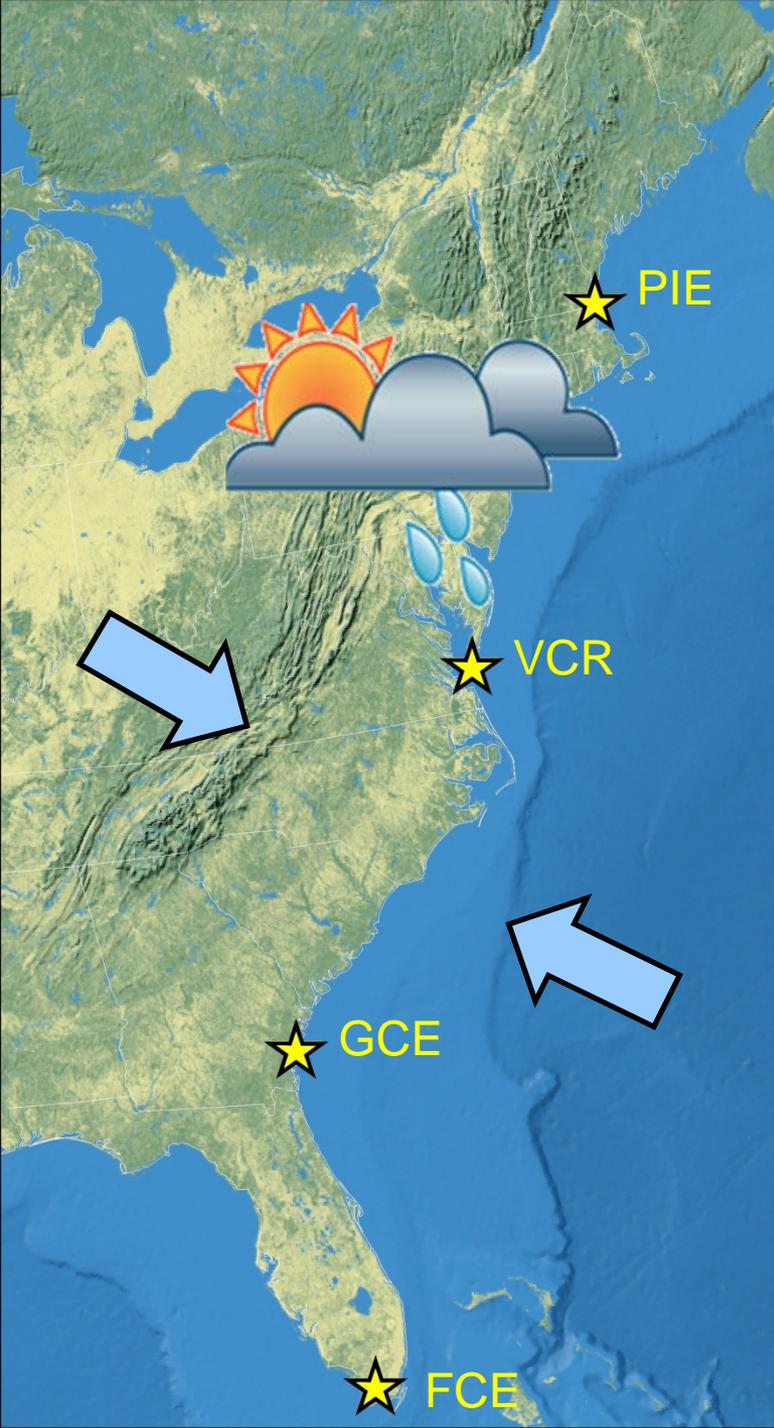


Cross-site research and synthesis in the LTER network – examples

Chuck Hopkinson – PIE and GCE LTERs

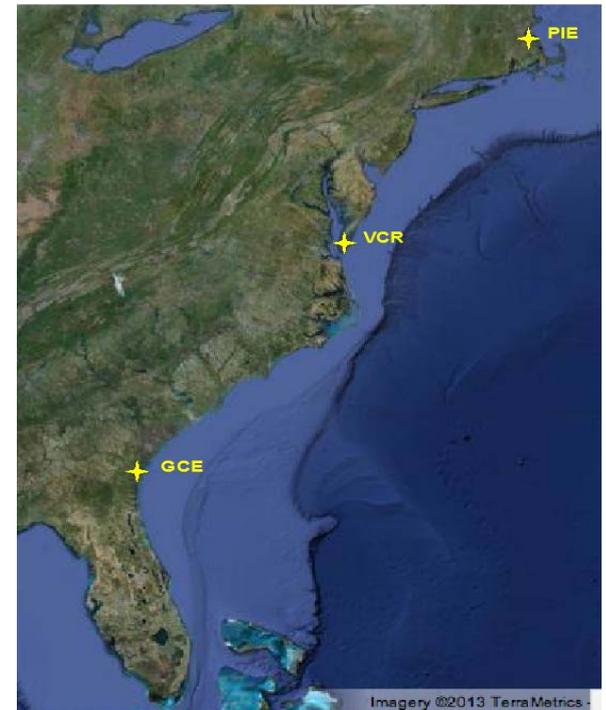
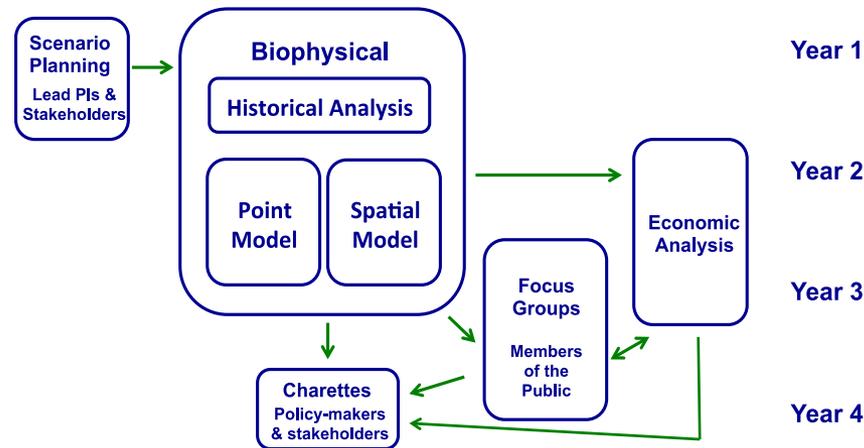


- The LTER network of sites is ideal for conducting cross-site observations from across a range of environmental conditions.
- Experiments can be executed across multiple gradients to better understand the controls over key ecosystem mechanisms and processes.
- Having similar datasets at multiple sites makes it possible to test process-based simulation models developed at single sites for generality of understanding.
- As with all NSF projects – data management is important. The “network office” has been developing querying systems to help find, compile and put into appropriate units data from across the network. Synthesis is the goal.

Example 1: Coastal SEES: Wetland Vulnerability to Sea-level Rise

McGlathery, Alber, Giblin, Johnston, Kirwan, Wiberg, Morris, Alexander, Polsky

How will feedbacks between marsh response to SLR and human adaptation responses affect sustainability of the socio-ecological system?



