Carbon Storage in Wood Products -
Credits for projects, uncertainty and bias

Forestry and Agriculture Greenhouse Gas Modeling Forum

Workshop #5: Meeting the Challenges of a Rapidly Changing Climate Policy Environment

April 6-9, 2009 – National Conservation Training Center

Shepherdstown, WV

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Harvested wood products (HWP)

= products made from wood harvested and removed from forests

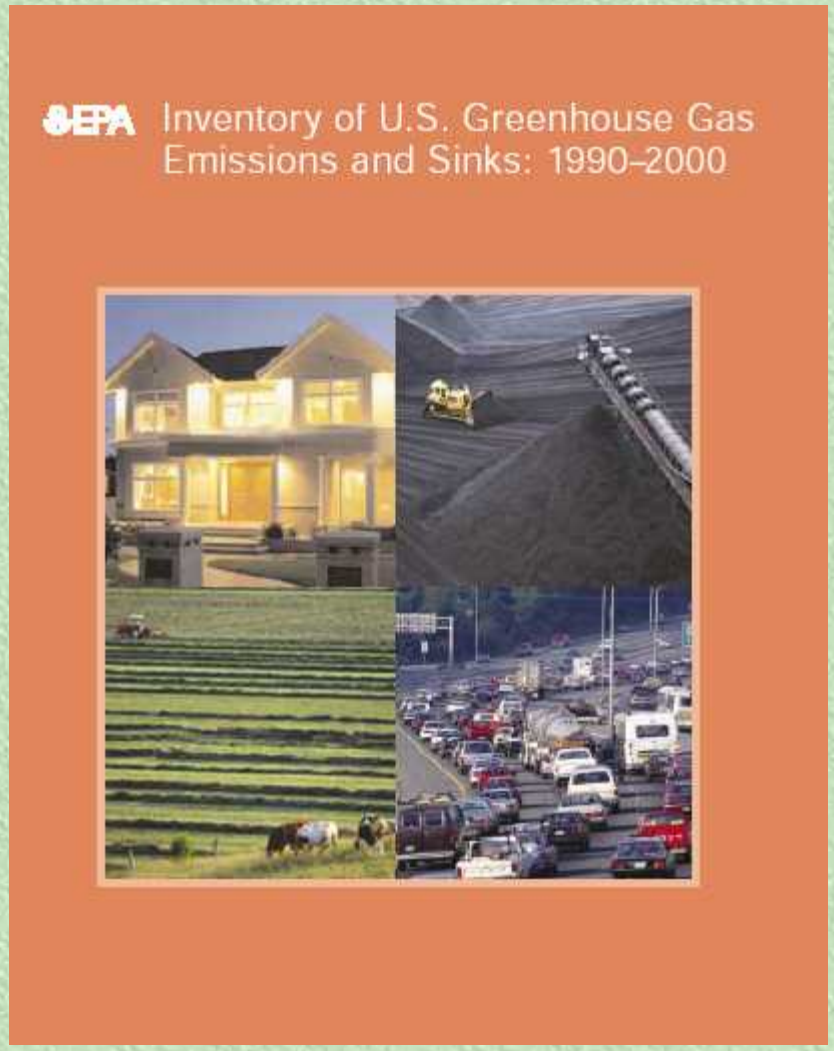
Excludes slash

<u>This presentation</u> – focus on HWP from wood harvested in the U.S.

