Climate Change at the Land-Sea Interface

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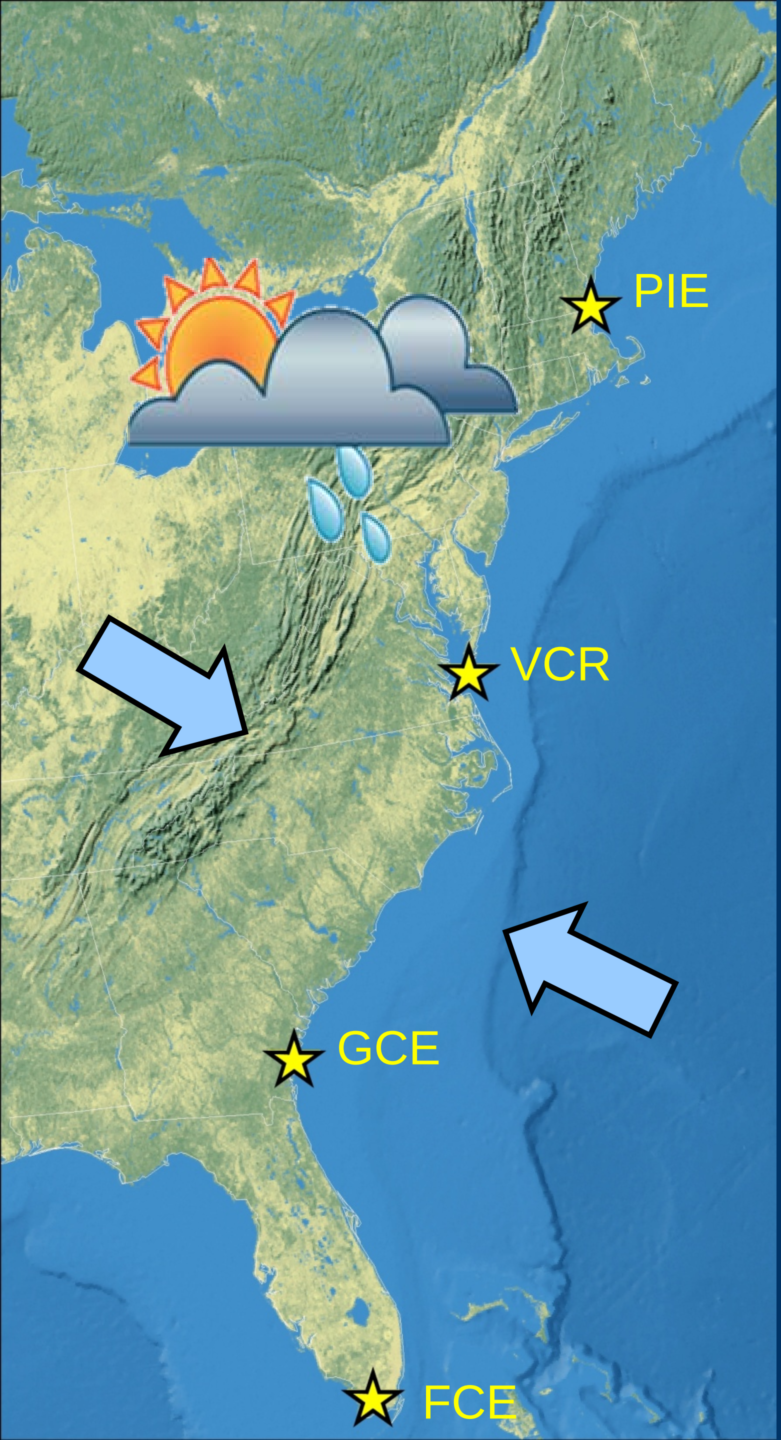
This presentation builds on work conducted at LTER and NERR sites on the east coast and an earlier presentation of M. Alber's at an NSF-mini-symposium



