Estimating carbon in harvested wood products

Richard Birdsey, Program Manager
USDA Forest Service
Northern Research Station
Newtown Square, Pennsylvania

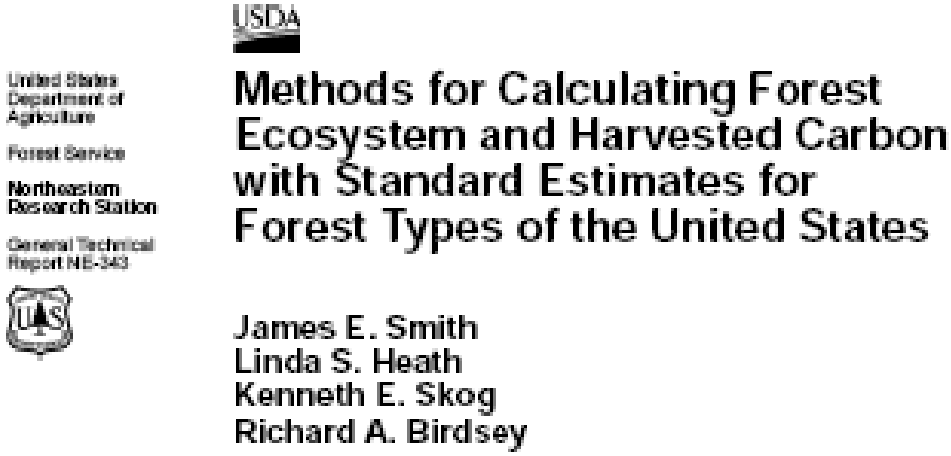
Ken Skog, Project Leader
USDA Forest Service
Forest Products Laboratory
Madison, Wisconsin

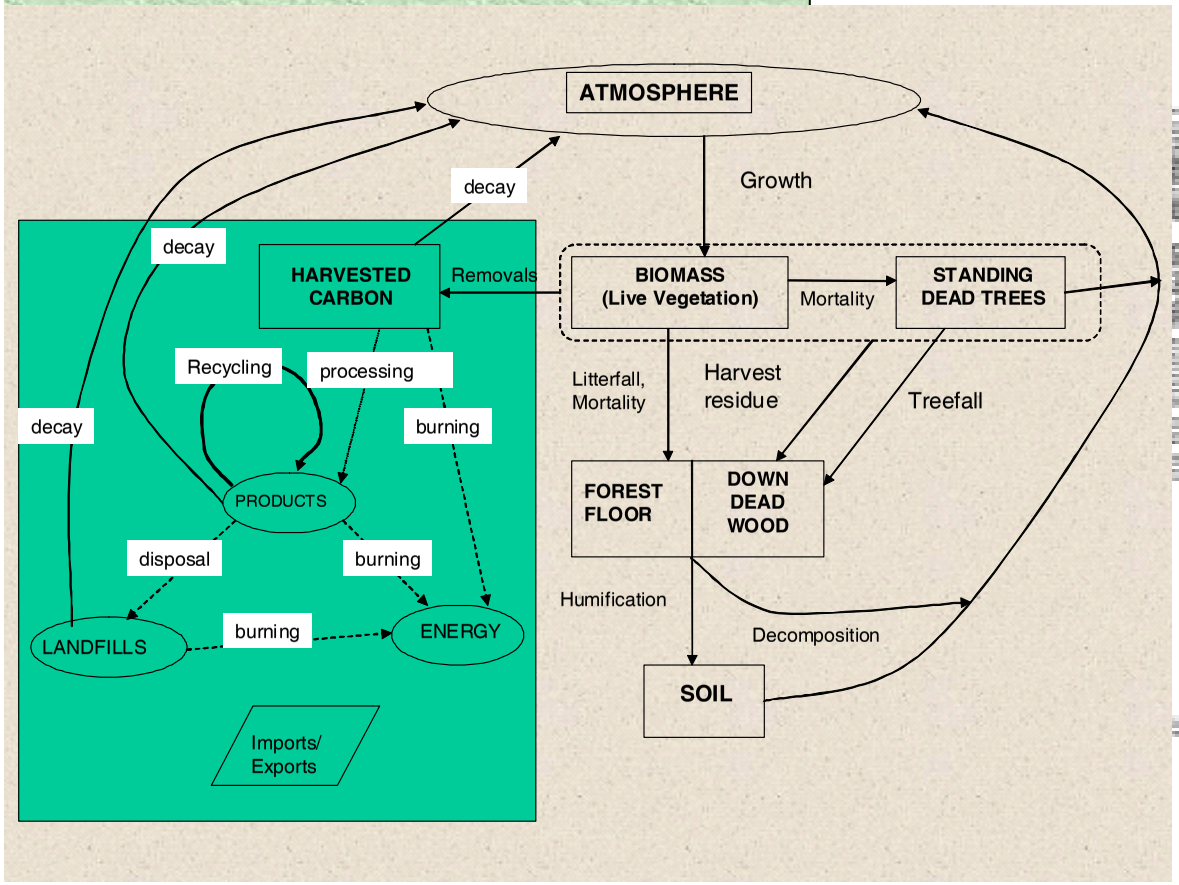
Topics

- HWP carbon flows and pools
- How to estimate additions to HWP pools from harvested wood
- Managing HWP carbon
- Estimates of HWP carbon for the U.S.

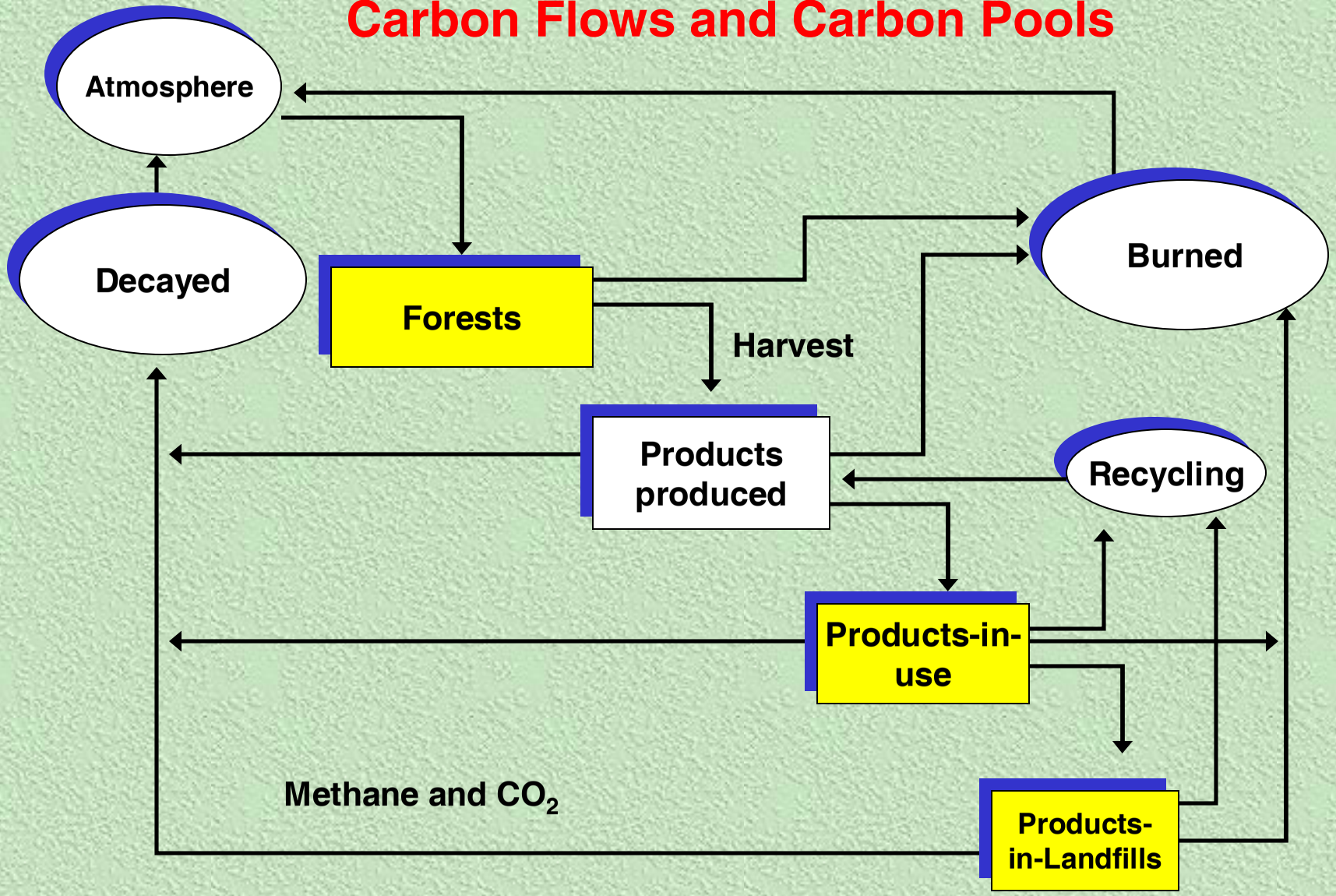
Methods as Developed and Reported for the U.S. Greenhouse Gas Registry 1605(b)

