

Climate Change Research US Forest Service, 2007





Forest Service Climate Change Vision

FS Mission:

Sustaining the health, diversity and productivity of the nation's forests and grasslands to meet the needs of present and future generations for forest products and services

- Products include timber, water supplies, wildlife, wild foods
- Services include carbon storage, clean air, recreation, biodiversity, and aesthetic and spiritual benefits

Climate change affects all of these products and services

Climate change effects must be integrated into management systems to continue delivering these products and services



Forest Service Global Change Research Goals

- Research products mandated by Congress
 - RPA Forest Assessments: Renewable Resources Planning Act (RPA) of 1974
 - Research on Carbon Cycle, Water Cycle, Ecosystems, Land Use and Cover: US Global Change Research Act of 1990
 - US Greenhouse Gas Assessment: UN Framework Convention on Climate Change, 1992
 - Voluntary Reporting of Greenhouse Gas Emissions: Section 1605b of the Energy Policy Act of 1992
- Research to manage the forests of the future to sustain and enhance
 - Water supplies
 - Carbon stocks
 - Biodiversity
 - Timber production
 - Wildlife habitat
 - Recreation



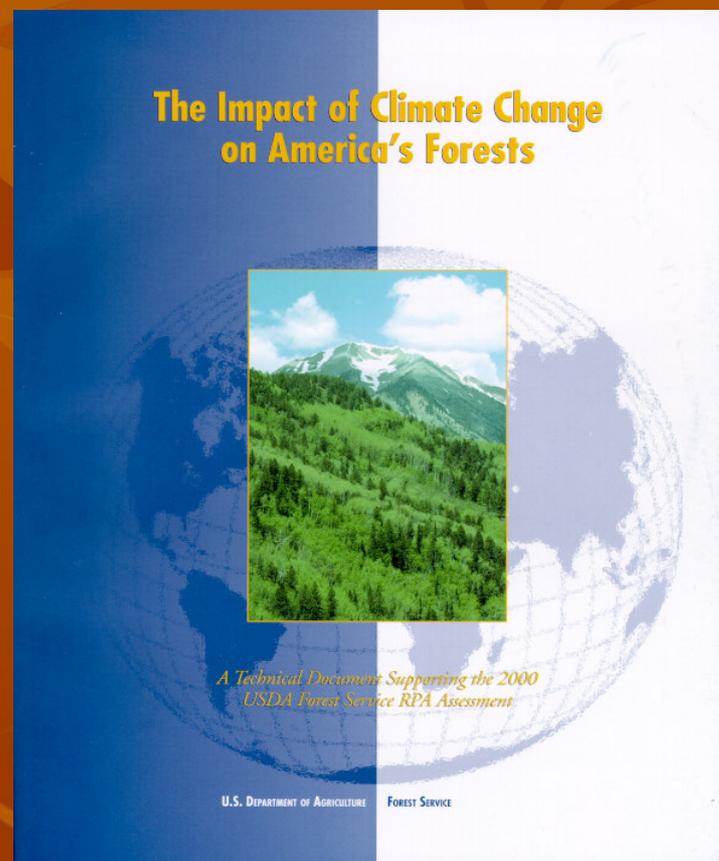
Origin of the RPA Assessment

- Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974
- Global change research with agricultural and forest carbon accounting added in 1990



RPA 2000 Climate Change Assessment

- Reviews State-of-the-Art in Modeling Climate Change Impacts:
 - Forest productivity
 - Vegetation change
 - Supply and demand
 - Carbon accounting
 - Management activities for carbon sequestration





U.S. Climate Change Science Program (CCSP): Forest Service Research Goals

1. Improve observations of carbon stocks and flows
2. Integrate observations and process studies to understand climate-forest relationships
3. Provide predictive models of forest carbon dynamics
4. Improve technical information for forest GHG accounting rules and guidelines
5. Develop forest management systems to increase carbon sequestration



“1. Improve Observations of Carbon Stocks and Flows”