Coastal SEES: Wetland Vulnerability to Sea-level Rise

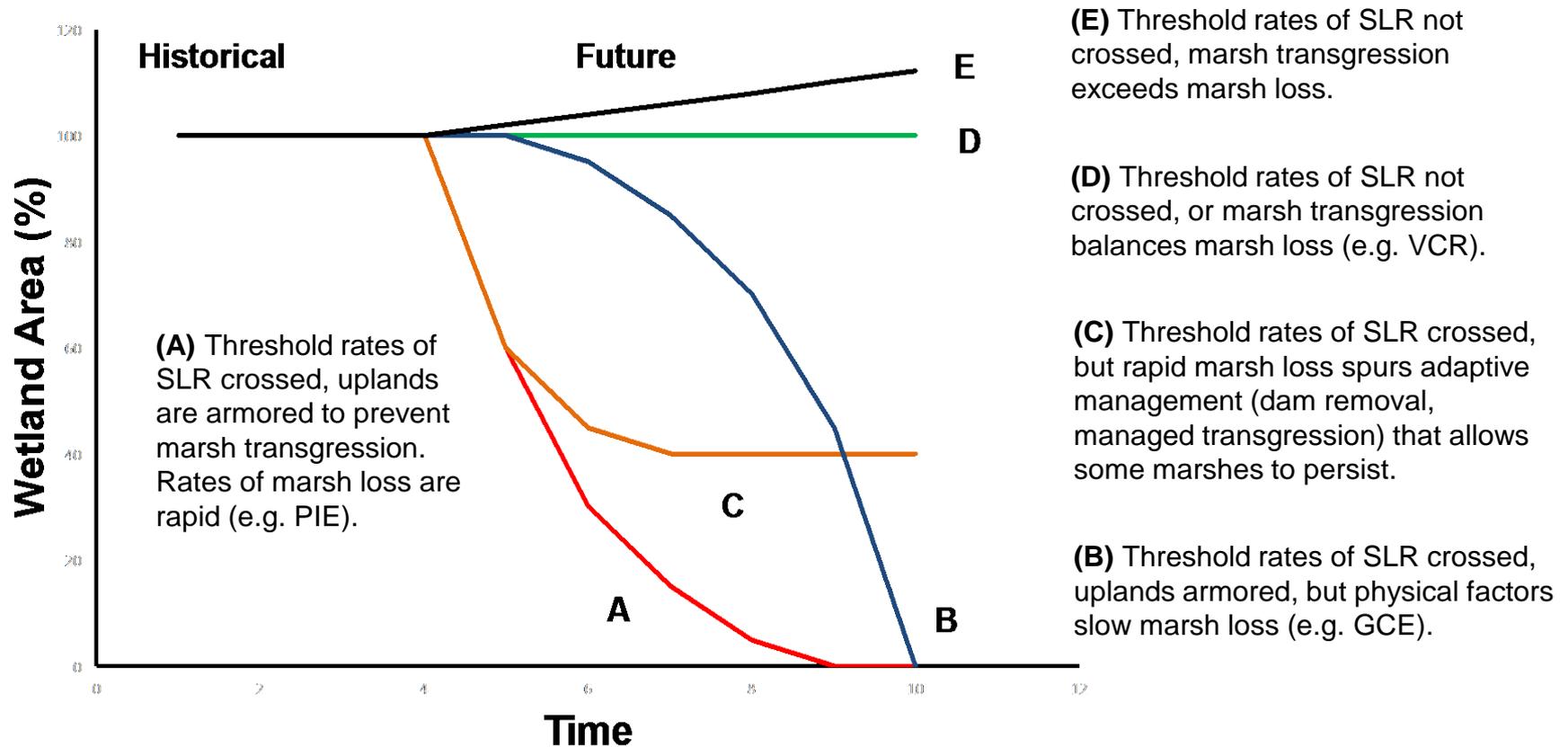
- 1) how marsh vulnerability to current and projected SLR, with and without adaptation actions, compares across biogeographic provinces and a range of biophysical and social drivers
- 2) which marsh protection actions local stakeholder groups favor, and what are the broader sustainability and economic value implications of feasible adaptation options.

Table 1. General attributes of 3 study sites.

Site	Biogeographic Province	RSLR mm y ⁻¹	Tidal Range m	SSC mg L ⁻¹	Dominant Marsh Vegetation	Population Density People km ⁻²	Dominant Land Use
PIE	Acadian	2.6	2.9	5	<i>Spartina patens</i>	583	46% Forest 38% Urban
VCR	Virginian	3.9	1.2	20	<i>Spartina alterniflora</i>	25	57% Forest 34% Agriculture
GCE	Carolinian	2.9	2.0	40	<i>Spartina alterniflora</i>	70	60% Forest 25% Agriculture