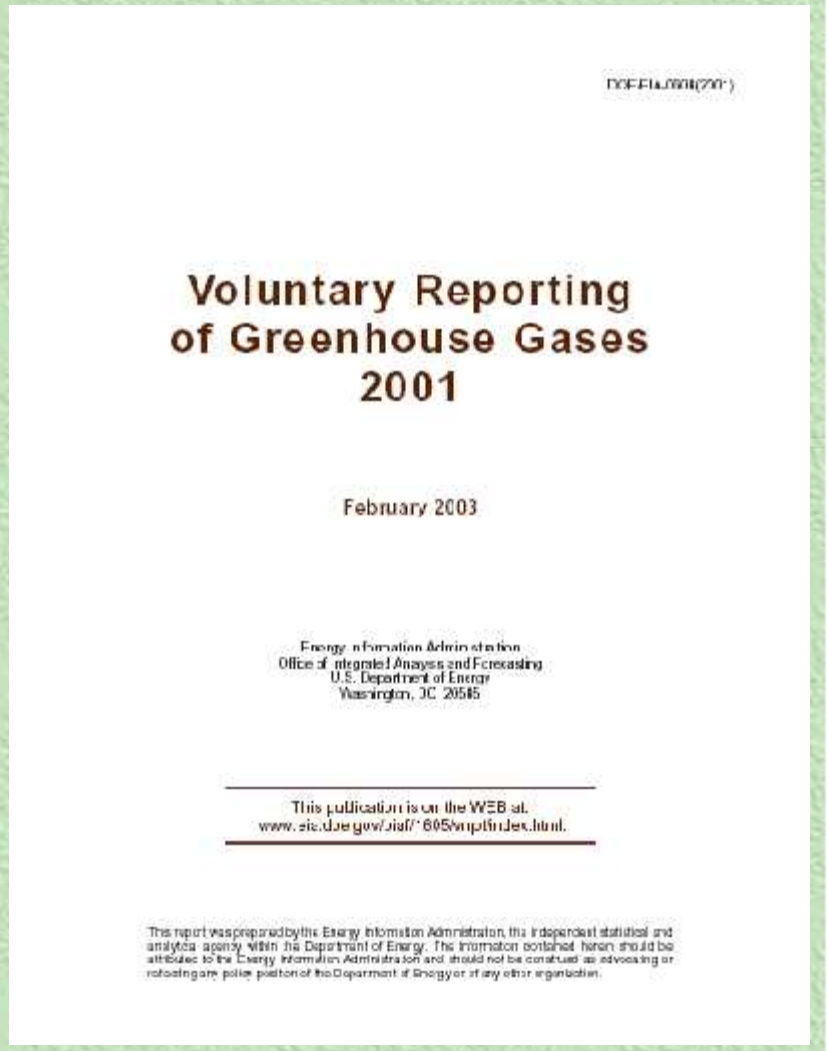
Main points

- **Carbon is accumulating in HWP worldwide and in the U.S.**
- For Forest Management projects - **what credit should be given for HWP Under cap and trade?**
  - A – Year 1 credit for carbon stored in HWP in 100 years (CCX, CCAR)
  - B – Year 1 credit based on present value of HWP carbon change
- **My argument for method B**
  - Method B attempts to give landowners equal incentive for storing carbon in forests OR carbon in HWP.
- **Uncertainty/ discounting for method A**
- **Uncertainty/ discounting for method B**
- **Bias - Methods A and B may underestimate HWP carbon**
- **Comparison of Methods A and B**

National level reporting



Project and Entity level reporting



Carbon is accumulating in HWP worldwide and in the U.S.

- "Worldwide - according to a study by Winjum *et al.* (1998) and a report by the UNFCCC secretariat (2003) - the amount of carbon held in harvested wood products is likely to be increasing." - ***2006 IPCC GHG inventory guidelines***

- U.S. Forest and HWP carbon stocks are increasing (**USEPA 09**)

Table 7-7. Net Annual Changes in C Stocks (Tg C/yr) in Forest and Harvested Wood Pools

Carbon Pool	1990	1995	2000	2005	2006	2007
Forest	**(144.3)**	**(155.0)**	**(109.0)**	**(237.7)**	**(215.9)**	**(220.8)**
Aboveground Biomass	(87.7)	(106.6)	(96.0)			23.4)
Belowground Biomass	(16.8)	(21.3)	(19.5)			24.7)
Dead Wood	(4.2)	(7.4)	(5.0)			10.0)
Litter	(18.5)	(10.1)	(4.0)	(21.7)	(18.7)	(19.3)
Soil Organic C	(17.1)	(9.4)	15.5	(51.9)	(42.5)	(43.3)
Harvested Wood	**(35.9)**	**(32.3)**	**(30.8)**	**(28.3)**	**(29.6)**	**(27.4)**
Products in Use	(17.7)	(15.1)	(12.8)	(12.0)	(12.3)	(10.1)
SWDS	(18.3)	(17.2)	(18.0)	(16.3)	(17.3)	(17.3)
Total Net Flux	**(180.3)**	**(187.2)**	**(139.8)**	**(266.1)**	**(245.5)**	**(248.2)**