http://www.nrs.fs.fed.us/pubs/8192



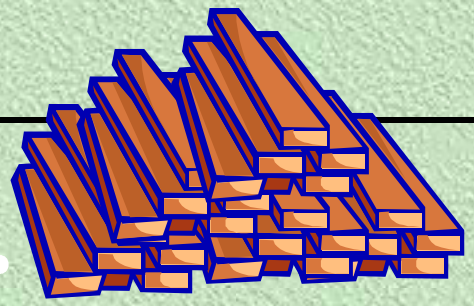


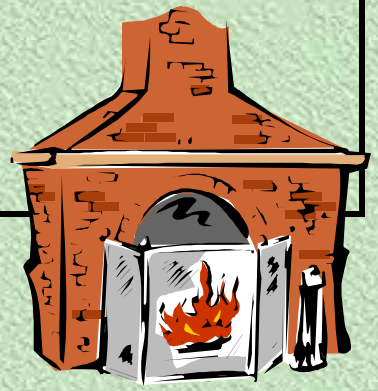
Carbon Flows and Carbon Pools



Components of Carbon in Harvested Wood

PRODUCTS IN USE	**LANDFILLS**	**EMISSIONS**	**BURNED FOR ENERGY**
Lumber Plywood Other panels Solid wood Paper Recycled Paper	Landfill wood Landfill paper	Waste wood, decayed or burned with no energy captured Decay of products & landfills	Products sent to landfills, recycling, emissions





Summary of Methods for Wood Products

- Harvested wood product carbon pools:
  - Wood and paper in use (Forest sector)
  - Wood and paper in landfills (Forest sector)
  - Wood burned for energy (Energy sector)
  - Wood product emissions
- Two estimation approaches:
  - Track stocks over time
  - Estimate stocks at end of 100 years
- Three “starting points”:
  - Forest ecosystem
  - Roundwood harvest
  - Wood products

Regional-specific Estimation Factors

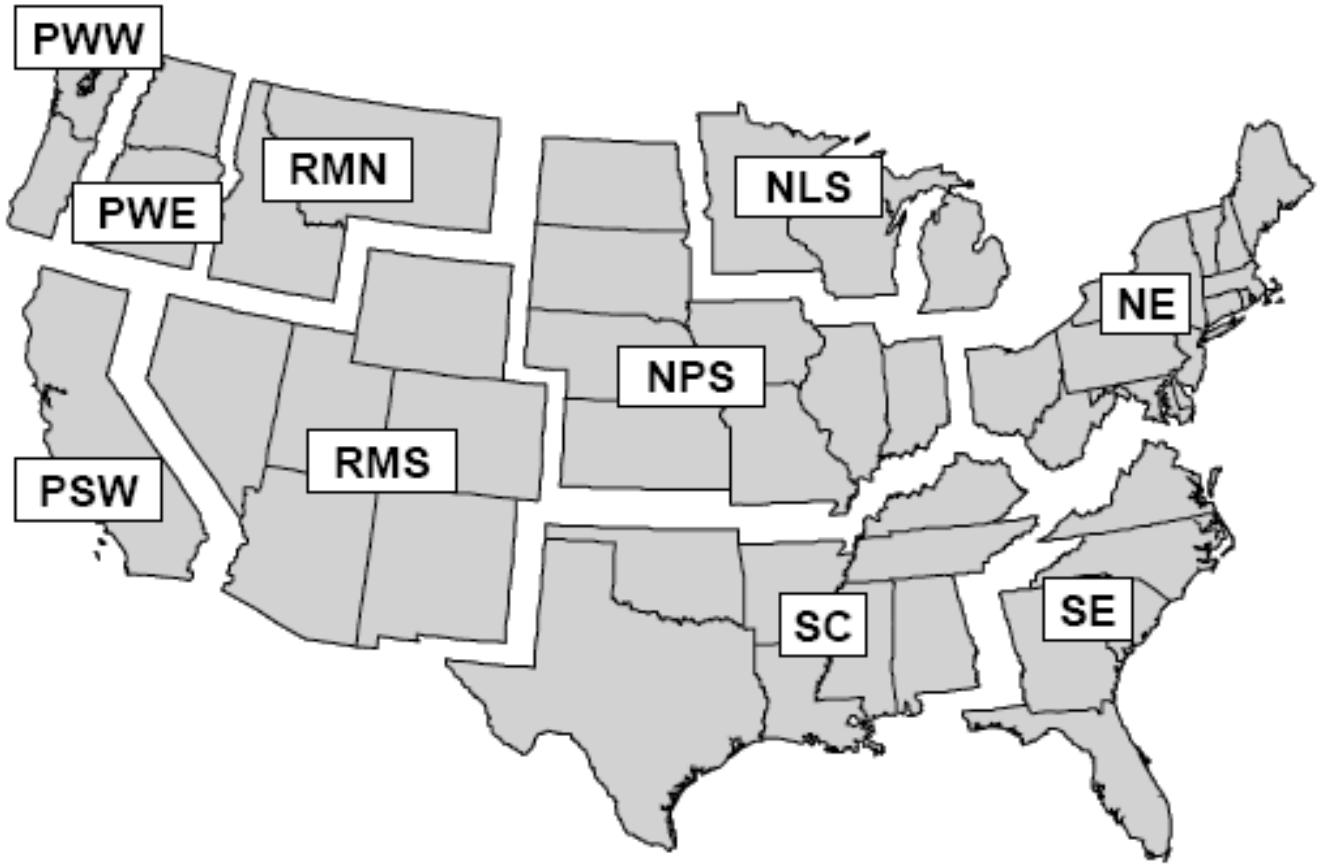


Figure 1.—Definition of regions: Pacific Northwest, West (PWW); Pacific Northwest, East (PWE); Pacific Southwest (PSW); Rocky Mountain, North (RMN); Rocky Mountain, South (RMS); Northern Prairie States (NPS); Northern Lake States (NLS); Northeast (NE); South Central (SC); and Southeast (SE). Note that regions are merged for some tables, these combinations include: NLS and NPS as North Central; PWW, PWE, and PSW as Pacific Coast; RMN and RMS as Rocky Mountain; SC and SE as South; and RMN, RMS, PWE, and PSW as West (except where stated otherwise).