Coastal SEES: Wetland Vulnerability to Sea-level Rise

Plausible scenarios of historically stable marshes under future SLR



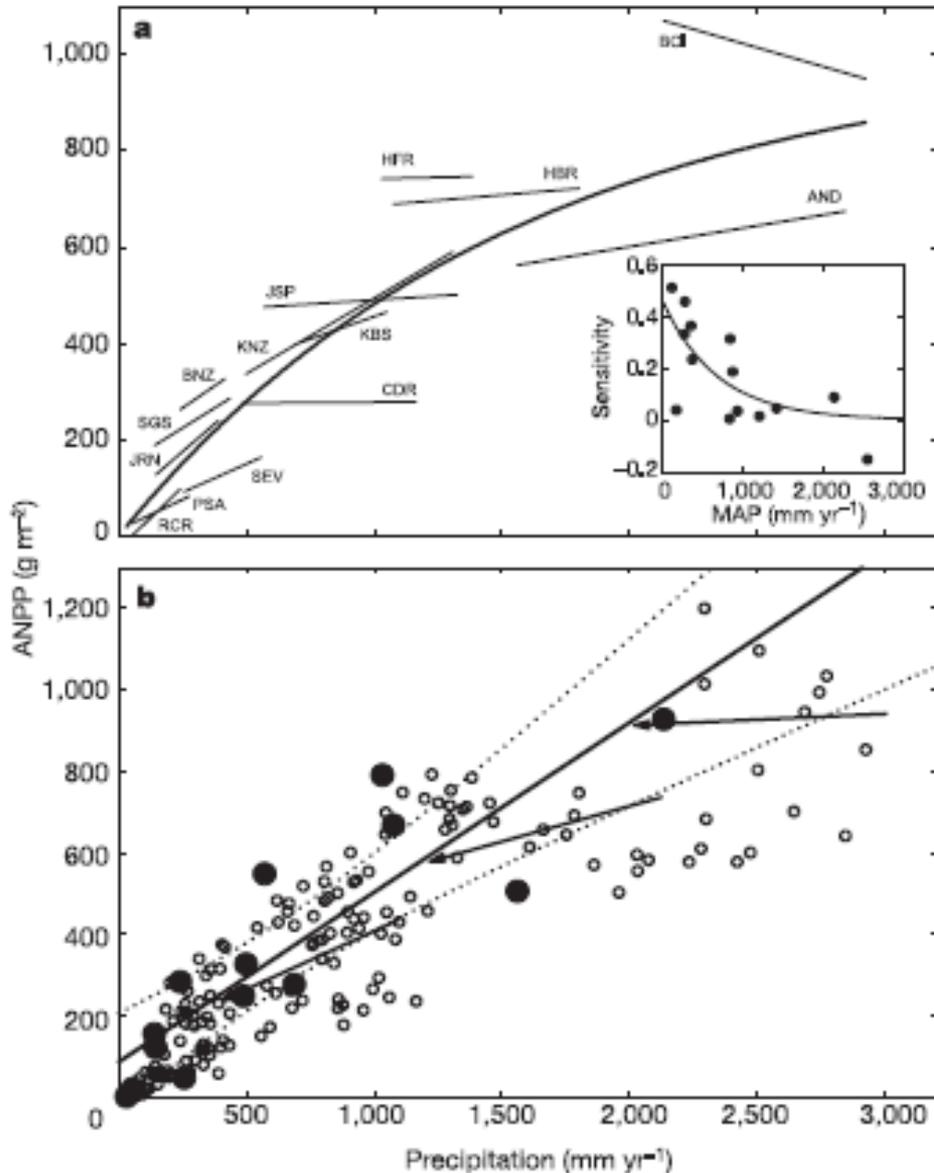
Example 2: Controls of Terrestrial Productivity

letters to nature

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Convergence across biomes to a common rain-use efficiency

**Travis E. Huxman^{1,*}, Melinda D. Smith^{2,3,*}, Philip A. Fay⁴, Alan K. Knapp⁵,
M. Rebecca Shaw⁶, Michael E. Loik⁷, Stanley D. Smith⁸, David T. Tissue⁹,
John C. Zak⁹, Jake F. Weltzin¹⁰, William T. Pockman¹¹, Osvaldo E. Sala¹²,
Brent M. Haddad⁷, John Harte¹³, George W. Koch¹⁴, Susan Schwinning¹⁵,
Eric E. Small¹⁶ & David G. Williams¹⁷**



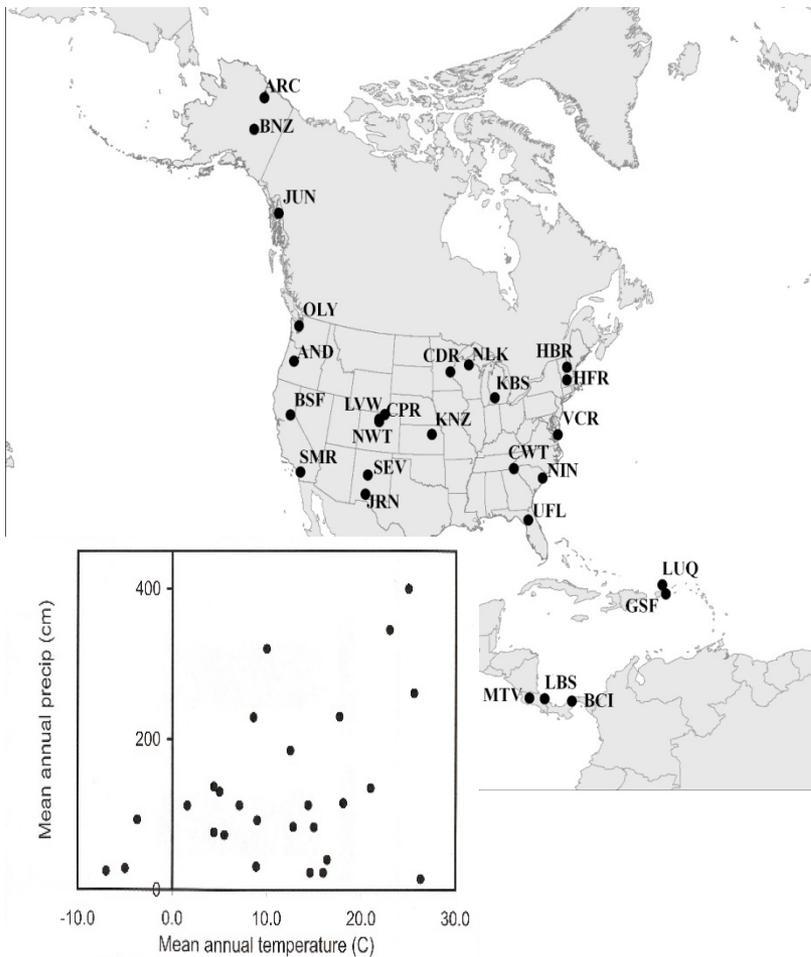
Each site shows a linear response to water availability. Only through cross-site research was this basic non-linear functional understanding revealed.

