Climate Change and the Prospects for Carbon Trading in the Northeast and Midwest

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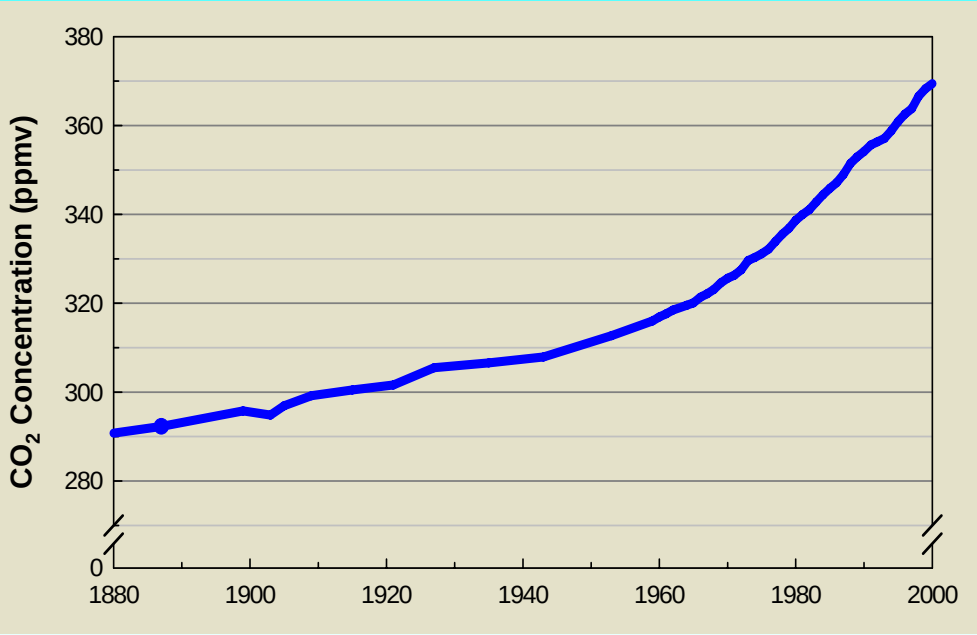
Importance of Climate Change to Agriculture and Forests

- Natural resources are potentially vulnerable to climate change
- Agriculture and forests are important sources and sinks of greenhouse gases
  - Agriculture contributes 6% of US emissions
  - US sinks offset 12% of overall emissions
- Carbon sinks offer a potentially significant low-cost opportunity to address climate change

Greenhouse Gases and Climate



Atmospheric CO_2 concentration has increased by 25% since 1880.

Land-use change, fossil fuel emissions, and climate variability are all cited as causes.

