

Harvested Wood Products, International Trade and Lifecycle Assessments: Their Role in Climate Change Policies

Workshop on:
Harvested Wood Products in the
Context of Climate Change Policies
Palais des Nations,
Geneva, Switzerland
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3 Part Presentation

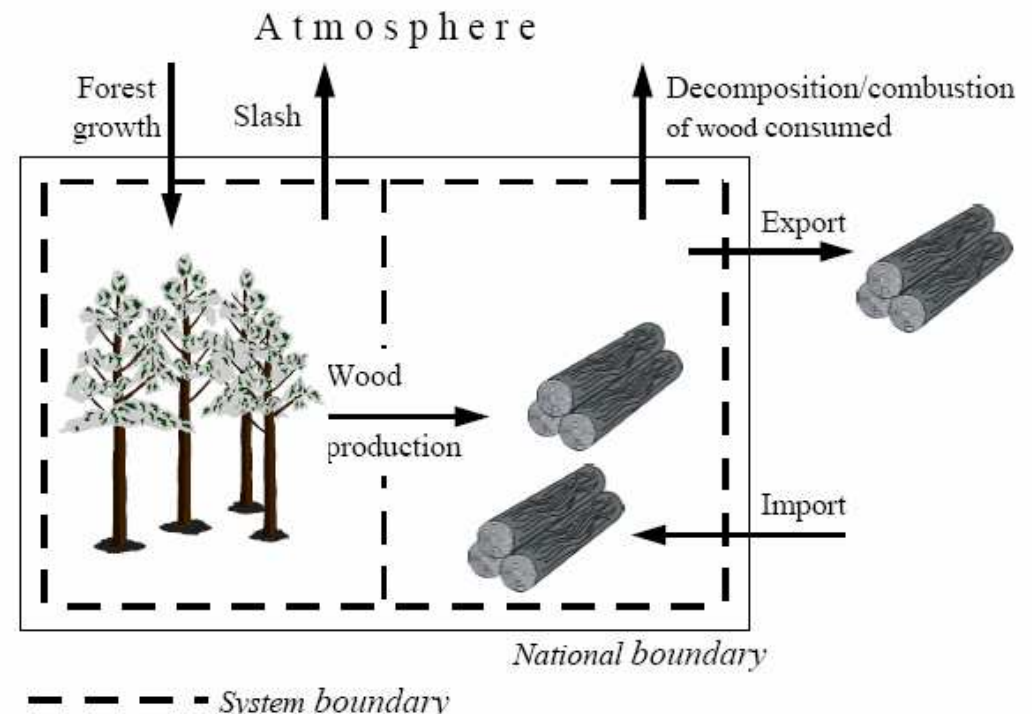


1. International trade of wood products and potential influence of different HWP accounting systems
2. Include some information on the work of CORRIM on LCA of HWPs.
3. General outlook for HWP accounting and inclusion of HWP in the post-Kyoto process

The Stock Change Approach



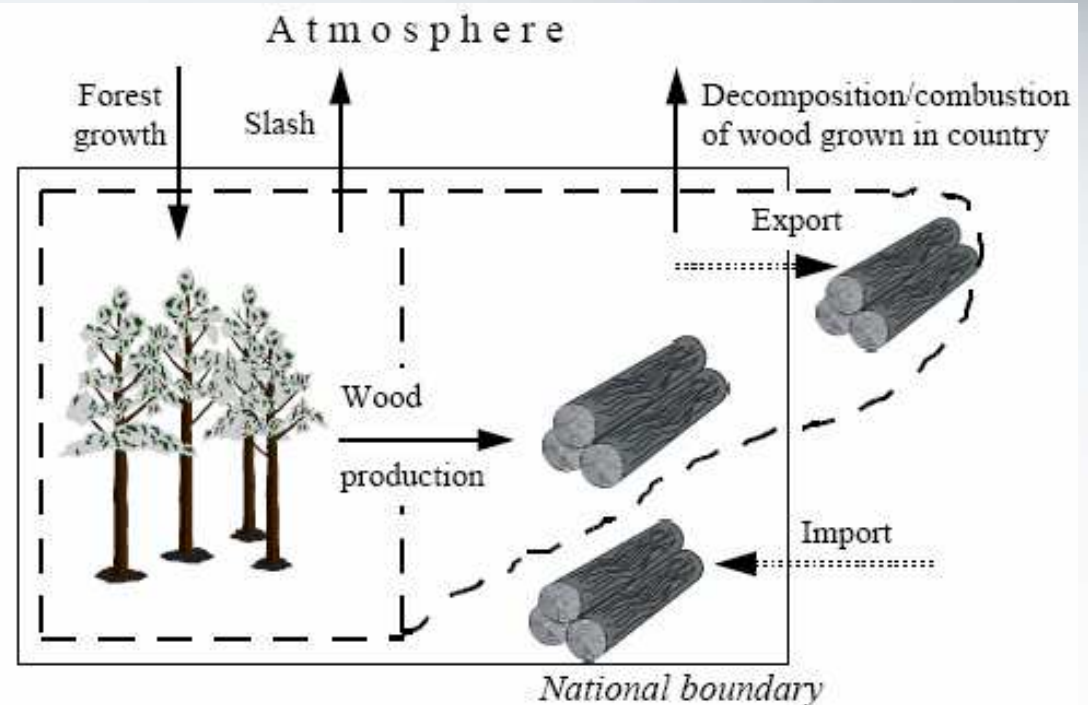
- Net changes in carbon stock occur in the producing country
- Changes in product pools occur in the consuming country
- These stock changes are counted where and when they occur