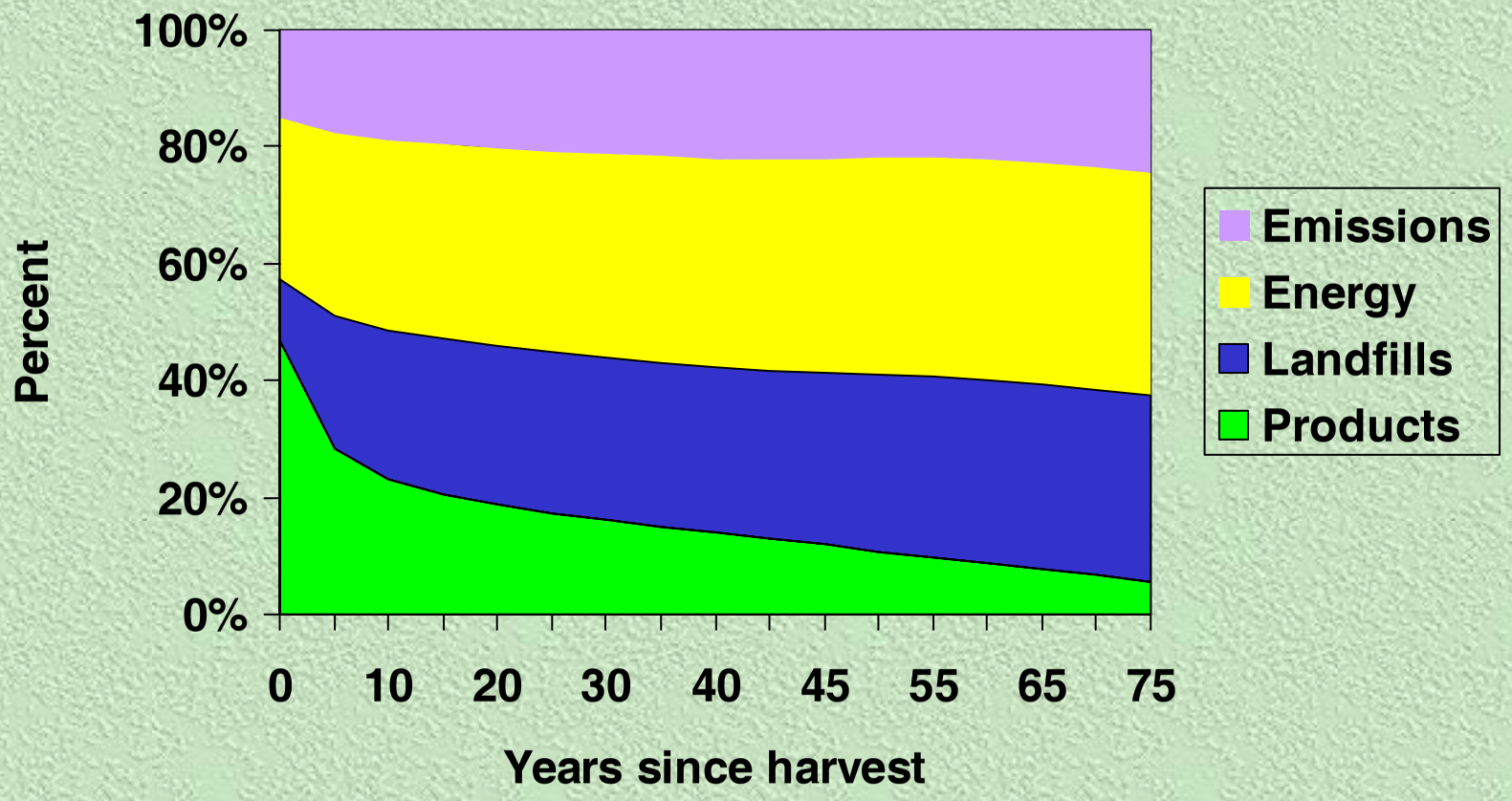
Starting Point for Calculations

Harvest **Manufacture**

Forest Ecosystem (Starting point 1 for calculations) → **Roundwood** (Starting point 2 for calculations) → **Wood Products** (Starting point 3 for calculations)

Carbon in harvested wood products

U.S. averages, starting point is roundwood harvested



Source: Heath and others, 1996; Skog and Nicholson, 1998

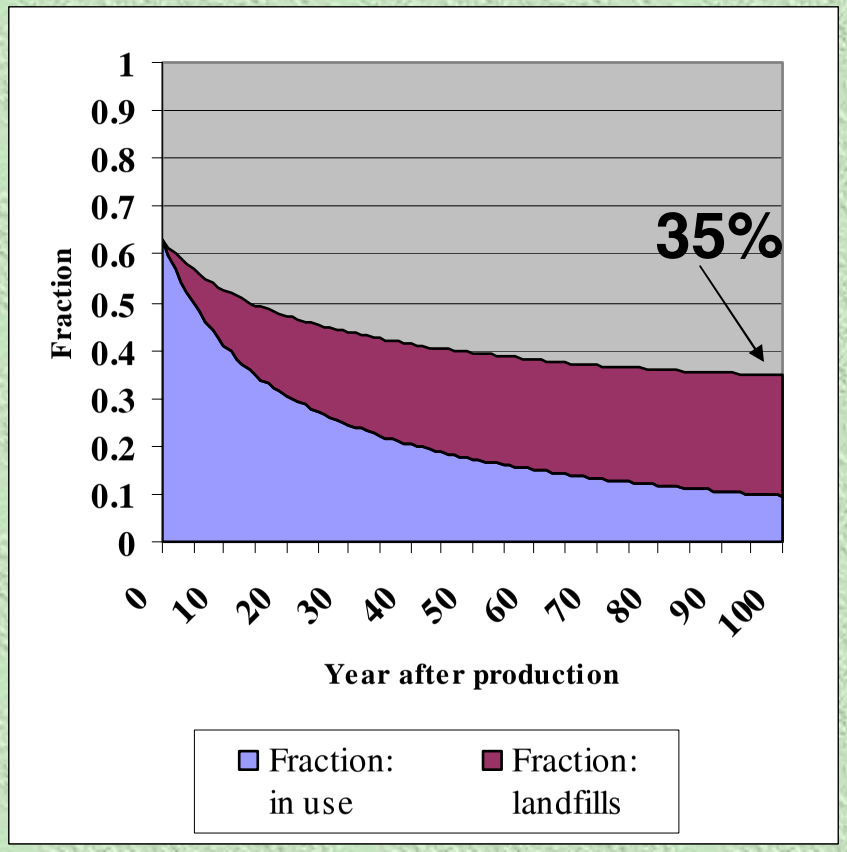
Carbon in HWP pools from harvest over time --

Disposition is modeled, based on product statistics and estimated usage, half-lives, and decay rates

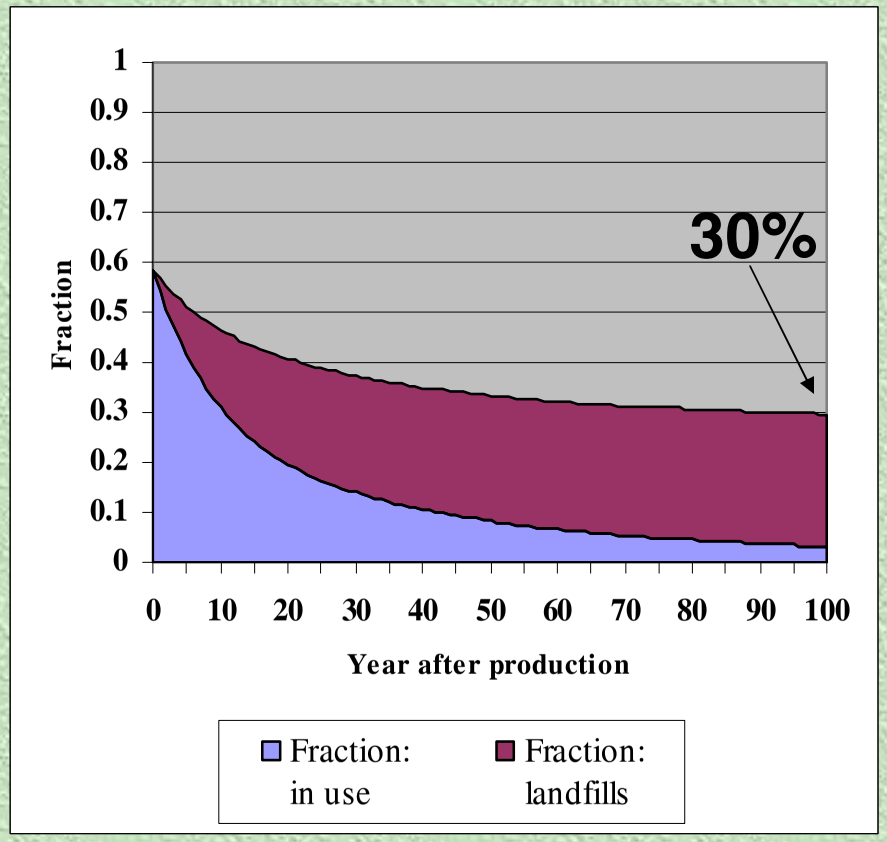
1. Disposition of sawlogs and pulpwood to primary wood products (e.g. lumber, panels, paper)
2. Disposition of lumber and panels to end uses (e.g. housing, other buildings, furniture)
3. Half-life of wood in each end use (e.g. housing, furniture, paper)
4. Recycling rate after use for paper and wood products
5. Fraction of wood/ paper discarded to landfills after use
6. Fraction of wood/ paper which <u>does not</u> decay in landfills (wood= 77%, paper = 44%)
7. Half-life for decay in landfills