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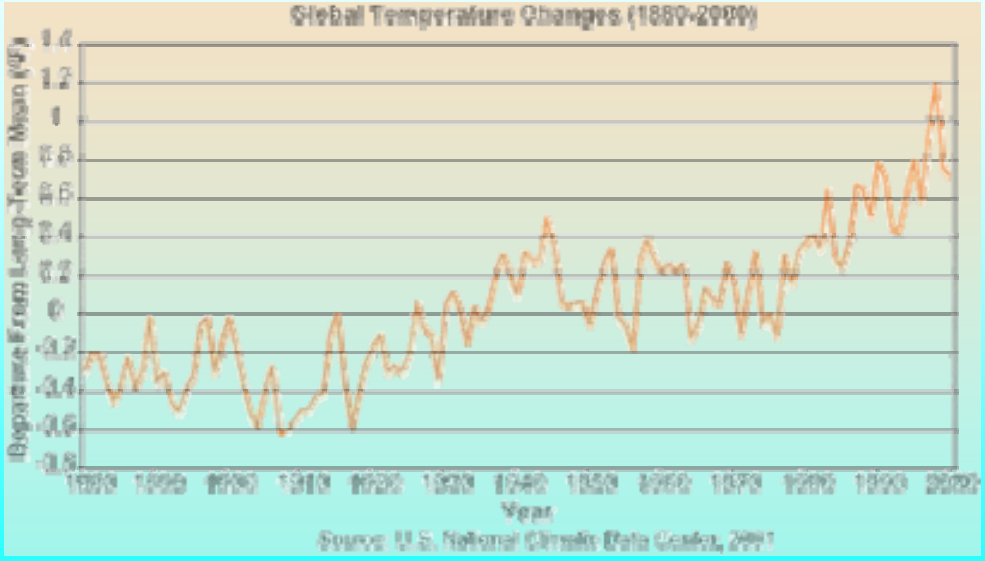
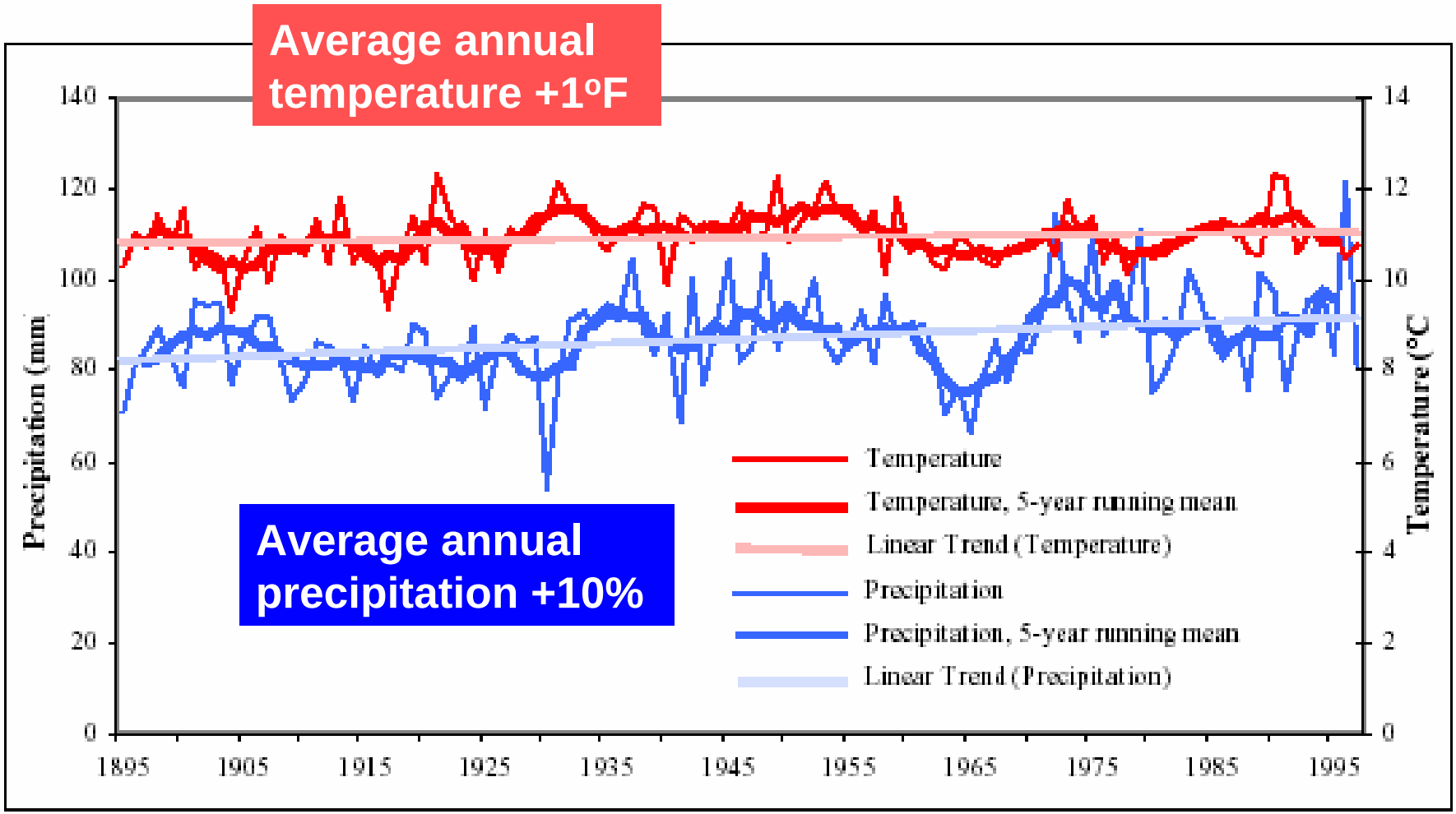


Global temperature has increased by about 1.5º F since 1880.

Increasing greenhouse gases and climate variability are cited as causes.

