Working Forests: A path to climate solutions

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Considering the joint provision of carbon benefits and sustainable wood products...

• **Working forests:**
  - Private forests that are actively managed to provide desired outcomes (timber, carbon, recreation...)

• **Carbon sink:**
  - The flow of atmospheric carbon (CO2) sequestered in solid form (C)

• **Carbon stocks:**
  - The amount of stored C at any given time

• **Stock change = sink:**
  - Changes in stocks are used to infer the magnitude of the sink
The ownership, age, and structure of forests varies across US regions...

- Public forests dominate in the west
  - Older forests overall
- Private forests dominate in the East
  - Younger forests overall
  - South’s age distribution indicates more management/harvesting
- Policy proposals need to account for vast differences in forests

Source: US Forest Service, FIA forest inventory databases.
The U.S. forest carbon sink is dynamic, substantial, and consequential...

- **Consequential?** Land and forest carbon sinks amount to about 12 percent of total US emissions.
- **Dynamic?** Robust with a gradual decline in size of sink (-13% since 1990)—wood products becoming a large share of total.

Source: US EPA Greenhouse Gas Inventory, based on USFS FIA inventories and FPL models
At the same time, the U.S. consumes and produces more timber than any other nation...

- Peaked in the late 1990s
- Increasingly dominated by softwoods
- Average diameter of harvested trees is declining
- Cyclical component: housing and construction
- Steady growth in pulpwood sized softwood timber

Source: USFS Timber Product Outputs periodic data, interpolated with RFF models
Harvests have shifted among regions; strongest growth has been in the South...
Timber production is now dominated by private working forests...

- Large declines in public output and share of production in the early 1990s
- Private forests now produce ~90% of all timber output
- Production in all regions is majority private

Source: FIA data on inventory removals reported in USFS RPA reports
Regions dominated by private forests also provide most of the US forest carbon sink...

• History demonstrates the joint production potential for carbon and timber

• Sink expansion in the East and especially in the Southeast
  • About 80 percent of the forest C sink is in the East
  • RPA projections indicate this could grow to 90 percent by 2030

Source: USFS RPA Assessment 2015 Update; Woodall et al. 2016
Wood products carbon stocks are dynamic and strongly linked to economic activity...

- Wood products carbon sink is dynamic
  - Affected by economic growth, housing starts and other demand factors
  - Strongly affected by 2008-2009 Great Recession
- Downward secular trend in wood products carbon sink
  - Declining per capita consumption in wood products

Source: US EPA Greenhouse Gas Inventories, based on USFS FPL models
The forest carbon sink is a tale of two dynamic carbon stocks...

**Forest ecosystem carbon stock**
- **Credits**
  - Growth (Photosynthesis)
  - Management to increase growth
  - Reforestation/Afforestation
- **Debits**
  - Disturbance (fire, wind,...)
  - Harvesting
  - Deforestation

**Wood products carbon stock**
- **Credits**
  - Utilization/New construction
  - Design to increase wood content
- **Debits**
  - Deconstruction
  - Decay

Stock = units * carbon density
How can the carbon sink be expanded in this market-driven private forest landscape?

1. Incentivize forest ecosystem carbon
   - Payments for enhancing forest carbon stocks
   - Encouraging growth in the average C-density of forests

2. Incentivize wood use
   - Payments for decreasing carbon footprint of construction (including substitution effects)
   - Encouraging growth in the C-sink of new buildings

3. Incentivize land use change
   - Increased forest returns (1 and 2) to encourage afforestation
   - Discourage deforestation for development
Wood products markets interact with land use decisions in the South...

- More housing construction:
  - Encourages tree planting
  - But forest gains are offset by forest urbanization
- Tree planting subsidies (50%)
  - Small net gains due to market feedbacks
- Increased wood content (20%)
  - Strongest afforestation effect
- Strong evidence that price incentives “work”

Source: RFF research on wood products markets and forest land use decisions (in process)
Expanding the role of working forests in climate solutions

- Wood product uses have expanded the forest carbon sink
  - Growth in product stocks
  - Substitution effects
  - Forests reset to rapid accumulation phase

- Policies that increase returns to forest uses have multiple effects
  - More afforestation
  - Less deforestation
  - More carbon sequestration

- Demand side policy is likely more effective than supply side
  - D-Building codes
  - D-Tax treatments
  - S-planting subsidies
Extent of knowledge is improving rapidly but some gaps exist...

• Need to improve precision of wood products carbon estimates...
  • Updated modeling is needed
  • Standardized estimates of carbon sink contribution of specific wood products
  • Same for substitution effects
  • Extend to regions
  • Links to national carbon stock inventories

• Continued enhancement of critical USFS FIA estimators for forest carbon...
  • National and regional estimators have been foundation for this topic
  • Continued work on small area estimators
Thank you.

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