



# Forests and Carbon: What's the Role of Management?

Maria Janowiak  
*Northern Institute of Applied Climate Science*

# Options for Responding



**Greenhouse  
Gases**



**Climate  
Change**

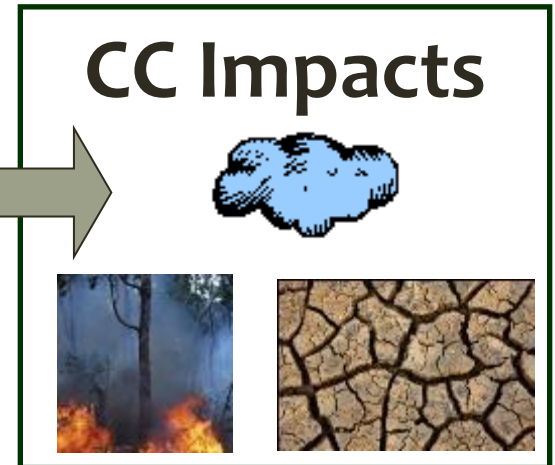
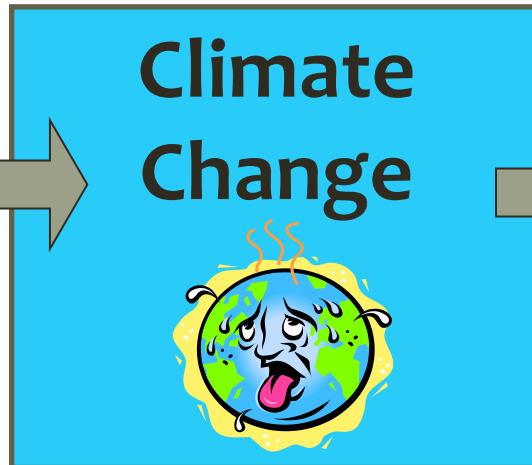
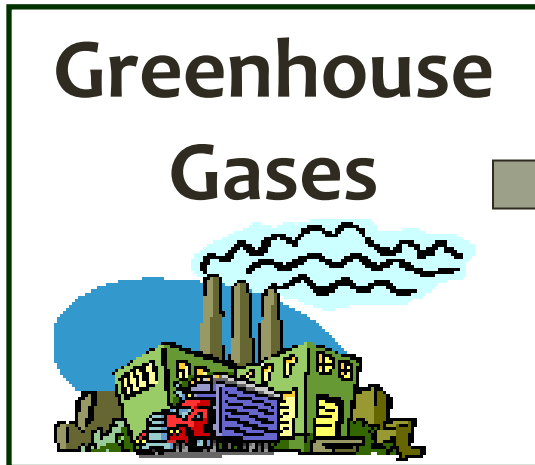


**CC Impacts**

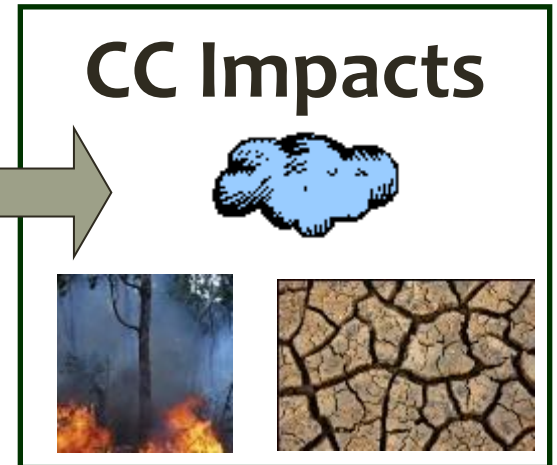
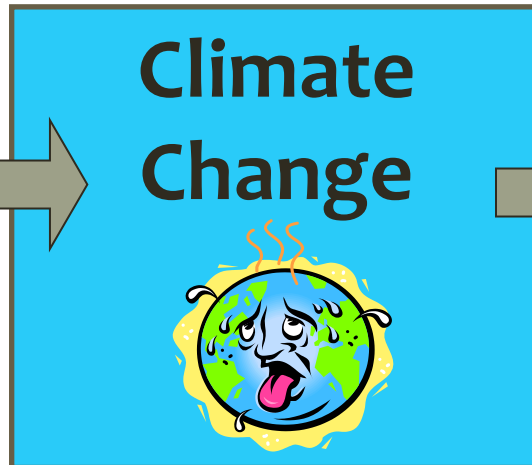
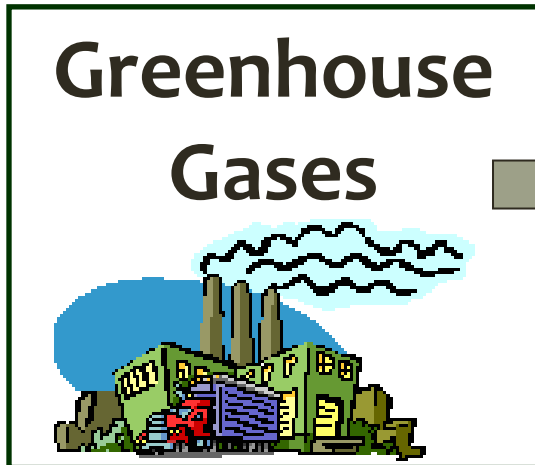




