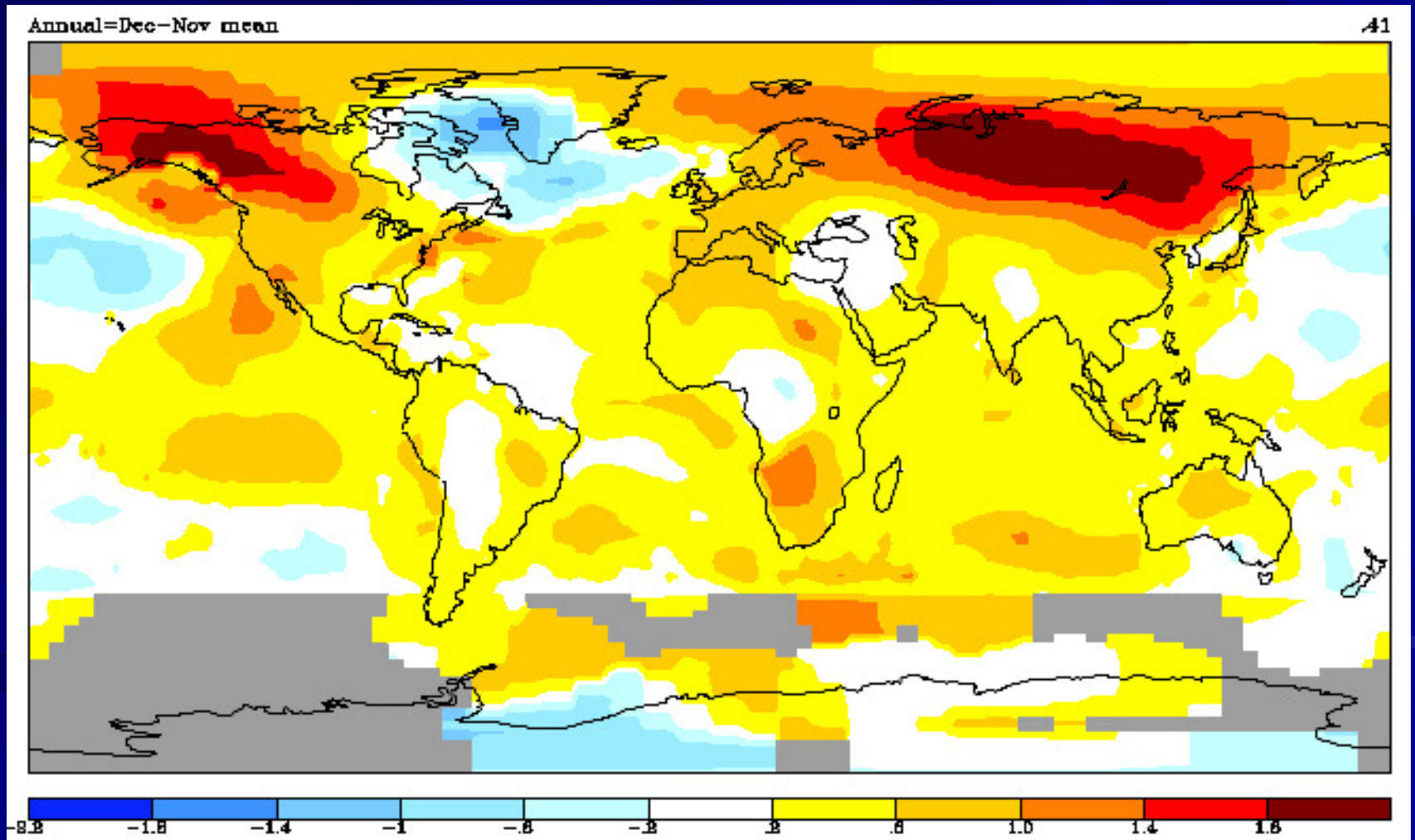


# Briefing on US Forest Service Climate Change Issues

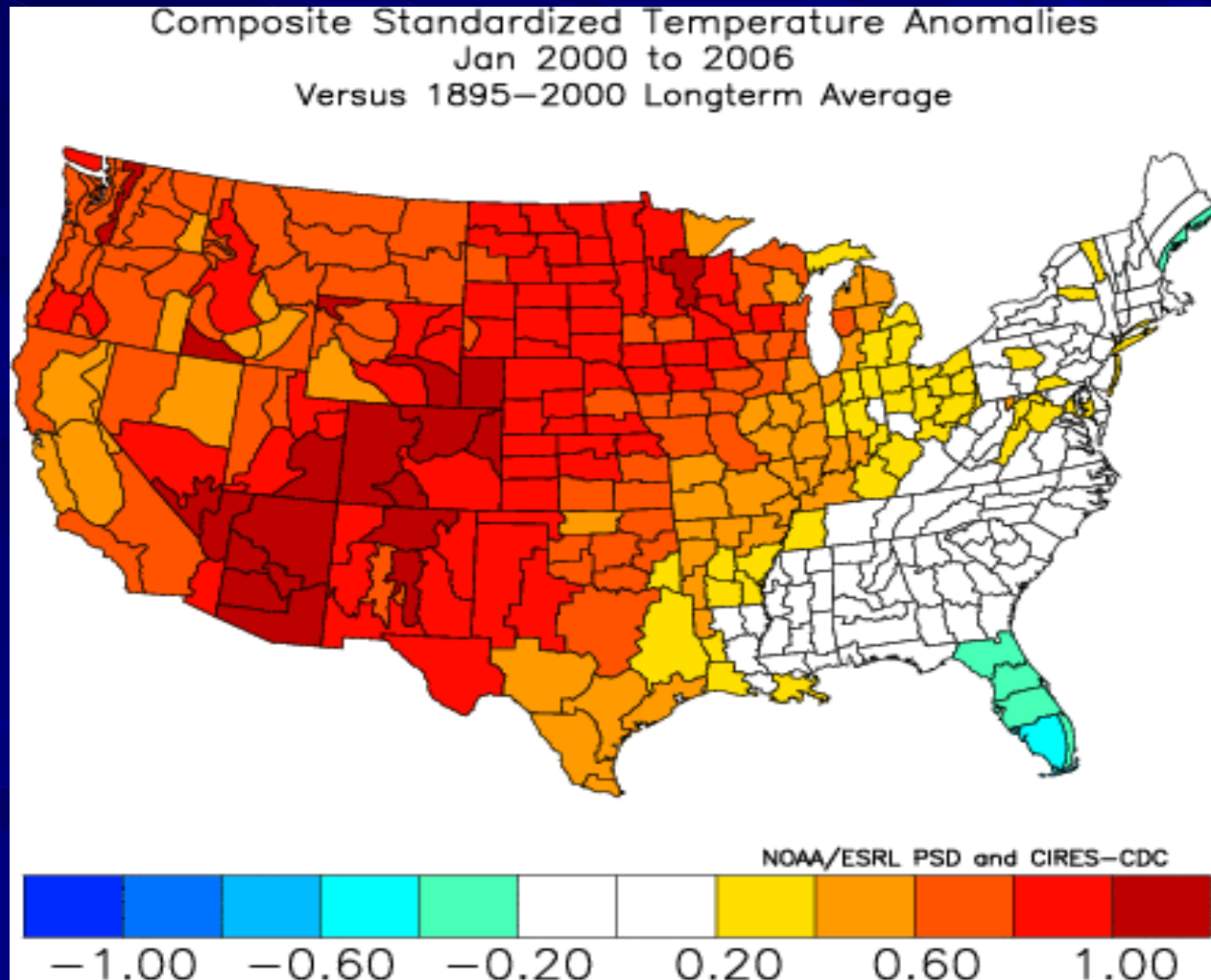
Allen Solomon and Susan Conard  