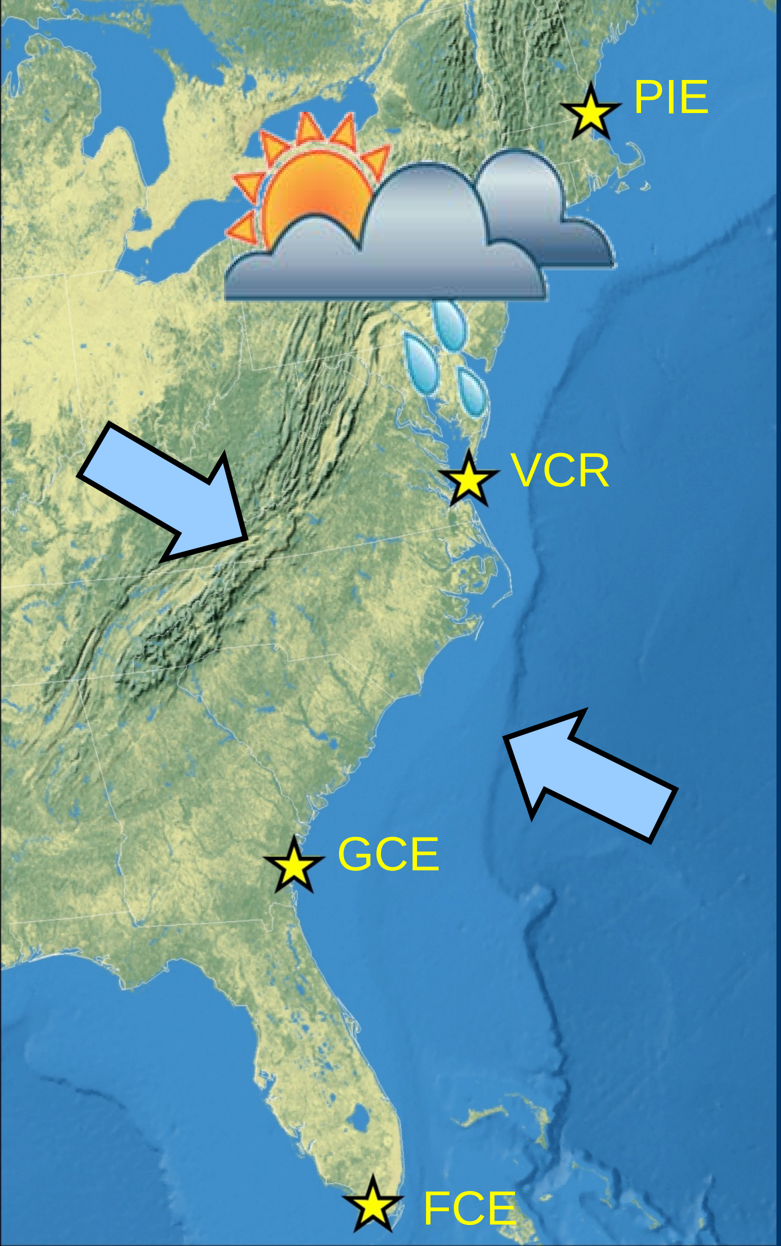
The Land-Sea Interface

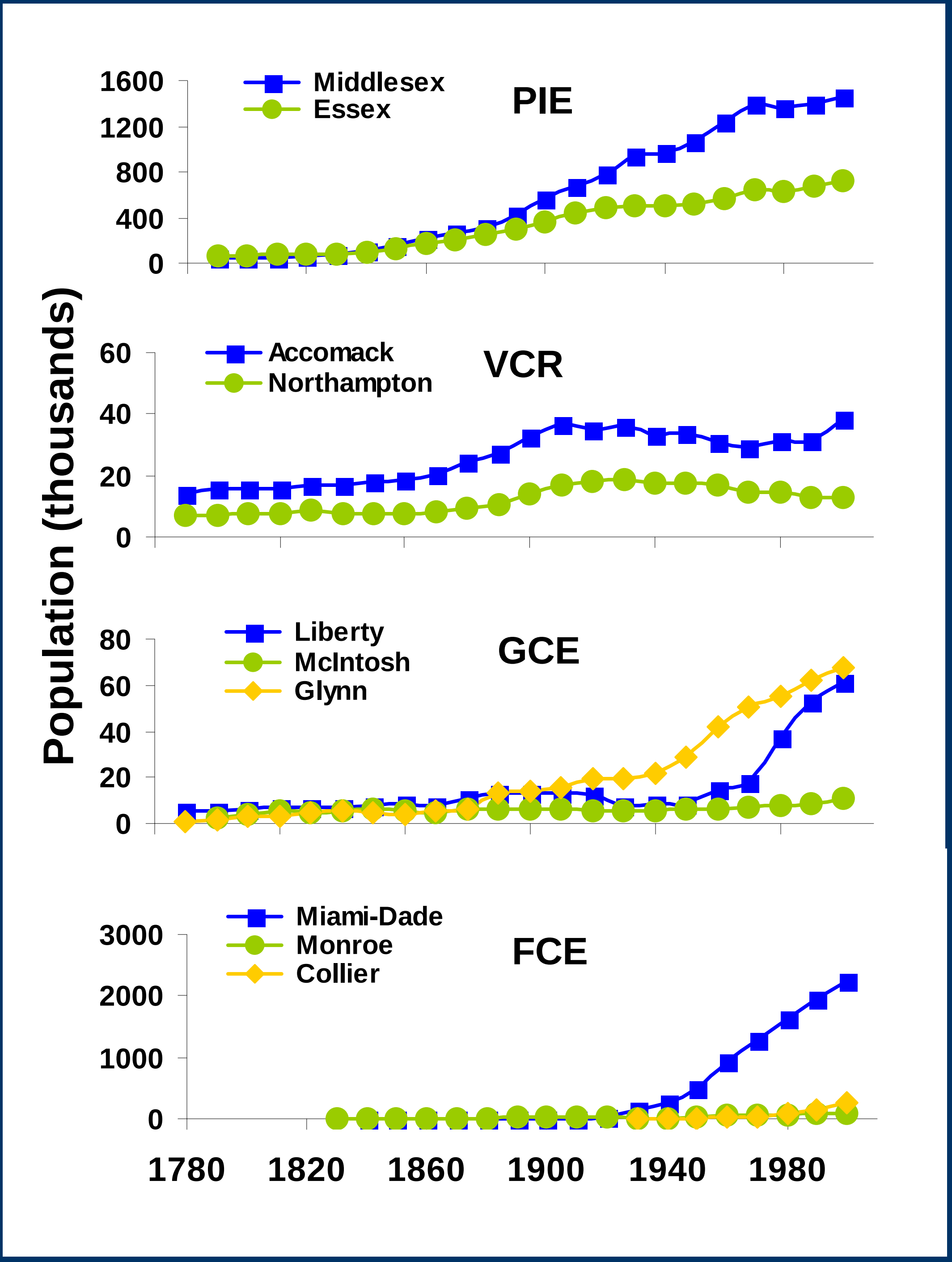
Difficult to study CLIMATE CHANGE without also considering equally important other aspects of global change

Land	Atmos	Sea
Changes		
Climate Population LU	CO_2	Climate
Affect		
Water Nutrient Sediment export	Acidity	SLR

Which in turn affect vulnerability of both natural and human systems at the land-sea interface

Population Growth





Freshwater inflow effects

Freshwater Inflow

- Quantity
- Timing
- Quality

Estuarine Conditions

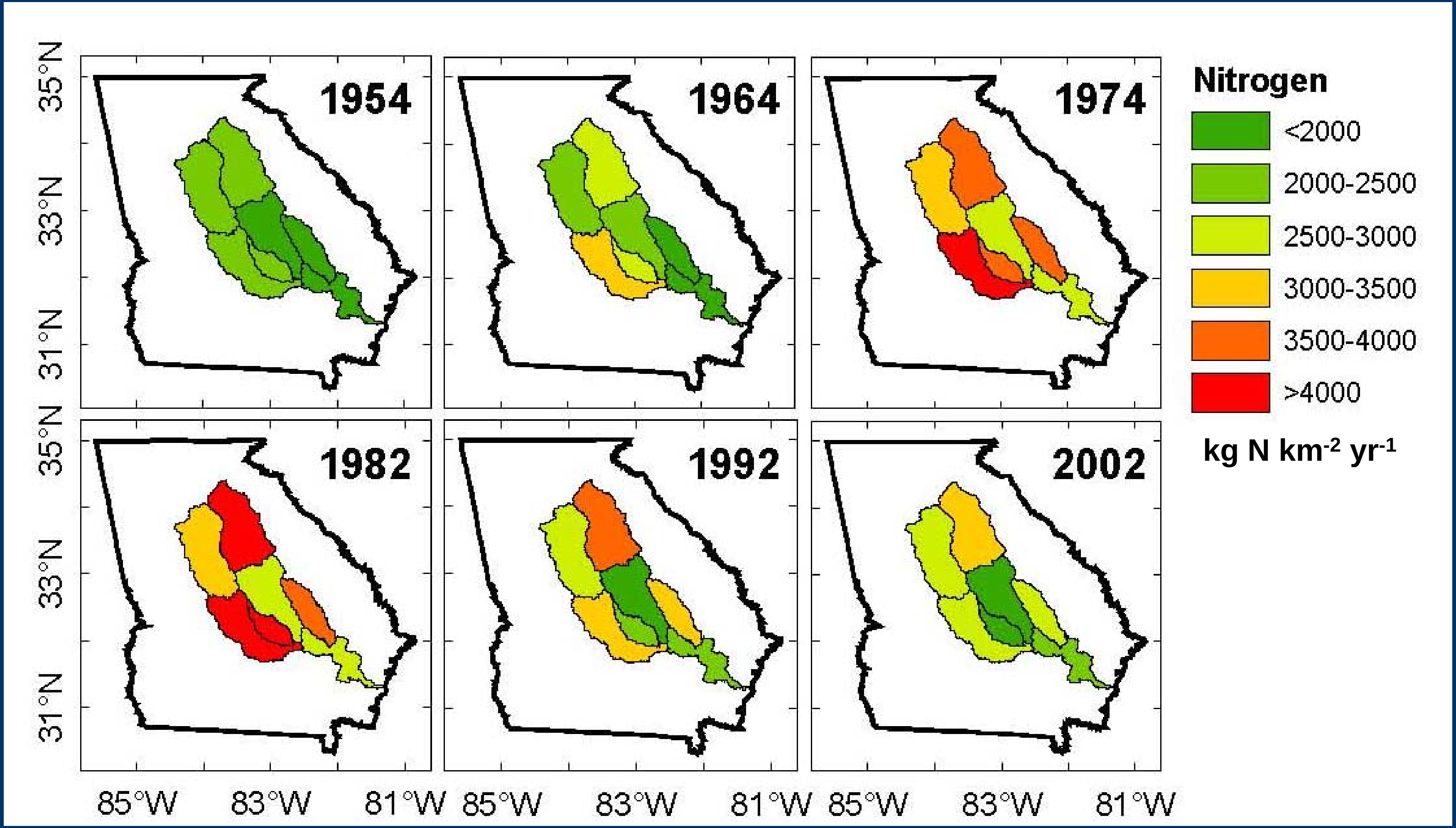
- Transit Time
- Salinity
- Sediment
- **Dissolved Materials**
- Particulate Materials

Estuarine Resources

- **Species Distribution**
- Foodweb Structure
- Primary and Secondary Production

