## Harvested Wood Product Carbon Storage for Oregon 1962 - 2017







UNIVERSITY OF MONTANA

# **Harvested Wood Product Carbon Storage Estimates**

#### Stockmann et al. Carbon Balance and Management 2012, 7:1 http://www.chmioumal.com/content/7/1/1



#### RESEARCH

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#### Estimates of carbon stored in harvested wood products from the United States forest service northern region, 1906-2010

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#### Abstract

Background: Global forests capture and store significant amounts of CO<sub>2</sub> through photosynthesis. When carbon is removed from forests through harvest, a portion of the harvested carbon is stoled in wood products, often for many decades. The United States Forest Service (USFS) and other agencies are interested in accurately accounting for carbon flux associated with harvested wood products (HWP) to meet greenhouse gas monitoring commitments and climate change adaptation and mitigation objectives. This paper uses the Intergovernmental Panel on Climate Change (IPCC) production accounting approach and the California Forest Project Protocol (CFPP) to estimate HWP carbon storage from 1906 to 2010 for the USFS Northern Region, which includes forests in northern Idaho, Montana, South Dakota, and eastern Washington.

Results: Based on the IPCC approach, carbon stocks in the HWP pool were increasing at one million megagrams of carbon (MgC) per year in the mid 1960s, with peak cumulative storage of 28 million MgC occurring in 1995. Net positive flux into the HWP pool over this period is primarily attributable to high harvest levels in the mid twentieth century. Harvest levels declined after 1970, resulting in less carbon entering the HWP pool. Since 1995, emissions from HWP at solid waste disposal sites have exceeded additions from harvesting, resulting in a decline in the total amount of carbon stored in the HWP pool. The CFPP approach shows a similar trend, with 100-year average carbon storage for each annual Northern Region harvest peaking in 1969 at 937,900 MgC, and fluctuating between 84,000 and 150,000 MgC over the last decade.

Conclusions: The Northern Region HWP pool is now in a period of negative net annual stock change because the decay of products harvested between 1906 and 2010 exceeds additions of carbon to the HWP pool through harvest. However, total forest carbon includes both HWP and ecosystem carbon, which may have increased over the study period. Though our emphasis is on the Northern Region, we provide a framework by which the IPCC and CFPP methods can be applied broadly at sub-national scales to other regions, land management units, or firms

#### Background

Recent estimates of net annual storage, or flux, indicate that the world's forests are an important carbon sink, removing more carbon from the atmosphere through photosynthesis than they emit through combustion and decay [1]. The forest sector of the United States (US) as a carbon sink, annually offsetting about 15 percent of stored about 48,437 teragrams of carbon (TgC) in 2010 the country's carbon emissions from fossil fuel

[2], or the equivalent of about 30 years of US fossil fuel emissions at the 2008 rate. The US Environmental Protection Agency (EPA) estimates that in 2010 net additions to ecosystem and harvested wood products (HWP) pools were 235 TgC yr<sup>-1</sup> [2]. Thus, US forests function combustion.

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About 5 percent of total US forest sector carbon stocks and 6 percent of the annual flux is attributable to carbon in HWP [2]. Though the HWP fraction of the

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### **Presentation Outline**

- The HWP framework
- Data and data sources
  - Yearly timber harvest data
  - Timber product ratios
  - Primary product ratios
  - End use ratios
- Results
  - Annual Oregon timber product output
  - Total Oregon carbon storage
  - Net change in carbon stocks

# The HWP framework <u>Distributions</u>

- Harvested timber
  - Board feet to cubic foot volume
- Timber products
  - sawtimber, poles, small roundwood, etc.
- Primary products
  - lumber, plywood, mill residue pulp, fuel, and non-structural panel, etc.
- End uses
  - New residential construction (single, multi family, mobile homes), new non-residential construction, manufacturing (household furniture, other furniture, other products), shipping, other uses

### **The HWP framework**



From Stockmann et al. 2012, Carbon Balance and Management 7:1.