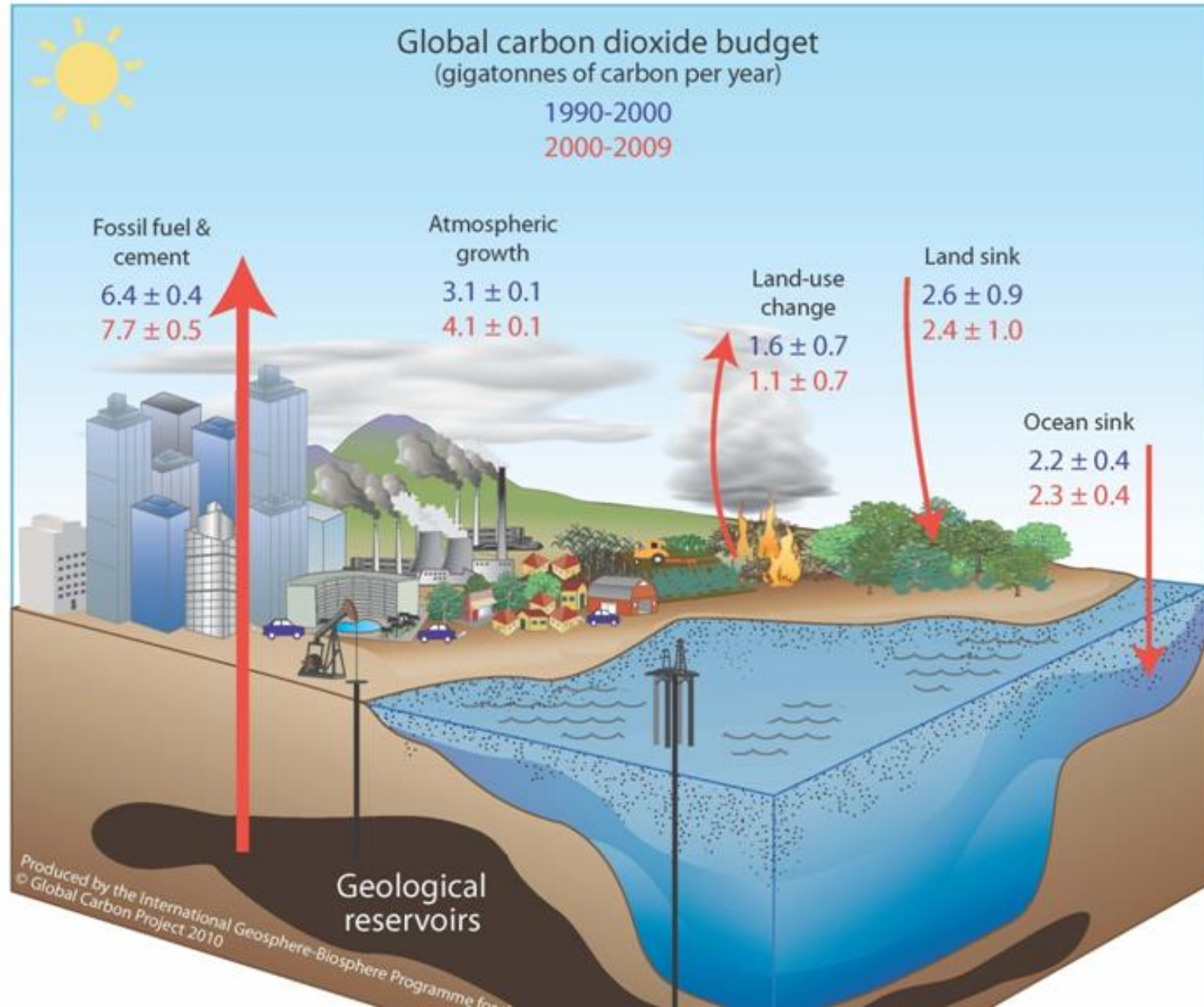
# Options for Responding



# Options for Responding

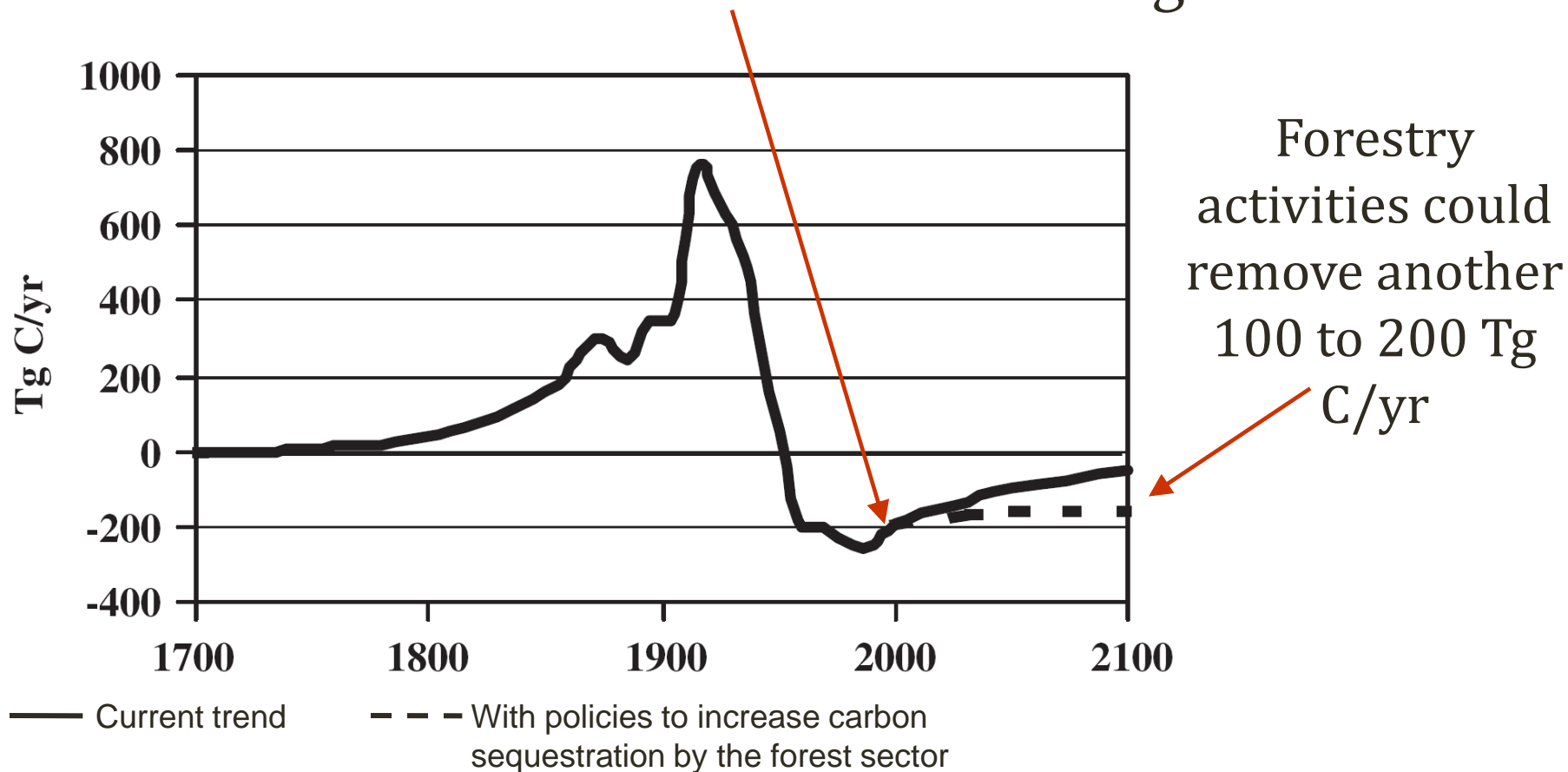


# Forests in the Carbon Cycle



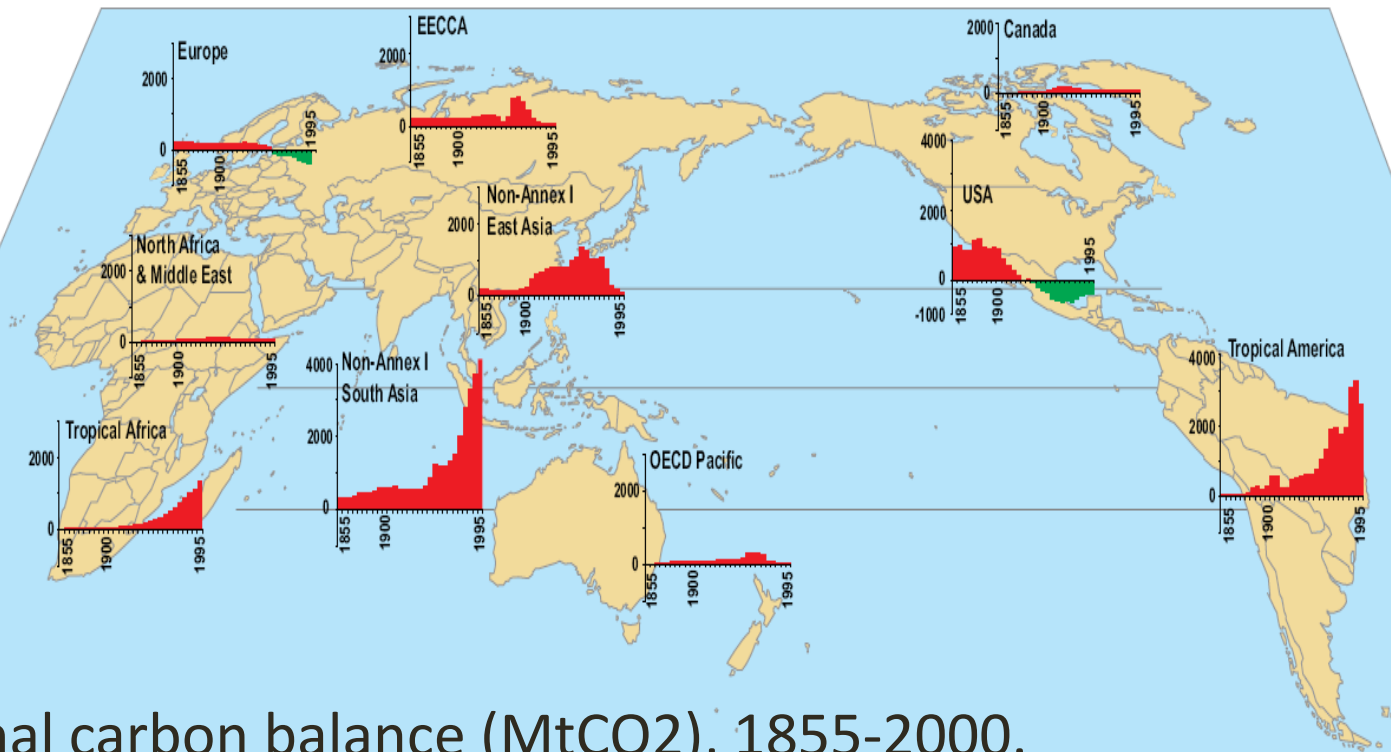
# US Forests in the Carbon Cycle

US forests annually sequester the equivalent of 10% of US carbon dioxide emissions from burning fossil fuels



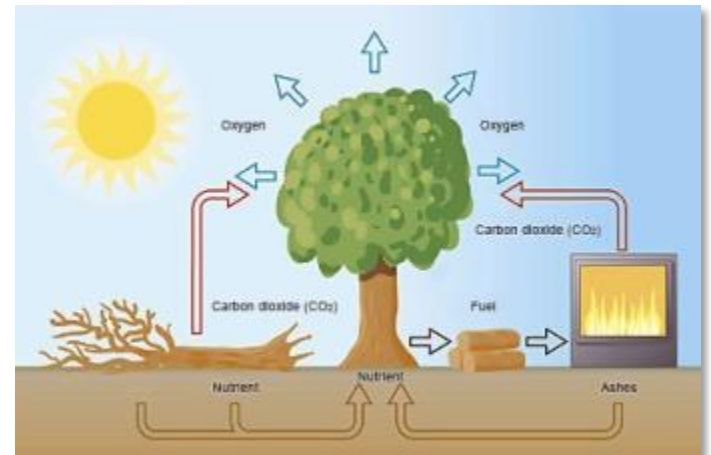
# World Forests in the Carbon Cycle

Globally, at least 17% of emissions are from the forestry sector: deforestation and land use change.