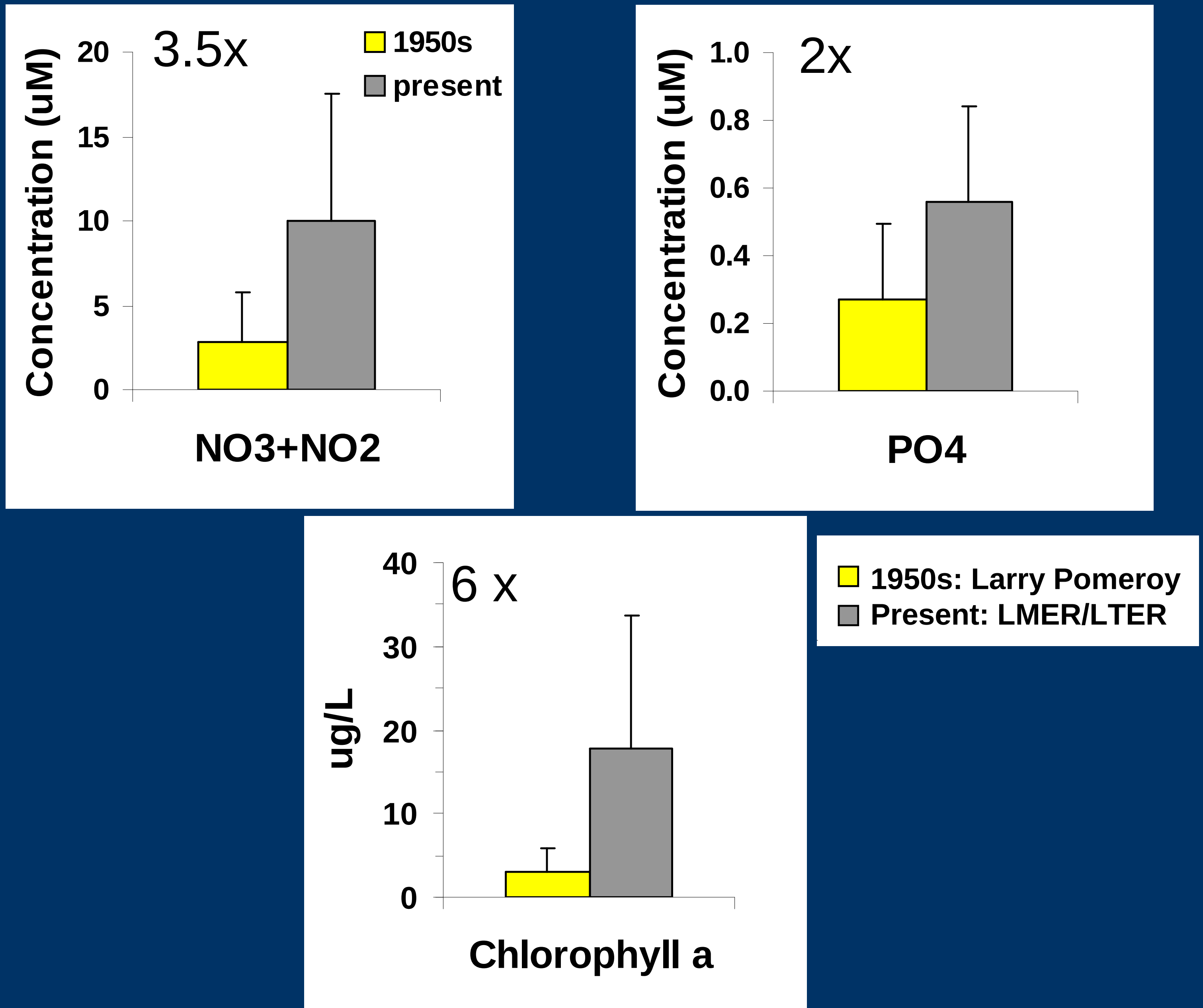
Alber 2002

LUC - N Input to the Altamaha River Watershed

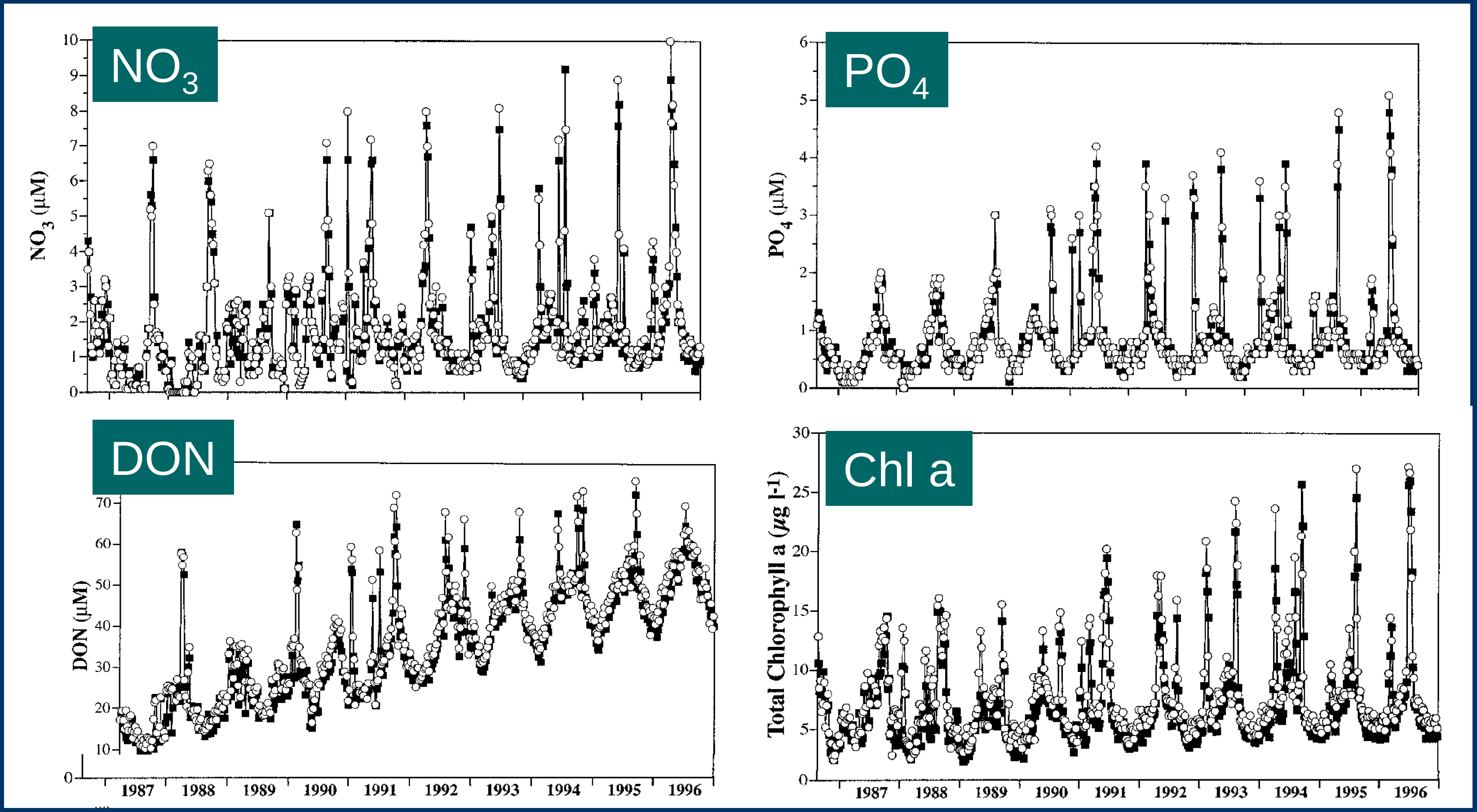


Schaefer & Alber 2007b

Land Use Effects - Altamaha River estuary

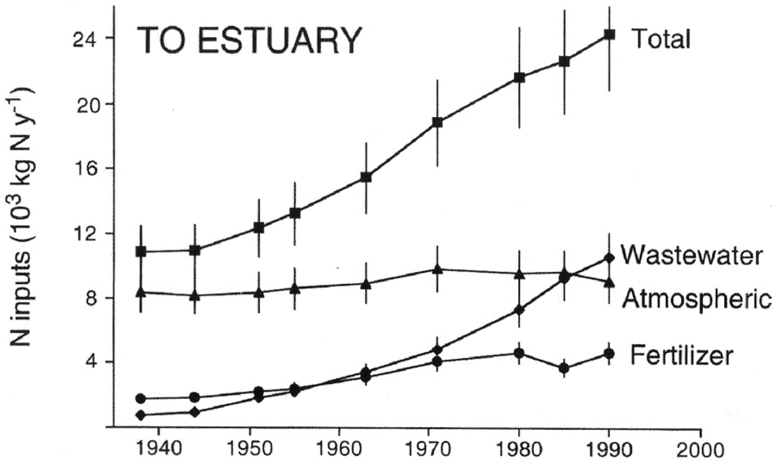


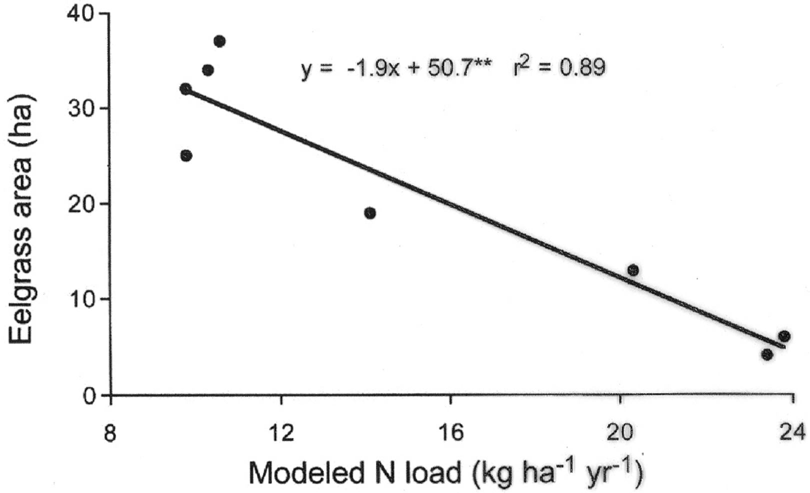
Water Quality at Skidaway



Verity 2000 a,b

Waquoit Bay: N Loading and Eelgrass Loss





1951 1971 1978 1987 1992

Costa in Valiela et al. 1992

LUC & freshwater inflow effects

Freshwater Inflow

- Quantity
- Timing
- Quality

Estuarine Conditions

- Transit Time
- Salinity
- Sediment
- Dissolved Materials
- **Particulate Materials**