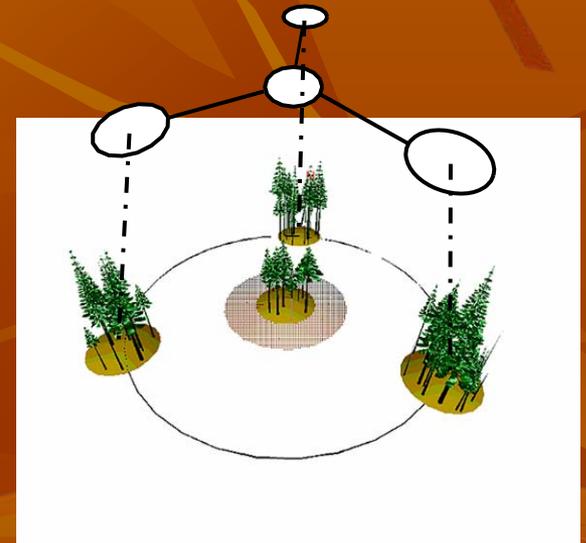
- Experimental research facilities
- Participation in NACP and other interagency research
- Use of forest inventory in analysis of forests role in the global carbon cycle



FACE Experiment



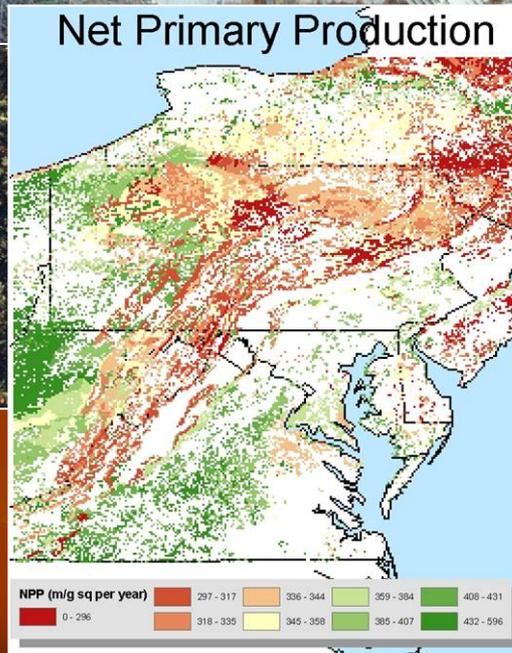
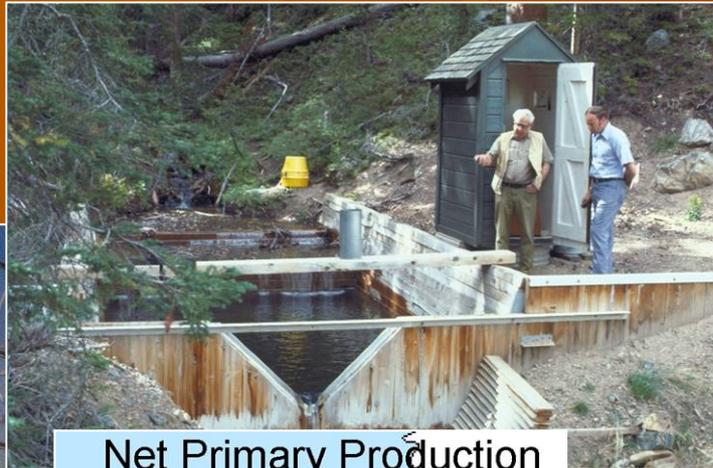
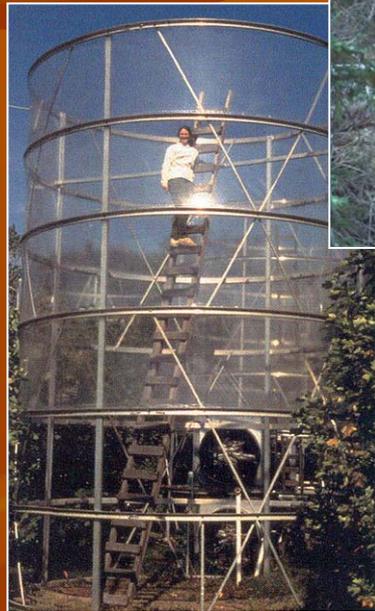
Flux Tower



Inventory Plot



“2. Integrate Observations and Process Studies to Understand Climate-Forest Relationships”