# Forest Carbon Markets

- Carbon sequestration in forests is used to “offset” emissions produced elsewhere
- \$237 million in 2011
- Compliance markets
  - California, British Colombia, elsewhere...
- Voluntary markets
  - Small, but growing



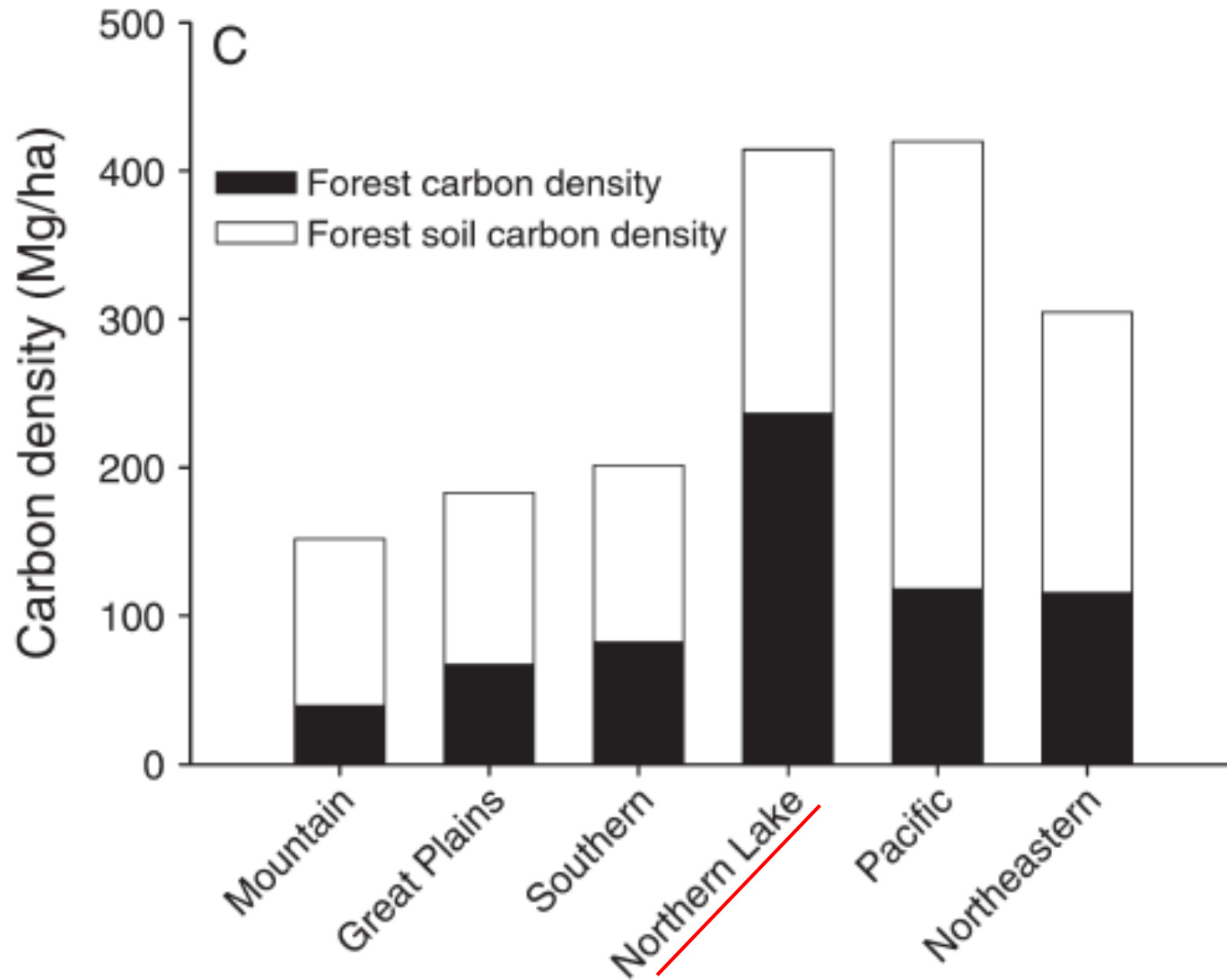


# Mitigation: Forest Carbon Mgmt.

- Mitigation includes human actions to reduce the effects of climate change by reducing sources and enhancing sinks of greenhouse gases
- Three broad categories:
  - 1) Sequestration
  - 2) Emission avoidance
  - 3) Substitution



