The Two Way Flow of Wood Carbon vs the One-Way Flow of Fossil Emissions

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Atmospheric CO$_2$ at Mauna Loa Observatory

Scripps Institution of Oceanography
NOAA Earth System Research Laboratory
Carbon Storage and Flow
Major sinks/sources

Ocean

That one way flow to atmosphere has to be taken up by other sinks

Land

Atmosphere

Forests

Fossil Fuel Reserves

One way flow to atmosphere
Annual Flux (Pg C/yr)

Source: adapted from Woods Hole Research Center
US forest growth, removals, and mortality by region, 1953-2006

- Source: Smith et al. 2009
41.7 million acres in Western USA (1997-2009) from 21 different species of beetle

35 million acres in BC from mountain pine beetle
wildfire has near term consequences on air quality and GHG emissions

Severe Wildfire can lead to substantial losses in soil carbon and/or regeneration failure
Sustainable harvesting for products and fuels reduces fossil fuel flow.
Use Life cycle Assessment to Understand Alternatives

Life Cycle Inventories & Assessment of Products & Buildings & Biofuels
measures of all the inputs and outputs for every stage of processing
Total Energy for Life Cycle Stages (MJ/m³) SE/PNW ave.

- More resin
- Some resin feedstock
- Could be biofuel

Bar chart showing energy distribution for different stages and products, with labels for BC Interior, BC Coast, US Ave, and others.
Product Manufacturing Carbon Emissions

CO2: Kg/cubic meter wood eq.

- NW KD Lumber
- NW Plywood
- SE OSB
- Concrete floor area eq.

carbon neutral biofuel
fossil emissions
Comparison of Alternatives

Carbon Emission Reduction
by Displacing Non-wood Products & Fuels
(kgCO2/kg dry wood used)

ENERGY:
- Wood Residuals vs Coal
- Wood Residuals vs Natural Gas

WALL STUDS:
- BioDryStud vs Steel Stud

FLOOR JOIST:
- EWP I-joist vs Steel I-joist

COVERED FLOOR:
- EWP Joist+Ply vs Concrete Slab

CLADDED WALL:
- Biodry stud+Ply vs Concrete+Stucco

KgCO2 reduced per kg wood fiber used
An example of high substitution potential that the local design community is very excited about: [link](http://www.e-architect.co.uk/london/stadthaus_murray_grove.htm) to Seattle Planning, Land Use, and Sustainability Committee Meeting on 4/11/2012
Westside commercial forests – 45 year rotation
Carbon in Standing Inventory by Age Class for Western Washington Federal Lands

- Harmon et al 1990 – Oregon OG research plots 432 t C/ha
- Smith 1994: coastal BC – fully stocked OG – 230 t C/ha
- Smith 1994: coastal BC 146 OG stands – 133 t C/ha

Carbon in tonnes C/hectare

Age in Decades

- Carbon in Standing Tree Inventory
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Meta Substitution Ave:  
C:C 2:1:1  
CO2:bdt 3.8CO2/bdt
Carbon storage and offset potential from PNW commercial forests

Western Oregon Old Growth Washing Above ground Tree Lands / Carbon Standing Carbon after 100 years
Landscape level assessment

Landscape Carbon - Forest and Emissions by Component:
Inland West State and Private Forests - base case

- Stem
- Root
- Crown
- Litter
- Dead
- Harvest

Decade Beginning in

Metric Tons per Hectare

2005 2015 2025 2035 2045 2055 2065 2075 2085 2095 2105 2115
Landscape Carbon - Forest, Products, Emissions, Displacement, Substitution by Component: Inland West State and Private Forests - base case

- Substitution
- Displacement
- Manufacturing
- Harvest
- Long-Term
- Chips
- Dead
- Litter
- Crown
- Root
- Stem

Decade Beginning in

Metric Tons per Hectare

- 2005
- 2015
- 2025
- 2035
- 2045
- 2055
- 2065
- 2075
- 2085
- 2095
- 2105
- 2115
Some Bottom Line Conclusions

• Incentives to deliver more wood for products and available waste & residuals for biofuels will increase carbon mitigation across all pools.

• Carbon taxes are market efficient (if they cross the border)

• Any success in carbon mitigation will increase fossil prices & wood values (at least until a major green technology breakthrough)
Some Bottom Line Conclusions

• Fossil energy is too cheap and will out-compete wood markets in every downturn until the fossil fuel cost structure is increased.

• We have a long way to go to get the rules consistent with good science so they are not counterproductive.
LCI Data Collection Funded by

- CORRIM- Consortium for Research on Renewable Industrial Materials
  - 15 research institutions and 23 authors
- DOE & 5 companies funded the Research Plan
- USFS/FPL, 10 companies & 8 institutions funded Phase I solid wood products research
- USFS, 10 companies & 6 institutions funded Phase 2 solid wood products research
- USFS/FPL, DOE, several small companies & 6+ institutions funding biofuel LCIs and fire reduction
- Survey data from product manufacturers is key