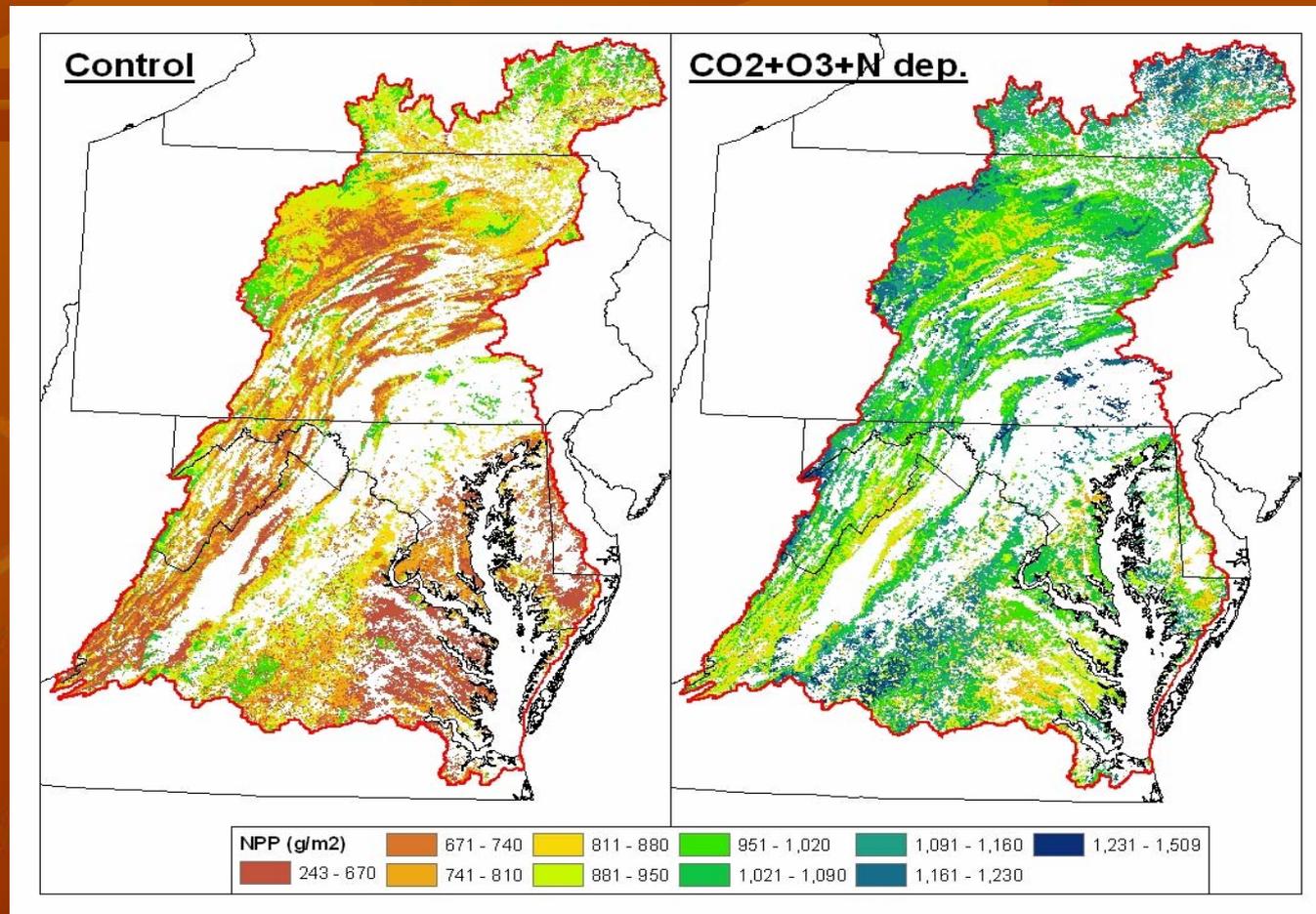


- **Long-term Monitoring**
 - Climate, soils, hydrology
 - Vegetation
- **Experimentation**
 - Greenhouse
 - Field, open-top chambers, FACE, flux towers
- **Ecological Modeling**
 - Biogeochemical models
 - Dynamic global vegetation models
 - Individual species models



“3. Provide predictive models of forest carbon dynamics”