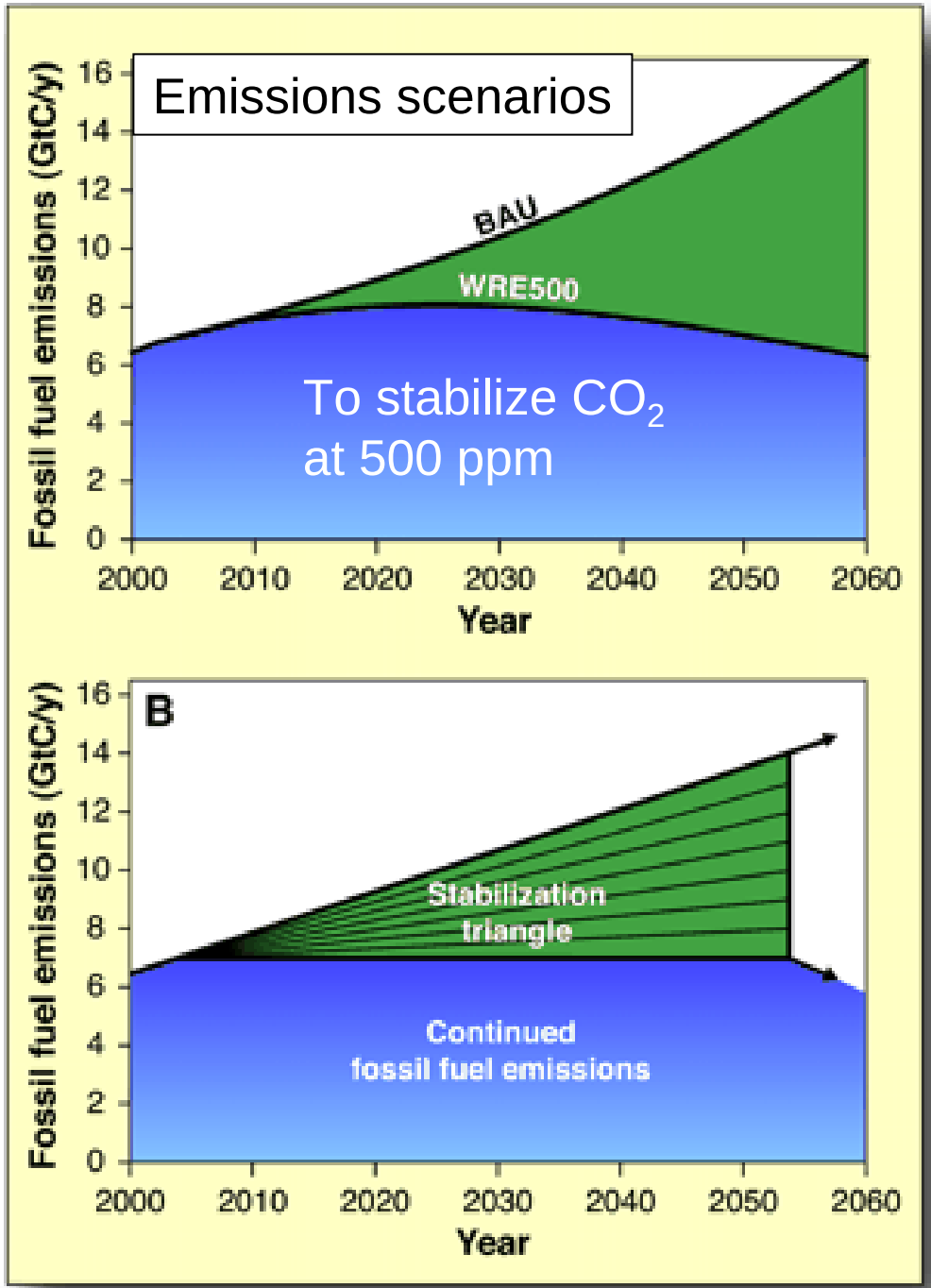
Climate Trends in the Mid-Atlantic Region



From Mid-Atlantic Regional Assessment

How Do Climate Change and Climate Variability Affect Forests?

- **Productivity may change**
  - Longer growing season **(+)**
  - Increasing atmospheric CO_2 **(+)**
  - Air pollution **(-)**
- **Species composition changes**
  - More oak, hickory, pine
  - Less aspen, maple, beech, birch
- **Damage from weather events**
  - Freeze/thaw events
  - Droughts, ice storms, etc.
  - Wildfire
- **Hydrology**
  - Water quality and quantity
- **Forest pests and wildlife**
  - Altered insect and disease incidence
  - Shifts in bird populations



From Pacala and Socolow in Nature 2004

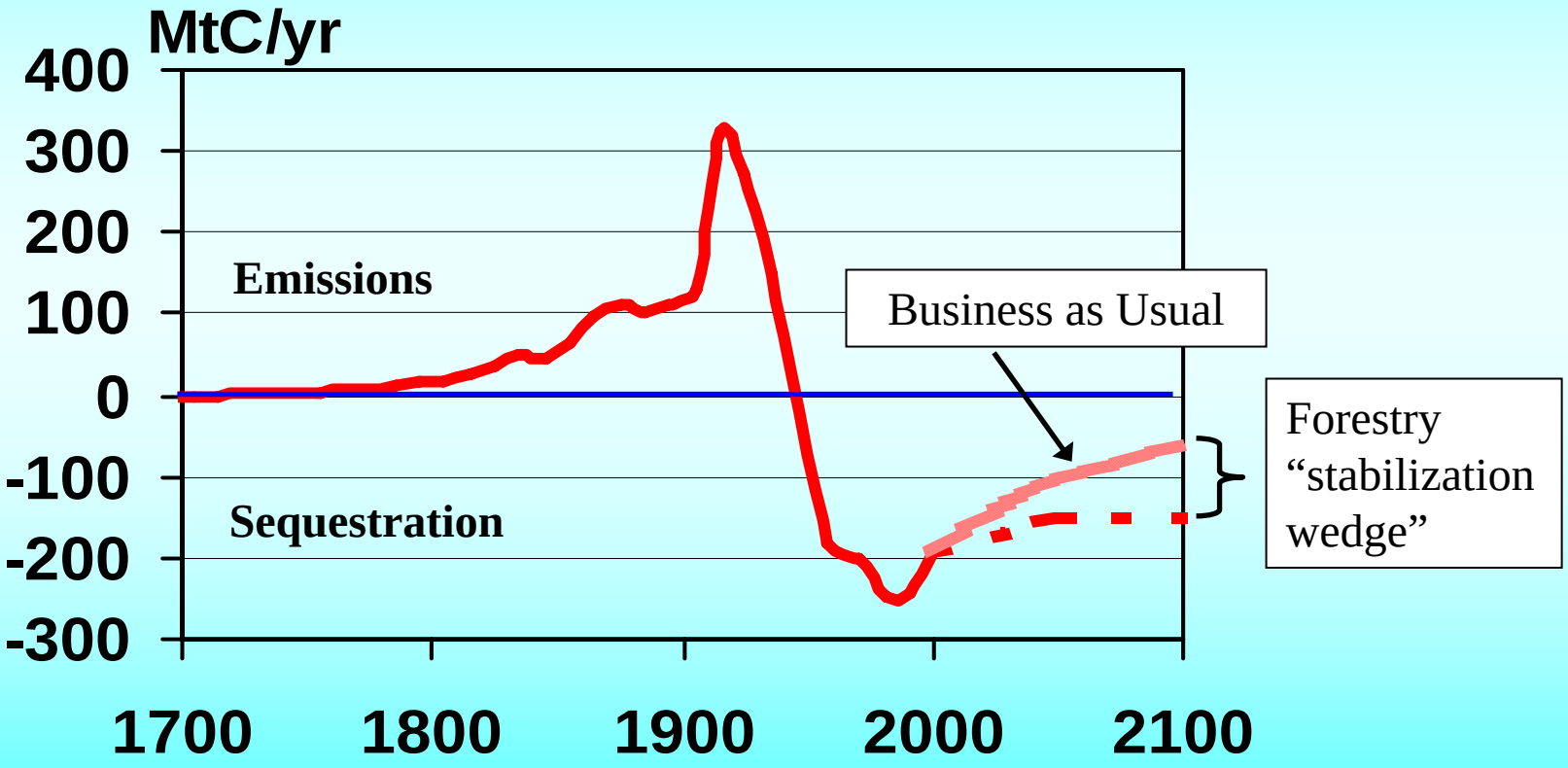
21st Century Challenge: Stabilize Atmospheric CO_2 Concentrations