Sawlog carbon disposition over time – Harvest in the North Central Region

Softwood sawlogs

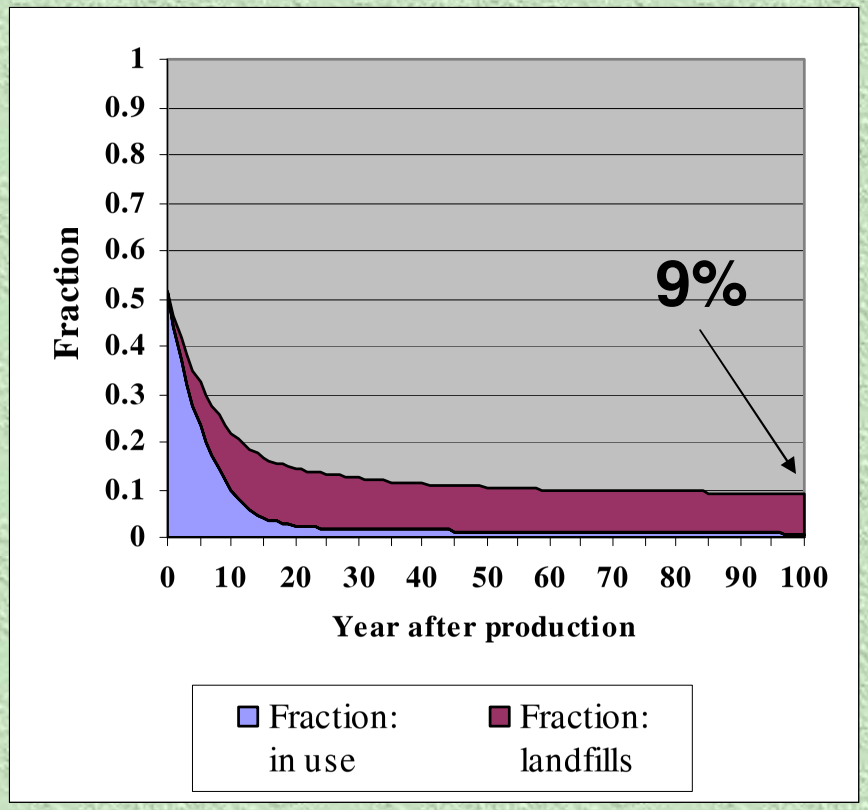


Hardwood sawlogs

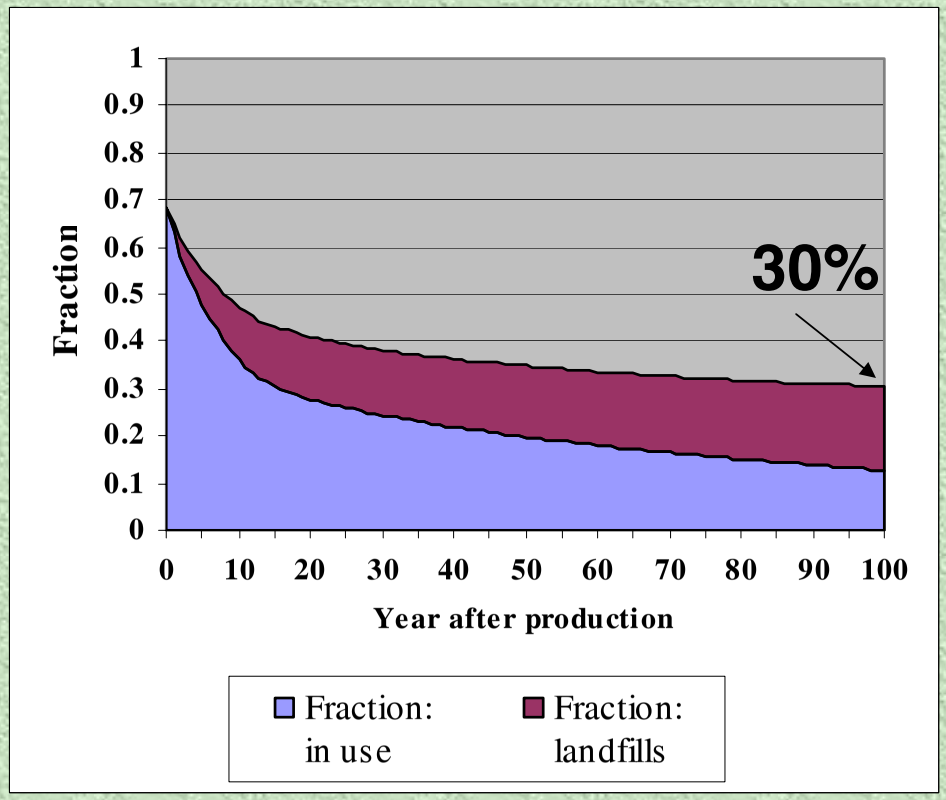


Pulpwood carbon disposition over time – Harvest in the North Central Region

Softwood Pulpwood



Hardwood pulpwood



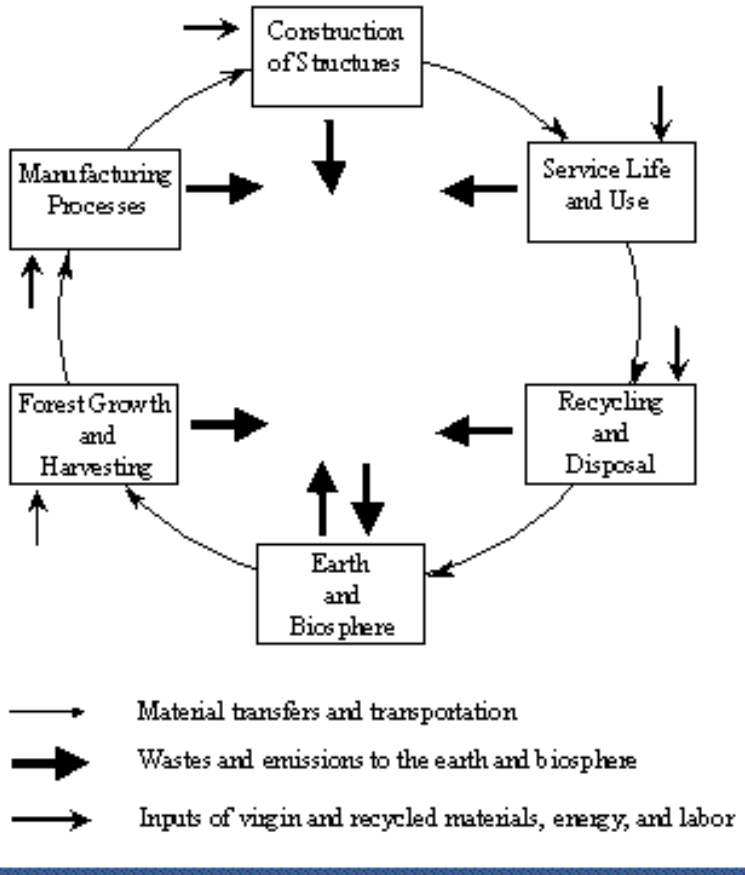
What a forest landowner may report in a given current year (1605b reporting)