Vegetation Management Science Staff  
R & D, USFS

February 21, 2007

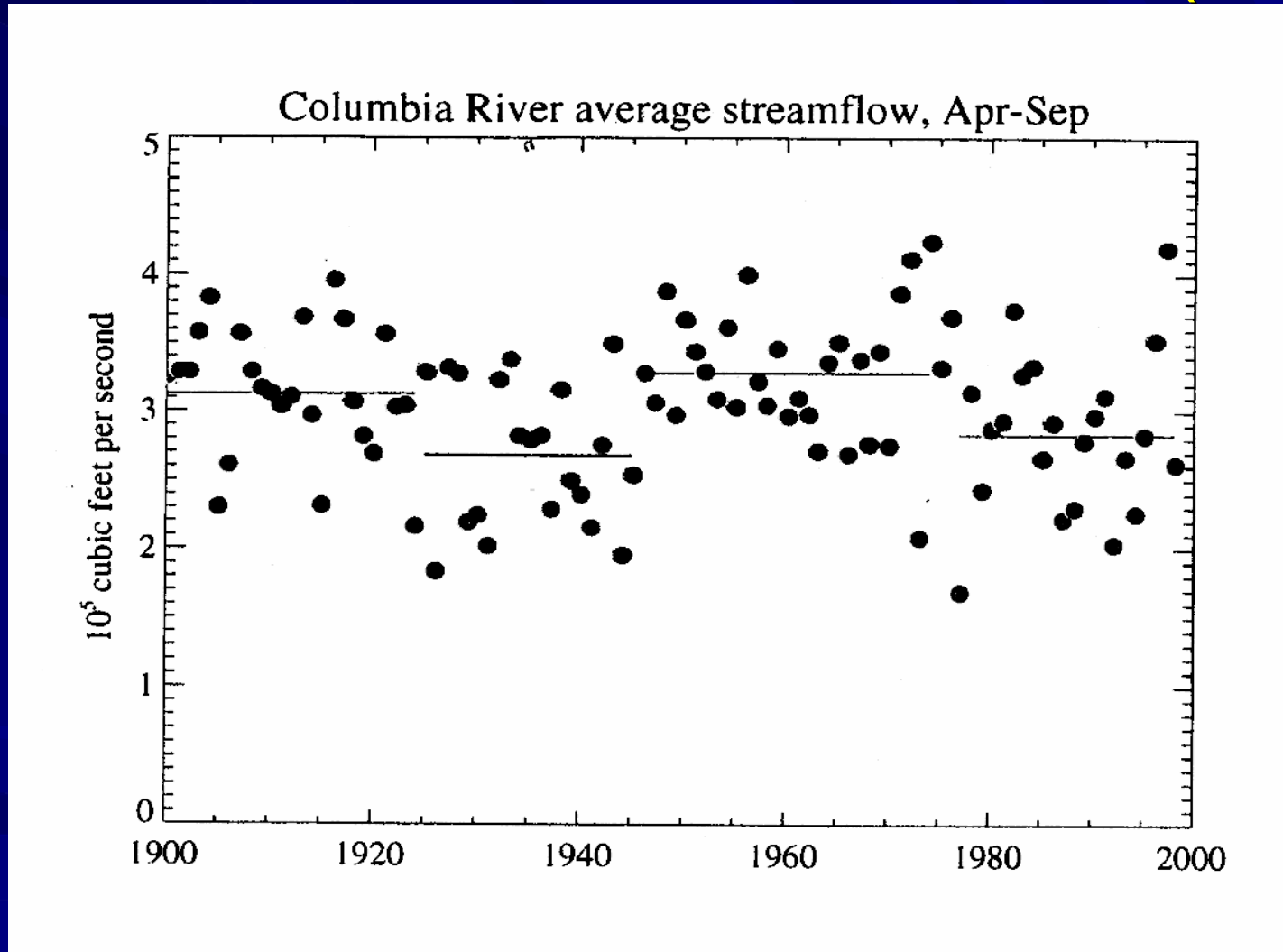
# Annual Temperature Changes From 1965 to 1995