Estuarine Resources

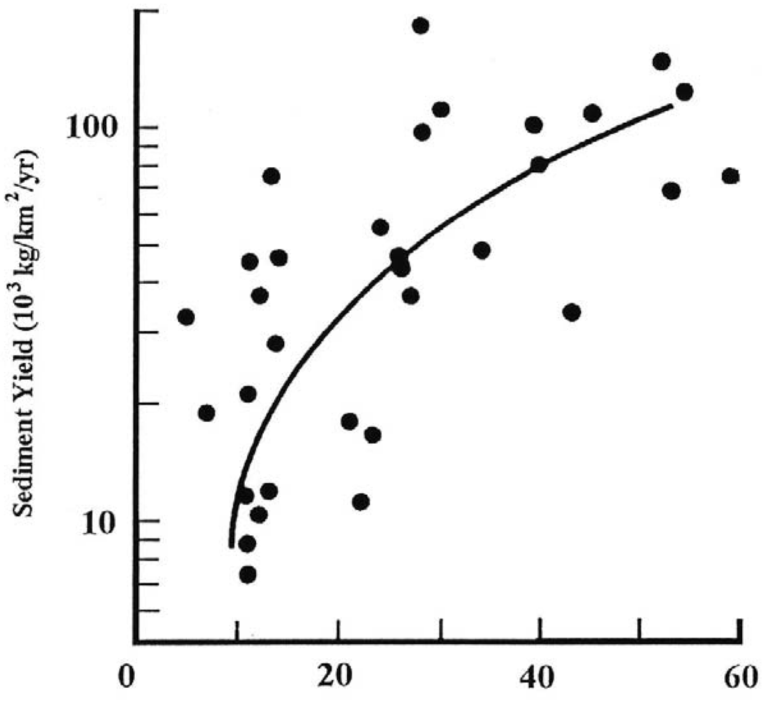
- **Marsh : Water ratio**
- **Marsh elevation**
- Primary and Secondary Production

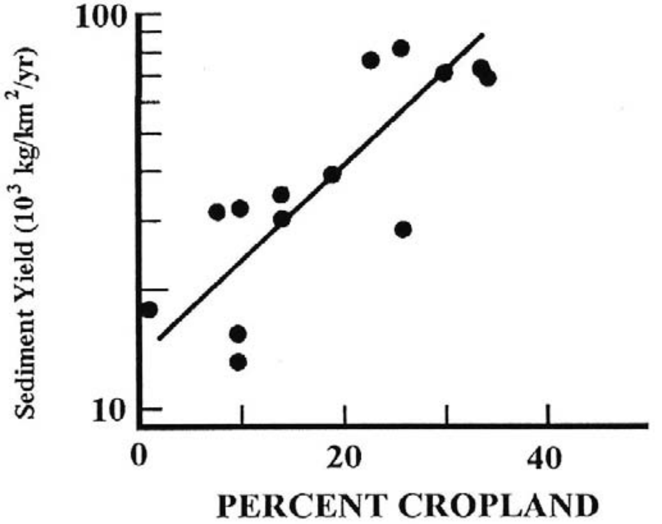
Alber 2002

LUC and Sediments: erosion related to Ag Land

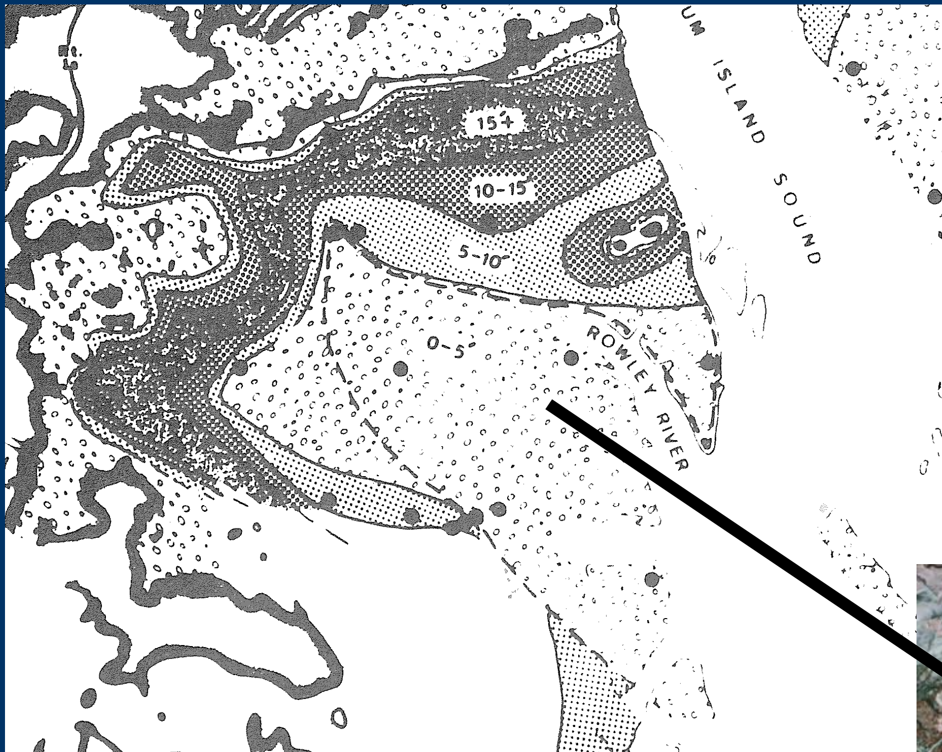
Potomac – top

Susquehanna – bottom



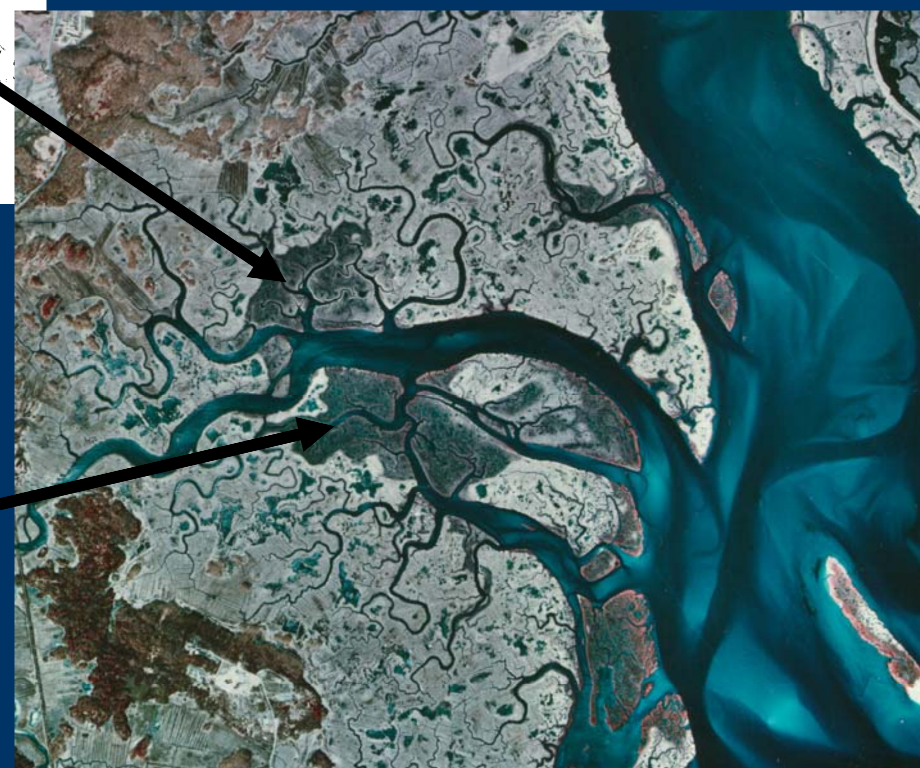


Land use change following colonial period resulted in rapid estuarine infilling and marsh creation