- Annual change in carbon stored in HWP from wood they have harvested
  - Reporting starts in certain year
  - Each annual report gives change in HWP C pools carbon from <u>all years</u> of harvest
- Amount of carbon stored <u>from current year's harvest</u> **IN 100 years TIME.**

Managing HWP carbon

- Increase additions to HWP C pools
  - Increase use life of products
    - Increase durability, Increase recycling
- Encourage use for long lived products versus short lived products ?
- Support Integrated management of forests, products, end uses, and disposal via life cycle assessment – Optimize combined carbon emission offset from forests and products over time

CORRIM – Life Cycle Analysis



Perez-Garcia et al.—CARBON STORAGE IN WOOD PRODUCTS

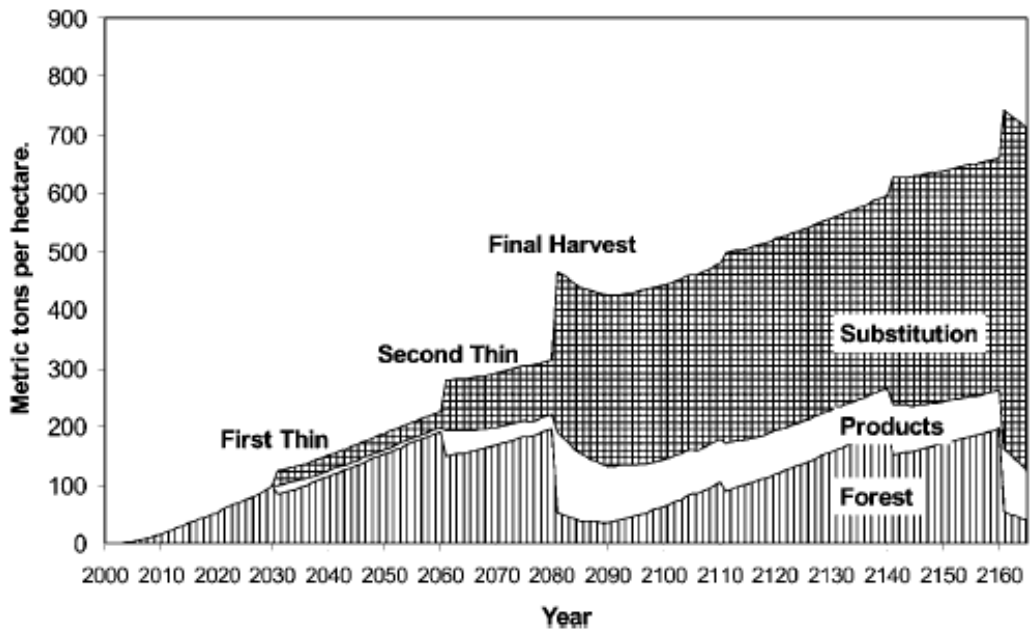
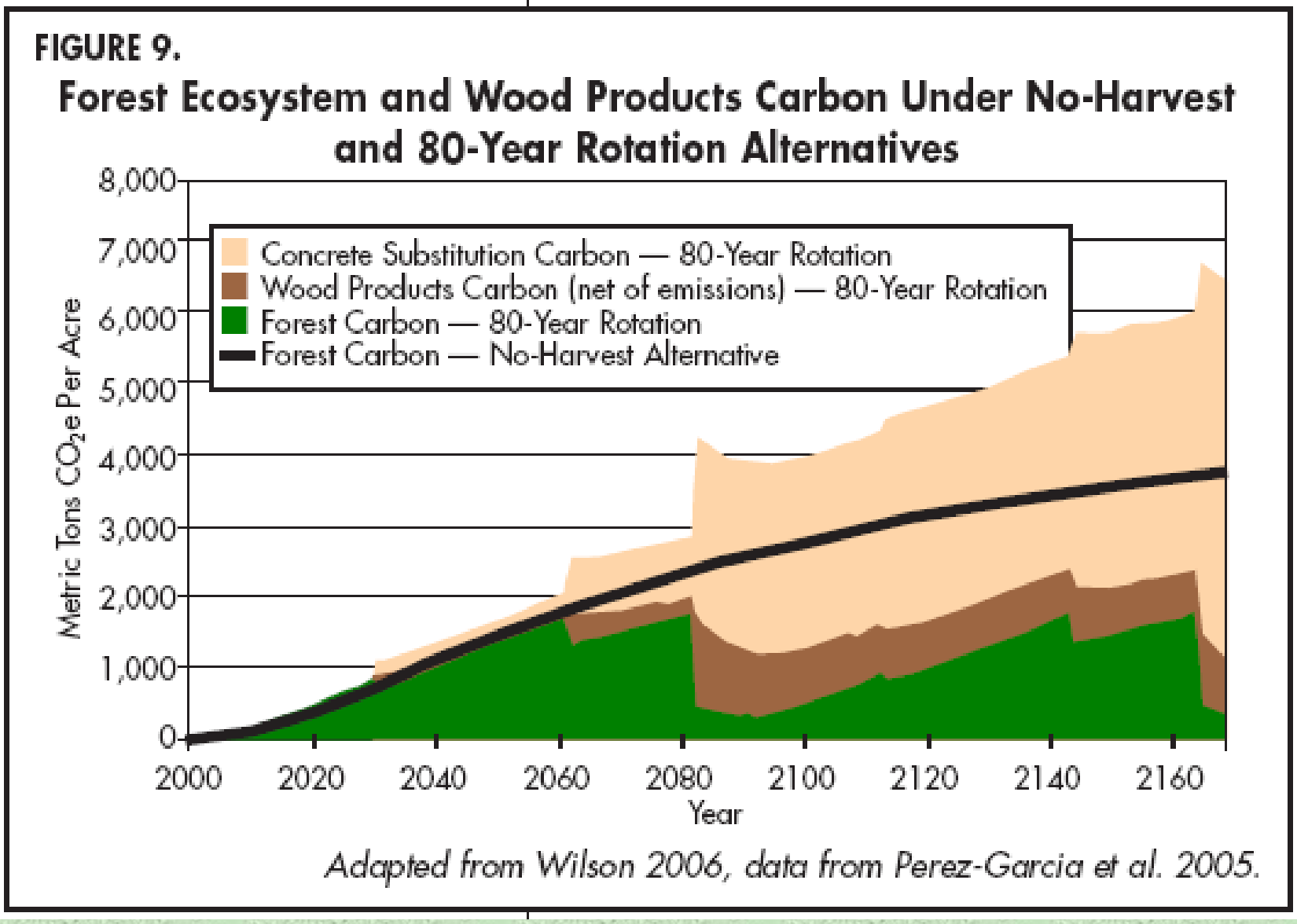


