



# Trees, Forestry, and Carbon 101

# Speaker Background

- Cynthia West
  - Current position:
    - Director, Office of Sustainability & Climate  
U.S. Forest Service  
Washington, DC...
  - Credentials:
    - B.S. Forest Management
    - MBA, Marketing & Management
    - PhD, Wood Science
    - Sustainability Profession Certification, CSE
  - Key experiences
    - Research Administration for 26 years
    - Forest Products Market & Economics Research for 10 years
    - Faculty for 12 years
    - Industrial Forestry for 5 years
    - Sustainability Professional for 5 years





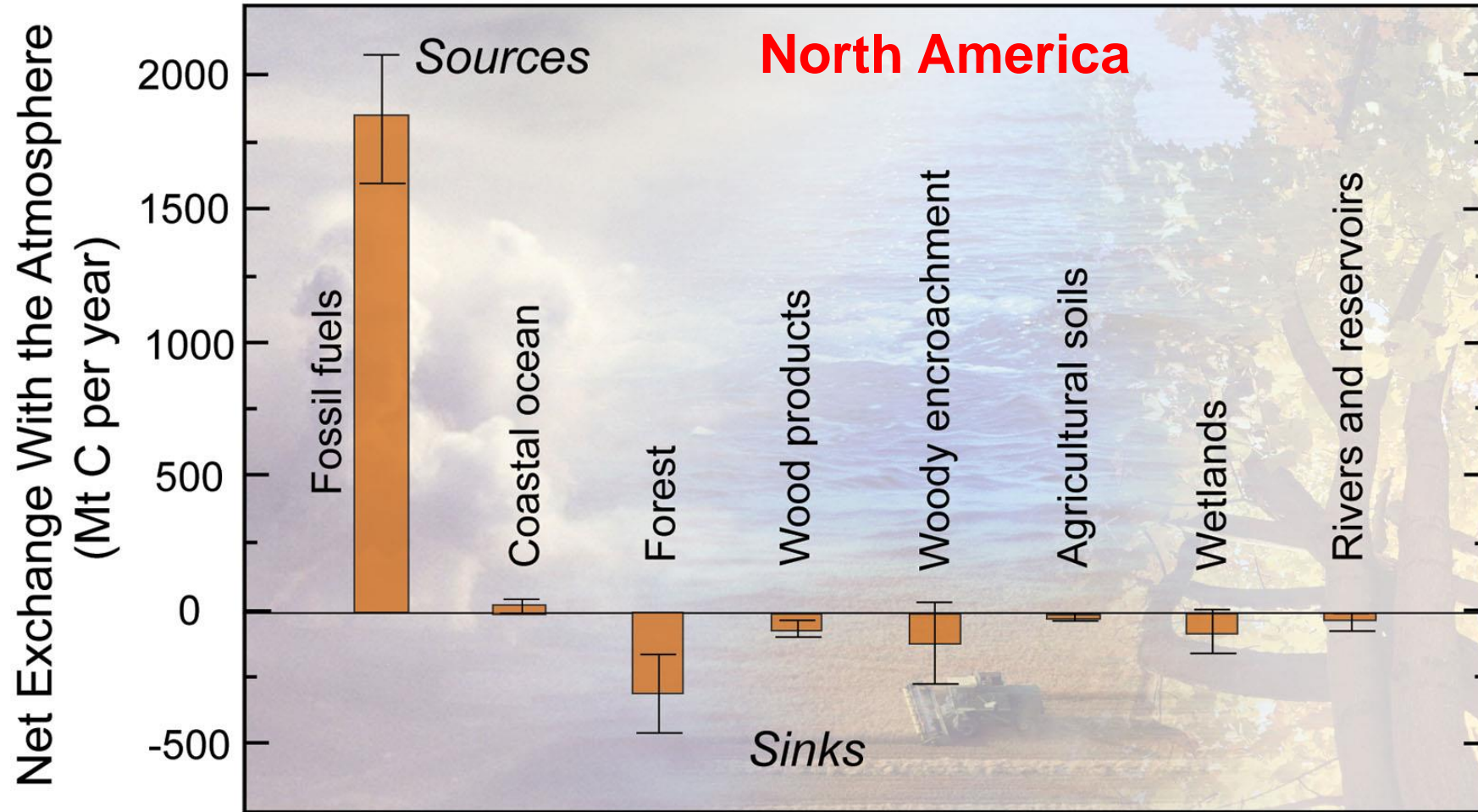
# **Credits for content:**

**Duncan McKinley**  
**Alexa Dugan**  
**Aurora Cutler**  
**Jessica Halofsky**



**How do we explain the role of forests and forest products in relation to GHG emissions?**

# U.S. Forests and Wood Products carbon sinks are equivalent to 12%–19% of Fossil-Fuel Emissions



# First, why are people interested?

## Summary:

1. Concerned about carbon emissions and effects on climate
2. Interest in using management to sequester carbon (i.e. Mitigation) and reduce carbon loss where appropriate (i.e. Adaptation)

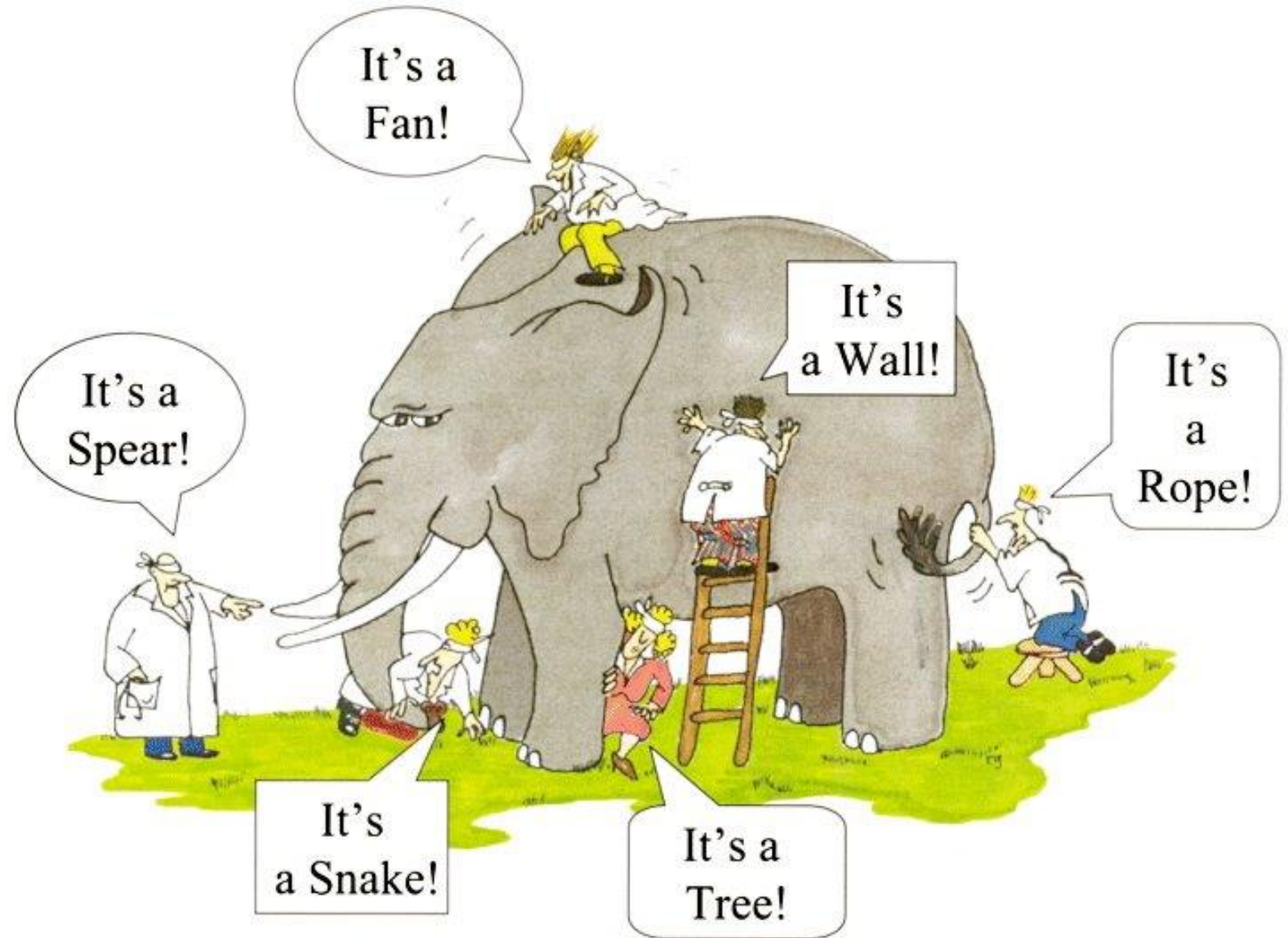
### Further reading:

- *Issues in Ecology* – Ryan et al. 2010 ESA synthesis for policy and managers (available:[www.esa.org/science\\_resources/issues.php](http://www.esa.org/science_resources/issues.php))
- McKinley, Duncan C.; Ryan, Michael G.; Birdsey, Richard A.; Giardina, Christian P.; Harmon, Mark E.; Heath, Linda S.; Houghton, Richard A.; Jackson, Robert B.; Morrison, James F.; Murray, Brian C.; Pataki, Diane E.; Skog, Kenneth E. 2011. A synthesis of current knowledge on forests and carbon storage in the United States. *Ecological Applications*. 21(6): 1902-1924.



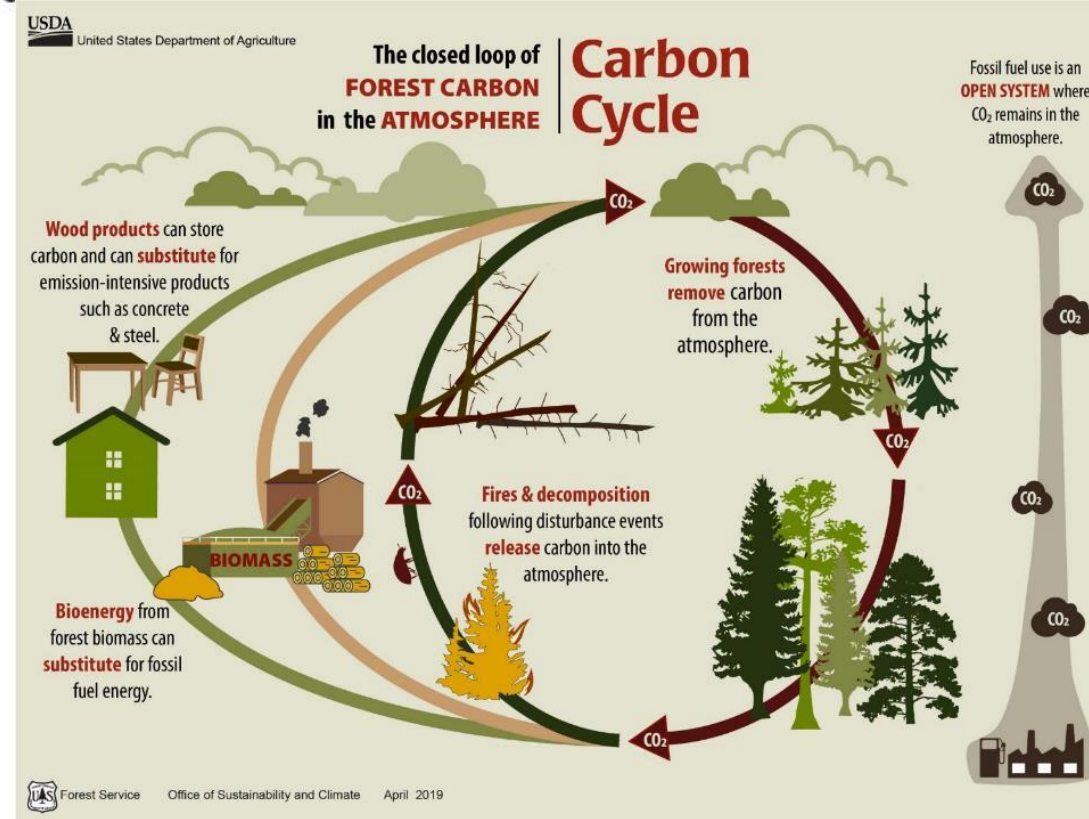
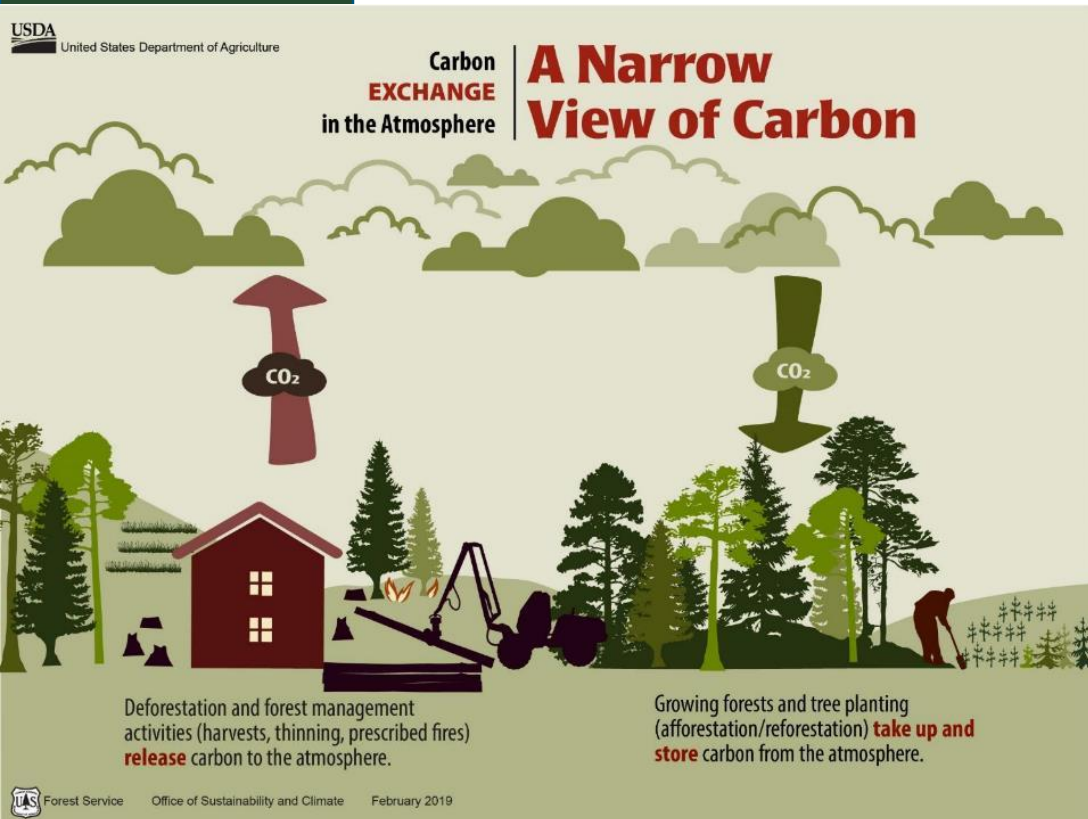
**Understanding the relationship of forests, forest management & use, forest products is like an elephant....**