- Water availability limits plant growth in all terrestrial systems, but biomes differ in sensitivity of ANPP to precipitation
- In years when water is most limiting, all terrestrial systems exhibit the same rate of ANPP per unit rainfall, despite differences in physiognomy.

Example 3: Long-term Intersite Decomposition Experiment Team (LIDET)

A 10-year field study testing the degree to which substrate quality and climate control the long-term carbon and nitrogen dynamics of decomposing leaf and fine root litter.

LIDET employed a standardized methodology at 27 sites to examine decomposition patterns of 30 species of litter.



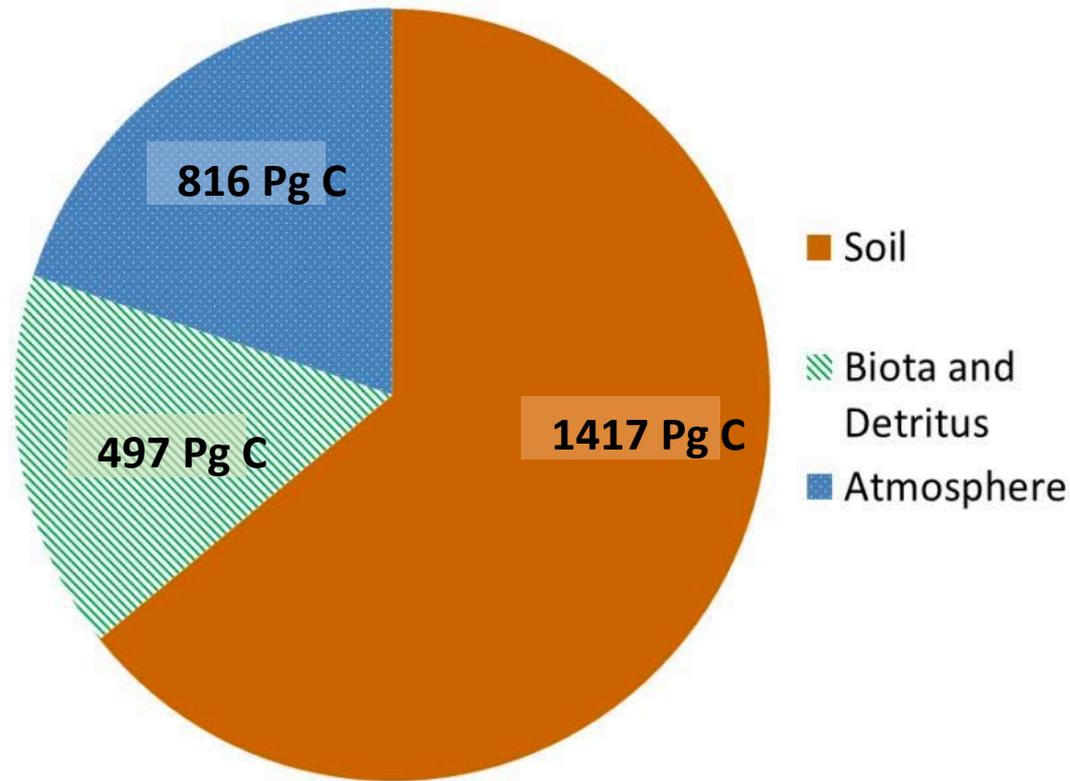
Leaf litter bags

Root litter bags

Example 4: Detritus Inputs & Forest Soil Organic Matter Formation:

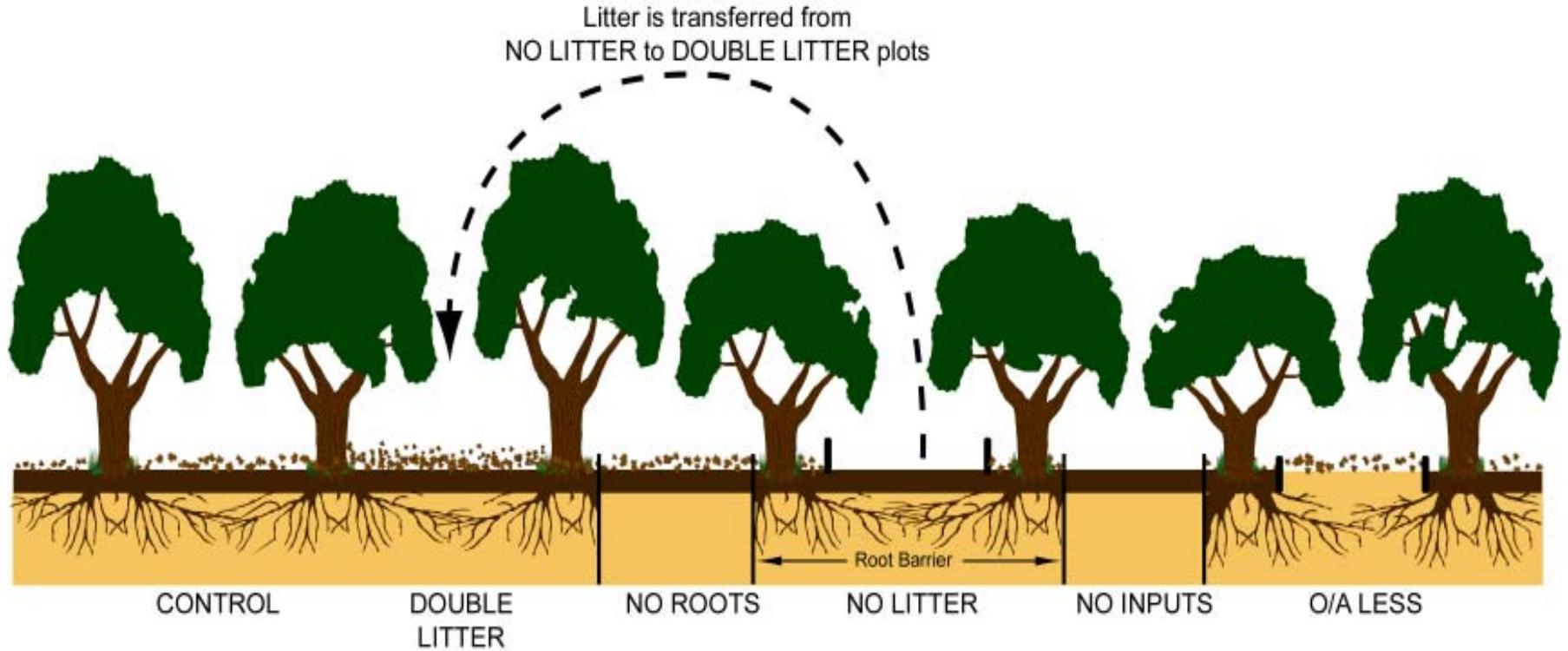
Formation:

Is There a Linear Relationship Between Detrital Input Rates and Soil Carbon Accumulation?