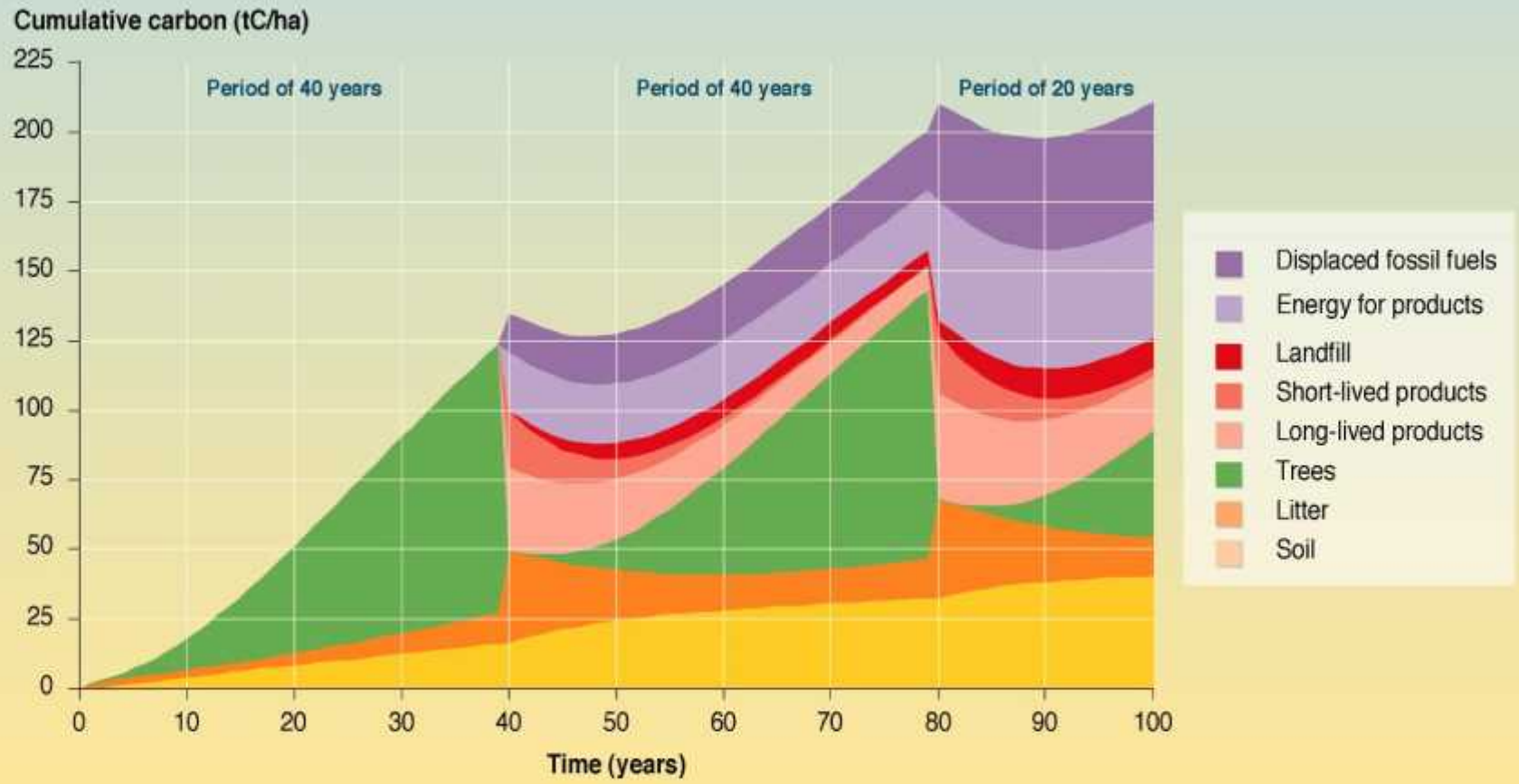
11% of annual additions

U.S. HWP annual carbon change – uncertainty evaluation

- Uncertainty for annual additions to carbon in products in use + products in landfills
  - Monte carlo simulations
  - 13 sources of uncertainty included
  - 2 calibration methods included
    - Housing carbon in 2001
    - Discards to landfills 1990 – 2001
- Uncertainty in change in HWP carbon for 2005 under the Production approach (U.S. Harvest)
  - + 24%, - 19% at 90% confidence

