for blue carbon: toward an improved understanding of the role of vegetated coastal habitats in sequestering CO2." *Frontiers in Ecology and the Environment* 9, no. 10 (2011): 552-560.

# Conceptual Diagram

**Drafted by Peter Thornton during the writing day**

This figure illustrates the complexity and variability of the terrestrial-aquatic interface, with a focus on spatial scales and ecosystem specific process.

One challenge is how are these connected in meaningful ways?



# Questions?

Terrestrial-Aquatic Interface Workshop Participants
September 7-8, 2016
Hilton Washington DC, Rockville, MD