**Sometimes you make the wrong conclusions when you don't look at the whole...**



G. Renee Guzlas, artist

# Challenges: Competing views

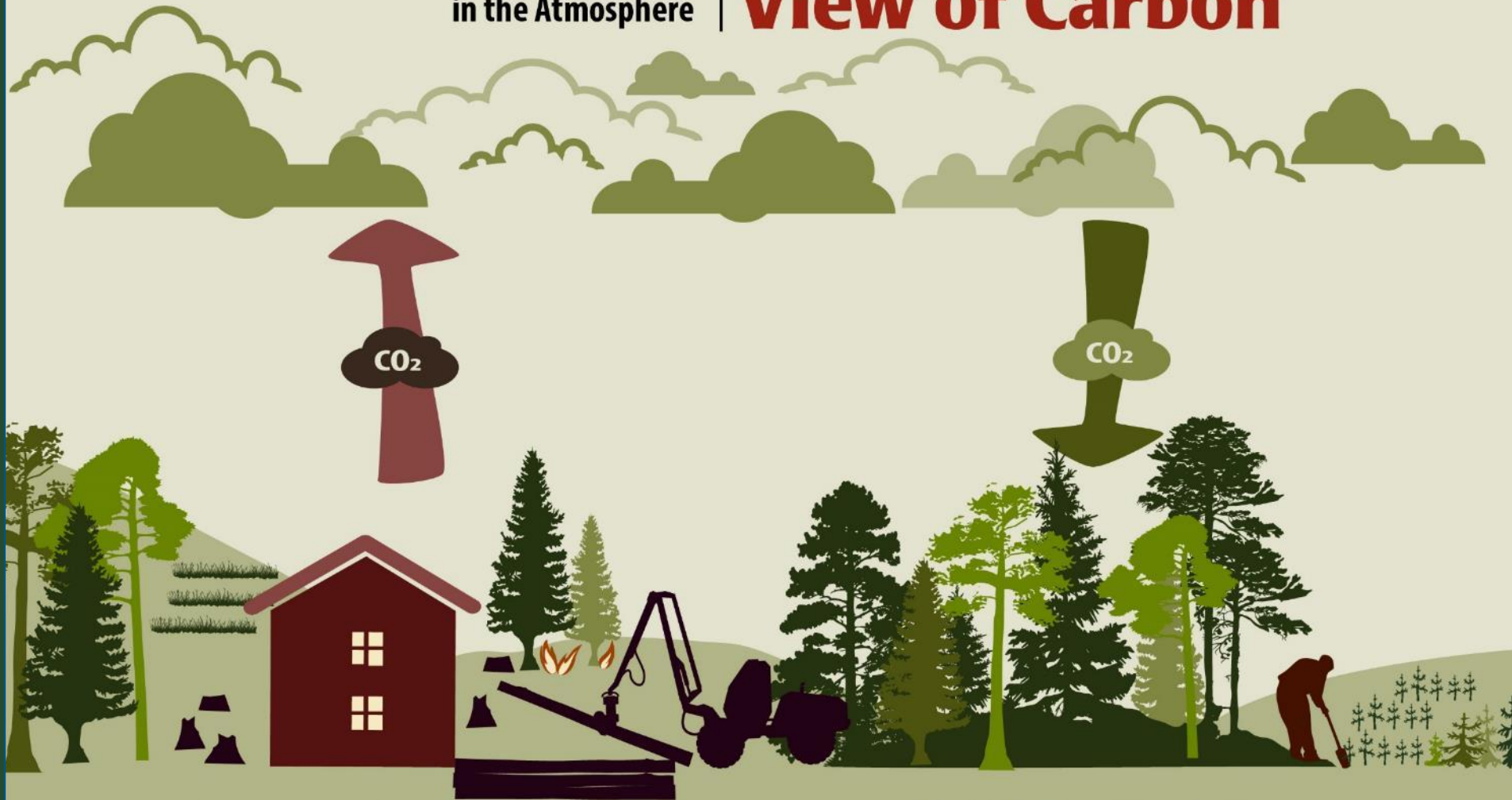


Differing perspectives on how to conceptualize the forest system is the greatest source of confusion and conflict!

How  
most  
people  
view the  
forest  
system  
...

Carbon  
**EXCHANGE**  
in the Atmosphere

# A Narrow View of Carbon



Deforestation and forest management activities (harvests, thinning, prescribed fires) **release** carbon to the atmosphere.

Growing forests and tree planting (afforestation/reforestation) **take up and store** carbon from the atmosphere.

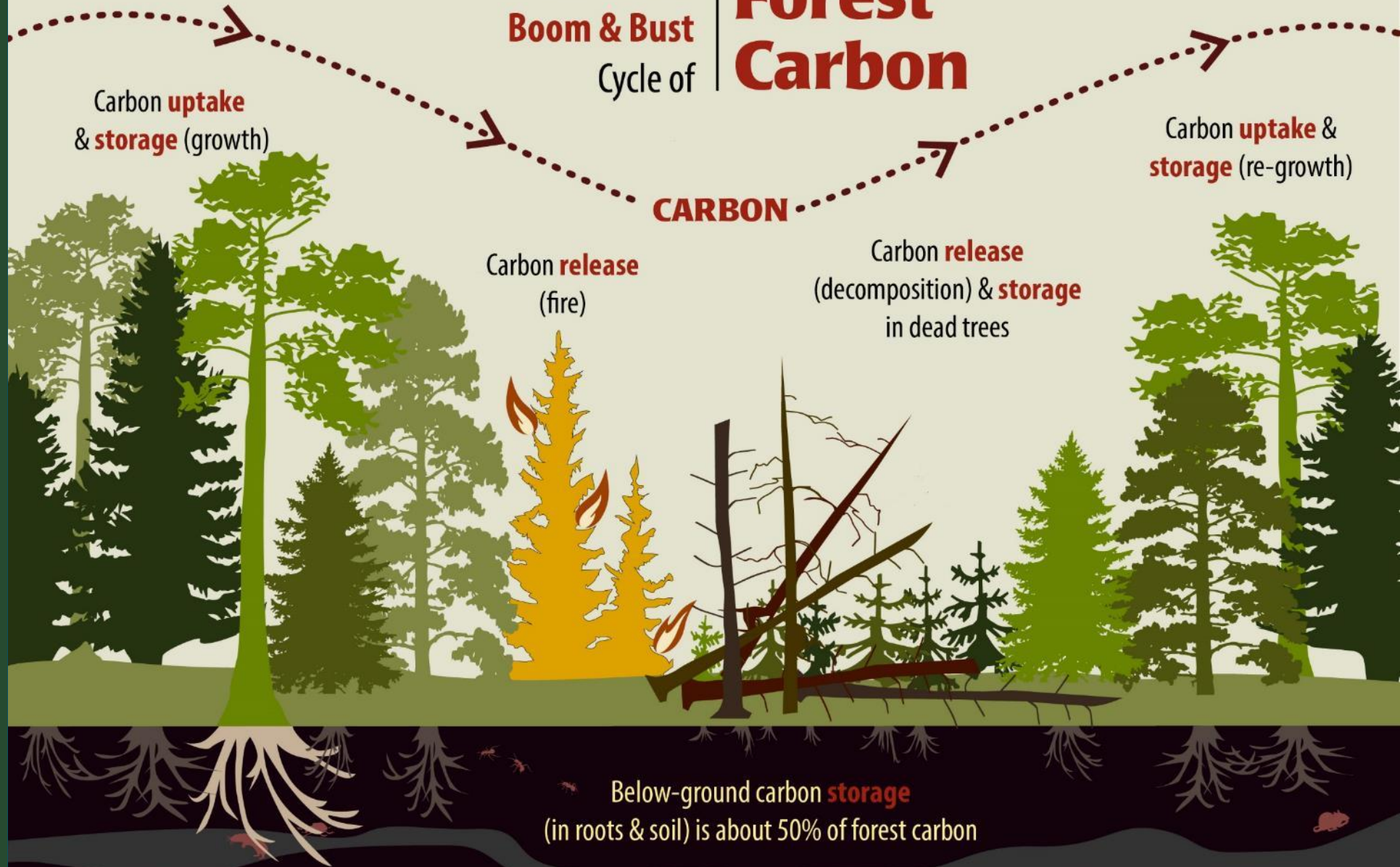
# But, we know there is A LOT more to the story...