Details: Skog, K.E. 2008. Carbon storage in forest products for the United States. Forest Prod. J. 58(6):56-72

Carbon balance from a hypothetical forest management project



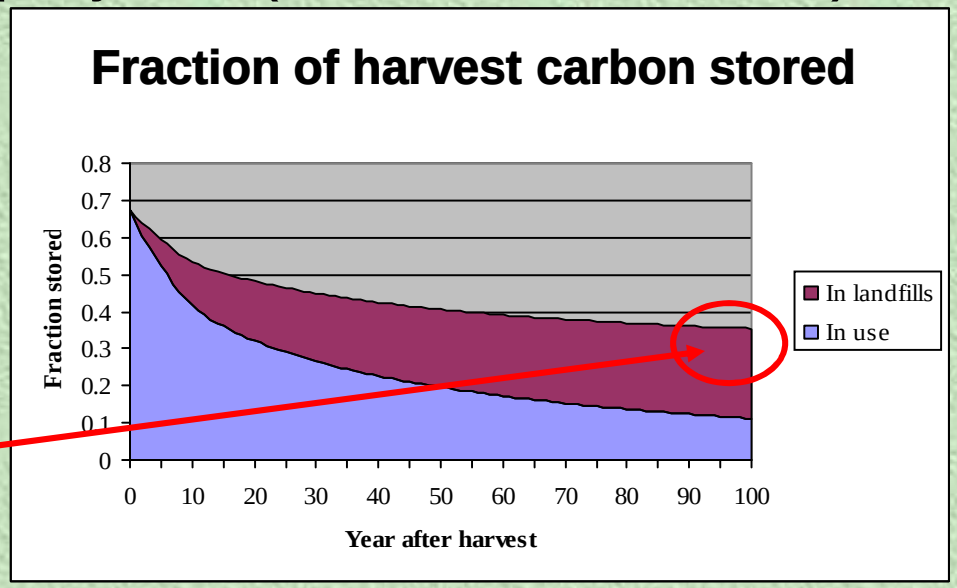
WG3 - FIGURE TS-6

HWP carbon credit for forest management projects – **Method A**

- **Method A –** Give Year 1 credit for carbon that will be stored in HWP in 100 years (CCX, CCAR)
- Rationale – only credit carbon amount that will offset carbon emission for entire 100 years
  - Matches the suggested commitment period for forest management projects (California - CCAR)

Example – softwood harvest in Pacific SW

Year 1 Credit
0.35 t C per unit harvest



Uncertainty in Method A estimate

Low storage case - % Change in paramenters	
Fraction wood placed in use	-20%
Use half lives (years)	-25%
Fraction of discards going to landfills	-25%
Landfill decay limits (fraction that decays)	-25%
Landfill half life (years)	-25%
Base case - amount stored in 100 years	0.35 t C Credit per t C harvested
Low storage case - amount stored in 100 years	0.26 t C Credit per t C harvested
Percent change from Base to Low storage case	**-28%**