Modeling multiple interacting stresses

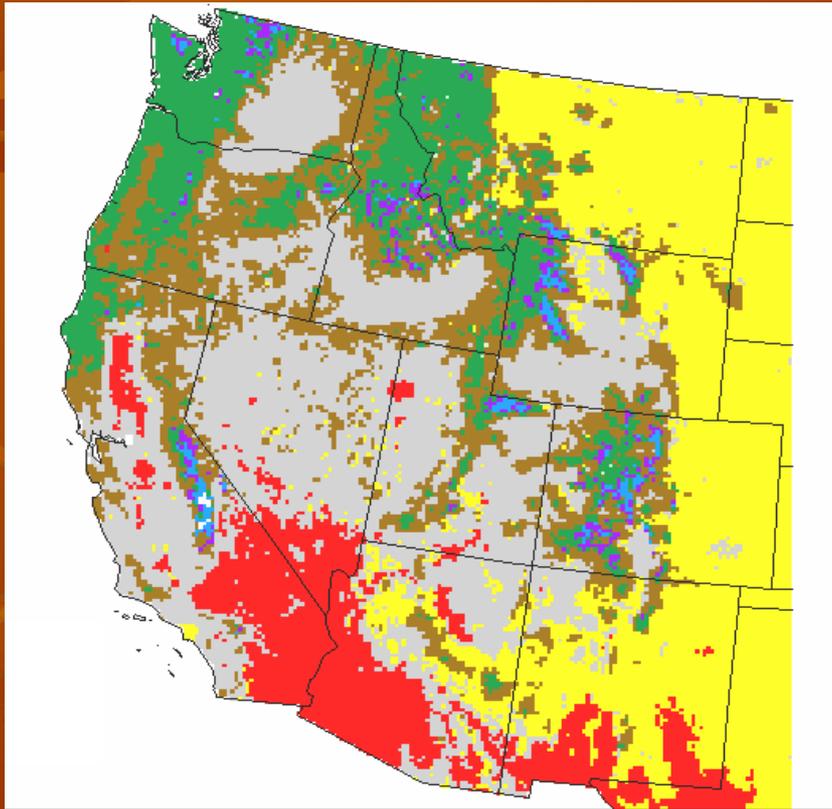


The combined effects of increasing CO₂, tropospheric ozone, and N deposition = **+20% NPP**

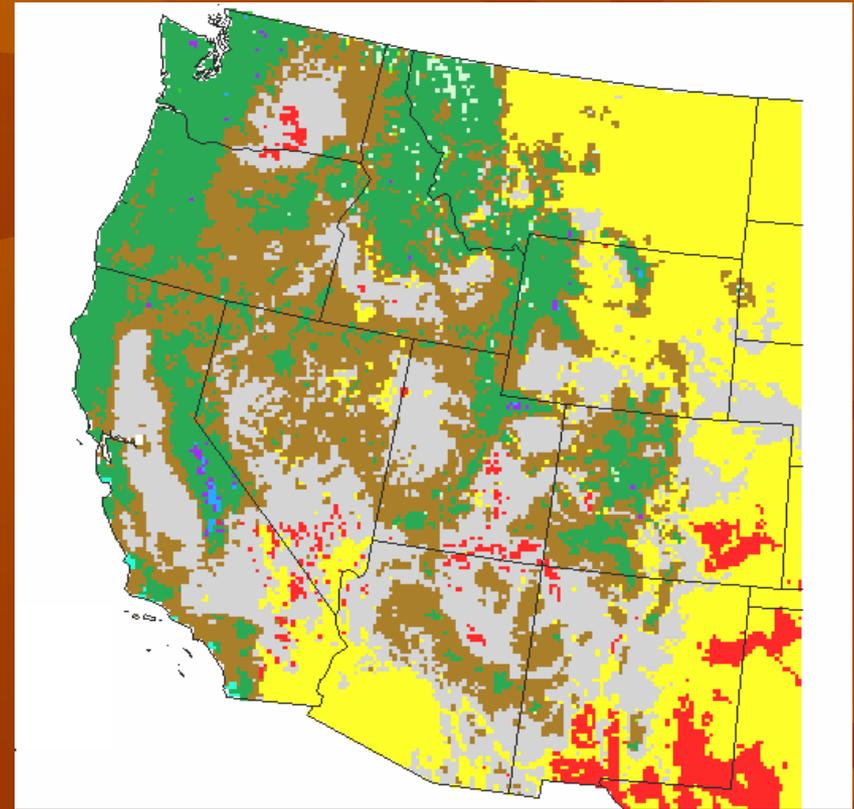


“3. Provide predictive models of forest carbon dynamics”