# Forest Carbon – Where is it?



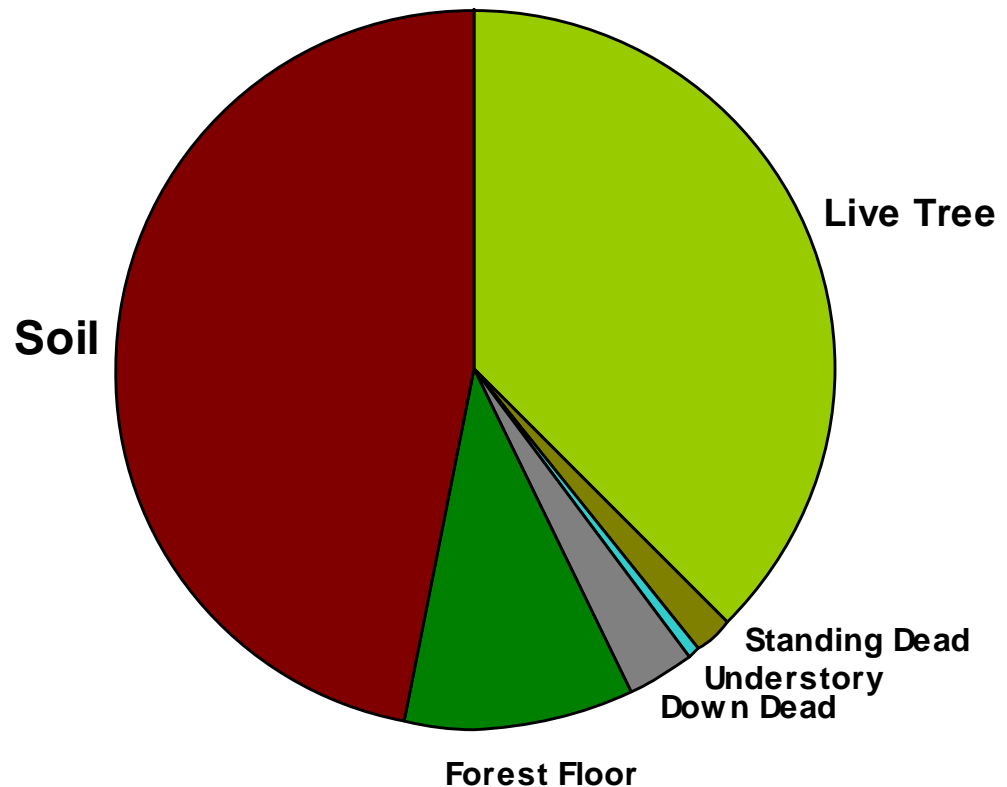
# Forest Carbon – Where is it?

Amount of C varies by forest type and region

***Example:***

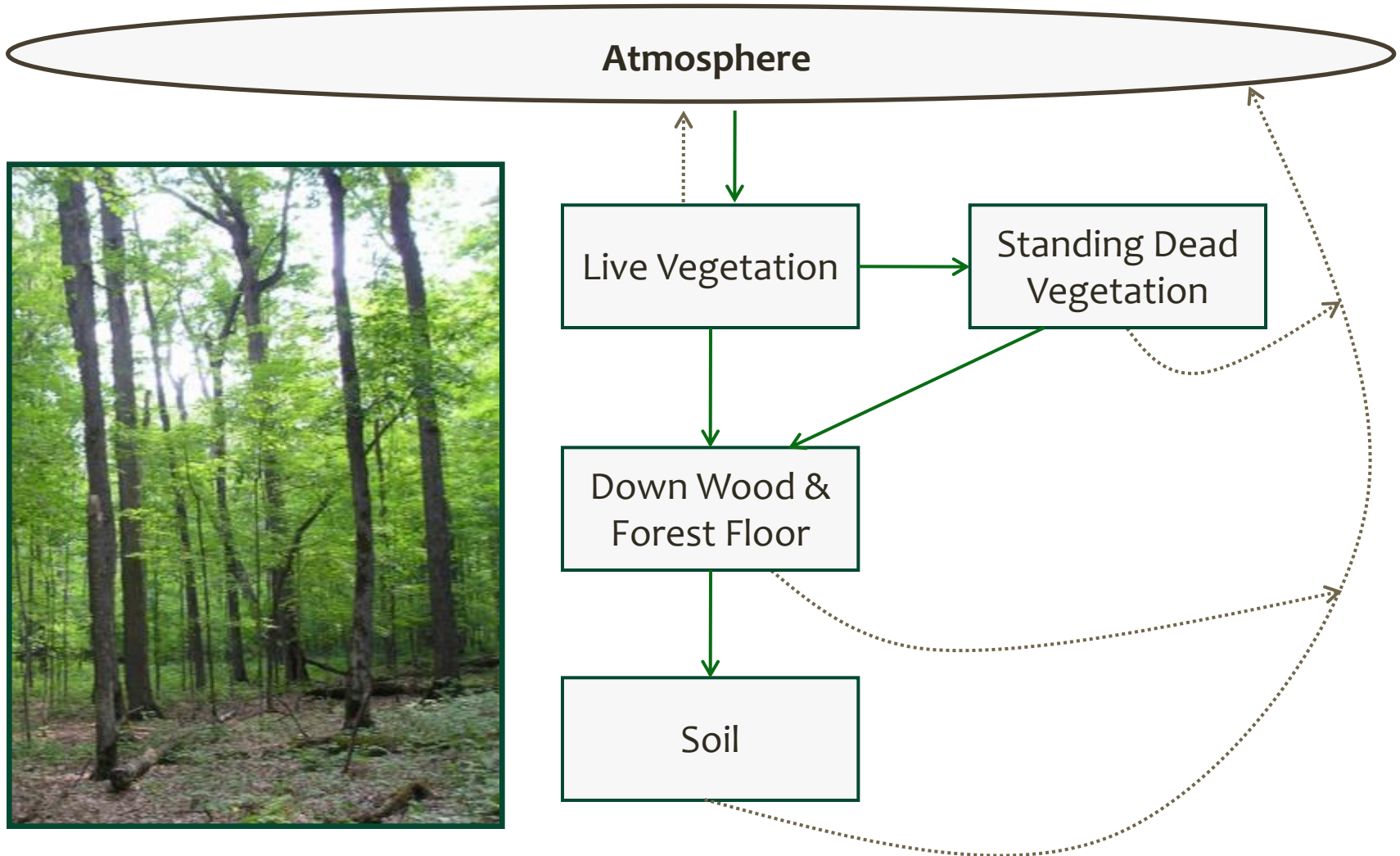
75-year-old stand of  
northern hardwoods  
(sugar maple, beech,  
and yellow birch) in  
the Lake States