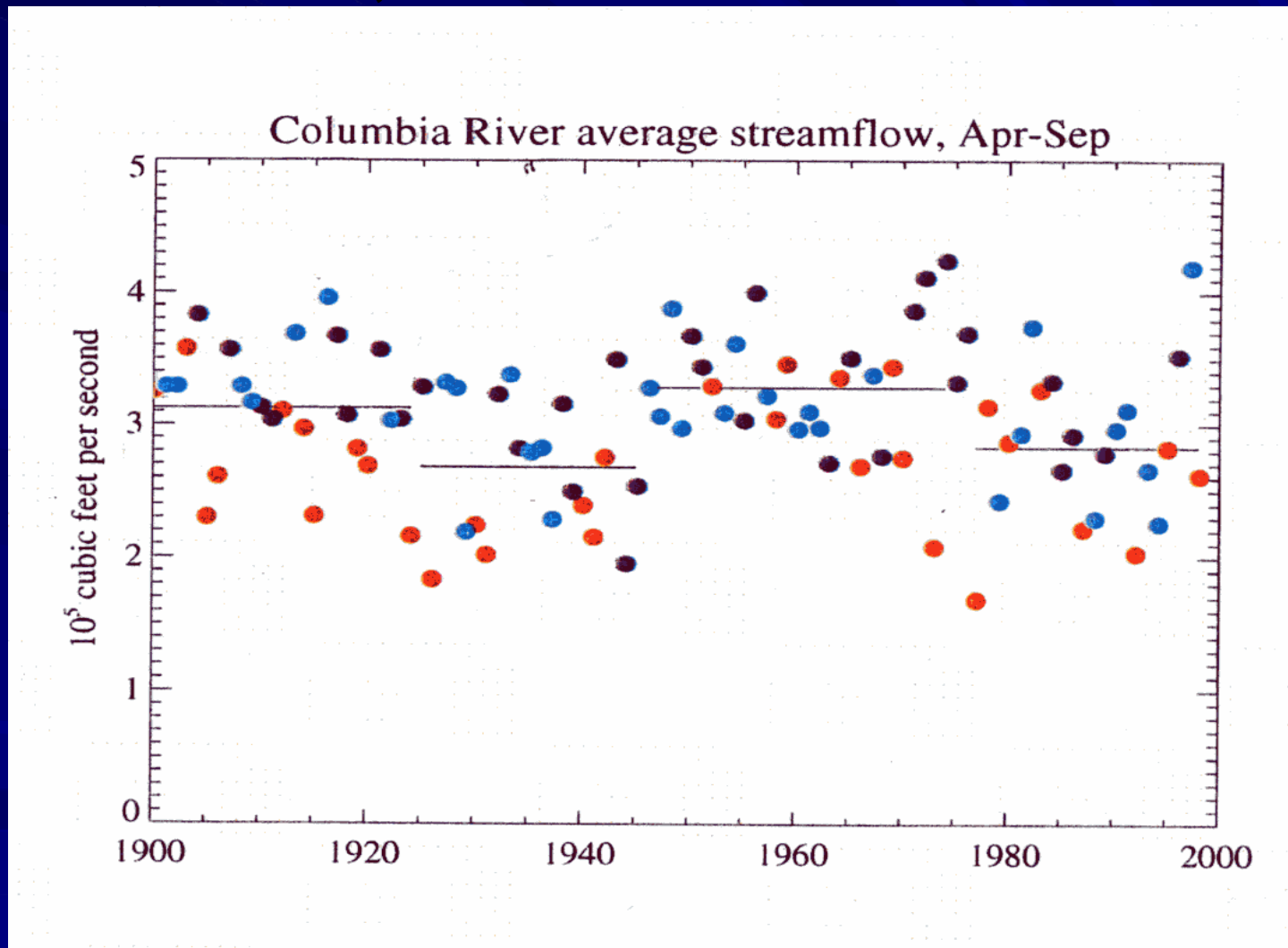
# Temperature anomalies: 2000-2006 versus 1895-2000