# Forests are dynamic biological systems capable of regenerating unless there is a major interruption



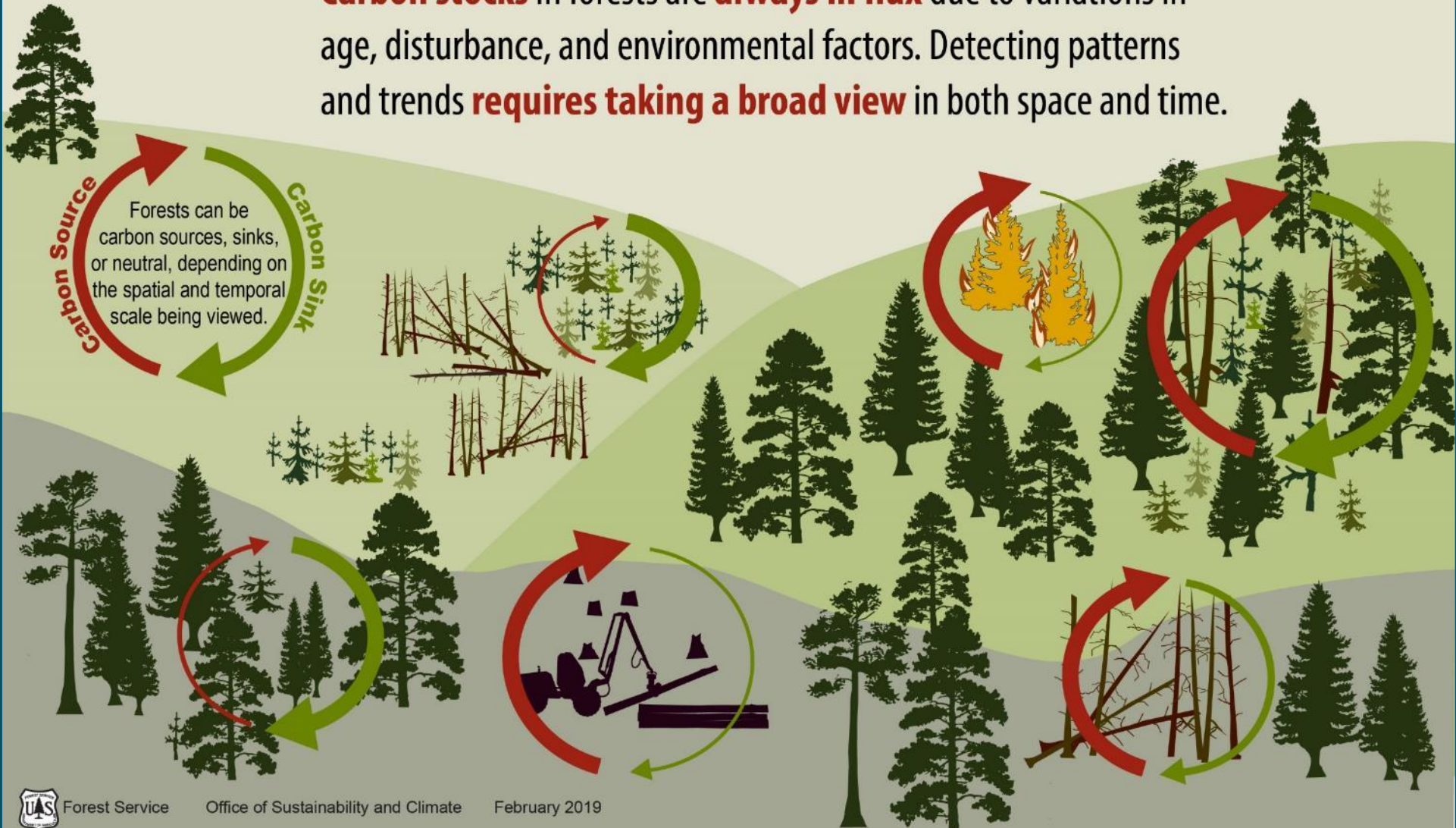
# The Natural Boom & Bust Cycle of Forest Carbon



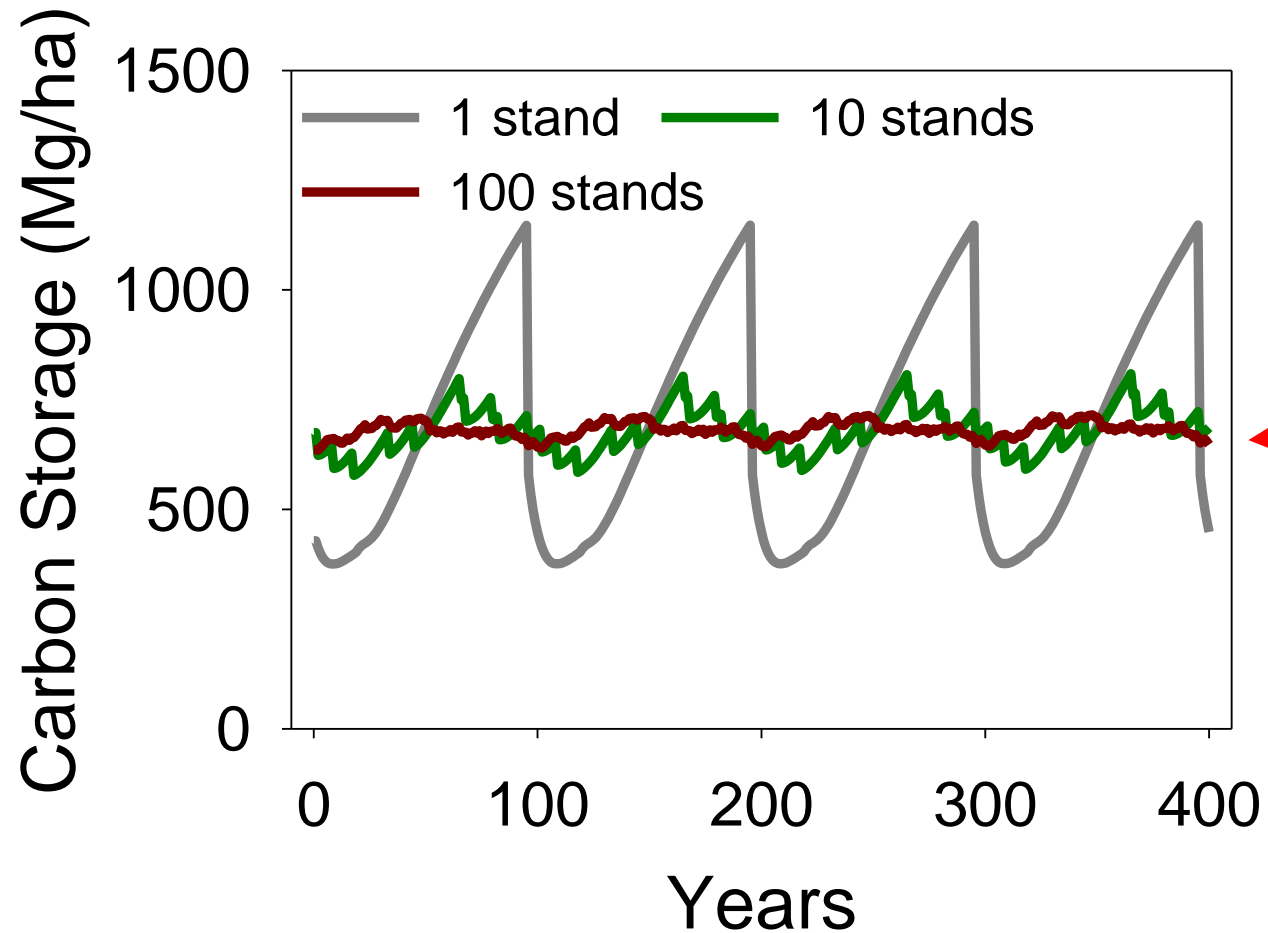


# A spatial and temporal view | Carbon in Time and Space

**Carbon stocks** in forests are **always in flux** due to variations in age, disturbance, and environmental factors. Detecting patterns and trends **requires taking a broad view** in both space and time.