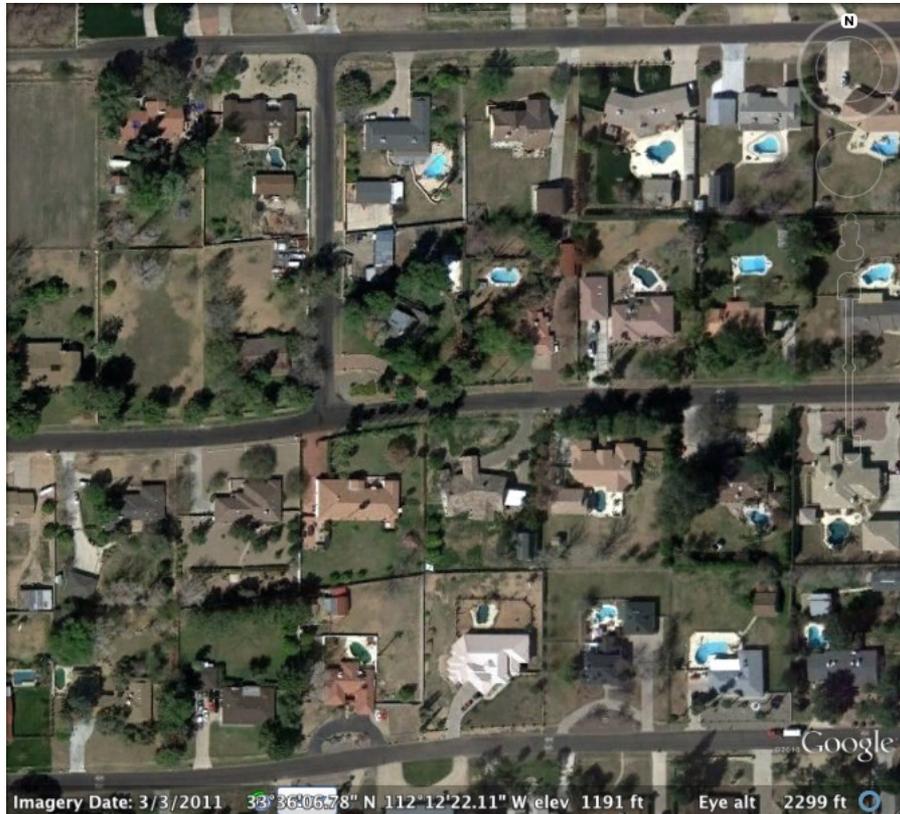
Global Atmospheric, Biomass and Soil Carbon Pools

Will increases in NPP translate into increased soil organic carbon storage?



Multifactor experiment conducted at multiple sites in US and Europe

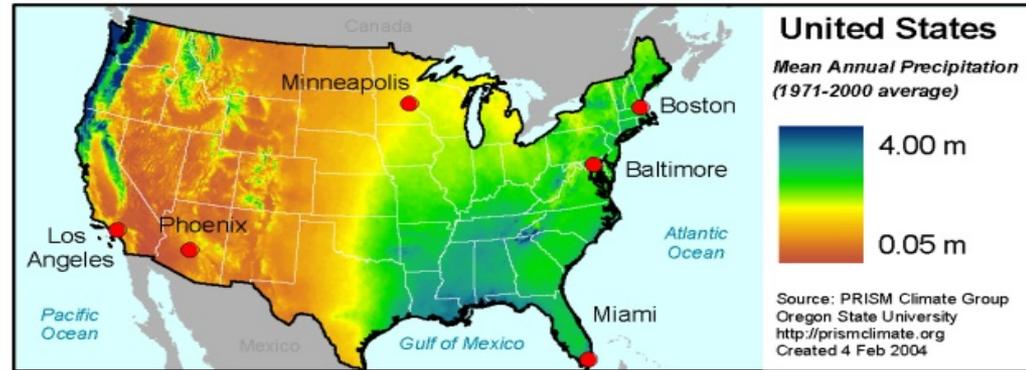
Example 5: What city is this: Phoenix or Boston?