# Historic Changes in River Flow and the Pacific Decadal Oscillation (PDO)



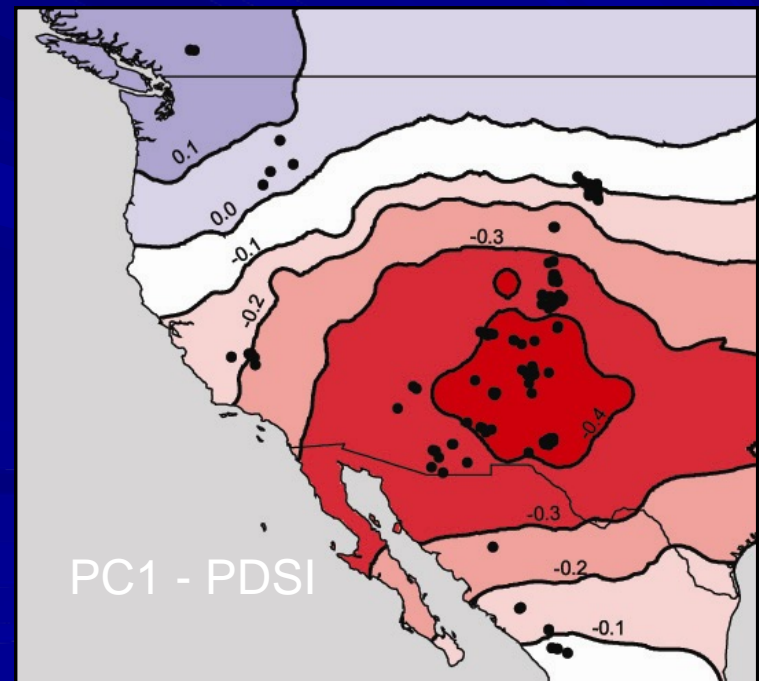
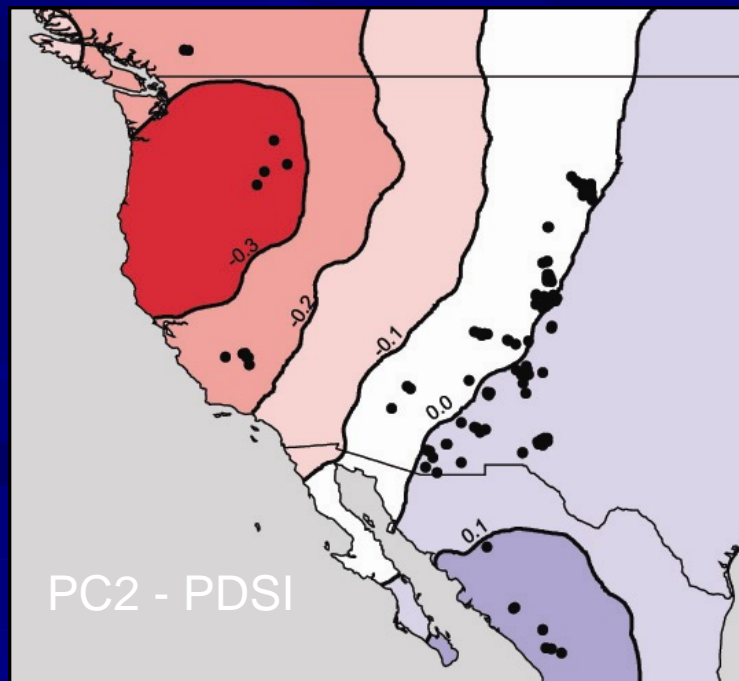
# Historic Changes in River Flow, PDO, el Niño and la Niña



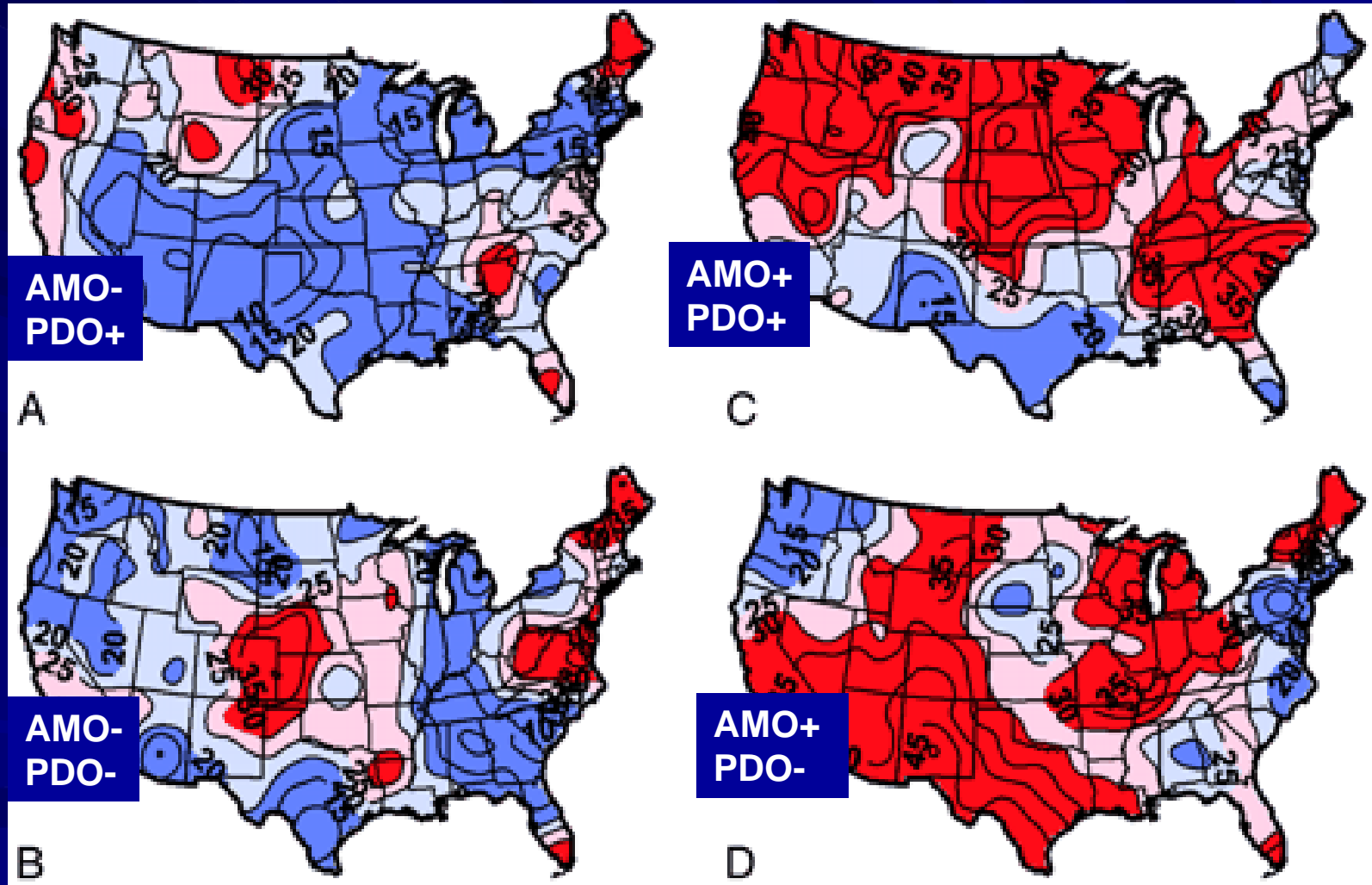
# Contingent Pacific–Atlantic Ocean influence on multicentury wildfire synchrony over western North America