Forest and range responses to changing climate & CO₂



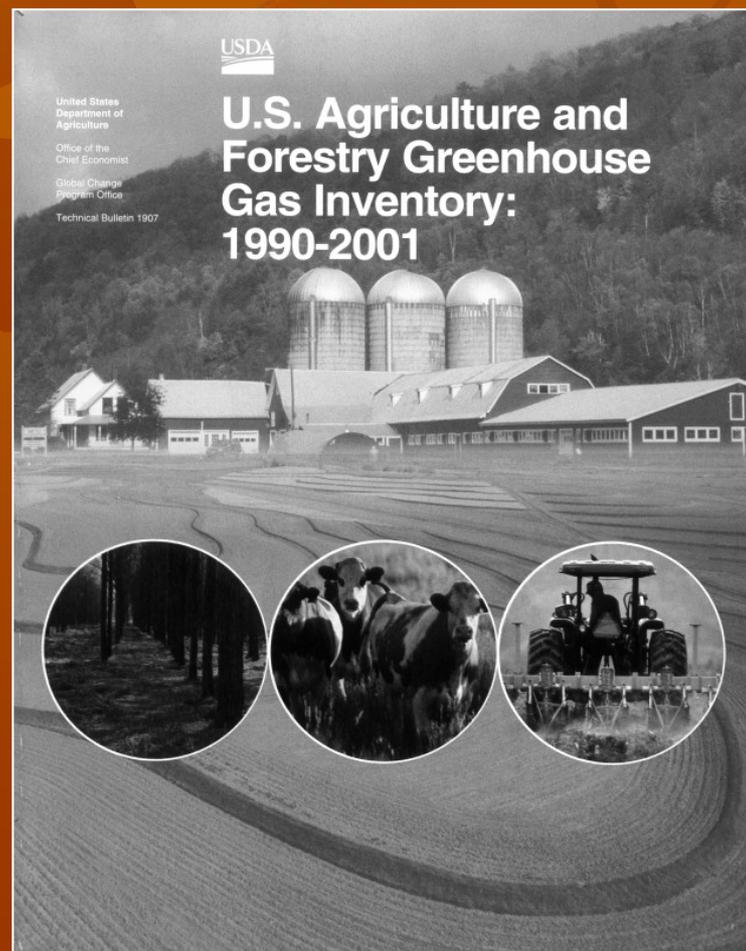
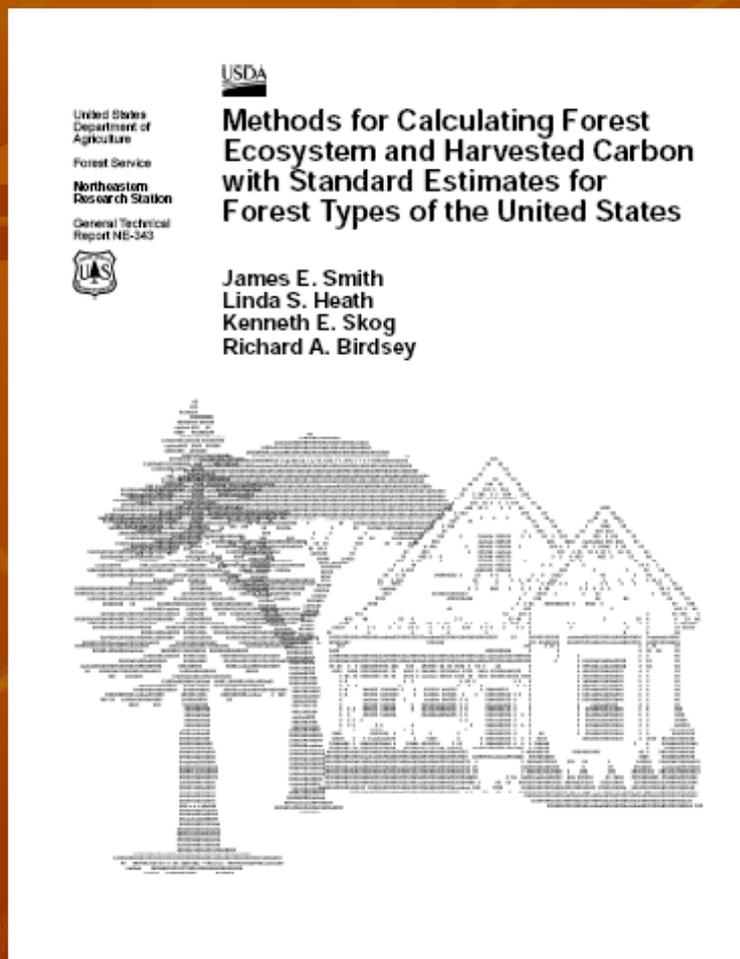
Current Climate