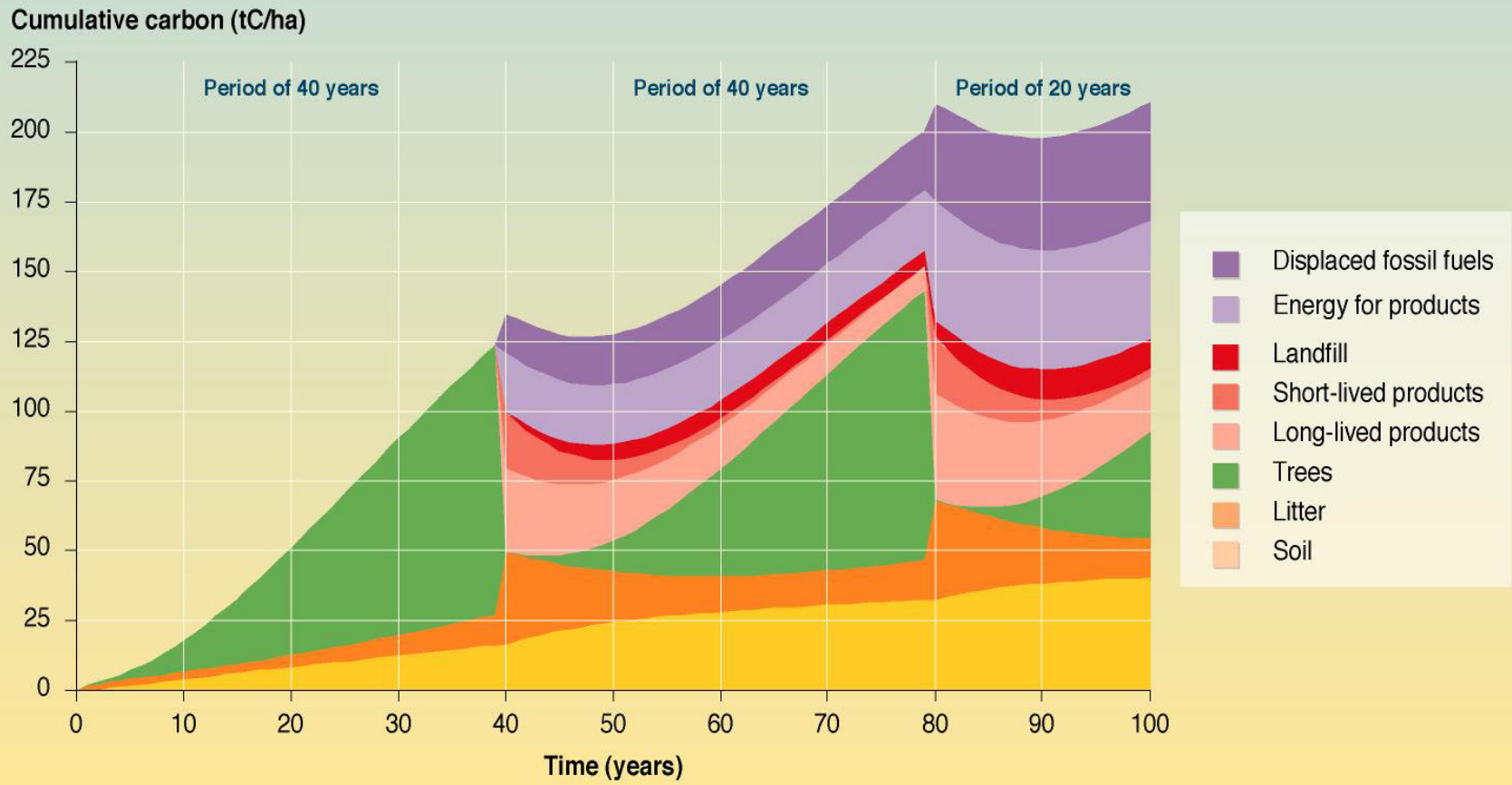
FIG. 2. Carbon in the forest and product pools with concrete substitution for the 80-year rotation.

Comparison of Land Management Alternatives



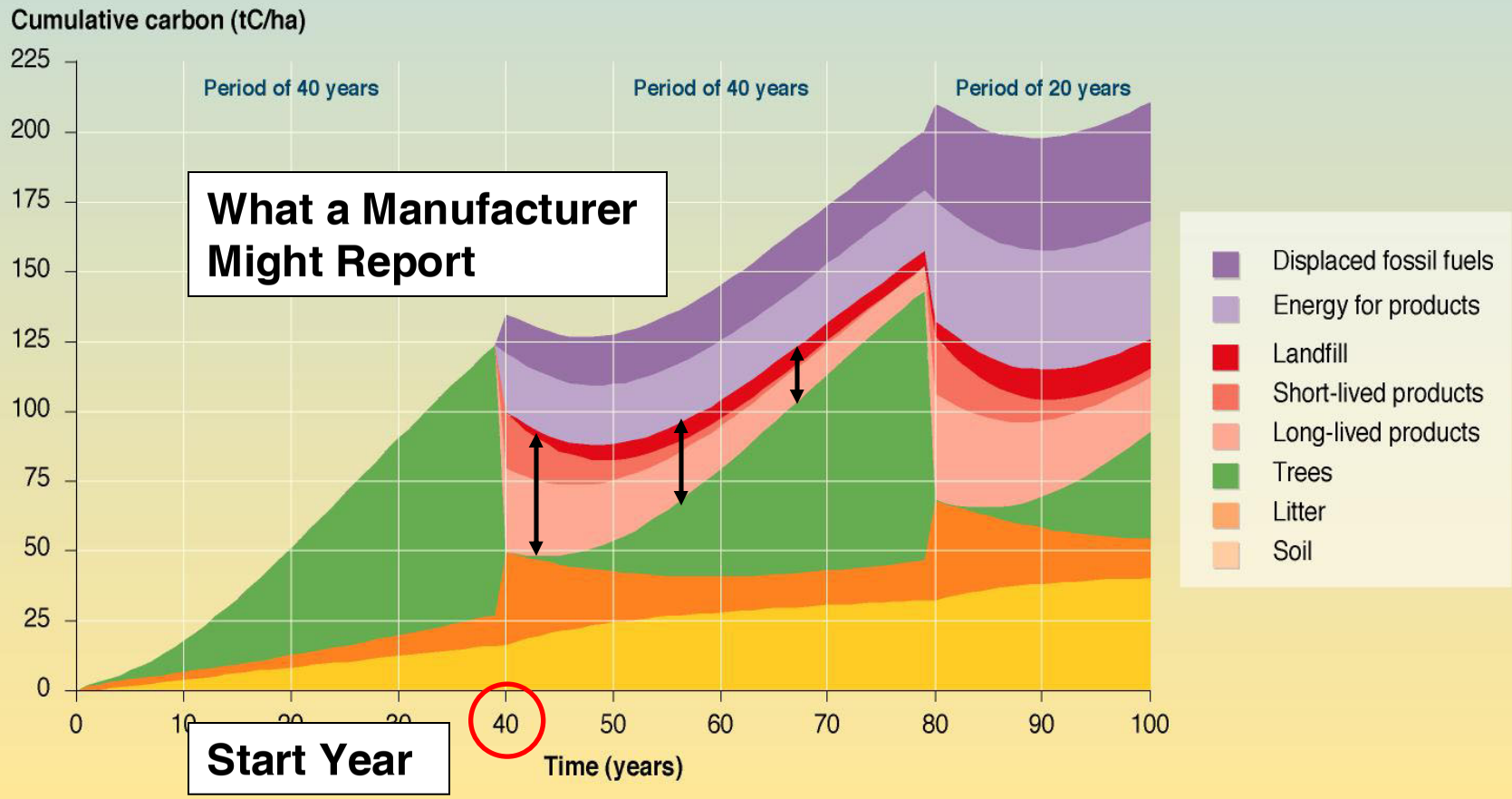
Borrowed from The Wilderness Society (2007)