Thomas Kitzberger<sup>\*†</sup>, Peter M. Brown<sup>‡</sup>, Emily K. Heyerdahl<sup>§</sup>, Thomas W. Swetnam<sup>¶||</sup>, and Thomas T. Veblen<sup>||</sup>

PNAS | January 9, 2007 | vol. 104 | no. 2 | 543–548



# Spatial patterns of 20-year moving drought frequency in the conterminous United States – percent of years in drought.





# Direct Impacts of Warming on Forests

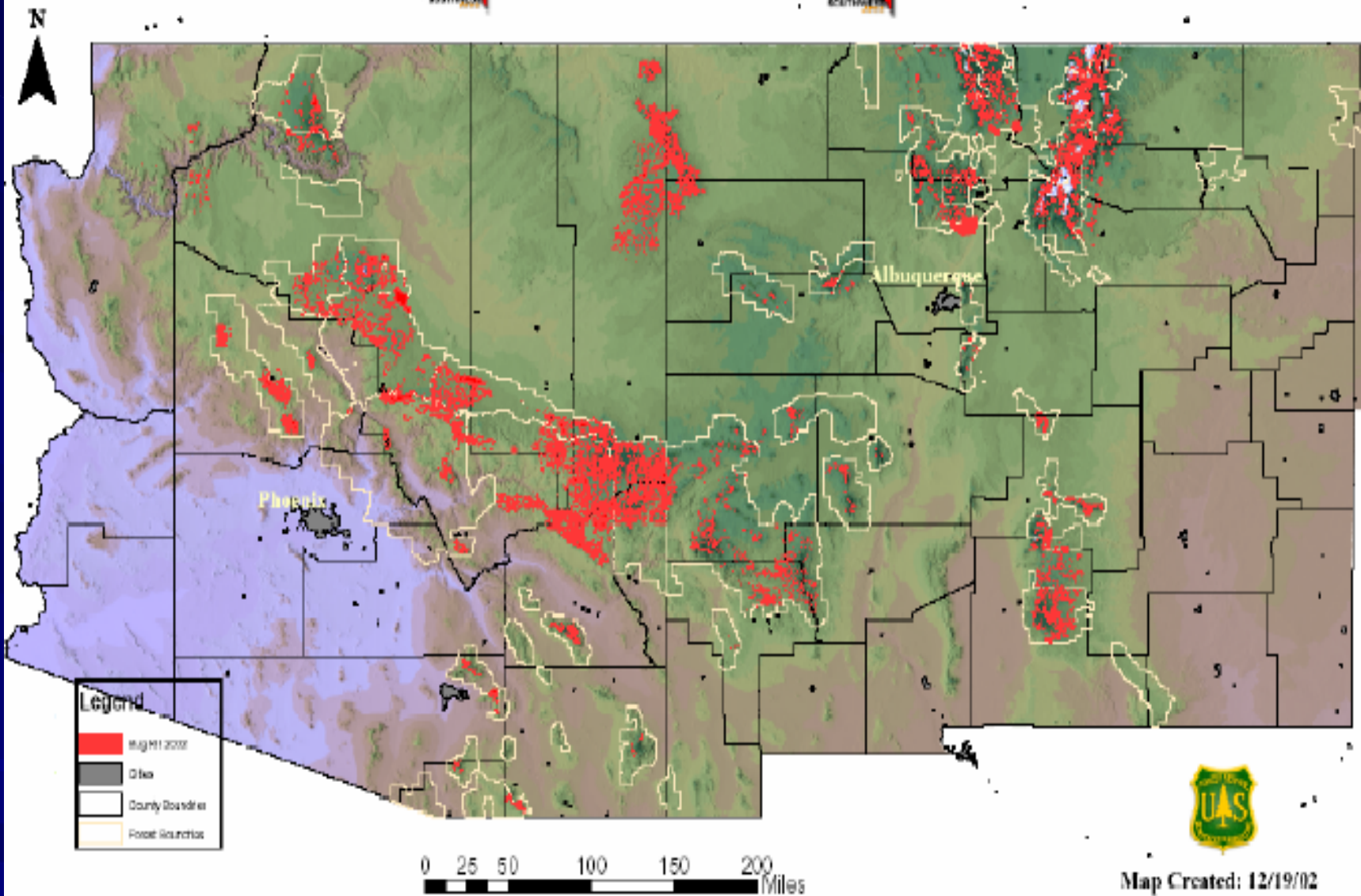




# Many Forests in the Western N.A. are Dying Back from Drought and Pests

Insect and disease epidemics are increasing in number and spreading rapidly in dense, warm and dry forests





- Areas of  $\geq 50\%$  tree mortality as surveyed in fall 2002

# Many Forests in Western N.A. are Undergoing Catastrophic Fires

Severe US wildfires burned more area this year than in any of the past 80 years

Area burned in each of the past 5 years is above 1995-2005 averages

Many fires were in diseased and drought stressed forests.