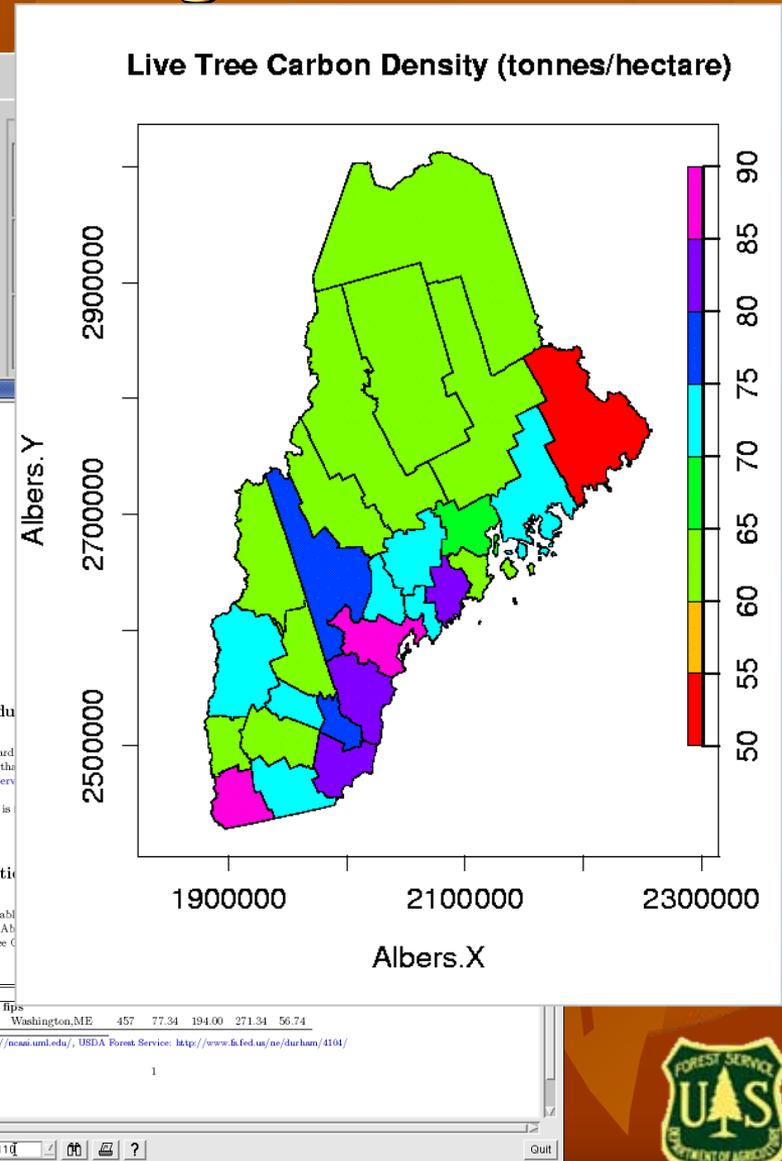
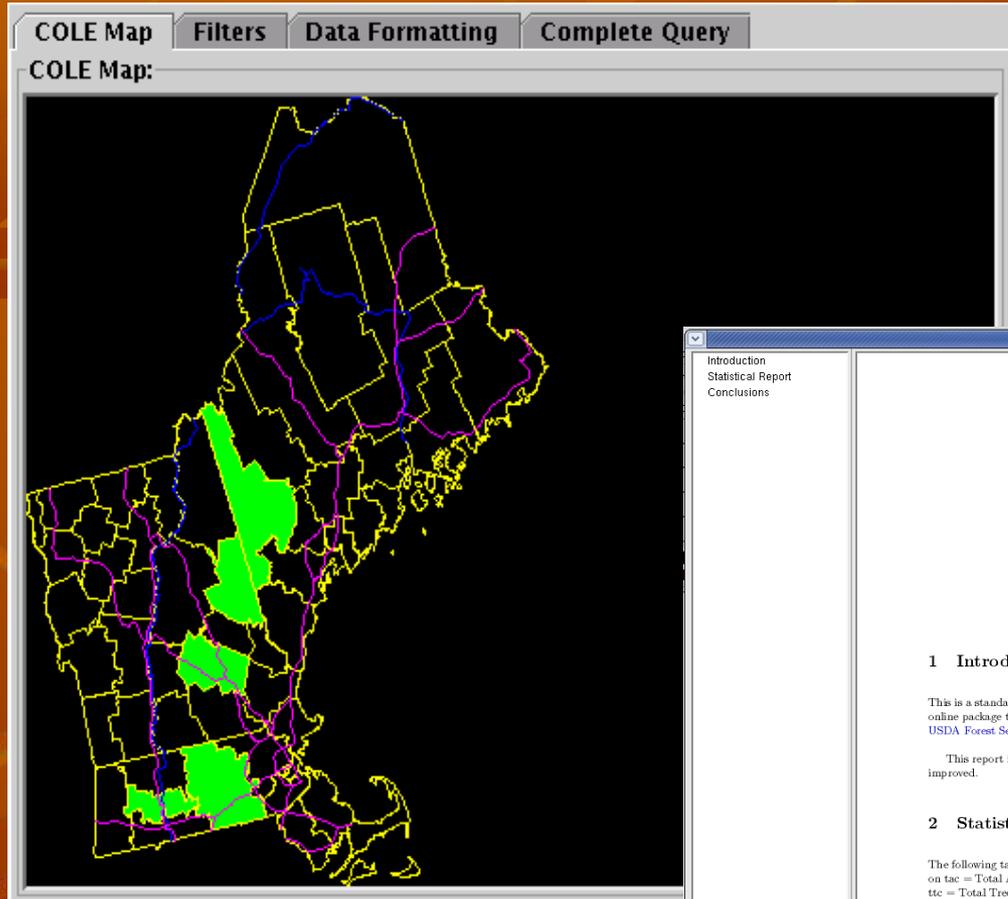
Future Climate (CGCM1)