### Data and data sources \*

- Yearly harvest data, converted to CCF (OR Dept. Forestry)
  - 1962 2017
  - Private (IP, NIP), State, Tribal, BLM, USFS, county and municipal
- Yearly timber product ratios
  - OSU, PNW, BBER FIDACS literature
- Yearly primary product ratios (OSU, PNW, BBER FIDACS )
  - 2013, 2008, 2003, 1998, 1994, 1992, 1988, 1985, 1982, 1976, 1972, 1968
- Wood to carbon estimates (Smith et al. GTR-343)
- Half-life data (Skog 2008)
- End use ratios (McKeever 2009)
- Fuelwood and wood waste emitted with energy capture
- Discarded products to landfills, dumps, compost (Skog 2008)

\* **Bold font = user created data**; plain font = examples of data and parameters hard wired in the current HWP model



### Yearly harvest data

### Yearly harvest data

### **Board foot Scribner to cubic foot conversion**

 $X MMBF_{Scribner} * \frac{1,000,000 BF}{MMBF} * \frac{1}{convers. factor} * \frac{CCF}{100 CF} = Y CCF$ 

Where MMBF = million board feet Scribner CCF = hundred cubic feet *convers. factor* = ratio of board feet per cubic feet (BF/CF), from: 1952 1070: **5** 42 (Keegen et al. EB | 2010 6(2))

- 1952 1979: 5.42 (Keegan et al. FPJ 2010 6(2))
- 1980 1989: 5.17 (Keegan et al. FPJ 2010 6(2))
- 1990 2000: 4.55 (Keegan et al. FPJ 2010 6(2))
- 2000 2003: 4.07 (Brandt et al. PNW GTR 681)
- 2004 2008: 4.18 (Gale et al. PNW GTR 868)
- 2009 2017: 4.02 (Simmons et al. PNW GTR 942)

### **Timber product ratios**

- 1962: Newport. PNW-9
- 1968: Manock et al. ODF, PNW (publish date unknown)
- 1972: Schuldt, OSU (published 1974)
- 1976: Howard and Hiserote. PNW-79
- 1982: Howard. PNW-118.
- 1985: Howard and Ward. PNW-RB-149
- 1988: Howard and Franklin. PNW-RB-183
- 1992: Ward. PNW-RB-207
- 1994: Ward. PNW-RB-216
- 1998: Ward et al. ODF, PNW (published 2000)
- 2003: Brandt et al. PNW-GTR-681
- 2008: Gale et al. PNW-GTR-868
- 2013: Simmons et al. PNW-GTR-942
- 2014-2017: ODF

### **Primary product ratios**

- The model has 64 primary product classes, 32 classes each for softwood and hardwood
- Amount in each class can vary from year to year
- Example of a timber product distributed to primary products:

**Timber product** 

Softwood sawtimber

Primary product Fuelwood and other Lumber Non-structural panels Oriented strand board Other industrial products Plywood Wood pulp

### End use ratios

- McKeever, David B. 2009. FPL-GTR-181
- 224 primary product end uses:

   47 each for hardwood and softwood sawtimber
   47 each for hardwood and softwood pulpwood
   36 for all other primary products



# **Running the HWP model**

Home About Advanced Contact

#### **Harvested Wood Products**

#### Configure a simulation.

Download an Excel macro-enabled workbook that will help create the input data files here. Use the HWP Ribbon to export data in the correct format for this tool or to add a new year. Do NOT change the basic format of any of the worksheets.

#### Steps:

1 Upload yearly harvest data Choose File No file chosen

2 Upload yearly timber product ratios Choose File No file chosen

Upload yearly primary product ratios or choose region for default ratios See a map of the regions here.

Choose Region • or Choose File No file chosen

Upload distribution parameters (optional and rarely used) Choose File No file chosen

Upload ratios for burned with energy capture (optional and rarely used) Choose File No file chosen

#### 6 Enter number of iterations

Any number larger than 1 will result in Monte Carlo simulation and the only output will be a table of confidence intervals around carbon storage for each year.

Address to send email when done with Monte Carlo:

Run the model Run

1

### http://maps.gis.usu.edu/HWP



Figure 1. Annual timber product output in Oregon, converted to MgC, 1962 to 2017.

#### **Total Carbon Storage**



Figure 2. Cumulative total carbon stored in HWP manufactured from timber harvested from Oregon forests 1962 to 2017. Carbon in HWP includes both products that are still in use and carbon stored at solid waste disposal sites.

#### Net Change in Carbon Stocks



Figure 3. The net change in Oregon timber carbon stocks in HWP from the previous year. The net stock change is the sum of net change for SWDS (red bar) and products in use (blue bar).



Figure 4. All ownership HWP C disposition of products in use and in SWDS



Figure 5. State, Tribal, County and Municipal ownership HWP C disposition of products in use and in SWDS







### Oregon Harvested Wood Product Carbon Report

- Currently working to integrate Oregon harvest data prior to 1962
- Analysis on schedule and report expected to be completed before October 2019.