# Many Forests in the Western U.S. are Unnaturally Dense

- Fire suppressed for the past 50 years
- Logging reduced for the past 20 years



# In eastern Canada and U.S. Atmospheric Pollutants also Increase Stress in Trees

Tropospheric ozone

Acid rains and fogs

Nitrogen deposition



# Improve technical information for forest GHG accounting rules and guidelines

The screenshot displays the COLE web tool interface. At the top, there are tabs for 'COLE Map', 'Filters', 'Data Formatting', and 'Complete Query'. The main area is divided into several sections:

- COLE Map:** A map of Maine with county boundaries highlighted in yellow and green.
- Live Tree Carbon Density (tonnes/hectare):** A zoomed-in plot of a region in Maine, showing carbon density by county. The plot is color-coded according to a scale from 50 to 90 tonnes/hectare. The x-axis is labeled 'Albers.X' (ranging from 1900000 to 2300000) and the y-axis is labeled 'Albers.Y' (ranging from 2500000 to 2900000).
- Map Tools:** Includes buttons for 'Change State', 'Reset Map', and 'Zoom'.
- Drawing Tools:** Includes buttons for 'Draw Polygon', 'Draw Circle', and 'Select User Shapes'.
- Layer Tools:** Includes buttons for 'Select All Counties' and 'Select by Layer'.
- Layer Buffering Options:** Includes a button for 'Select Buffers By Layer' and a dropdown menu for 'Selection Layer' (currently set to 'counties').
- Report Window:** A window titled 'Xpdf: /tmp/today\_999report.pdf' displaying the 'COLE Standard Report' by the 'COLE Development Group' dated 'January 21, 2004'. The report includes an introduction and a statistical report section.

**COLE Standard Report**  
COLE Development Group \*  
January 21, 2004

**1 Introduction**

This is a standard report produced by COLE, The Carbon Online Estimator. The is an online package that was developed under a cooperative agreement between NCASI and the USDA Forest Service, IRWU-4101 in Durham, NC.

This report is for demonstration purposes only. The table and the graph could both be improved.

**2 Statistical Report**

The following table is made from data from the region you selected. It provides information on tac = Total Aboveground C, tbc = Total Belowground C ttc = Total Forest Carbon, and ttc = Total Tree Carbon.

Table 1: Summary of Carbon Components N=8853

	N	tac	tbc	ttc	ttc
tips					
Washington,ME	457	77.34	194.00	271.34	56.74

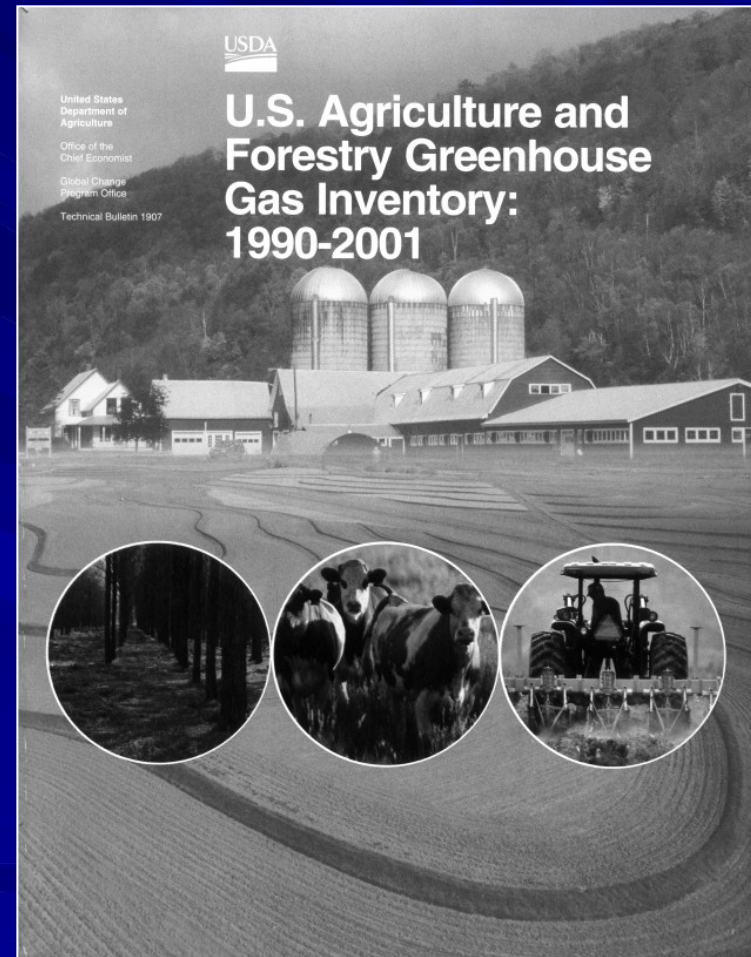
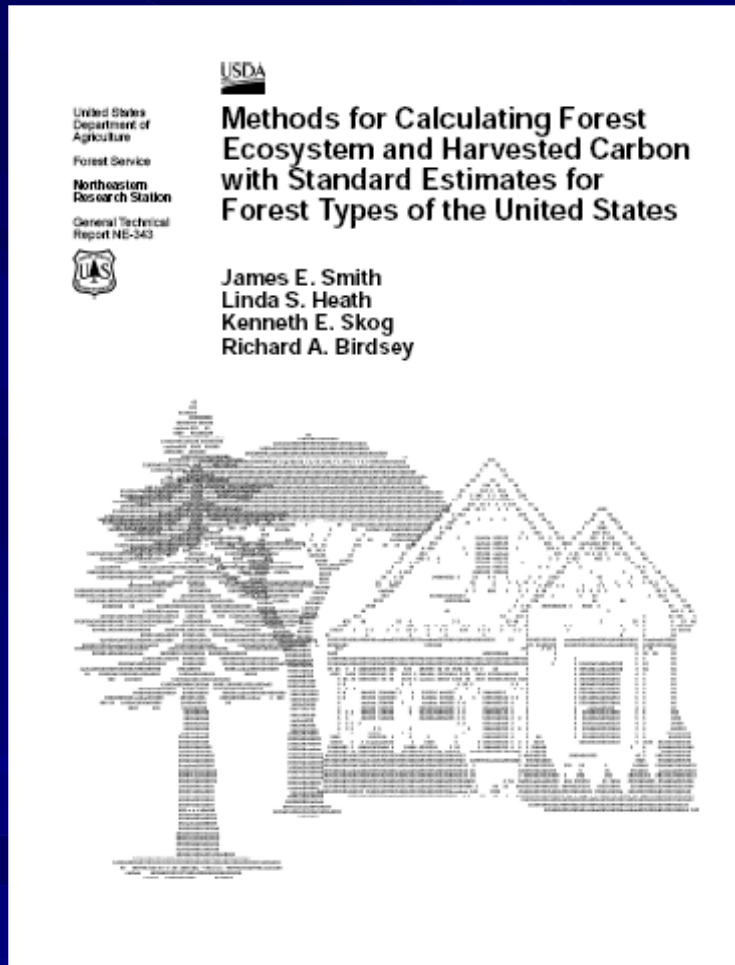
\*NCASI: <http://ncasi.uml.edu/>, USDA Forest Service: <http://www.fs.fed.us/nc/durham/4104/>

