LAND-ATMOSPHERIC INTERACTIONS IN THE SOUTHEAST UNITED STATES: CHALLENGES AND OPPORTUNITIES

Gregory Starr[1], Christina Staudhammer[1], Michael Binford[2], Paul Stoy[3], Henry Loescher[4]

[1] Department of biology, University of Alabama

[2] Department of Geography, University of Florida

[3] Biological Systems Engineering, University of Wisconsin, Madison

[4] Battelle Ecology

Overview

- Brief History of the Science
- Where the research is today
- Challenges/Opportunities (scientifically and operationally)

SEUS HAS RICH HISTORY IN LAND-ATMOSPHERIC RESEARCH

EPA Southern Oxidation Studies, SOS (mid 1990 –present)

NIGEC, National Institute for Global Environmental Change (develop region carbon budget estimates) (1995)

FACE - Free air carbon dioxide enrichment – ecosystem experiments

NICCR – National Institute of Climate Change Research. Mobilization of university researchers, in support of the climatic change research. (2003)

NIFA 2010 joint venture DOE, NSF, USDA ecosystem modeling efforts.

TES – Terrestrial Ecosystem Sciences / NGEE

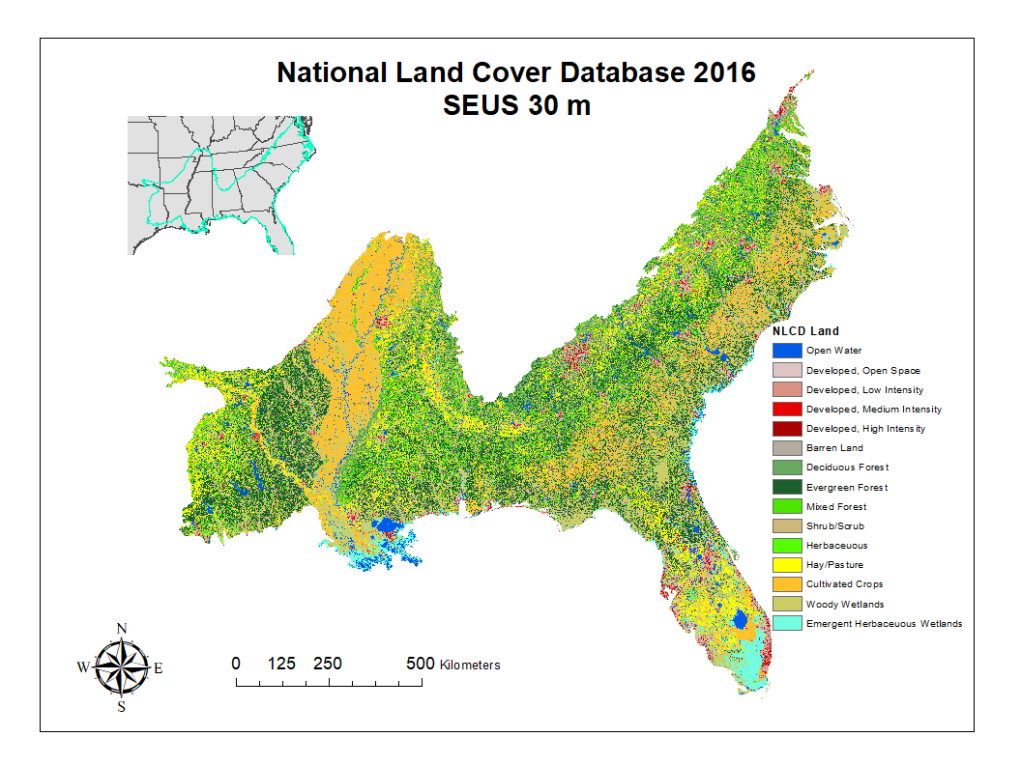
WHAT HAVE WE LEARNED

- Large variation in carbon and water exchange rates (climate, site preparation, site quality and Genetic Materials)
- Southeast United States has been a large sink of carbon, accounting for ~15 - 20% of US fossil fuel emissions
  - Large portion is southern Pine plantations (0.4 Tg C/yr, Brancho et al. 2011)
- Elevated atmospheric CO_2 concentration increases carbon sequestration capacity for short periods of time
- Consequences for water use (Trading Water for carbon; Jackson et al. 2005)
- What you measuring at the tower may not be coming from the source area
- Scale is a significant factor in the carbon and water budgets of the region (Binford Et al. 2006)
- Chu et al. in prep. AmeriFlux sites have relatively homogeneous land cover within the flux footprint, only a small portion of sites have similar land cover outside the footprint

UNKNOWNS FROM PAST RESEARCH

THERE WAS A STRONG FOCUS ON PINE PLANTATIONS

- WHAT ABOUT OTHER OTHER VEGETATION TYPES AND LAND USE?
- HOW DOES THE PINE FOCUS AFFECT LAND-ATMOSPHERE MODELING EFFORTS?
- IDEAL CONDITIONS FOR LAND ATMOSPHERE STUDIES BUT WE DIDN'T UNTANGLE HETEROGENEITY IN FLUXES



SCIENTIFIC CHALLENGES AND OPPORTUNITIES

1. How do we as a community study the large variance in fluxes that we see in the region?

2. What are the methane sinks in the region?

3. How does Urbanization and urban pollution change energy balance, aerosol emissions, LE, etc.?

4. How do privately owned, small units of land affecting our ability to study the region?

CHALLENGES AND OPPORTUNITIES SCIENTIFICALLY CONTINUED

5. As forests in the region age, how will this affect Land-atmospheric processes?

6. What is the role of prescribed fire in the region's land-atmospheric processes?

7. How will genetic improvement of crops influence surface fluxes, temperature, BVOCs, LE?

Operational Challenges/Opportunities

- We can't be everywhere? We may not want to be everywhere?
- Development of new Partnerships
  - University
  - Other observatories – NEON?
- Linking measurements at different scales

THANK YOU