***Total = 112.8  
Mg C per acre***



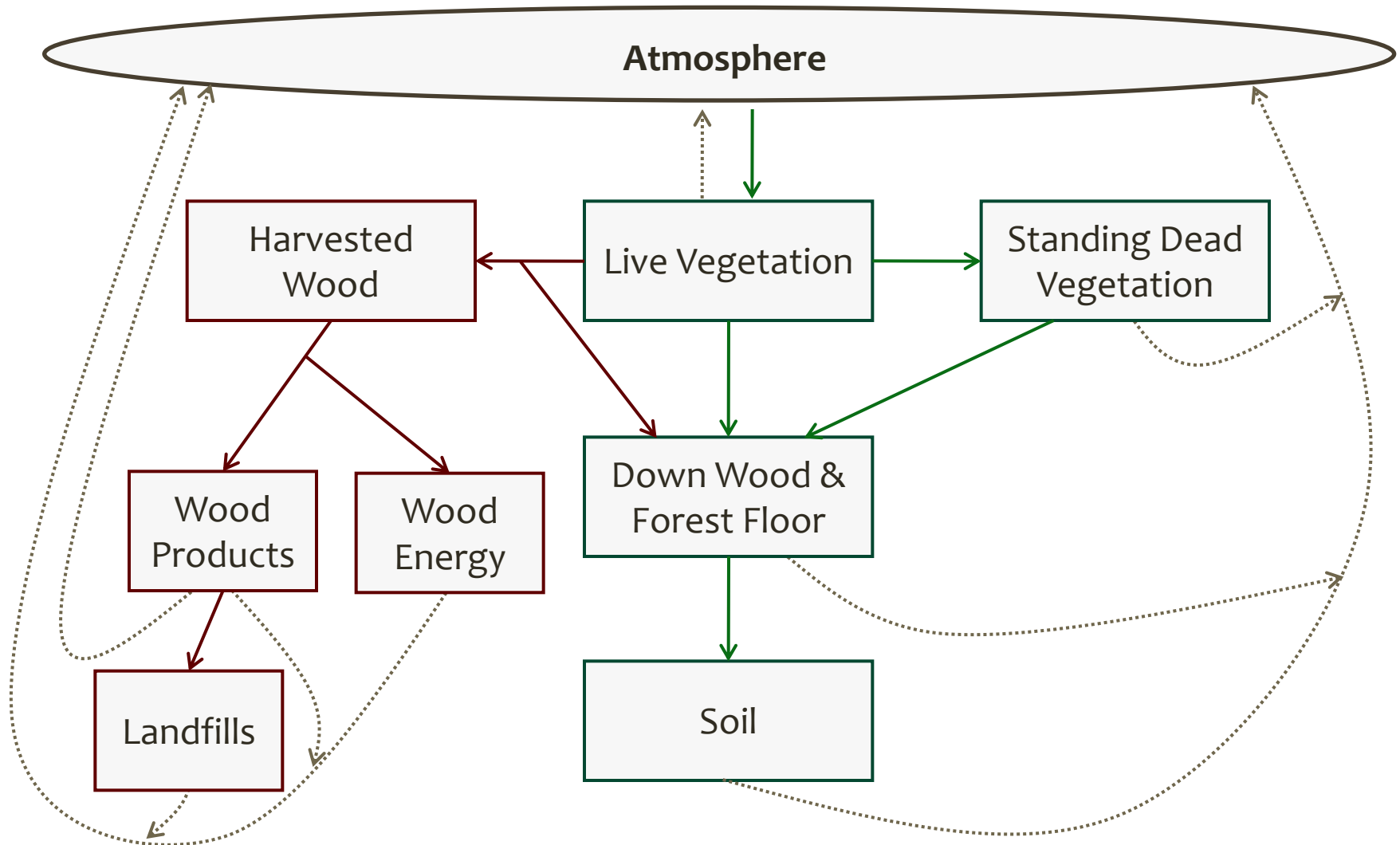
*Data from: Smith et al. 2006*

# Forest Sector Carbon Cycle



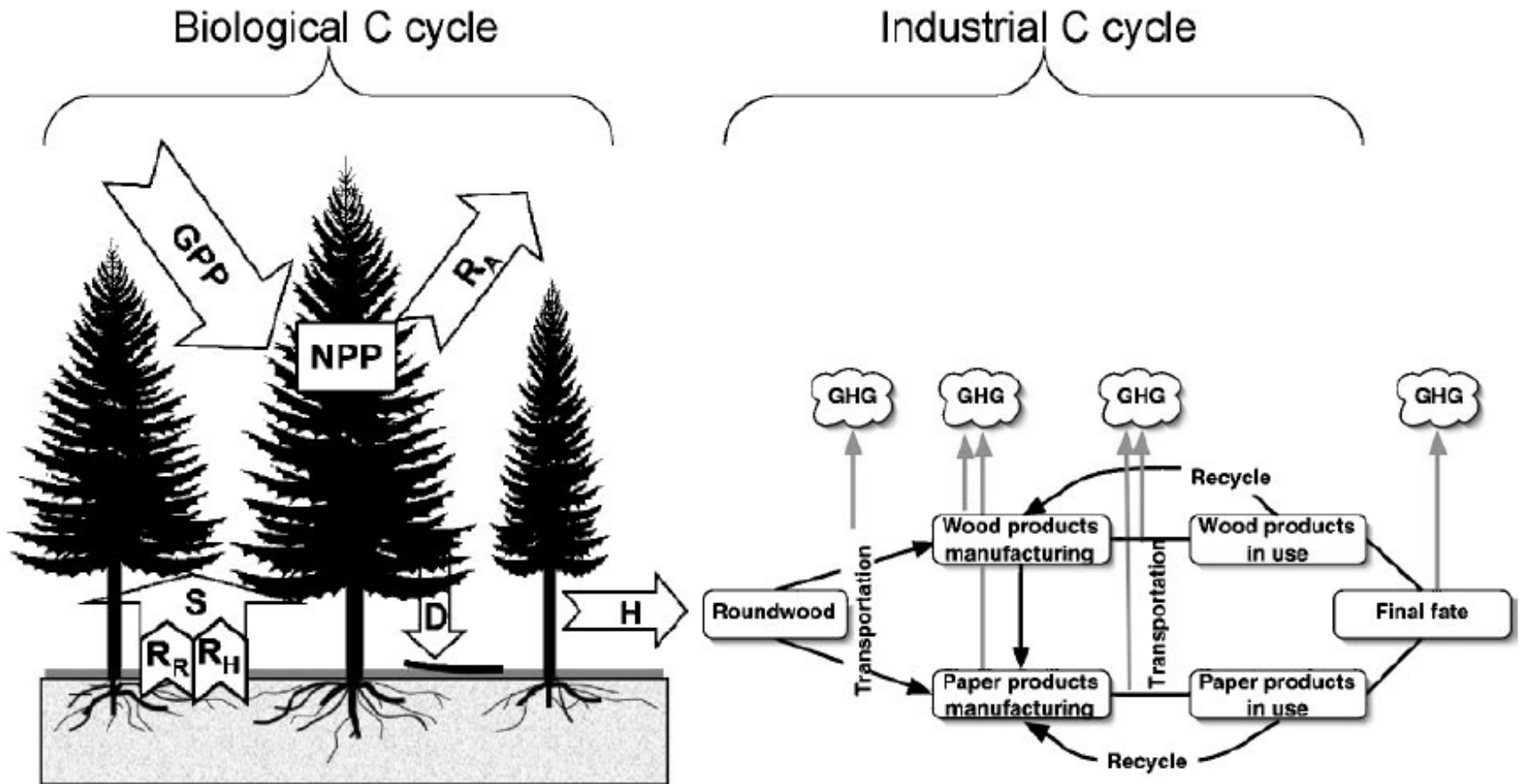


# Forest Sector Carbon Cycle



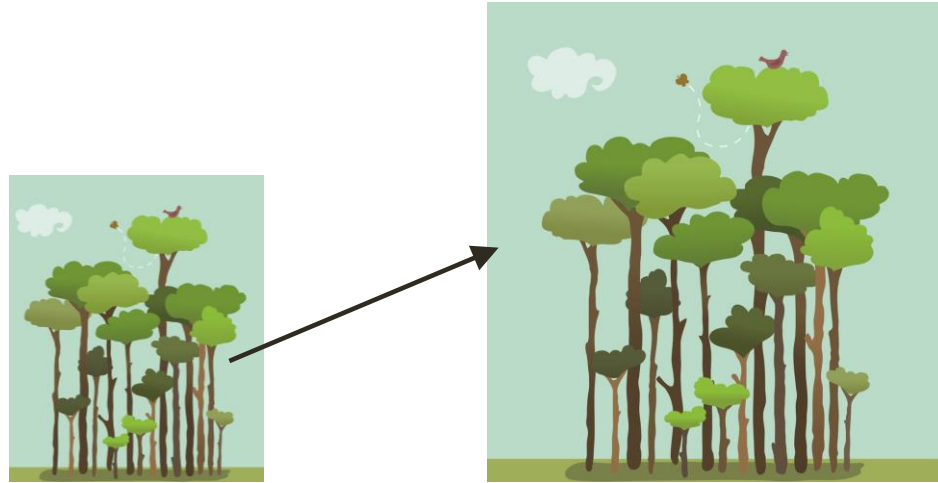
# Forest Sector Carbon Cycle

## Life Cycle Emissions



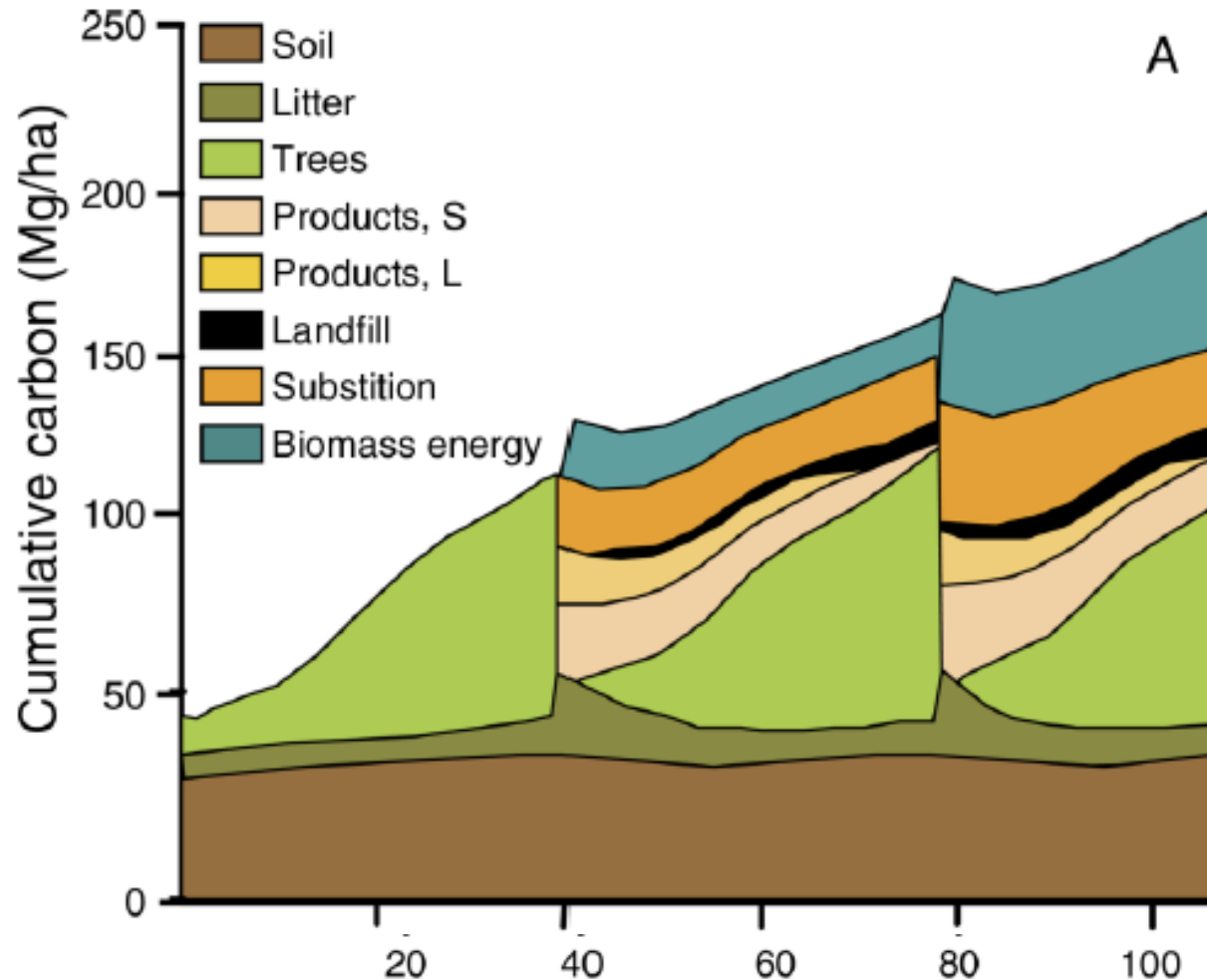