Page 1 of 4

<http://ncasi.uml.edu/COLE/>

COLE: Carbon On-line Estimation web tool

# Improve technical information for forest GHG accounting rules and guidelines



# Improving Observations of Carbon Stocks and Flows

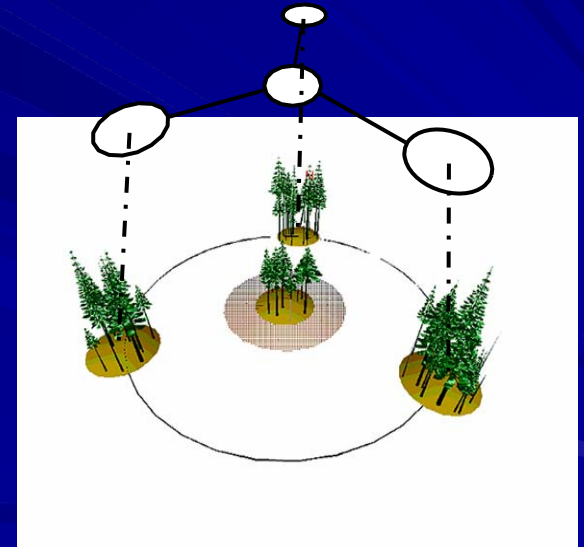
- Experimental research facilities
- Participation in NACP and other interagency research
- Use of forest inventory in analysis of forests role in the global carbon cycle



FACE Experiment



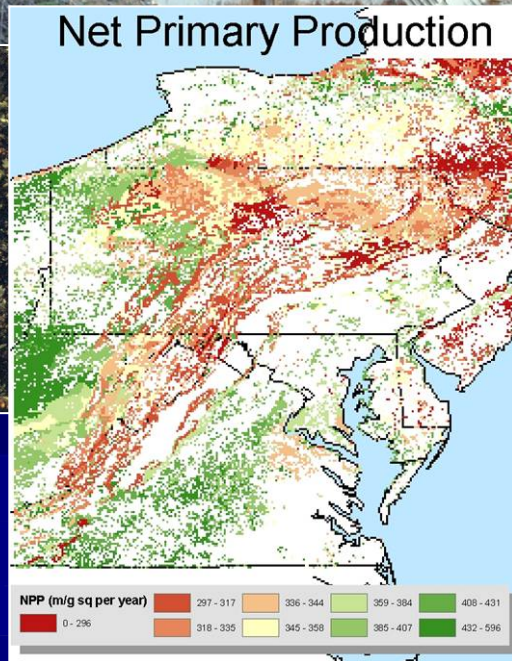
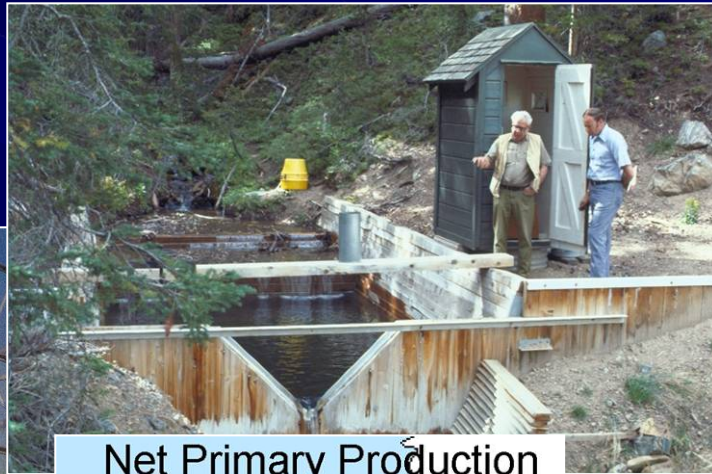
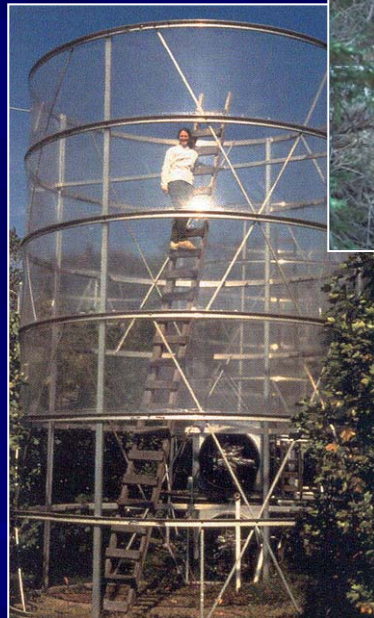
Flux Tower