The larger the landscape considered, the more accurate the representation of the forest and the more stable the carbon seems



Best scale to identify trends related to environmental change and land-use

To look at the complete picture of forest carbon:

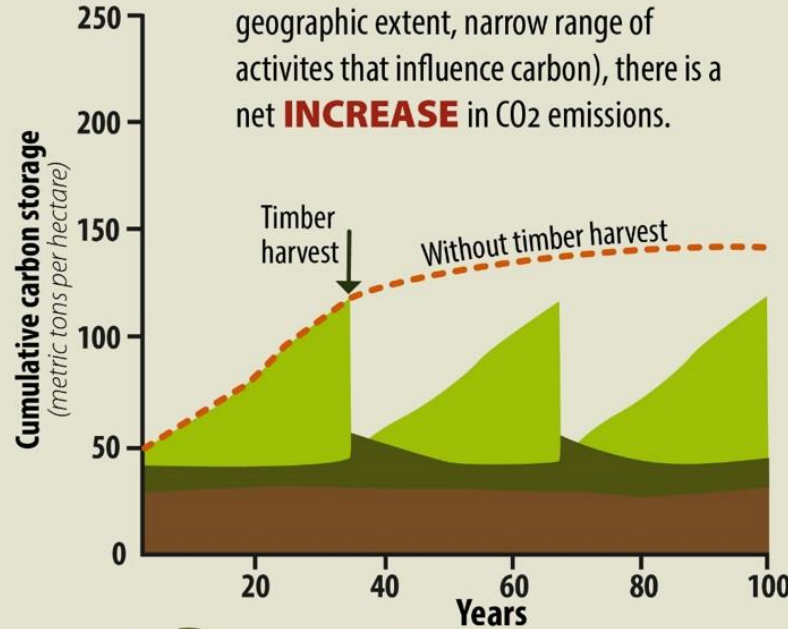
Look across an appropriate ecological time scale

Include a complete accounting of all carbon pools in the closed biogenic carbon cycle

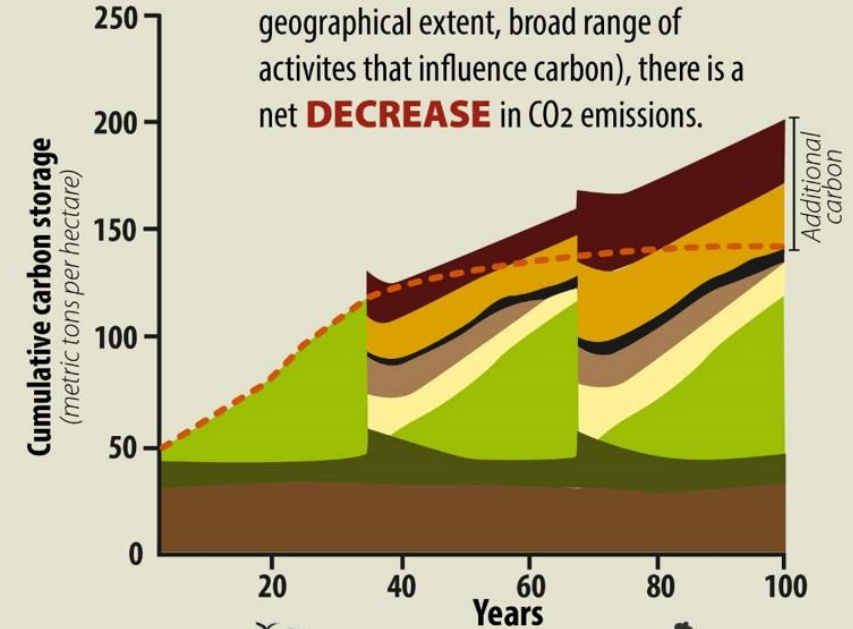
Carbon **BENEFITS** in the Broad View

**How Carbon Stacks Up**

In the **NARROW VIEW** of the forest system (shorter time scale, smaller geographic extent, narrow range of activities that influence carbon), there is a net **INCREASE** in CO<sub>2</sub> emissions.

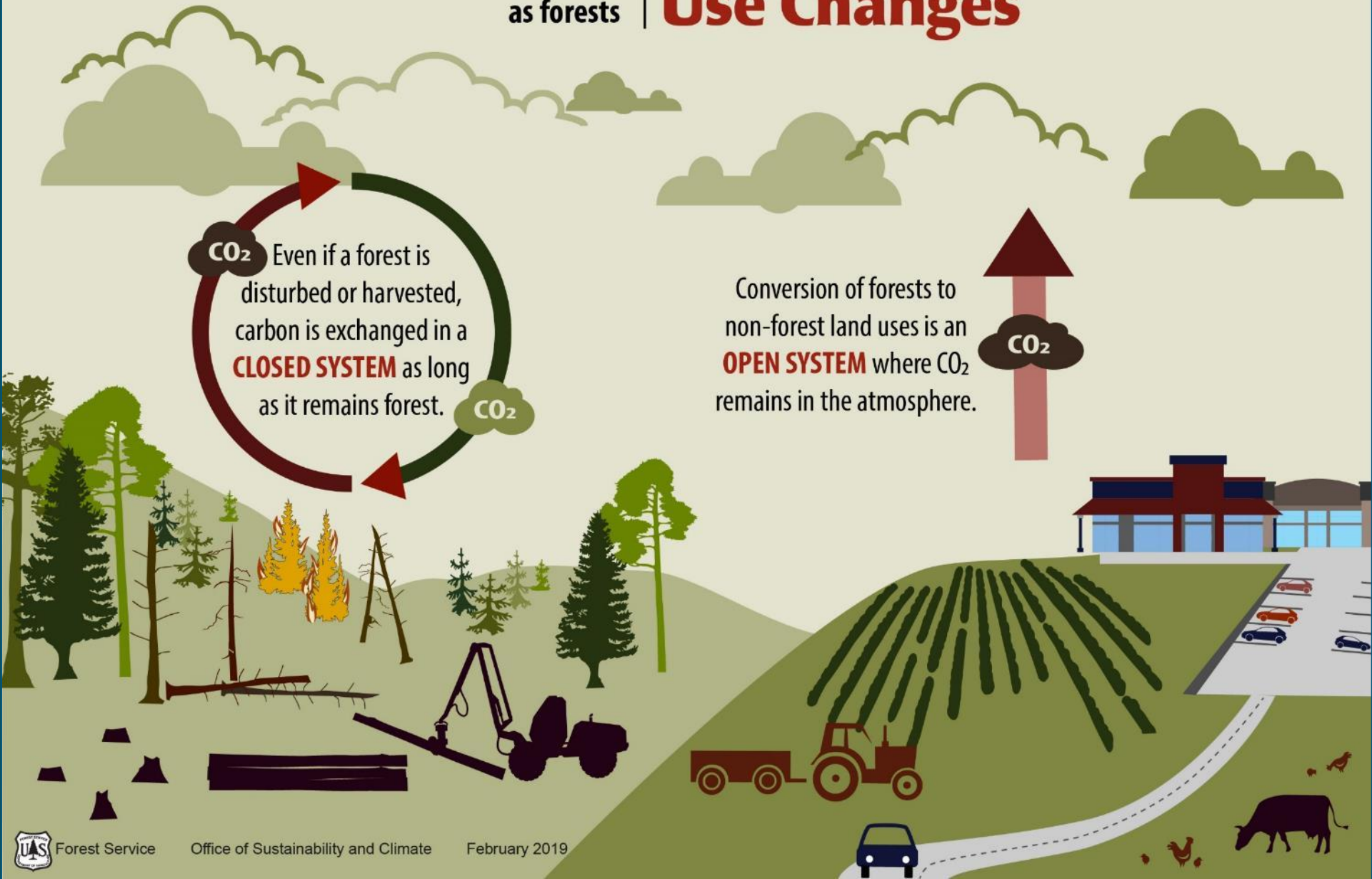


In the **BROAD VIEW** of the forest system (longer time scale, broader geographical extent, broad range of activities that influence carbon), there is a net **DECREASE** in CO<sub>2</sub> emissions.