Carbon balance from a hypothetical forest management project



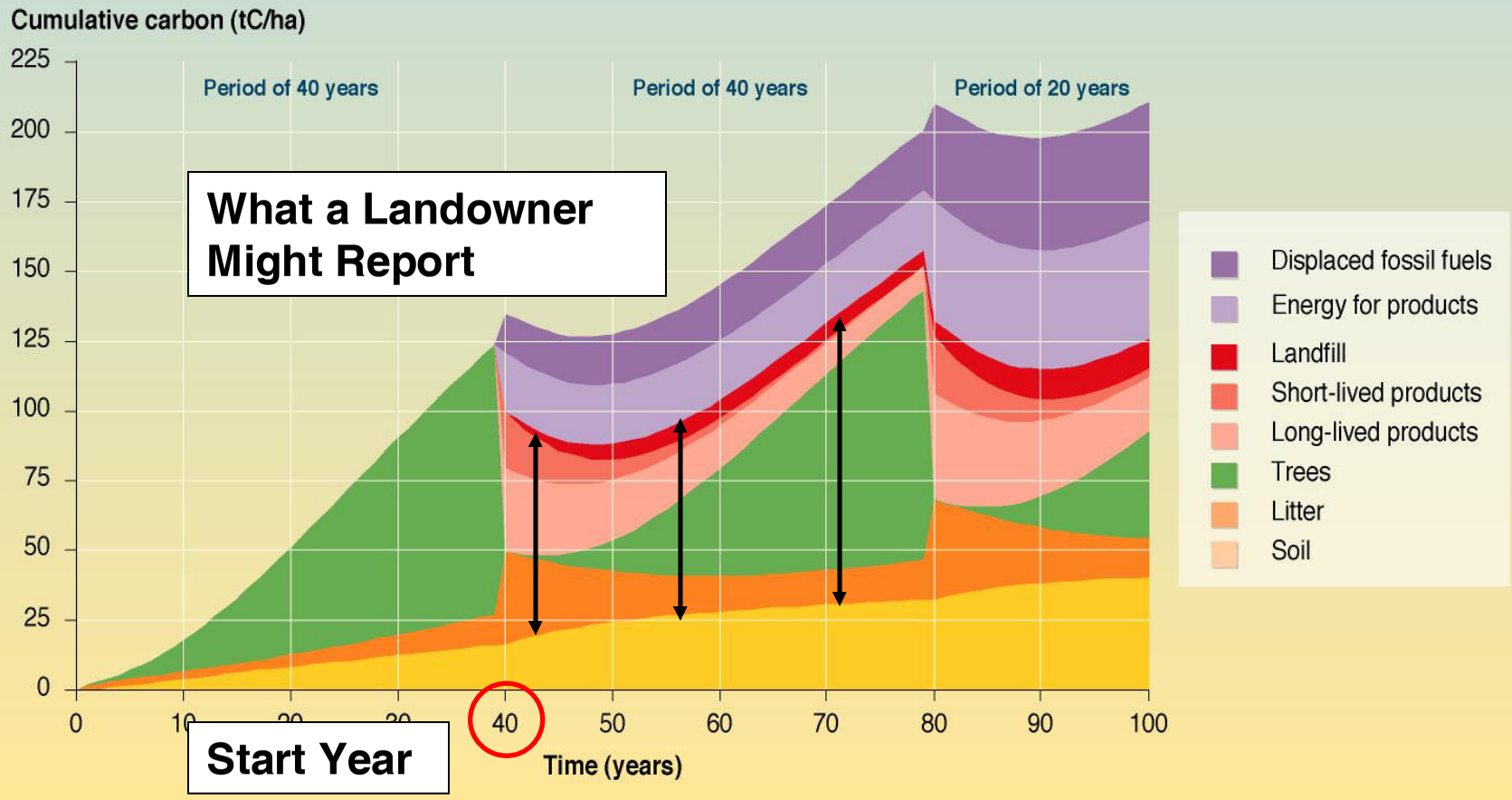
WG3 - FIGURE TS-6

Carbon balance from a hypothetical forest management project



WG3 - FIGURE TS-6

Carbon balance from a hypothetical forest management project



WG3 - FIGURE TS-6

Table 2. Changes in wood products carbon stocks using annual tracking method, reporting year XXXX (in metric tons of carbon).

Activity	C stock in reporting year 1	C stock in reporting year 2	C stock in reporting year 3	...	Rating
Harvest year 1					
Harvest year 2					
Harvest year 3					
…					
Total C Stock					
Change in total C stock[1]					

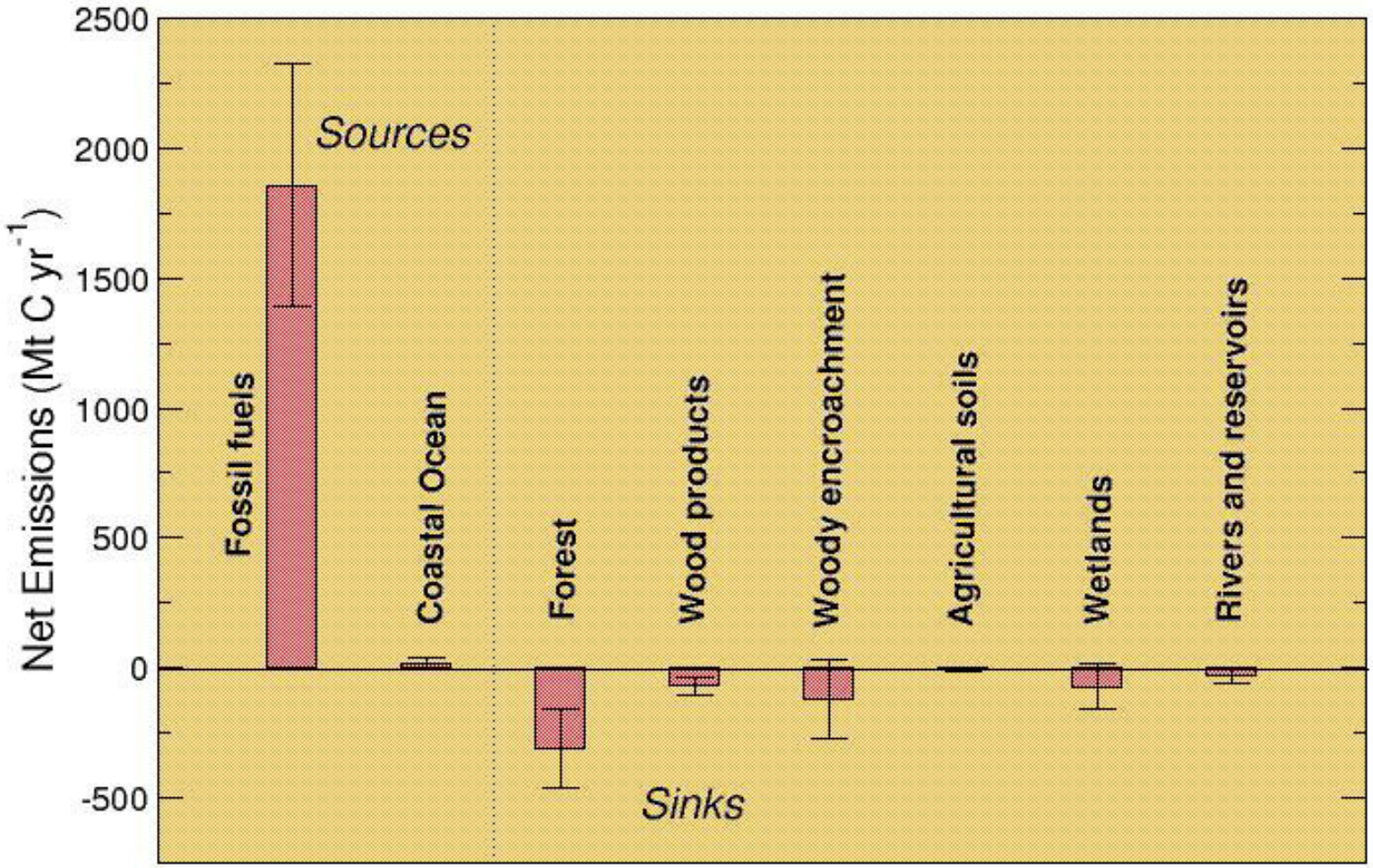
[1]Calculated as difference between total C stock in successive reporting years. A positive number = increase in carbon stocks; a negative number = decrease in carbon stocks.

Table 3. Changes in wood products carbon stocks using 100-year method, reporting year XXXX (in metric tons of carbon).

Activity	C stock in reporting year 1	C stock in reporting year 2	C stock in reporting year 3	...	Rating
Harvest in reporting year					
Change in total C stock[1]					

[1]Equal to total C stock in current reporting year. A positive number = increase in carbon stocks.