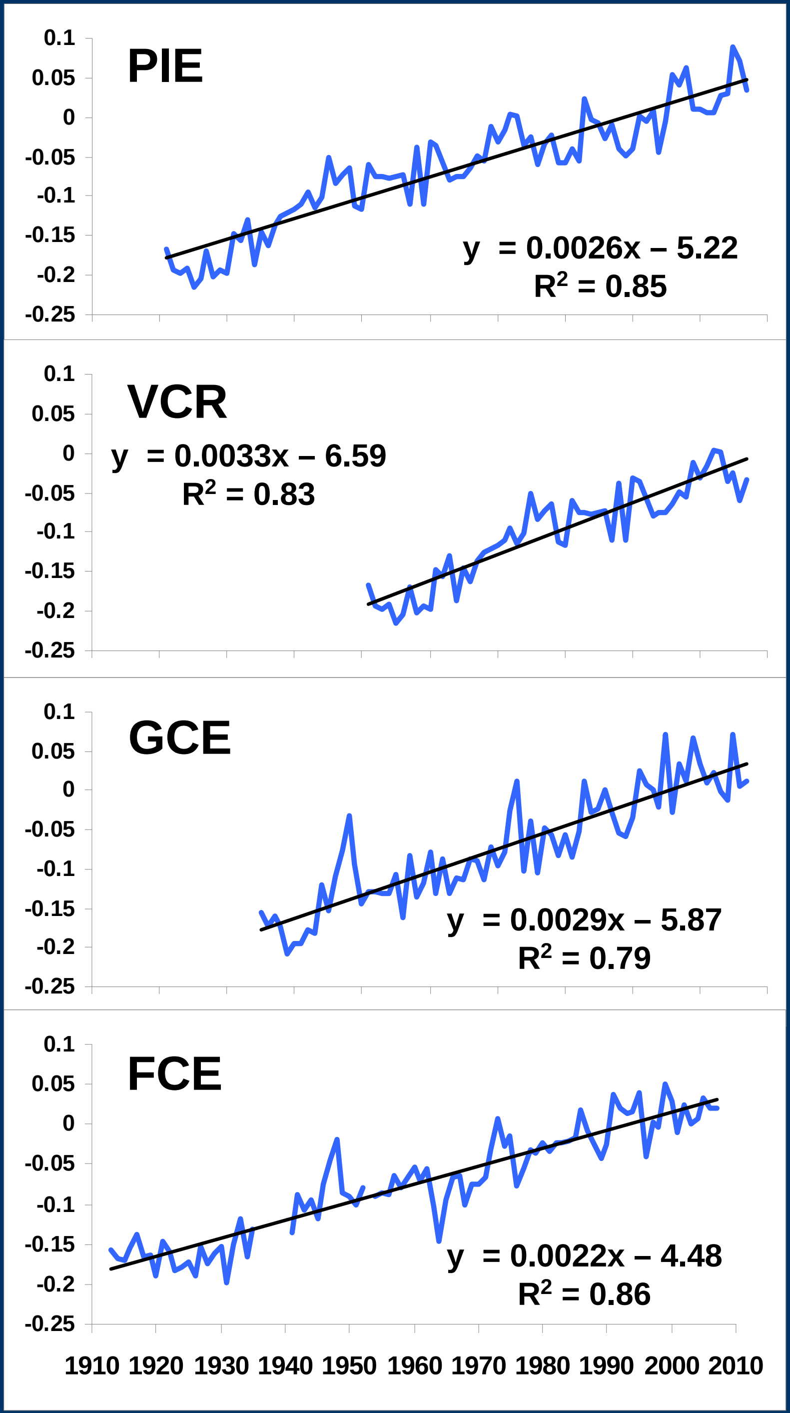
Peat Isopachs from McCormick 1969

mid-March 1992 Color Infrared photograph



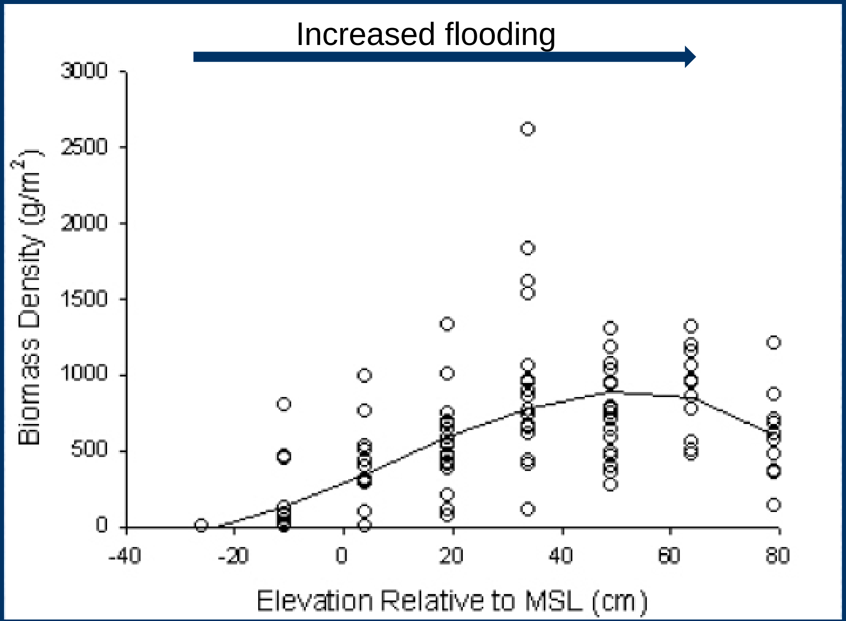
Dark marsh regions highlight low elevation marshes that flood on every high tide and which have yet to completely infill