“4. Improve technical information for forest GHG accounting rules and guidelines”



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

COLE: Carbon On-line Estimation

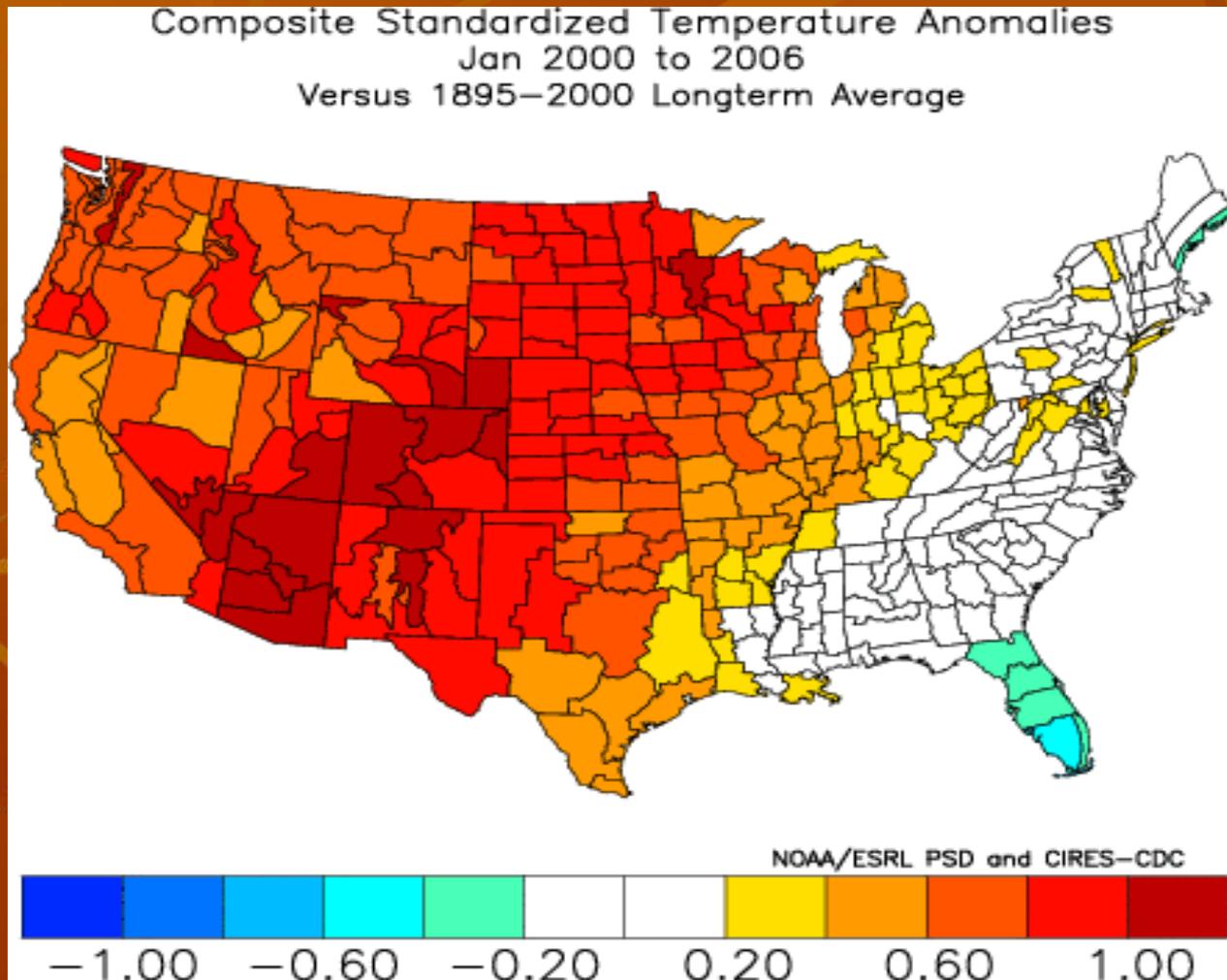


“5. Develop Forest Management Systems to Increase Carbon Sequestration”

- The critical challenges for management of carbon stocks under changing climate intersect with other management objectives:
 - Water supply protection
 - Timber growth
 - Biodiversity preservation
 - Wildfire control
 - Invasive pest management
 - Urban-Wildland interface effects reduction



Temperature anomalies: 2000-2006 versus 1895-2000



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

Suppressing fire for the past 50 years and reduced logging for 20 years, has increased the density of many forests



Many Forests in the Western U.S. are Dying Back from Drought and Pests

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



Many Forests in the Western U.S. are Undergoing Catastrophic Fires

Severe wildfires are worse this year than in the past 80 years, and in the past 5 years, all are above 1995-2005 averages, many in diseased and drought stressed forests.



Many Forests in the Western U.S. are Increasingly Dominated by Citizen Activities

Low density
rural
residential
land use now
covers 25% of
the land,
greatly
complicating
management



Forest Management Actions are Critical to Reducing Carbon Emissions

- Specifics of future climate changes cannot be predicted
- Yet much of the climate-related stress on trees can be relieved by management actions.