# Mitigation #1: Sequestration

Use management in forest ecosystems to sequester additional carbon



# Mitigation #1: Sequestration

*Example: Afforestation (create forest)*





# Mitigation #1: Sequestration

*Example:* Forest management for increased carbon storage

## Increased forest growth:

- Enhanced regeneration
- Competition control
- Fertilization
- Improved/superior stock

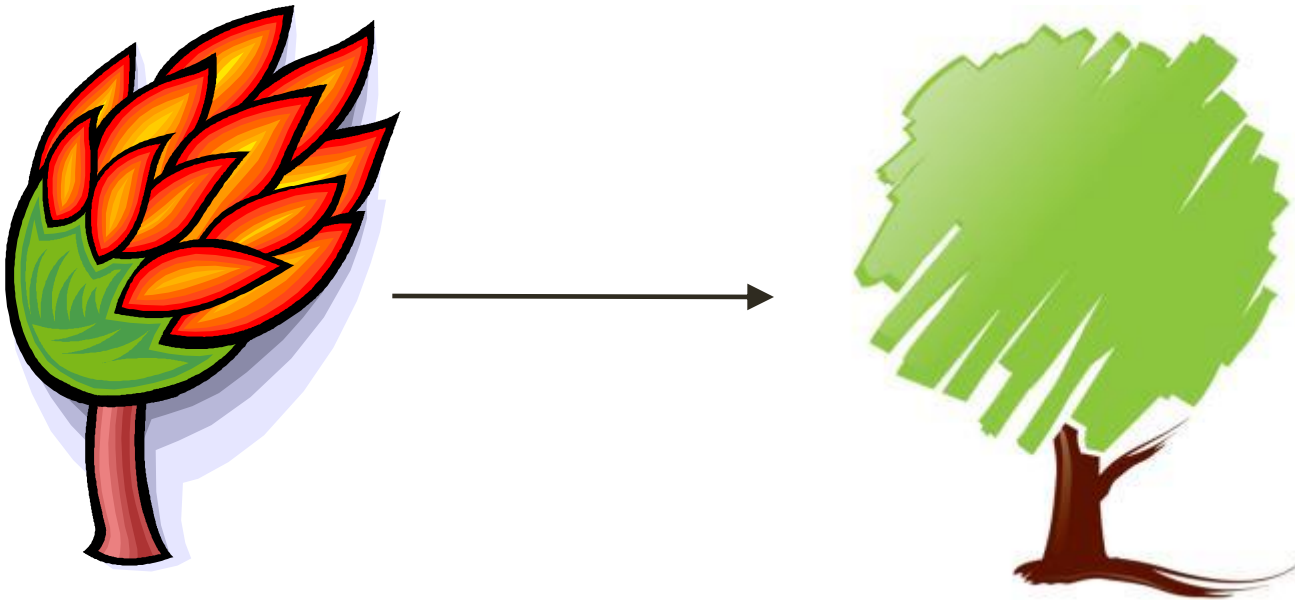
## Wood Products:

- Products in use
- Landfills



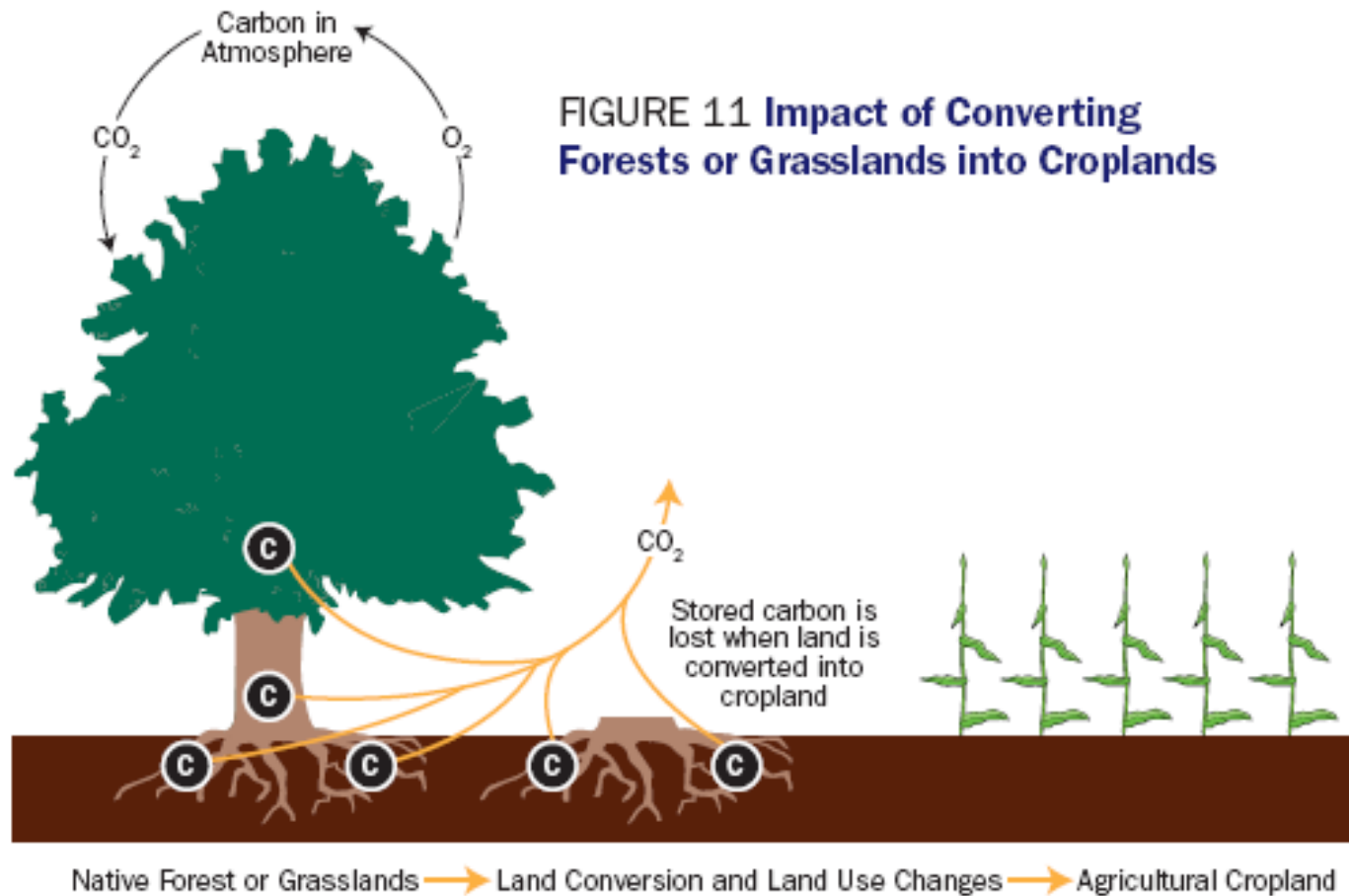
# Mitigation #2: Emission Avoidance

Prevent carbon from being emitted into the atmosphere



# Mitigation #2: Emission Avoidance

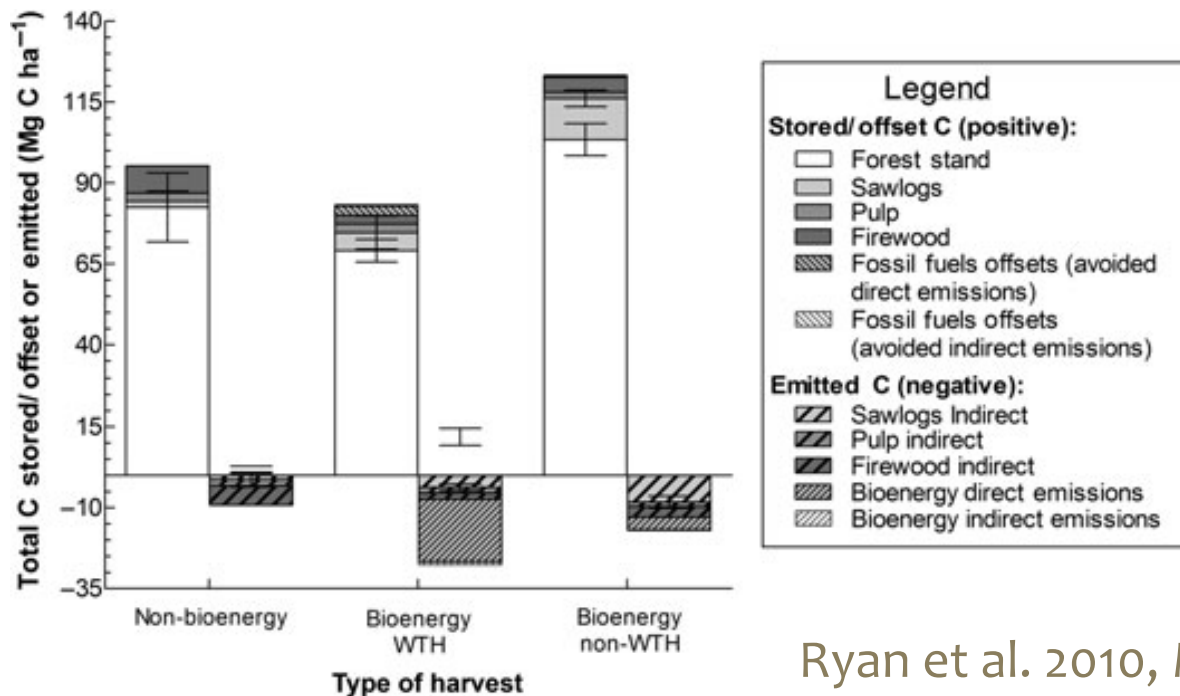
*Example: Avoided deforestation/degradation*



# Mitigation #2: Emission Avoidance

*Example: Mgmt. for reduced emissions*

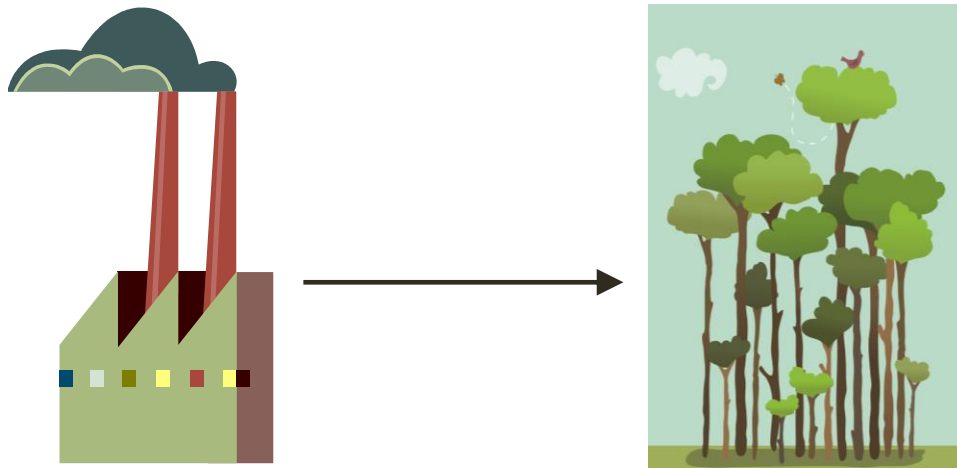
- Reduced harvest levels
- Longer harvest intervals
- Reduced emissions from machinery, etc.