HWP carbon credit for forest management projects – **Method B**

- **Landowner financial objective (subject to constraints)**

Carbon price

Value of wood products sold

Annual change in forest carbon

Annual change in HWP carbon

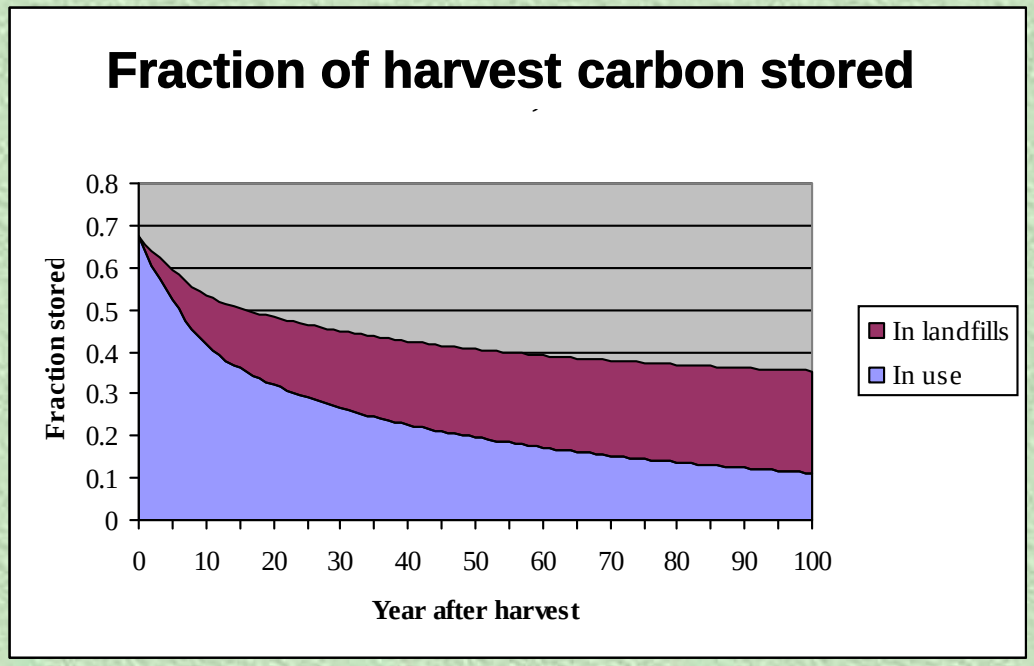
$$\underset{H_t}{Maximize} \sum_{t=1}^{100} \{P_C(t) * [\Delta CForest_t(H_t) + \Delta CHWP_t(H_t)] * (1+r)^{-t}$$

$$+ P_{HWP}(t) * HWP_t(H_t) * (1+r)^{-t}\}$$

The financial incentive for HWP should credit <u>actual annual HWP carbon change</u> (to match the forest carbon incentive)

<u>We Assume the carbon change baseline for forests + HWP is fixed</u>

Method B – Recognized HWP credits and debits over time



Source: DOE 1605b guidelines

Annual change in carbon stored in HWP

Year	Carbon credit (debit) TOTAL	Credit (debit) to IN USE	Credit (debit) to IN LANDFILLS
0	0.67	0.67	0.00
1	-0.02	-0.04	0.02
2	-0.02	-0.03	0.02
3	-0.02	-0.03	0.01
....			
100	0.35	0.11	0.24
Total	0.35	0.11	0.24

Method B – Estimate year 1 credit as present value of HWP carbon changes

$$\sum_{t=1}^{100} \Delta CHWP_t (H_{t=1}) * (1+r)^{-t} \}$$

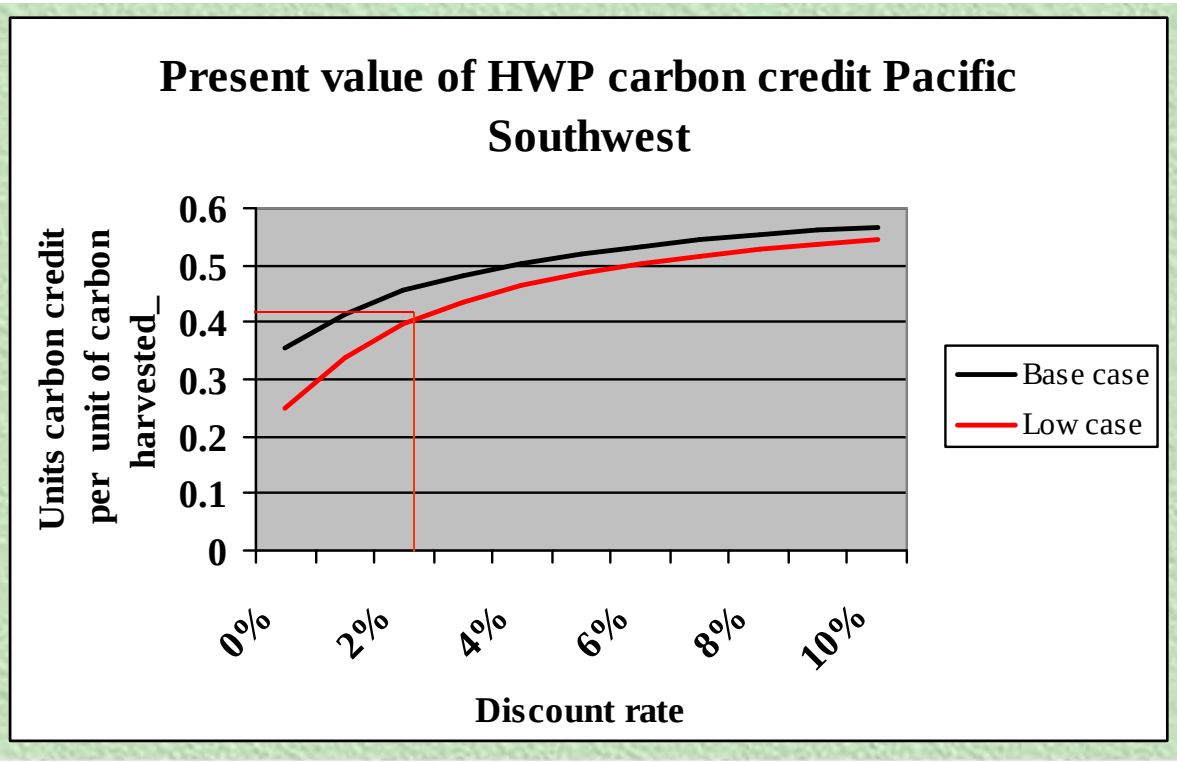
- Assume constant real carbon price
- Assume conservative alternate real rate of return – 2.8% (30 year treasury bonds) (OMP circular A-94, 2008)