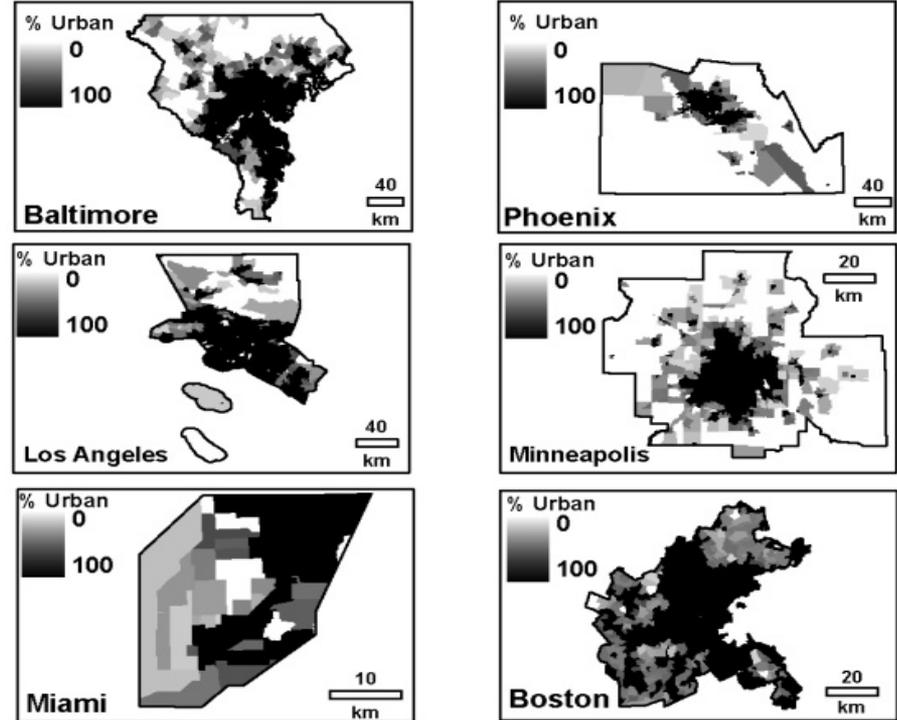
Source: Groffman for Urban Homogenization

Six study cities, 14 co-pi's, 11 institutions:

- Why do our cities look so similar?
- What are the effects of this urban homogenization on:
 - Biodiversity
 - Soil biogeochemistry (carbon, nitrogen)
 - Hydrography
 - Microclimate
 - Quality of life



Urbanicity by Census Block Groups

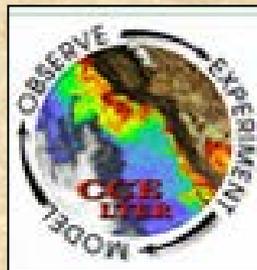


Source: US Census Bureau, 2000

Example 6: General understanding of abrupt state shifts

Cross-site analysis of LTER time series data from 4 sites to:

- 1) Assess analytically whether & when abrupt transitions occurred
- 2) Evaluate proposed methods of forecasting abrupt shifts
- 3) Seek evidence of hysteresis



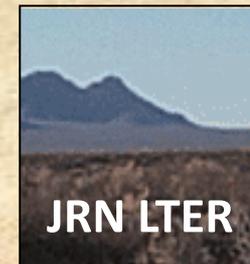
California Current
Ecosystem LTER



Palmer Station
Antarctica LTER



Santa Barbara
Coastal LTER



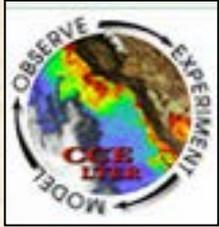
JRN LTER

Jornada Basin
LTER

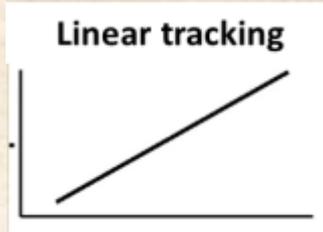
Evidence for mode of the abrupt transition (e.g., Hysteresis)

Examined relationships between response & driver variables

Likely mode



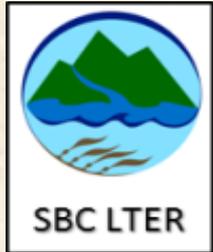
Krill



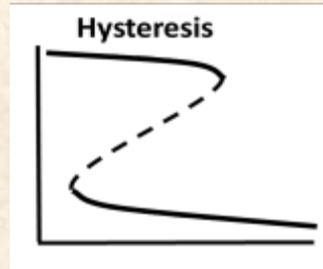
Hysteresis mechanism?

(identified by LTER studies)

—



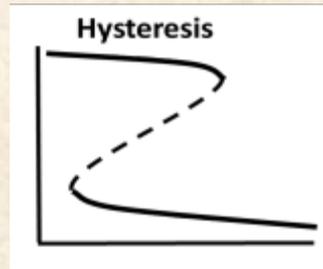
Sea Cucumber



Positive predation-mediated feedback



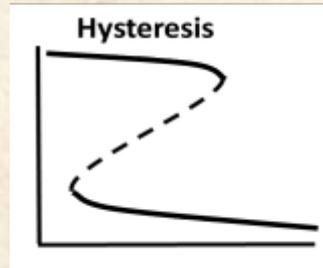
Penguins



Positive predator- & breeding-mediated feedbacks



Black Grama Grass



Positive feedback between soil erosion & low grass cover



Questions?