<u>Options to achieve stabilization</u>

- Reduce emissions
- Renewable energy
- Forestry and agriculture
- Carbon capture and storage

The Carbon Budget of the U.S. Forest Sector

(Forest Ecosystems and Wood Products)



The Forest Sector Stabilization Wedge

Activities:

- Afforestation
- Mine land reclamation
- Forest restoration
- Agroforestry
- Forest management
- Biomass energy
- Forest preservation
- Wood products
- Urban forestry

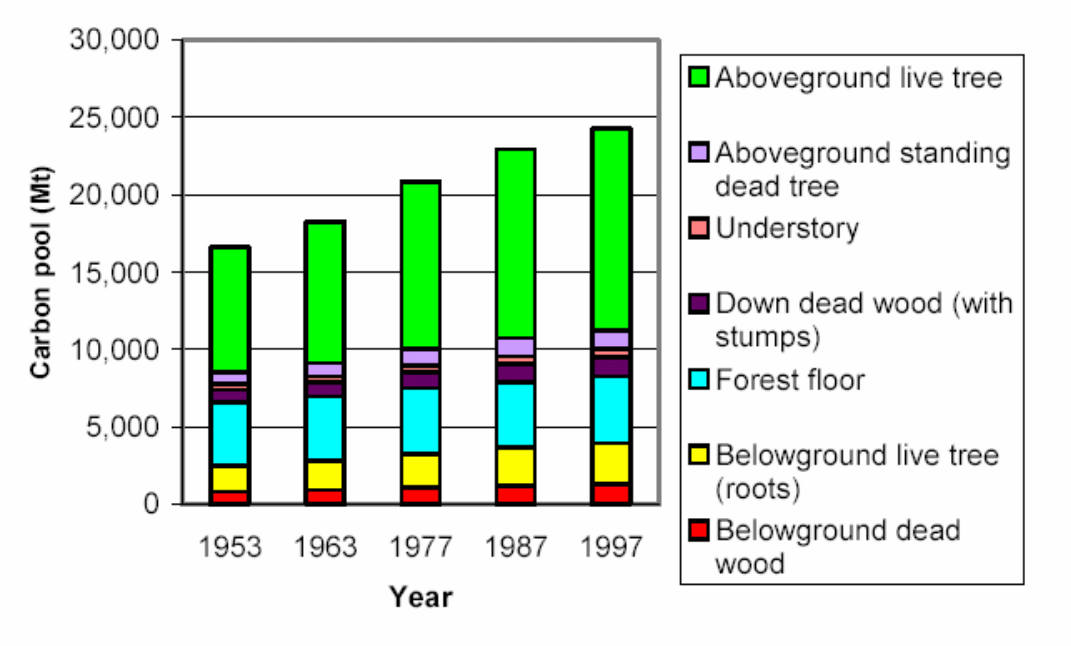
Example Practices:

- Thinning
- Rotation length
- Residue management
- Species/genotypes

→ **Decision support systems**

Potential Role of Forests in Mitigating Greenhouse Gas Emissions

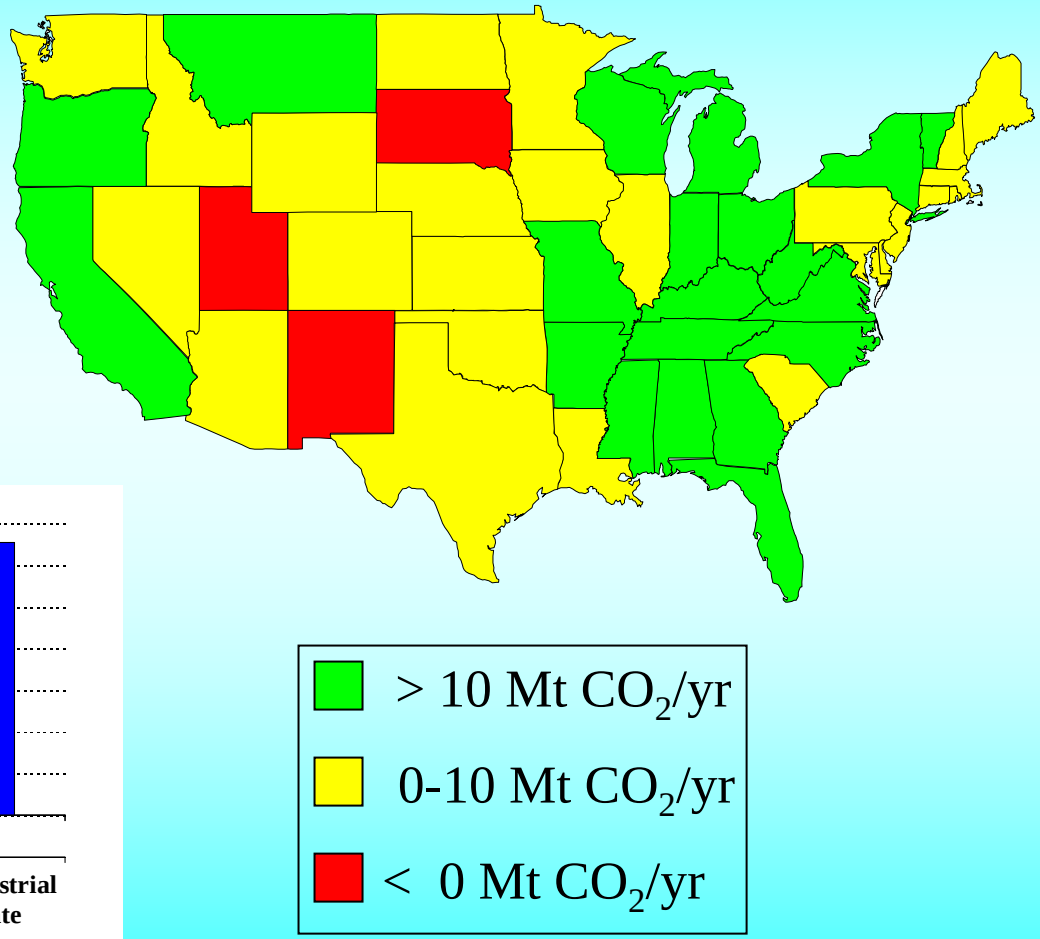
- **U.S. forests remove carbon dioxide from the atmosphere**
  - 200 million tons per year (10% of U.S. fossil fuel emissions)
- **It is feasible to increase the rate of carbon sequestration in forests**
  - Plant more trees
  - Maintain healthy forests
  - Manage productivity
- **Forest Products**
  - Biomass energy
  - Use more wood



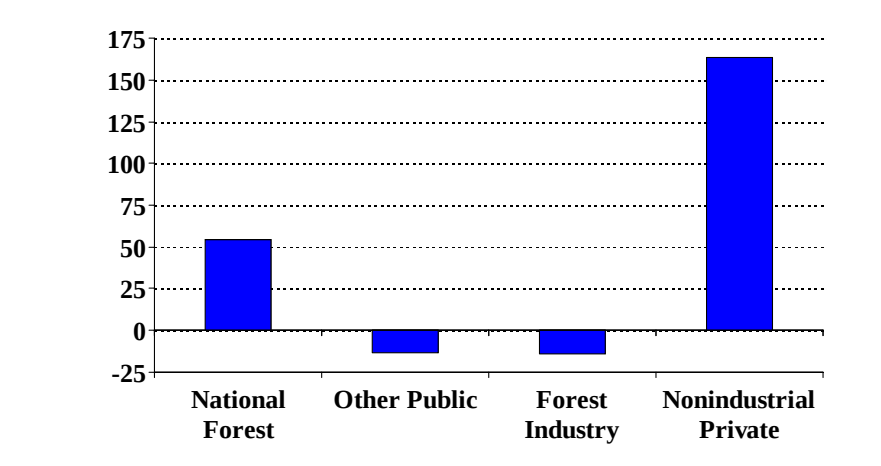
Increasing carbon stocks in U.S. forests (from Heath et al.)

Net Change in Forest Carbon Stocks by State, 2001

(excludes soil C)