Uncertainty in Method B estimate

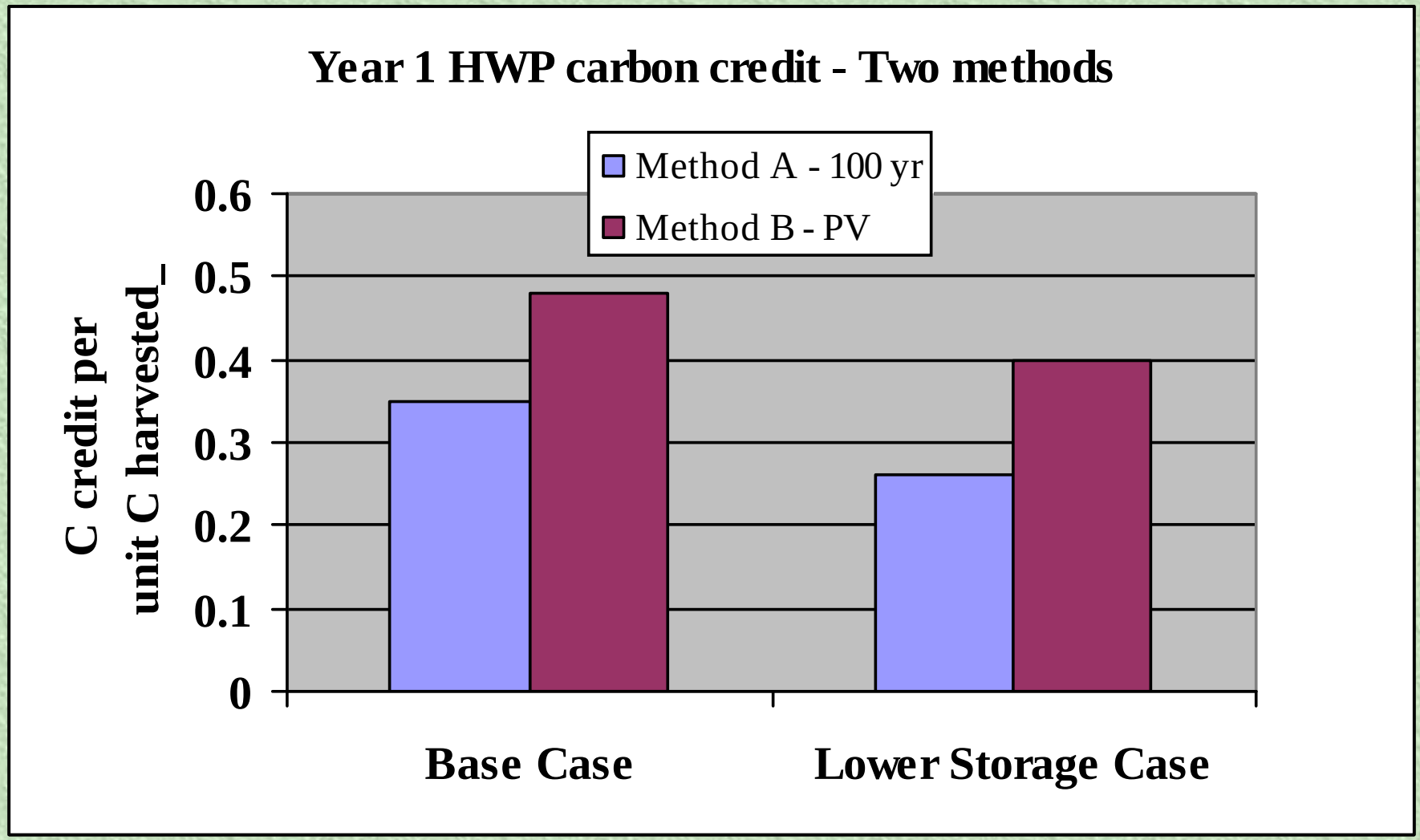
Low storage case - % Change in paramenters