- Current research involves win-win options:
 - Reducing density of forests: increases water and nutrients for each remaining tree while reducing fuel loads
 - Planting mixtures including warm-region varieties and species: hedges climate uncertainty while reducing insect infestations.
 - Harvesting wood products: permits long-term carbon storage and material substitutions while reducing fuels and increasing carbon sequestration
 - Thinning forest stands and clearing brush for use as biofuels: replaces fossil fuels while reducing fuel loads





The Fundamental Goals of Research on Global
Change by Forest Service Scientists:

Understanding Carbon Fluxes and Enhancing
Forest Sustainability in the Face of
Continuous Environmental Change

Thank you.





Forest Service Climate Change Resources

- **Began with \$22.1 million in 1991**
- **Current funding is \$18.7 million**
 - \$12.2 million in USGCRP
 - \$6.0 million in CCRI
 - \$0.5 million in CCTP
- **Program implemented by many research units and cooperators**
 - Leverage large research base (e.g. forest inventory)
 - Capability for interdisciplinary research



Forests Under Climate Stress are Dying Back in the Western States

- Suppressing fire for the past 50 years and reduced logging for 20 years, has increased the density of many forests
- Insect and disease epidemics are increasing in number and spreading rapidly
- Severe wildfires are worse this year than in the past 80 years, and in the past 5 years, above 1995-2005 averages
- Low density rural residential land use now covers 25% of the land