# Mitigation #3: Substitution

Replace fossil fuels with wood-based energy and products



# Mitigation #3: Substitution

*Example:* Renewable energy production from biomass in place of fossil fuels

Percent reduction in lifecycle greenhouse gas emissions

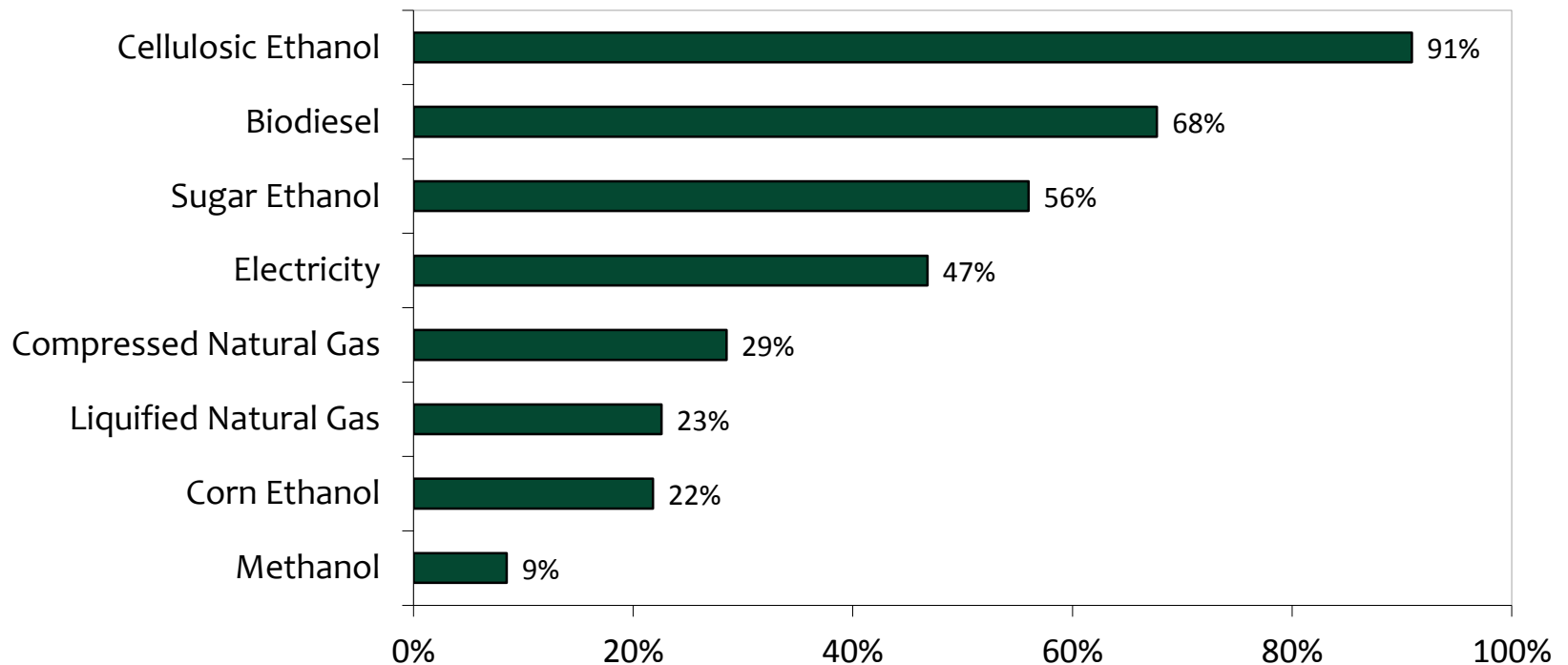


Figure data from EPA 2007

# Mitigation #3: Substitution

*Example: Wood used in place of more energy or emissions intensive materials*

Embodied energy in three different types of houses.

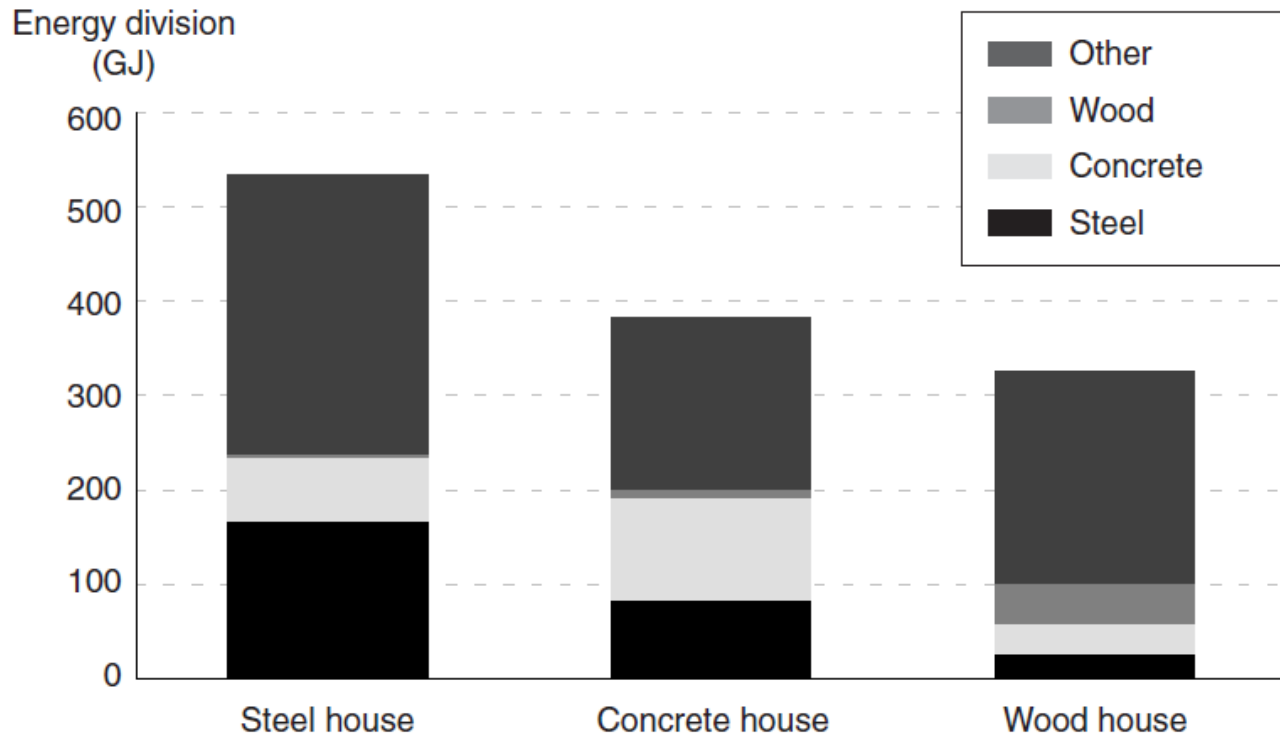


Figure from Glover et al. 2002

# Forest Mitigation Complexity

## **1) Location and situation specific**

- Ecosystem, Management goals, Condition

## **2) Determining 'baseline'**

## **3) Multiple scales**

- Time, Space

## **4) Life cycle emissions**

- Upstream, Downstream



# Summary – Managing Carbon in Forests

## Forests in the carbon cycle:

- Forests are really good for carbon.
- Sustainably managed forests are better.

## Carbon in forest management:

- Carbon is an important ecosystem benefit.
- Carbon can be balanced with other management objectives.