Fraction wood placed in use	-20%
Use half lives (years)	-25%
Fraction of discards going to landfills	-25%
Landfill decay limits (fraction that decays)	-25%
Landfill half life (years)	-25%

Base case - PV of HWP credits/ debits	0.48 t C Credit per t C harvested
Low storage case - PV of HWP credits/ debits	0.40 t C Credit per t C harvested
Percent change from Base to Low storage case	**-16%**



Comparison of year 1 credits – Methods A and B



Sources of bias in estimated credit for HWP carbon change

- Landowner does not get incentive (payment) for certain carbon offsets (caveat below)
  - Offset from reduction in fossil carbon emissions via wood burning
  - Offset from reduction in fossil carbon emissions by substituting wood for products that emit more in manufacture
- Landowner may get **partial credit** to the extent that cap and trade **raises** wood price
- Landowner does not get a debit for landfill methane emissions from wood and paper

- **Landowner financial objective (subject to constraints)**

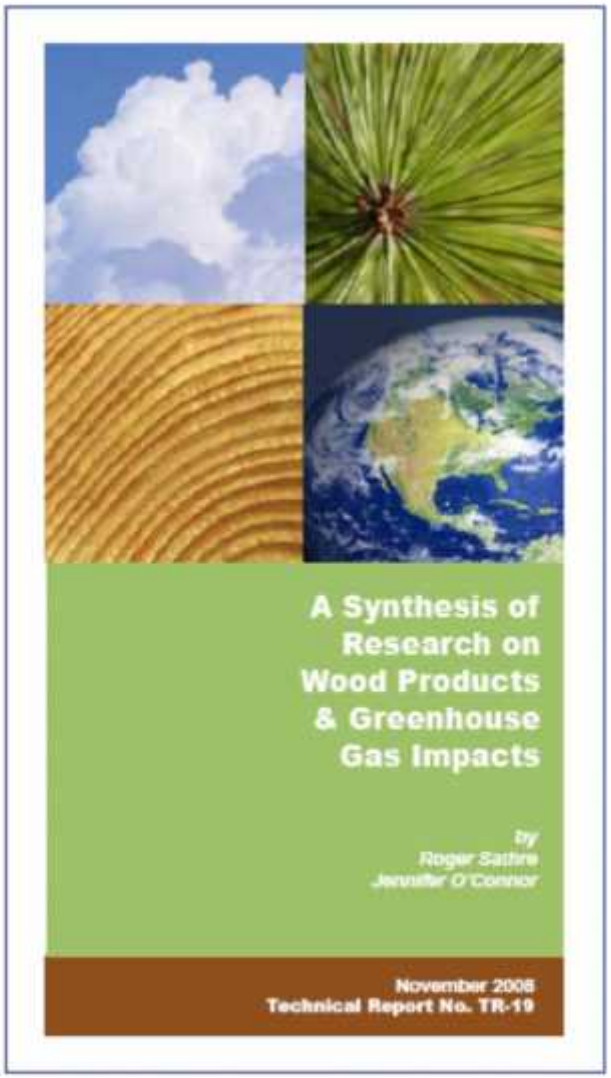
Wood use for energy may raise wood price

Wood use in place of more fossil intensive products may raise wood price

Value of wood products sold

$$\underset{H_t}{Maximize} \sum_{t=1}^{100} \{P_C(t) * [\Delta CForest_t(H_t) + \Delta CHWP_t(H_t)] * (1+r)^{-t}$$