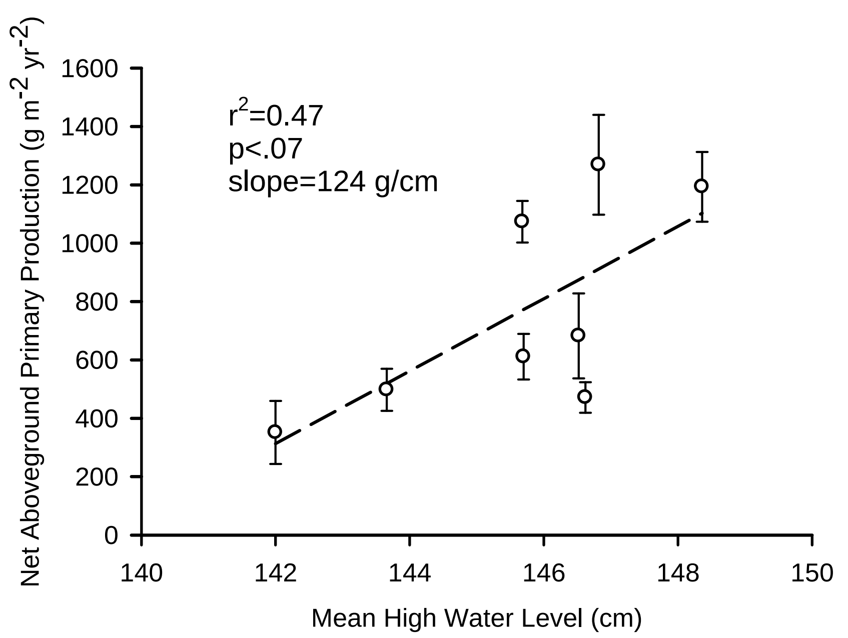
Relative Sea Level



LTER Ecotrends

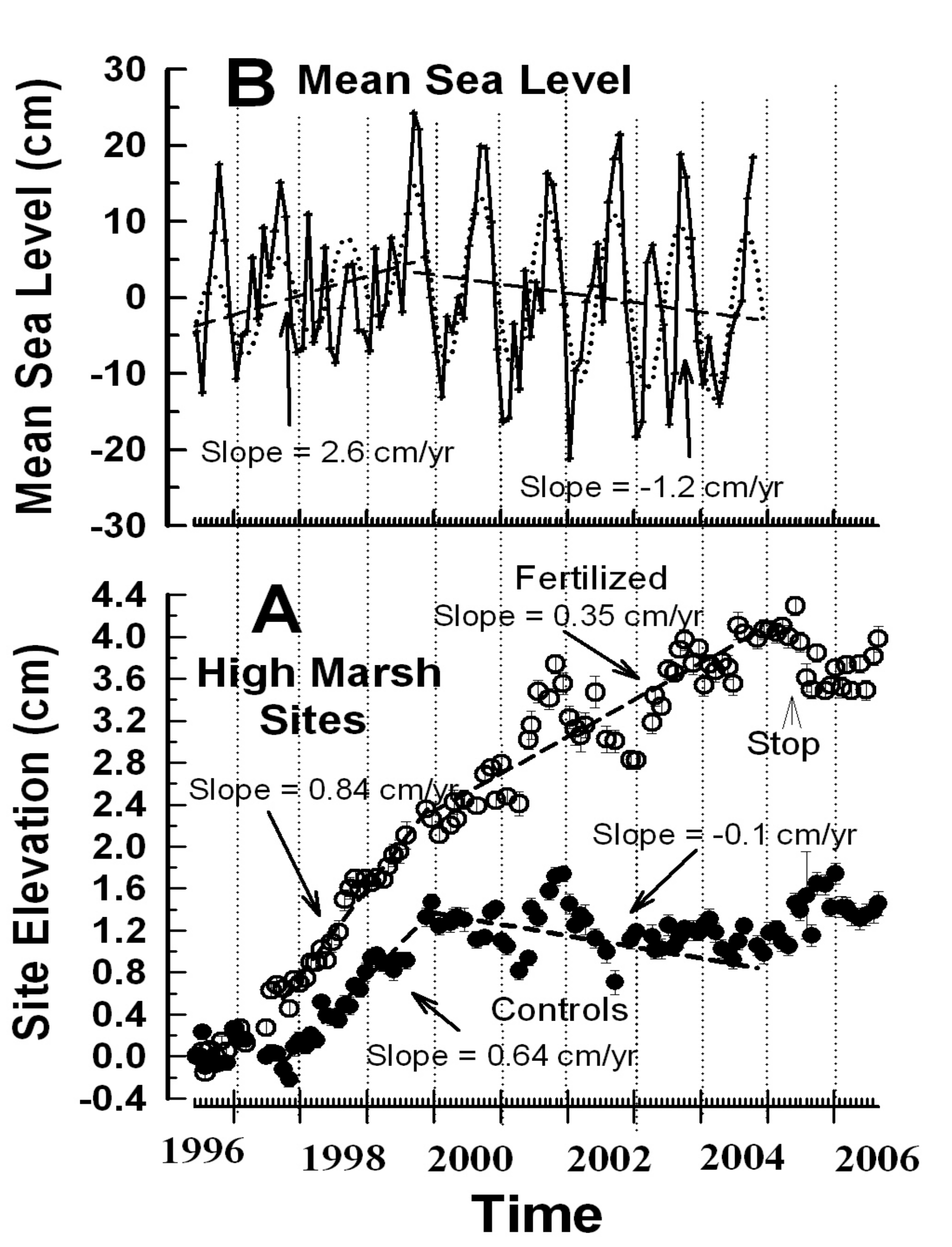
Marsh grass response to sea level





Morris et al. 2002

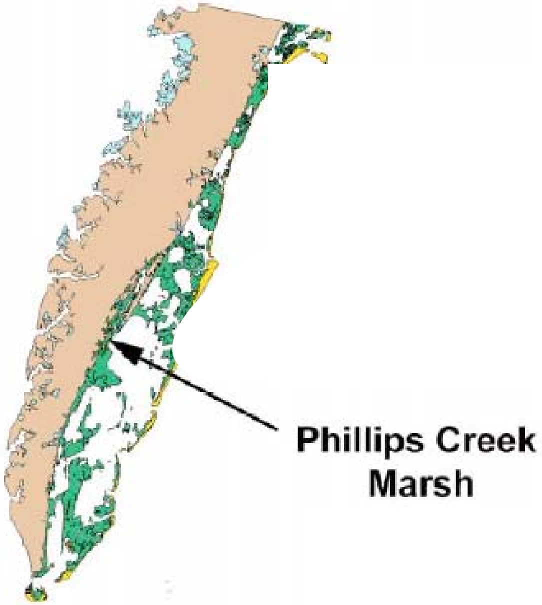
SLR, Plant Production, and Sediment Accretion

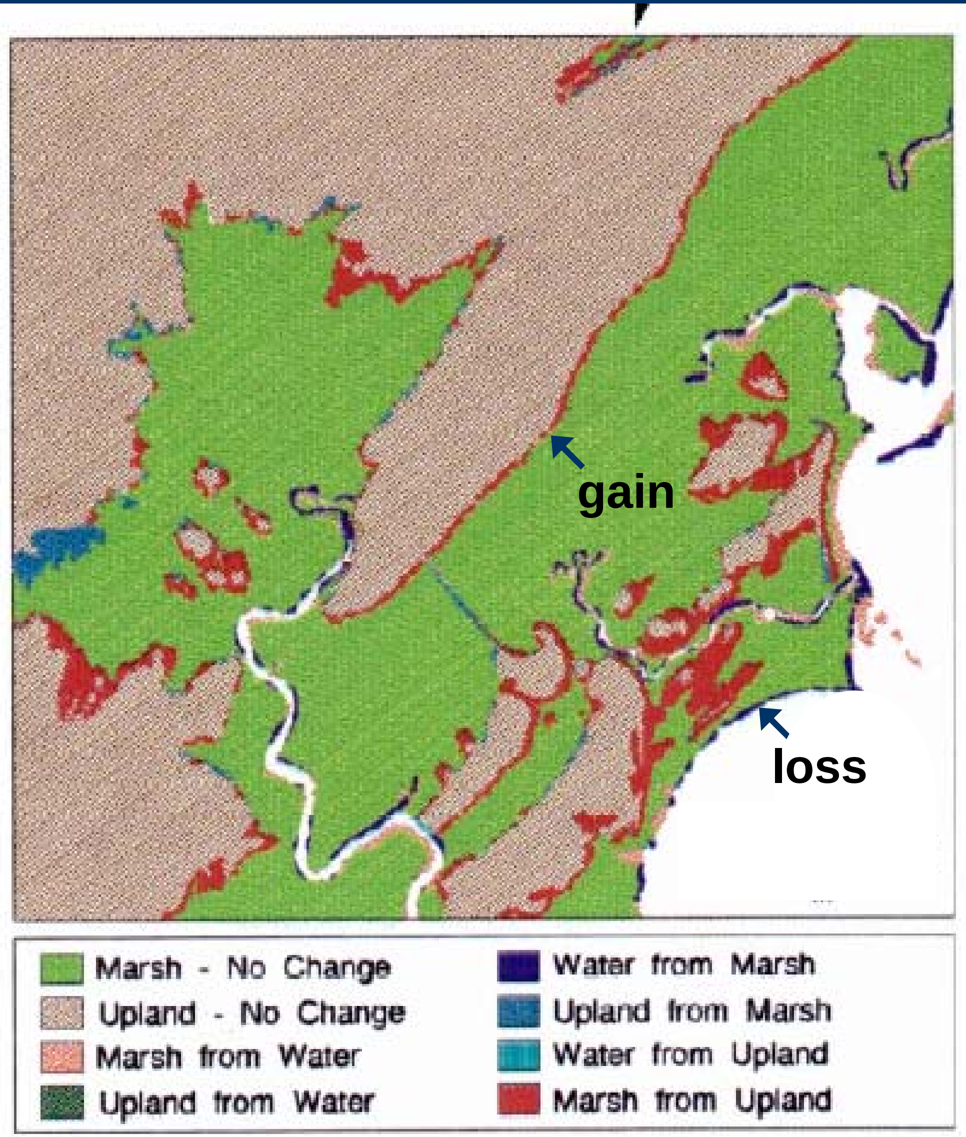


- Sediment accretion on the marsh is a function of plant density and flood frequency & duration. Here we see that expt'ly increased plant prod leads to increased accretion.
- Note that the marsh was not able to keep up with the rapid rate of SLR prior to 2000. 0.8-1.0 cm/yr is probably about the limit in this area