The importance of  
**KEEPING FORESTS**  
as forests

# Carbon & Land Use Changes

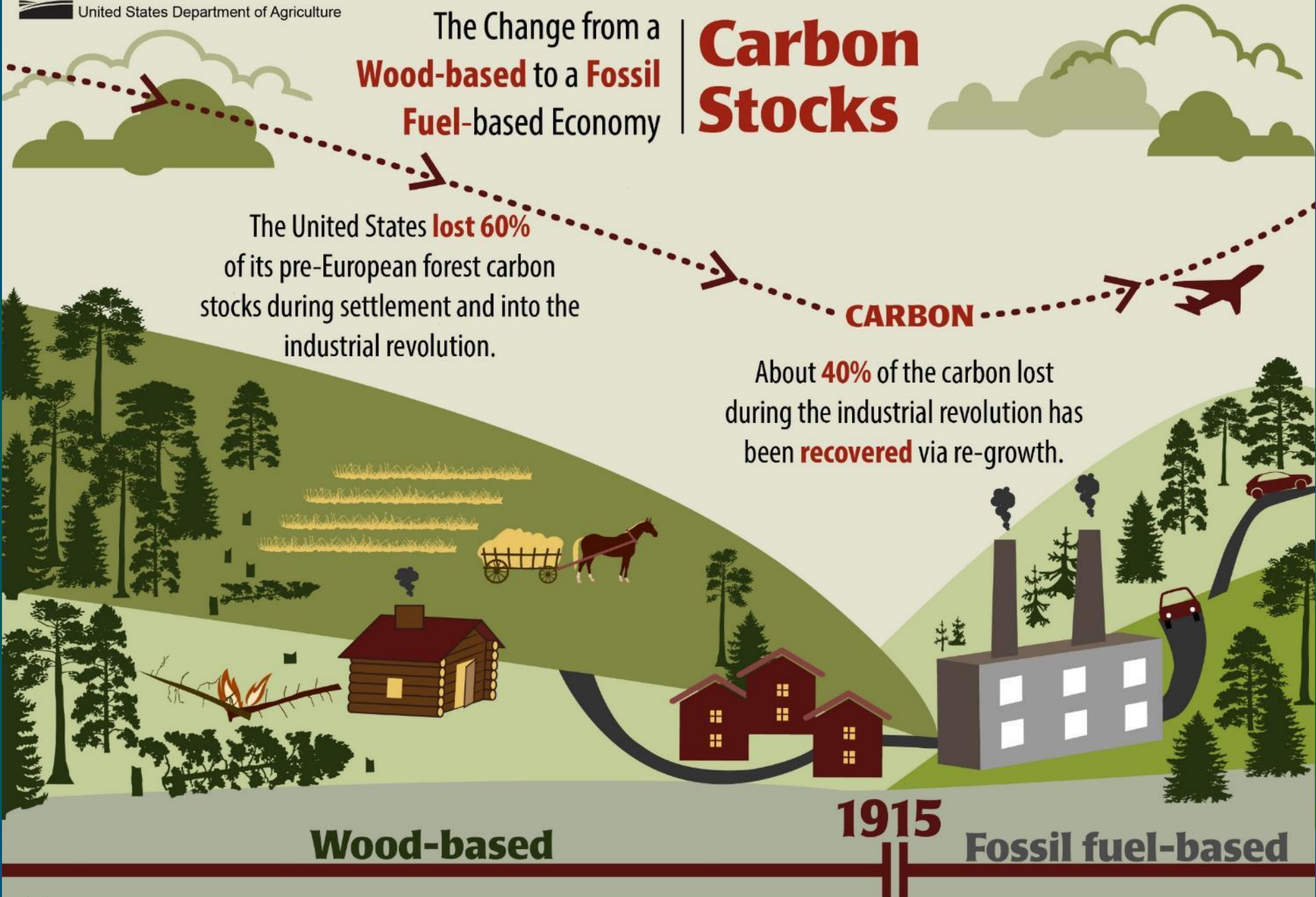


The Change from a  
**Wood-based** to a **Fossil  
Fuel-based** Economy

# Carbon Stocks

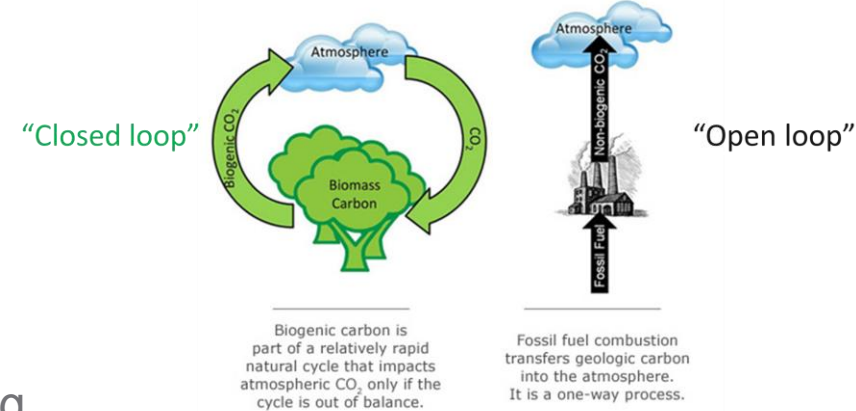
The United States **lost 60%**  
of its pre-European forest carbon  
stocks during settlement and into the  
industrial revolution.

About **40%** of the carbon lost  
during the industrial revolution has  
been **recovered** via re-growth.



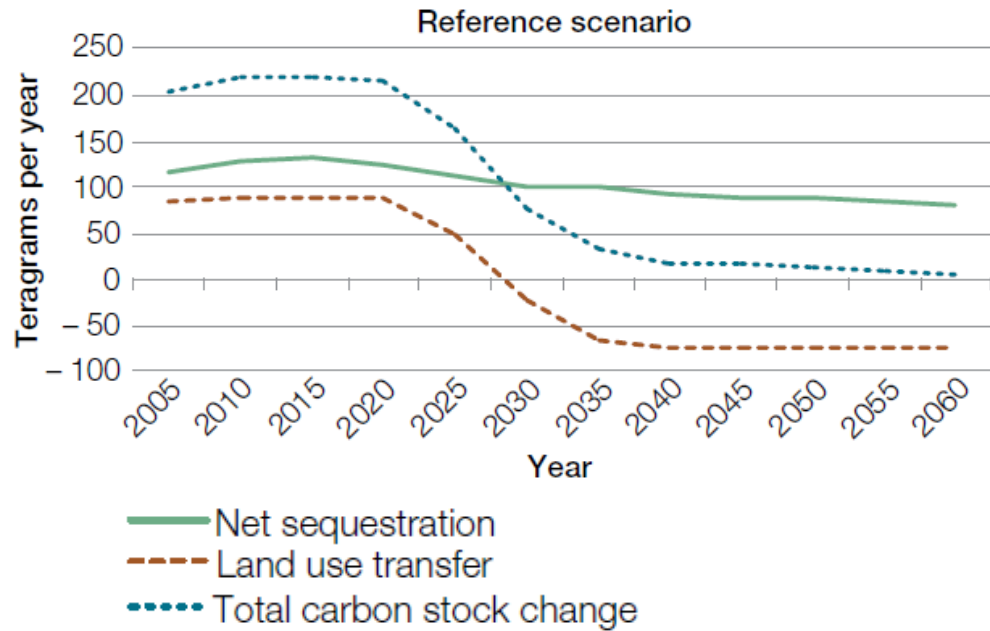
# Keeping Forests as Forests is the major concern with respect to carbon

- Carbon cycle does not close, effectively making the impact of biogenic emissions the same as fossil fuels
- Development, conversion to agricultural or other use. Important for U.S., not just tropics
  - 2000-2005 gross deforestation rate in U.S. was 600,000 ha/yr, but about 1,000,000 ha/yr of non-forested land reverted to forest during this same time.
  - Globally, deforestation releases 1,400-2,000 million tonnes of C per year
  - 156,000 million tonnes of C have been released globally due to land use change (1850-1998)