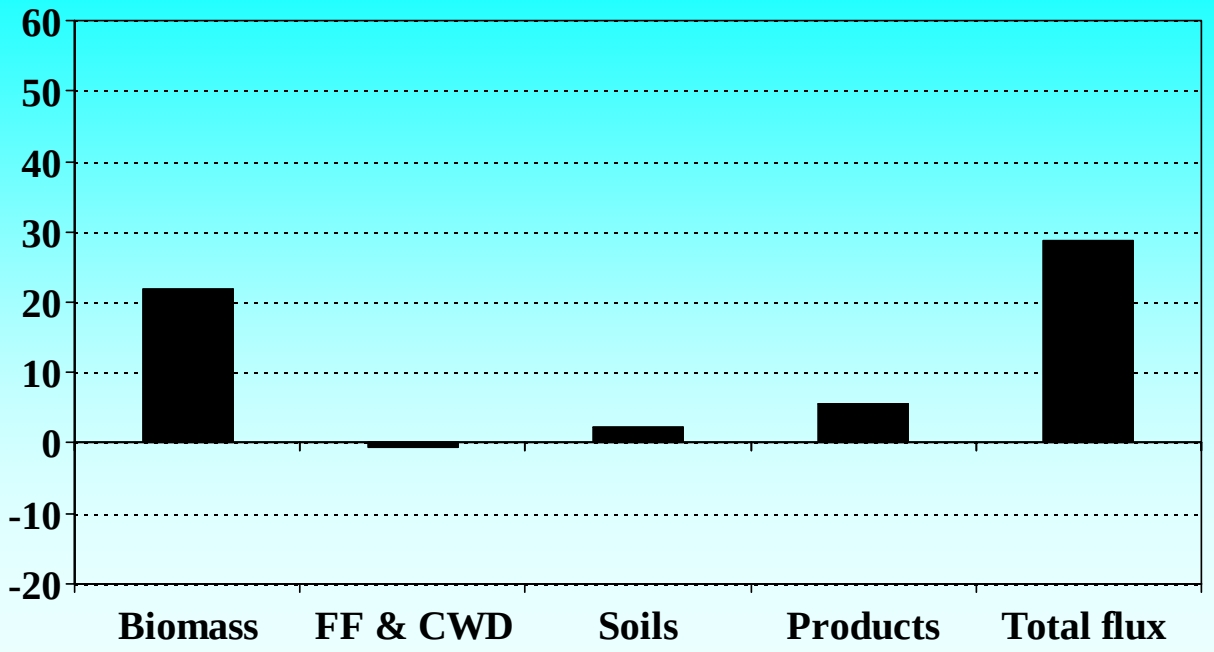


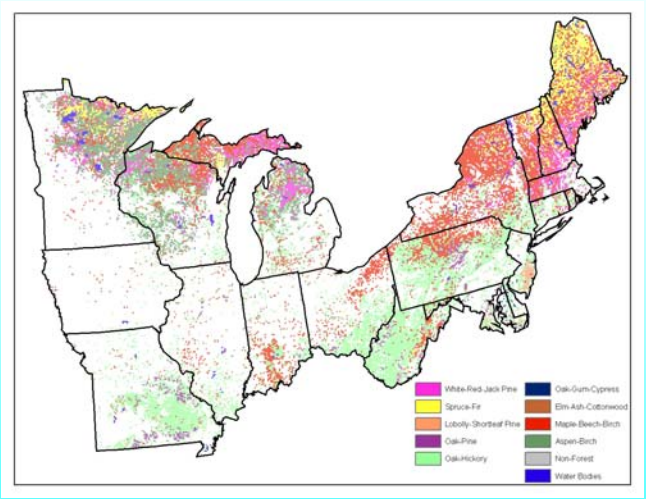
Change in Carbon Stock by Ownership Group, 1987-1997

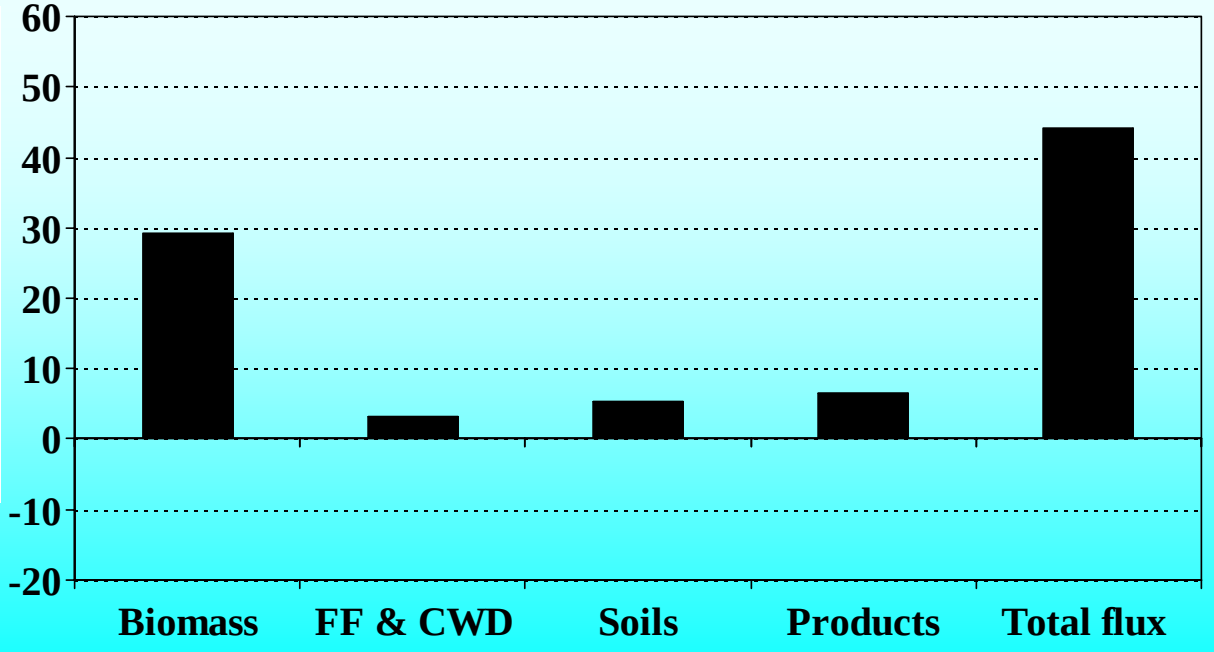


From USDA Greenhouse Gas Inventory (Heath et al.) and special report for EPA (Birdsey and Lewis)