North America is currently a net source of CO_2 with 30% of fossil fuel emissions offset by a net terrestrial sink of 520 ± 260 Mt C yr^{-1}



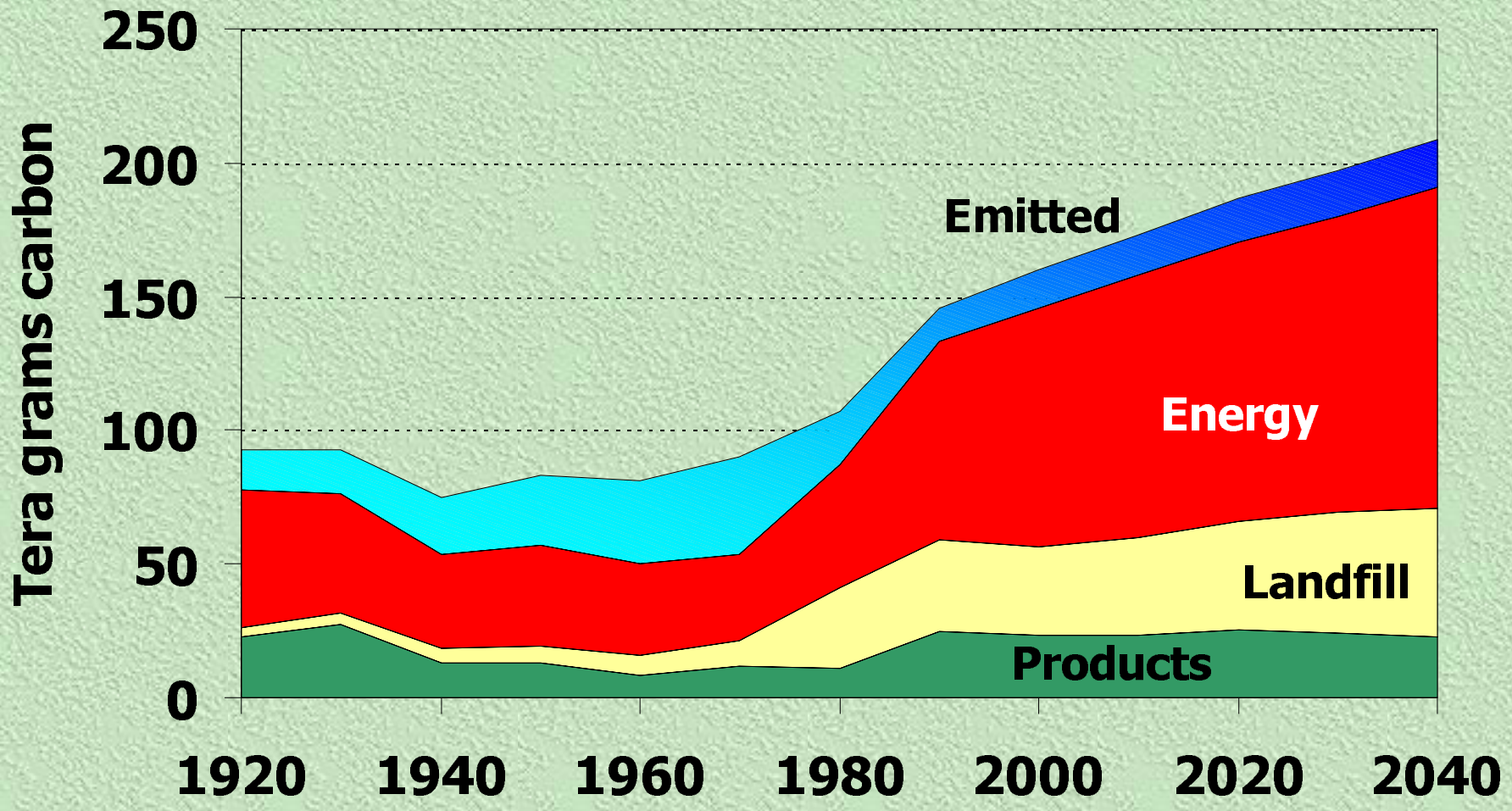
Chapter 11: North American Forests

Table 11.3 Change in carbon stocks for forests and wood products by country (Mt C per year). See Box 11.1 for uncertainty conventions.

Carbon pool:	Canada[a]	U.S.[b]	Mexico[c]	Total
Forest ecosystem	–17**	–236***	+52**	–201
Wood products	–11**	–57***	ND[d]	–68
Total	–28**	–293***	+52**	–269

Birdsey et al. 2007

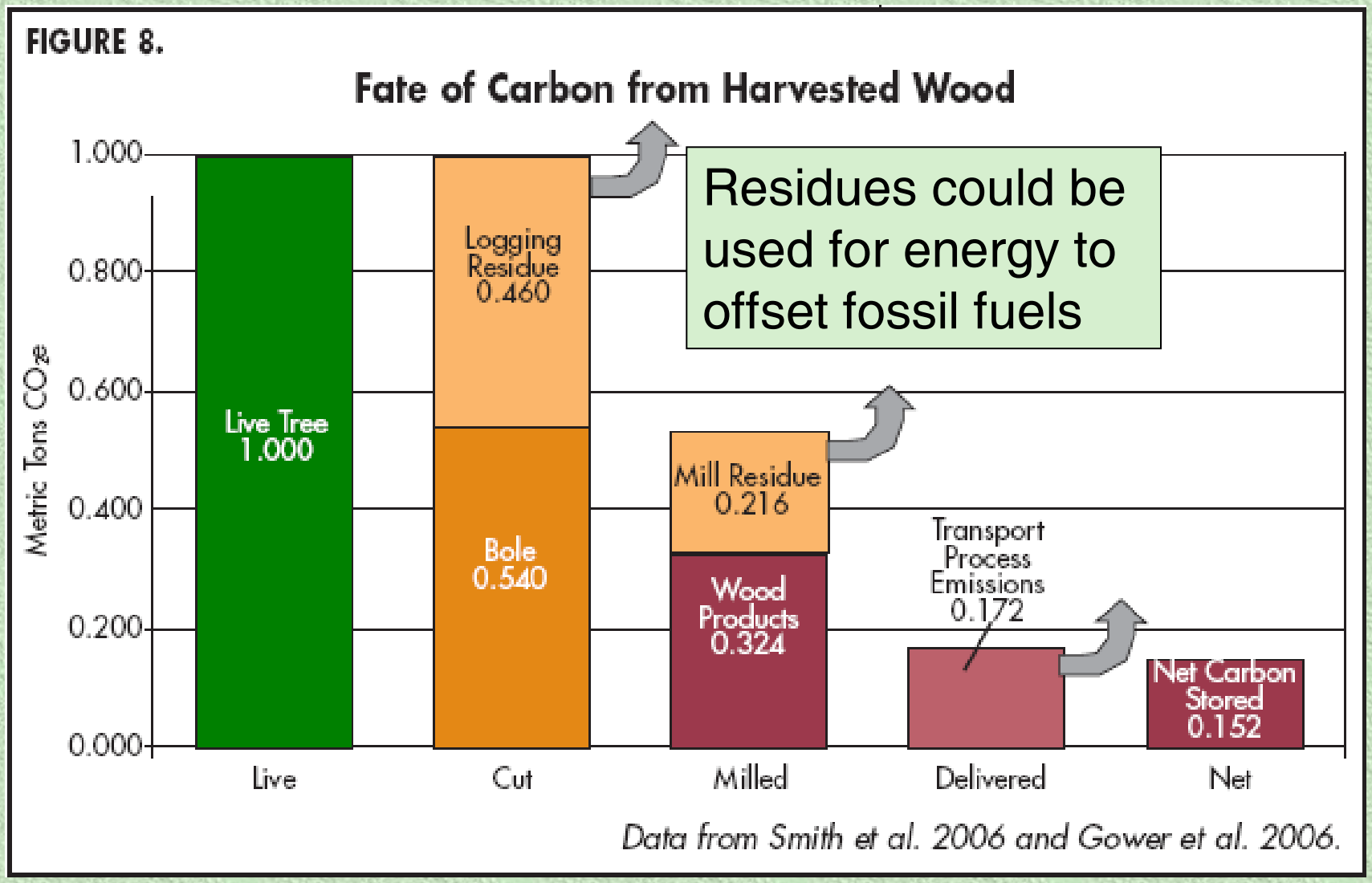
U.S. Net Annual Changes to Stocks, and Emissions from Harvested Wood*



Source: Ken Skog, 2002

*Includes net imports

Summary



Residues could be used for energy to offset fossil fuels

Borrowed from The Wilderness Society (2007)