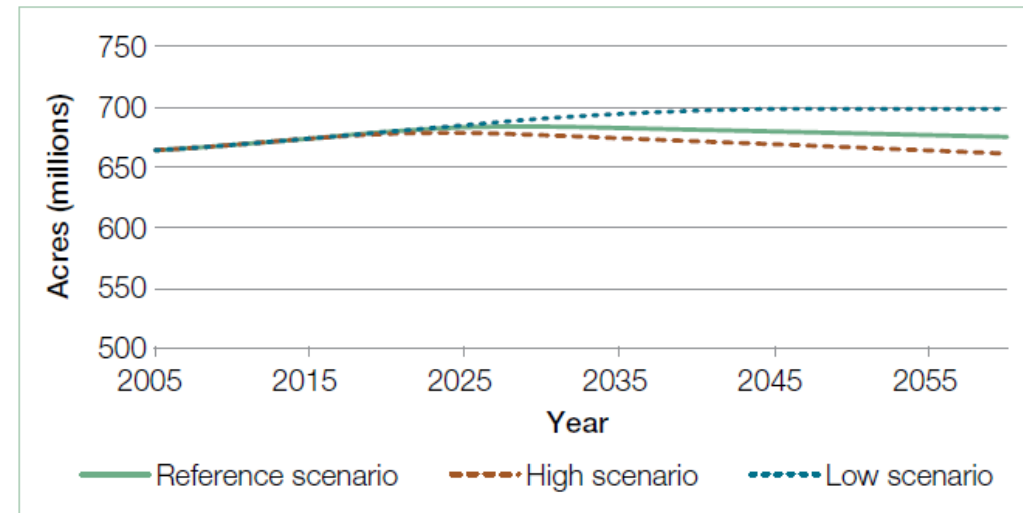


# Loss of forest land is primary driver of forest carbon loss in the future

Projections of U.S. carbon stock changes, including transfers associated with land-use change



Area of U.S. forest land use

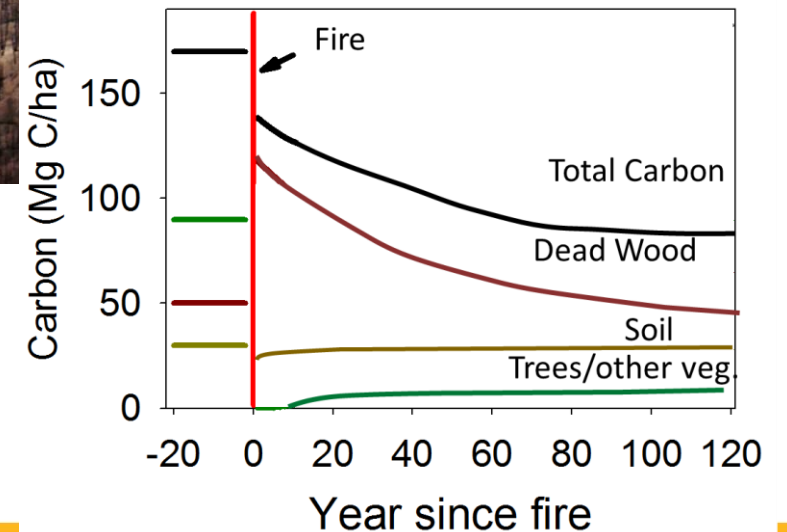
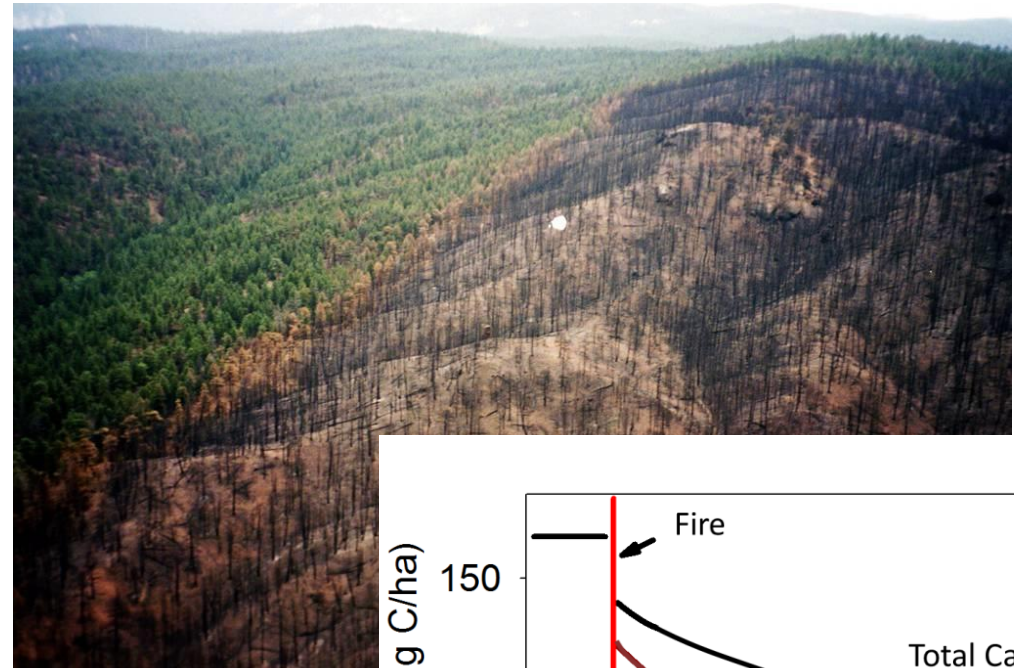
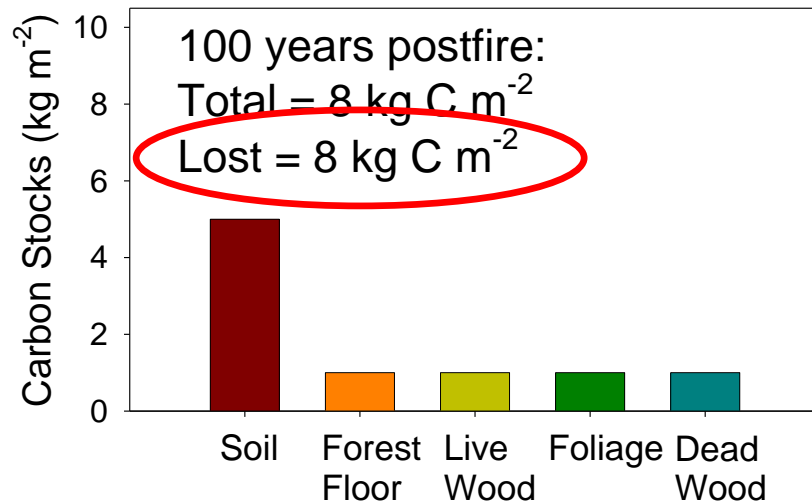
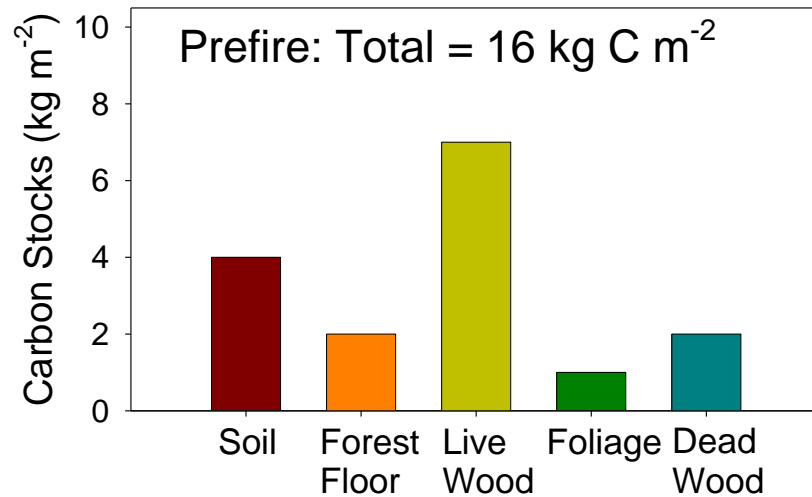