Carbon Changes in Northeast (top) and Midwest (bottom) Forests







The United States Plan for Reducing Greenhouse Gases

The National Greenhouse Gas Registry

- In 2002, the President directed Secretaries of Energy and Agriculture to revise guidelines for reporting
- Registry may support a market for transferable credits
- Take into account emerging domestic and international approaches

Implementation

- Program is voluntary
- Develop new targeted incentives for carbon sequestration and greenhouse gas reductions
- Research and development

Regional Initiatives on Climate Change

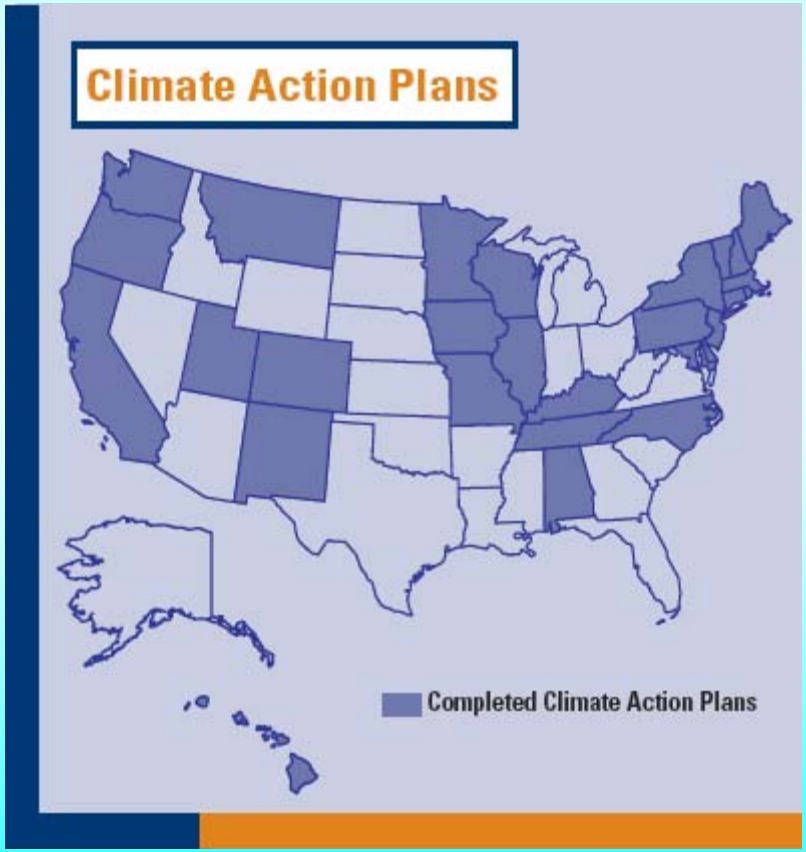
(from the Pew Center)

The Northeast Regional Greenhouse Gas Initiative (RGGI)

- RGGI is a cooperative effort by Northeastern and Mid-Atlantic states to reduce carbon dioxide emissions and increase carbon sequestration
- Central to this initiative is the implementation of a multi-state cap-and-trade program with a market-based emissions trading system

Northeast and Midwest Regional Greenhouse Gas Management Activities

- U.S. Mayors Adopt Climate Protection Agreement
- Iowa Governor Encourages Efficiency and Renewable Energy
- Pennsylvania Adopts Alternative Energy Portfolio Standard
- Maine Releases Climate Action Plan
- Climate Change as a Reporting and Crediting Issue - Wisconsin



From the Pew Center

New Project: Carbon Forestry Protocol for Northeast and Midwest

- Pilot study to develop regional protocols for forestry
- Pinchot Institute, FS S&PF Northeastern Area, FS Northeastern Research Station
- Initial States: Maine, Pennsylvania, Wisconsin

Key Elements of the U.S. and State Greenhouse Gas Action Plans

United States	*States/regions*
Voluntary	Mandatory
Incentive basis	Emissions allowances assigned
Limited emissions trading	Active emissions trading
National registry	State registries
Research commitment is substantial	Research commitment is moderate
Emissions reduction and sequestration	Mostly emissions reduction
Large potential for forestry	Large potential for forestry

Who Cares About Forest Carbon Management? Some examples…

- States, e.g. Maine, California, Texas, many others
- AF&PA, some timber companies
- Electricity producers
- Conservation Organizations (e.g. TNC)
- National Arbor Day Foundation
- Management and restoration of Lower Mississippi bottomland hardwoods (Cooperative)
- Southeast Pennsylvania tree planting initiative (Cooperative)
- City of Baltimore
- Chicago Climate Exchange

Carbon Sequestration Opportunity – Southeast Pennsylvania Tree Planting Initiative

- Partnership to plant 20,000 shade trees and restore 2000 acres of riparian buffers
- Led by PA Dept. of Conservation and Natural Resources
- Partners include:
  - PECO Energy - Philadelphia Eagles
  - PA Horticultural Society - County and local govts.
  - City of Philadelphia - Penn DOT
  - Suburban Water - USDA FS
  - Many others
- Carbon credits to be shared among $$$ contributing partners
- Carbon sequestration estimates to be provided by UFORE (Urban Forest Effects Model – Nowak et al.)