MSL changed direction in 1999/2000

Horizontal Marsh Change due to SLR

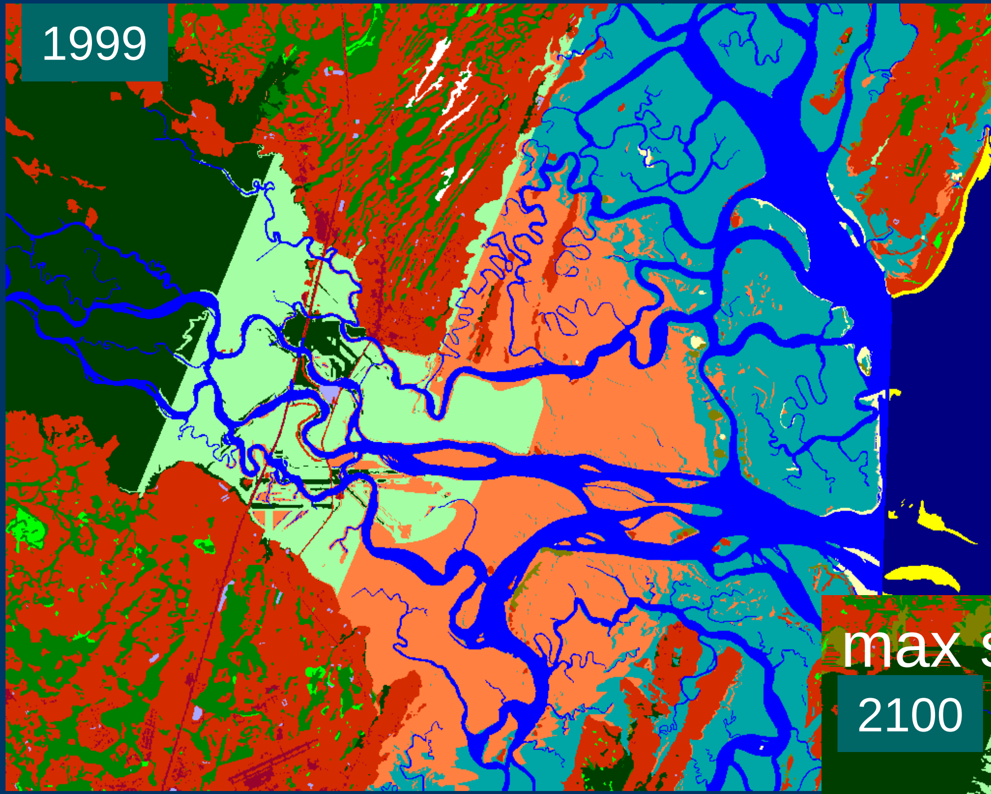


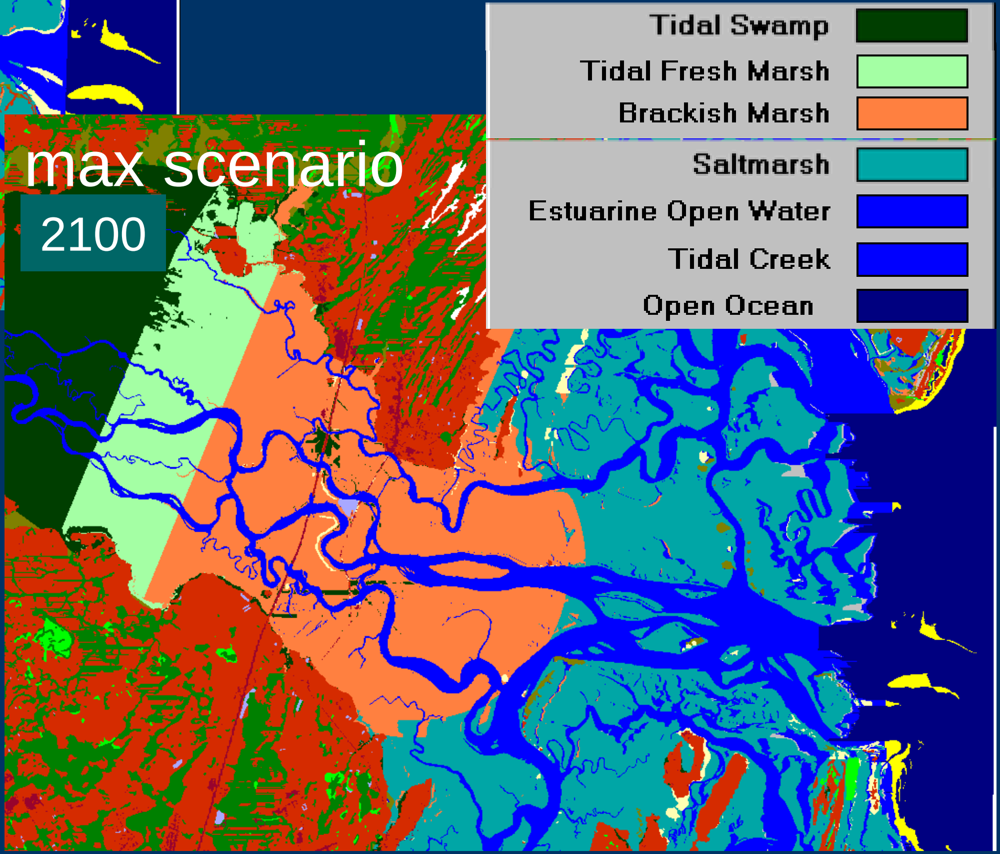


VCR marsh area increased 8.2% (1940-1991)

Kastler and Wiberg 1996

Slamm model showing effects of SLR on salinity distribution and species / habitat distribution





Mean - Max IPCC scenario:

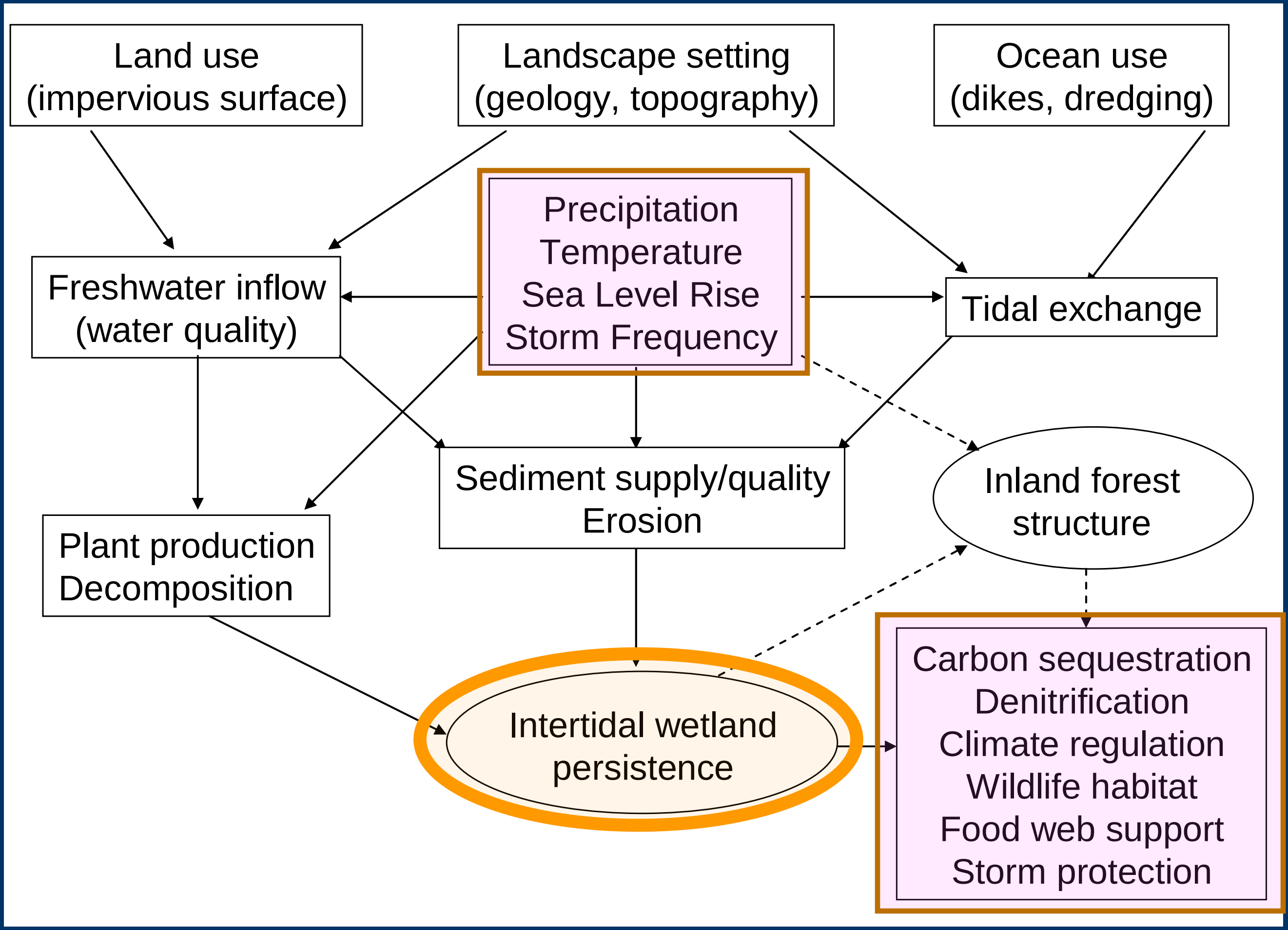
Salt marsh: -20 - -45%

Brackish marsh: +10 - -1%

Tidal fresh: +1 - -39%%

Craft et al. 2009, EPA project

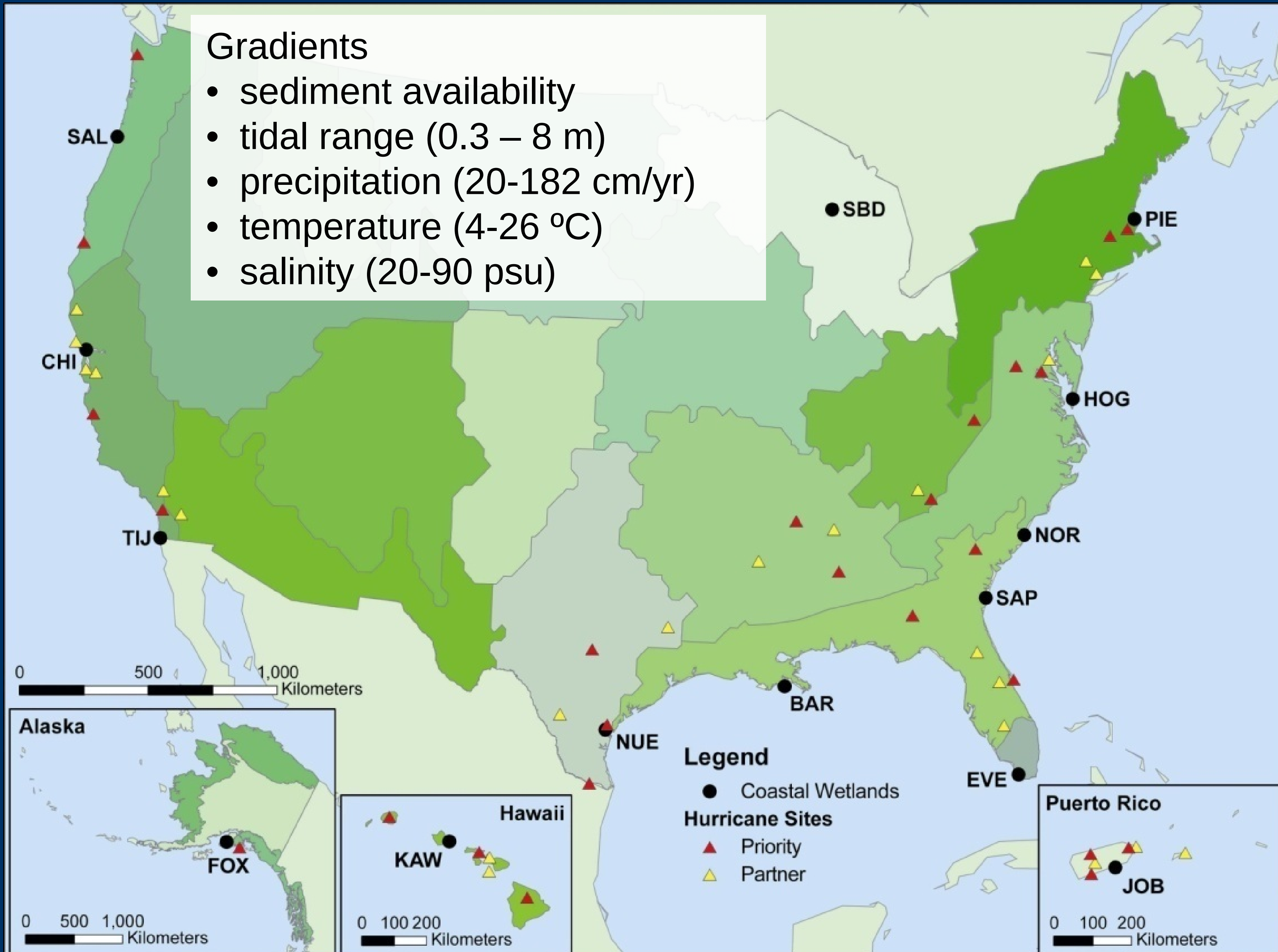
NEXT STEPS: Status, Trends, Predictions. Developing a national network to assess wetland persistence