**Net sequestration:** forest carbon stock change minus land-use carbon transfers

# What happens to carbon with no regeneration?

## Main concern for NFS lands

Example: Hayman Fire, Colorado, 2002





# The story of “This Old House”

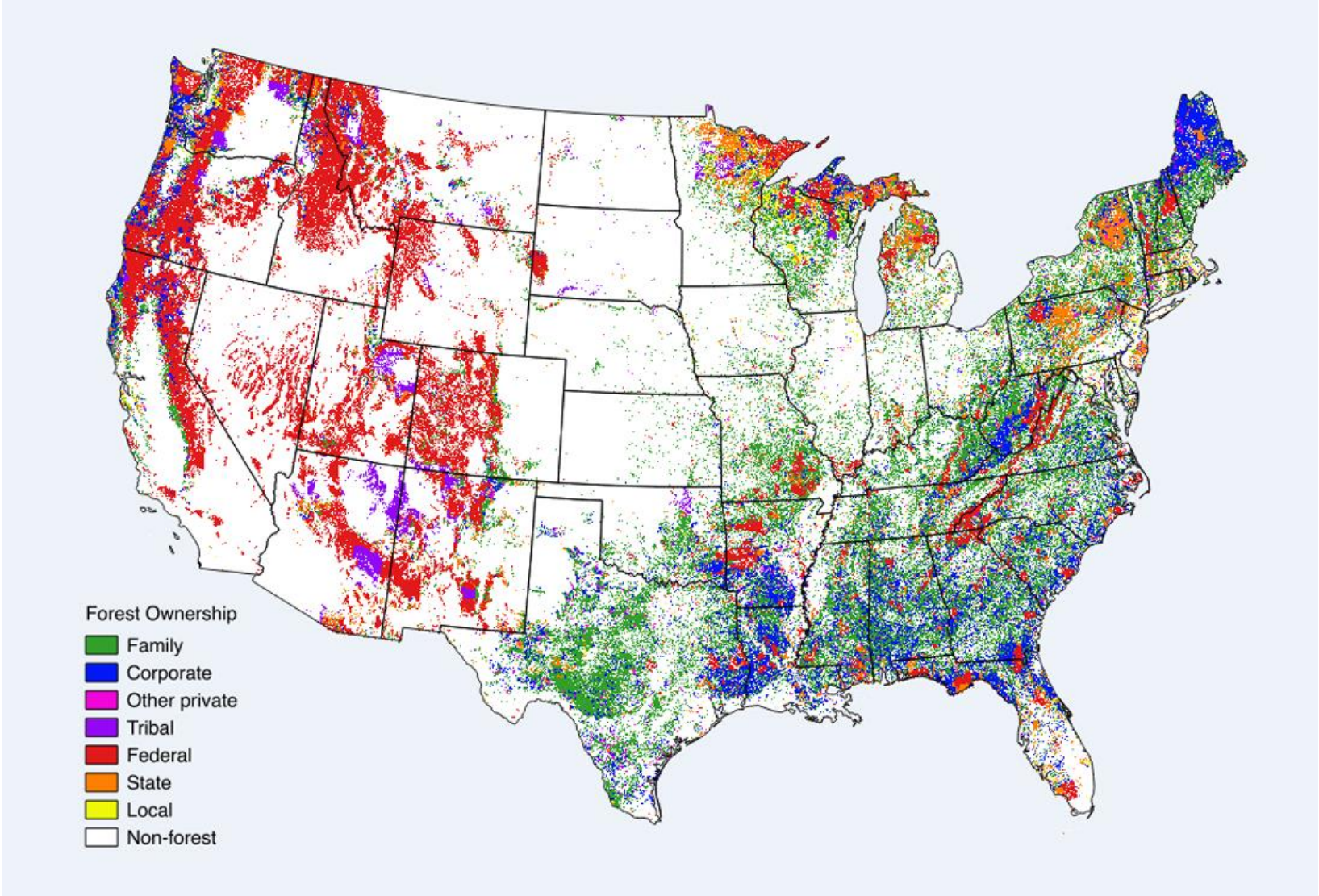






**Additional slides**

# Forestland Ownership:



# Carbon in Harvested Wood Products

- Baseline report
- Regional scale
- Cut & sold reports
- Net increase in recent years – C sink
- Monte Carlo uncertainty
  - Model uncertainty
  - Commodity proportions
  - Product decay rates

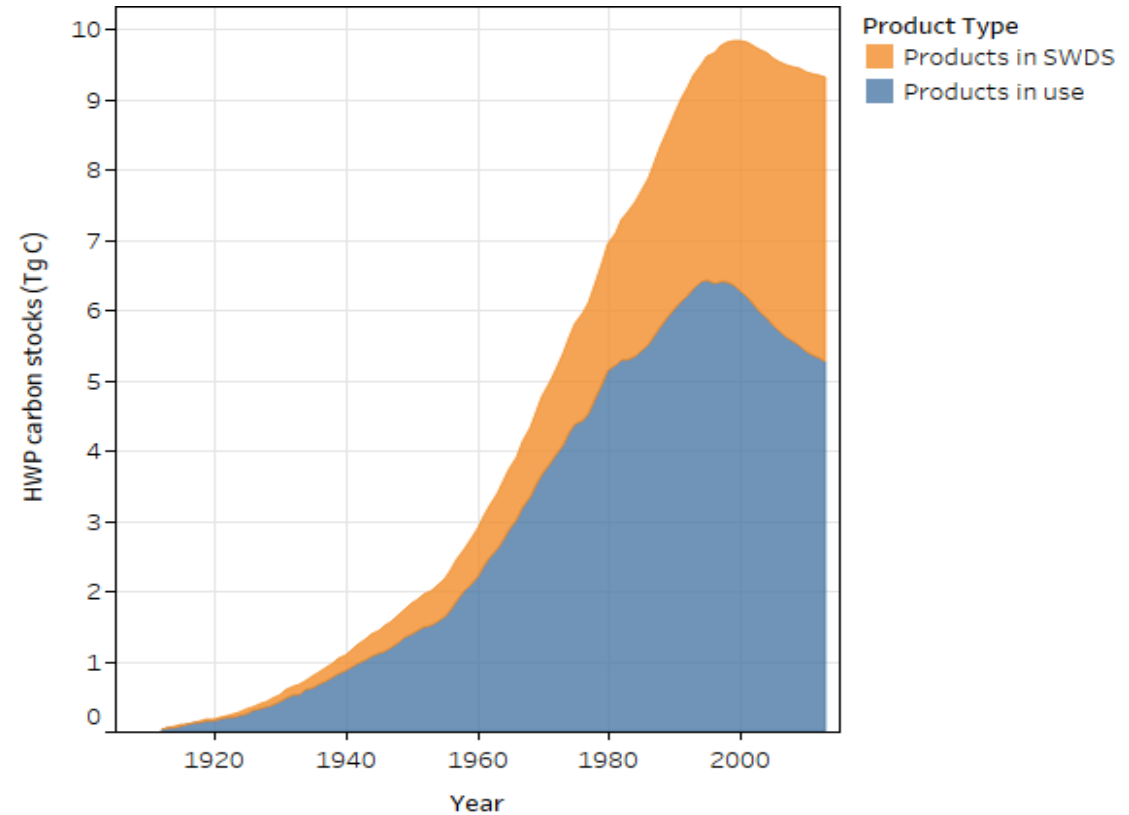
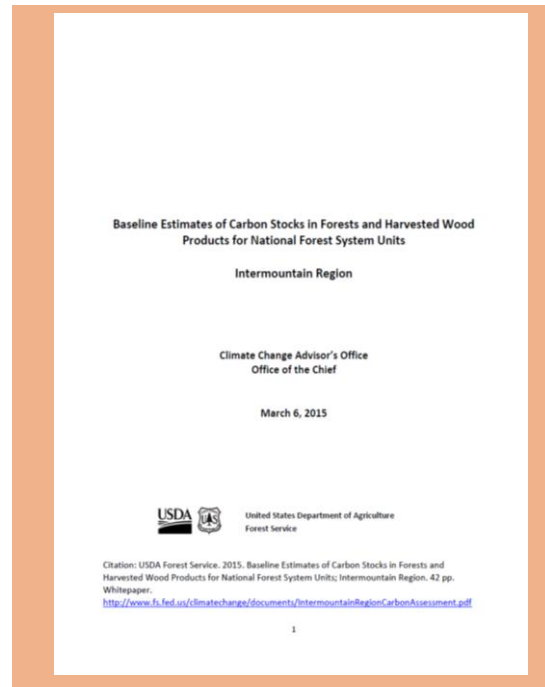


Figure 5. R4