Inventory Plot



# Integrate Observations and Process Studies to Understand Climate-Forest Relationships



## – Long-term Monitoring

- Climate, soils, hydrology
- Vegetation

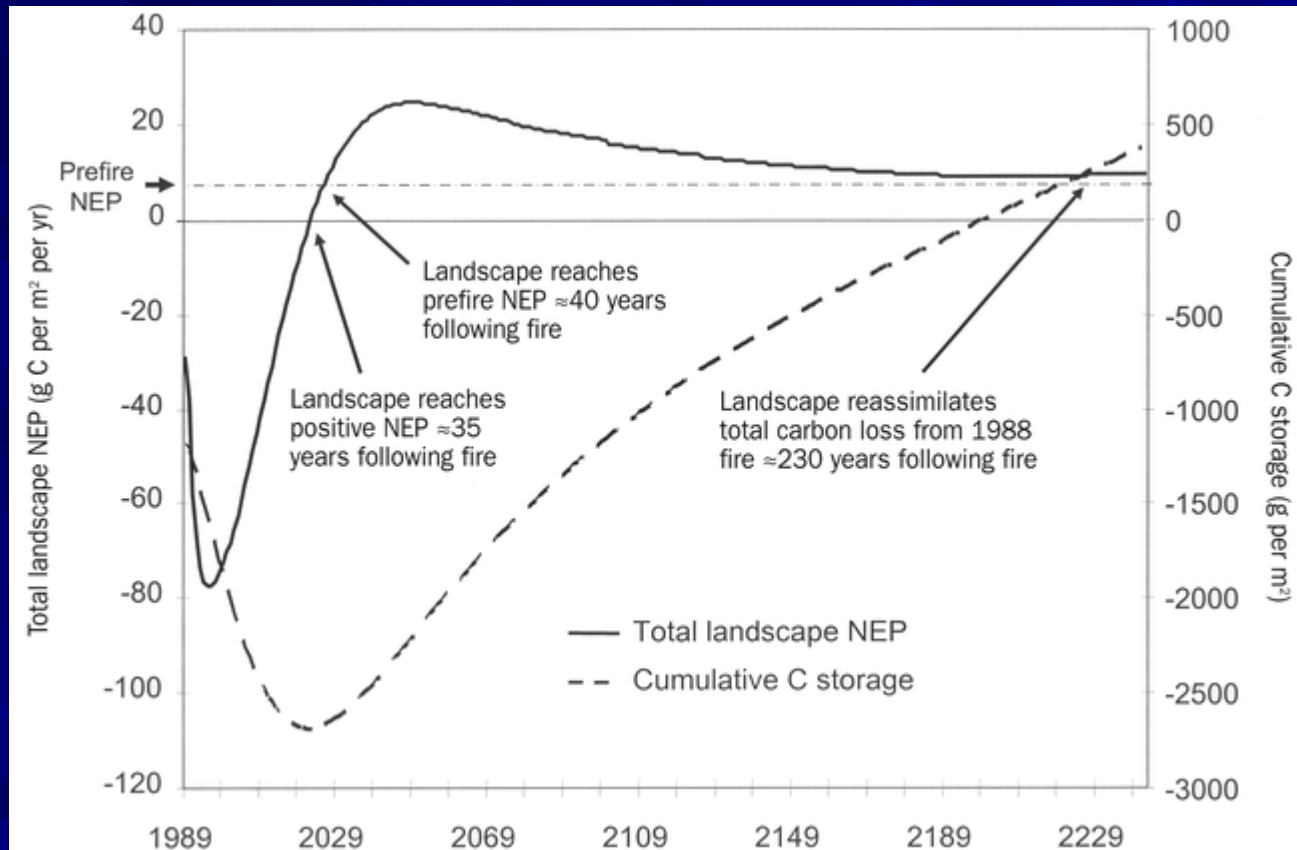
## – Experimentation

- Greenhouse
- Field, open-top chambers, FACE, flux towers

## – Ecological Modeling

- Biogeochemical models
- Dynamic global vegetation models
- Individual species models

# Forest recovery from fire: Carbon sequestration vs carbon storage.



# A Forest Resilience Research Agenda: How much to Decrease Forest Density?



# A Forest Resilience Research Agenda: How to Enhance Diversity of Provenances and Species?



# What Forest Service Research could accomplish with additional funding support

- PNW, PSW, RMR have developed an initiative to implement global change science with decision-support tools for forest management planning
- SRS and NRS are currently discussing a potential joint climate change initiative.
  - NRS is developing science-based management systems that integrate carbon sequestration with other ownership and management objectives.
  - SRS is completing a hydrological model to predict national water supply and demand.