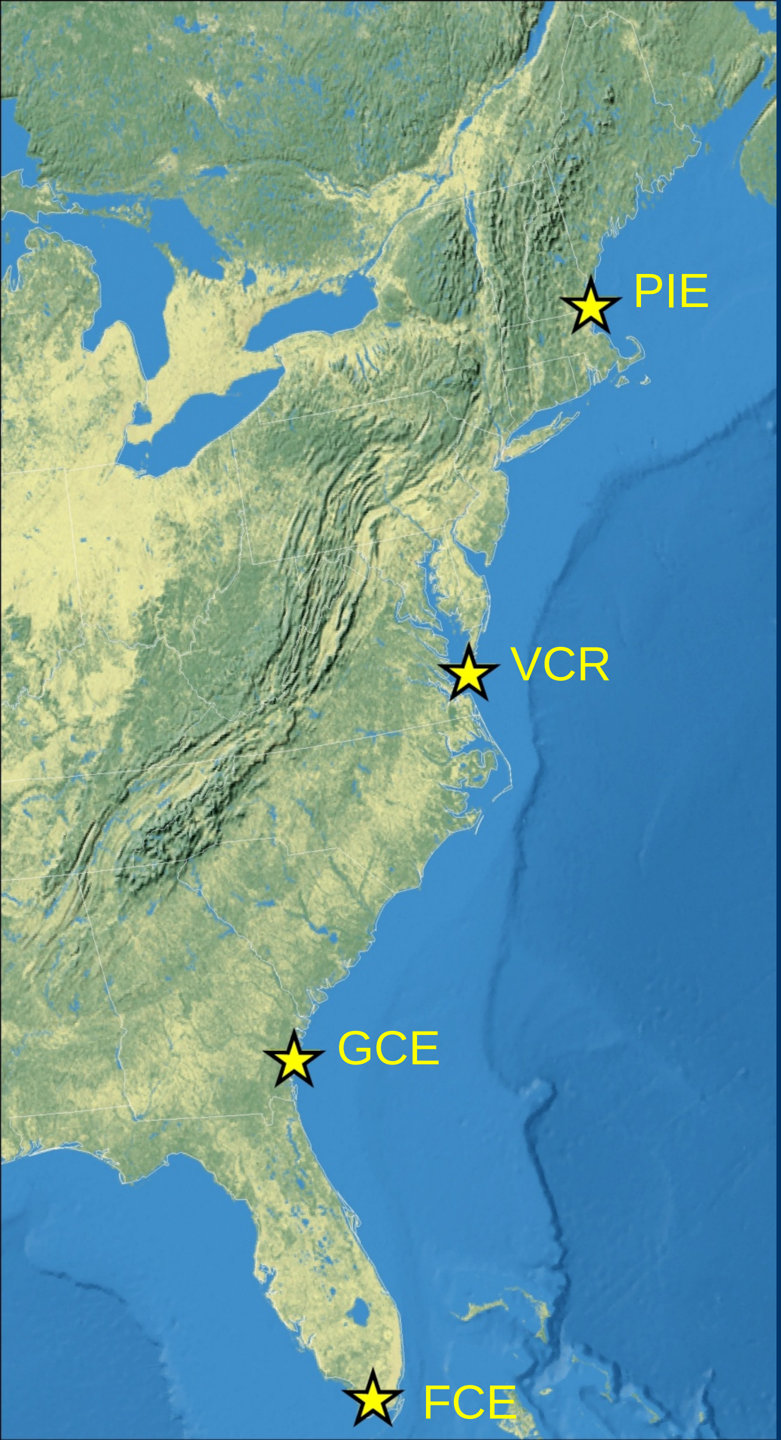
Searching for support:
NEON
NOAA
NERR
LTER
Other?

Hopkinson, Alber, Lugo

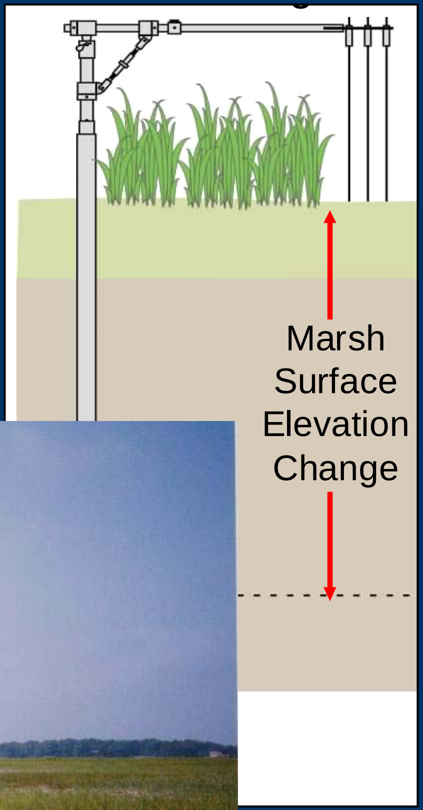
Gradients
- sediment availability
- tidal range (0.3 – 8 m)
- precipitation (20-182 cm/yr)
- temperature (4-26 ºC)
- salinity (20-90 psu)



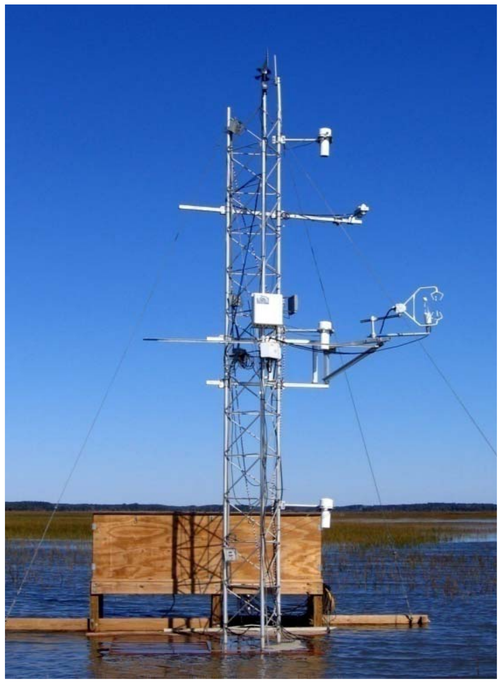
Hopkinson, Alber, Lugo



SETs



Flux Towers



Experiments and more

Many thanks to those who have provided data and slides for this presentation.

Questions?

Helpful Input From:

PIE: Anne Giblin, Jim Morris, Chuck Hopkinson

VCR: Karen McGlathery, Linda Blum, Bob Christian, Mark Brinson, Jose Fuentes

GCE: Merryl Alber, Adrian Burd, Chris Craft, Joan Sheldon, Steve Pennings, Sylvia Schaefer, Wade Sheldon

FCE: Evelyn Gaiser, Vic Engel, Tom Smith

North Inlet NERR: Jim Morris

Waquoit NERR: Ivan Valiela

Skidaway/Wilmington River: Peter Verity