Carbon Sequestration Opportunity – Reducing Carbon Emissions from Maine's Forests

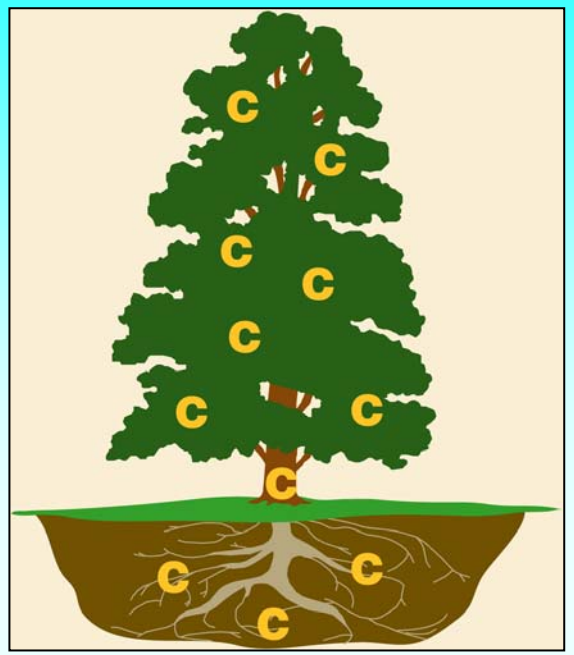
- Maine's forests have been losing carbon from harvesting and insect damage
- Proposal by Maine Forest Service to reverse this trend
- Sequester more carbon by increasing stocking
- Reducing emissions by removing material that would decay and by protecting soil
- What financial incentives would be needed?
- What prices in carbon trading would make this work?

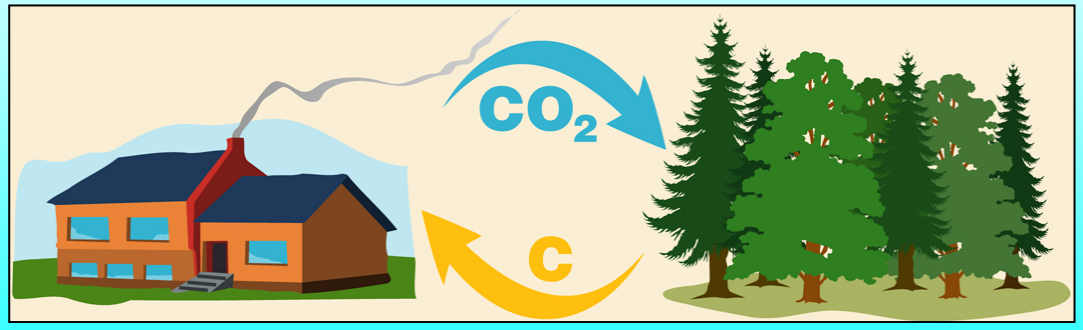
Carbon Management Opens New Horizons

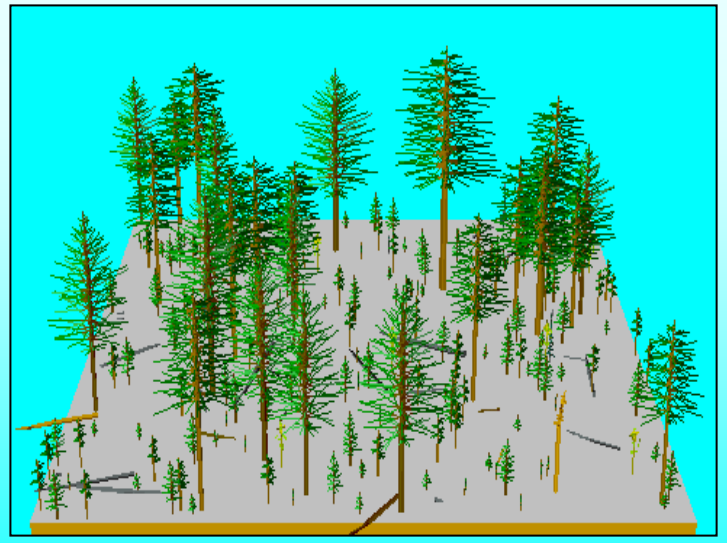
- Carbon has economic value—about $2/ton in the United States
- Markets are developing for trading carbon credits (e.g., Chicago Climate Exchange)
- Carbon management of forests results in other societal benefits:
  - Timber production
  - Biomass energy
  - Ecological restoration
  - Preservation
  - Clean water and air

Research Needs for Forest Carbon Management

- Forest carbon accounting
- Forest measurements
- Carbon management technology
- Socioeconomic issues
- Decision-support systems







“Portal” to Decision-support for Forest Carbon Management

Start Page (select domain)

- Regional estimates
- Forest Management
- Urban Forestry
- Wood Products
- Natural disturbance
- Need more help?

COLE
Carbon On Line Estimator
Version 2.0
ncasi

Forest Management Service Center
FVS
Forest Vegetation Simulator

UFORE
Urban Forest Effects Model
USDA

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niacs.org

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