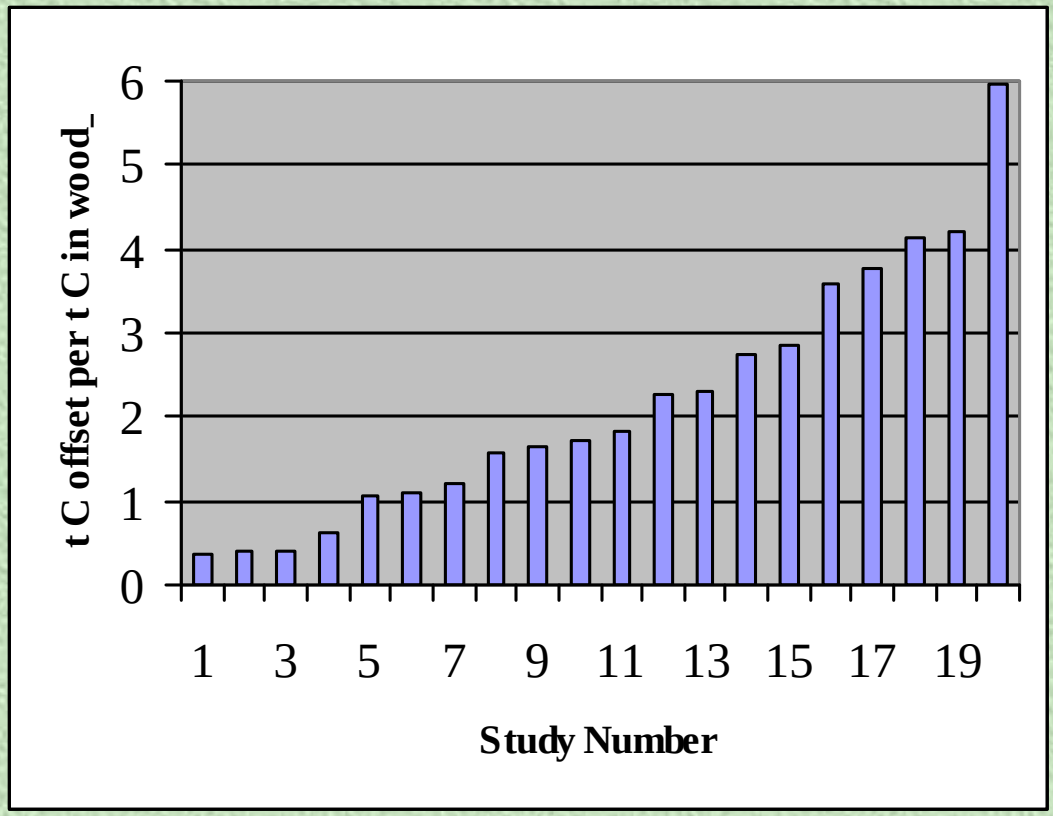
$$+ P_{HWP}(t) * HWP_t(H_t) * (1+r)^{-t} \}$$



Results from 20 studies --

C offset from substitution of wood for other products in construction

(t C offset/ t C in wood)



Comparing Methods A and B

A: **Credit in yr 1 = 100 C amount** B: Credit in yr 1 PV **HWP C change over 100 years**	Method A	Method B
Landowner financial incentive is "equal" for storing forest and HWP carbon	No	"Yes" Excluding bias
Uncertainty estimate based directly on in HWP carbon estimate	Yes	No Also carbon price and alt ROR
Adjusts for possible bias due to energy, substitution, and methane offsets	No	No

Notes on attaining highest carbon offsets – forests + products

- Landowner is motivated to maximize PV of credits + product value (given constraints)
- With equal value for forest and HWP carbon change **in each year –** choice will be for least cost C addition and result will be highest C storage per unit cost
- Are additional incentives needed?
  - Wood burning / substitution
    - Is pass through price increase enough?
  - Recycling (for longer storage)
  - Avoid landfill methane emissions

Some findings

- To give equal credit to forest and HWP carbon additions
  - Method B is closer to equal incentive
- Methods A and B both may be biased low
- Methods do not include incentive to extend use life, or avoid landfill emissions

Thank you !

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