The Production Approach



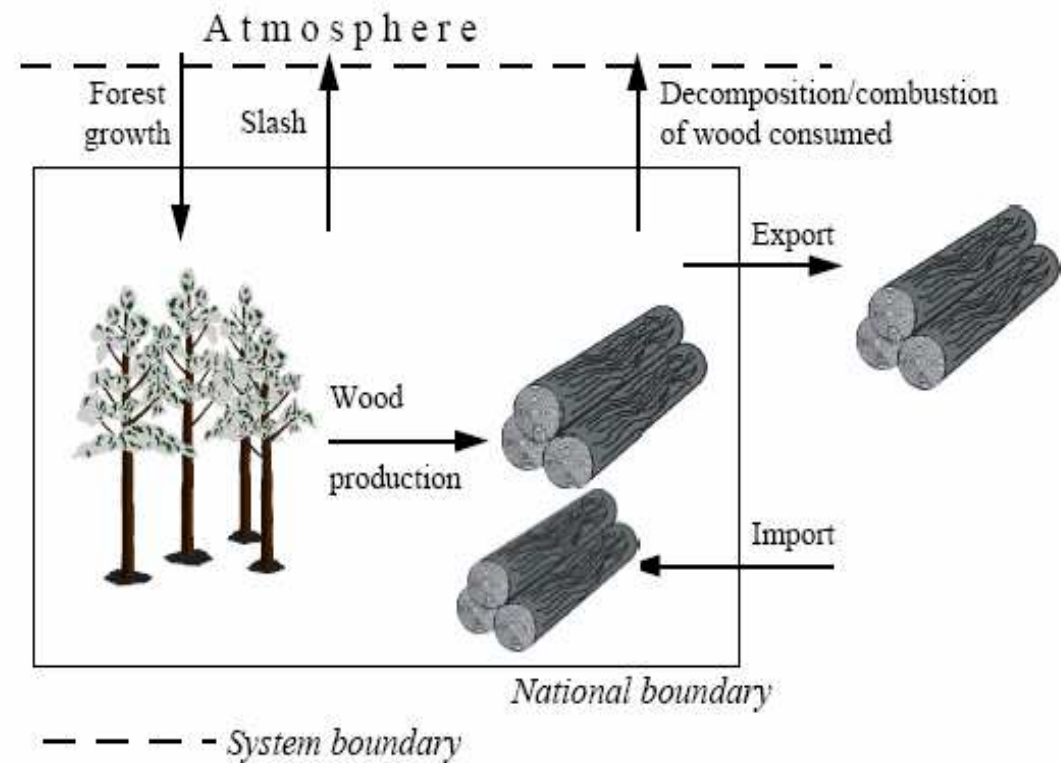
- Changes in forest stock and product pool are attributed to the producing country
- These stock changes are counted when but not where they occur



The Atmospheric-Flow Approach



- Accounts for net emissions or removals of carbon to/from the atmosphere within national boundaries, where and when these emissions occur
- All emissions of carbon that result from the HWP pool are attributed to the consuming country.



Calculations for carbon stock in products in use for each year



- *Stock Change inflows to in-use stocks_t*
 $= (\text{production} + \text{imports} - \text{exports})_t$
- Consumption values were converted to Mg product and then Mg carbon
- Carbon was accumulated in the product in-use pool by adding this year's inflow to last year's pool and correcting for the fraction of wood leaving the in-use pool each year.

$$\text{Product in-use stock}_t = (\text{Product in-use stock}_{t-1} + \text{Stock Change inflow to in-use stock}_t) * (1/(1+r))$$

- We started in 1961; For years between 1900 and 1960, the product in-use pools were calculated from back-casting algorithms

Calculation of the carbon stock in landfill for each year



- $Discards_t = Stock\ Change\ inflow\ to\ in\text{-}use\ stock_t + Product\ in\text{-}use\ stock_{t-1} - Product\ in\text{-}use\ stock_t$
- $Discards\ to\ landfill_t = Discards_t * m$
- $Discards\ permanently\ sequestered_t = Discards\ to\ landfill_t * q$
- $Accumulated\ discards\ from\ permanently\ sequestered_t = Accumulated\ stock\ from\ permanently\ sequestered_{t-1} + Discards\ permanently\ sequestered_t$
- $Discards\ temporarily\ sequestered_t = Discards\ to\ landfill_t - Discards\ permanently\ sequestered_t$
- $Accumulated\ discards\ from\ temporarily\ sequestered_t = (Accumulated\ stock\ from\ temporarily\ sequestered_{t-1} + Discards\ temporarily\ sequestered_t) * (1/(1+i))$
- $Stock\ in\ landfill_t = Accumulated\ discards\ from\ permanently\ sequestered_{t-1} + Accumulated\ discards\ from\ temporarily\ sequestered_t$

Stock Change Approach



- *Stock Change Approach* $Stock_t =$
Product in-use stock_t + Stock in landfill_t
- *Estimated Emissions_t =*
Stock Change Approach Stock_t
- Stock Change Approach Stock_{t-1}
- *A positive stock change represents a reduction in reported emissions of CO₂ from the atmosphere under the IPCC reporting guidelines.*

Production Approach: Changing Consumption to a Production basis



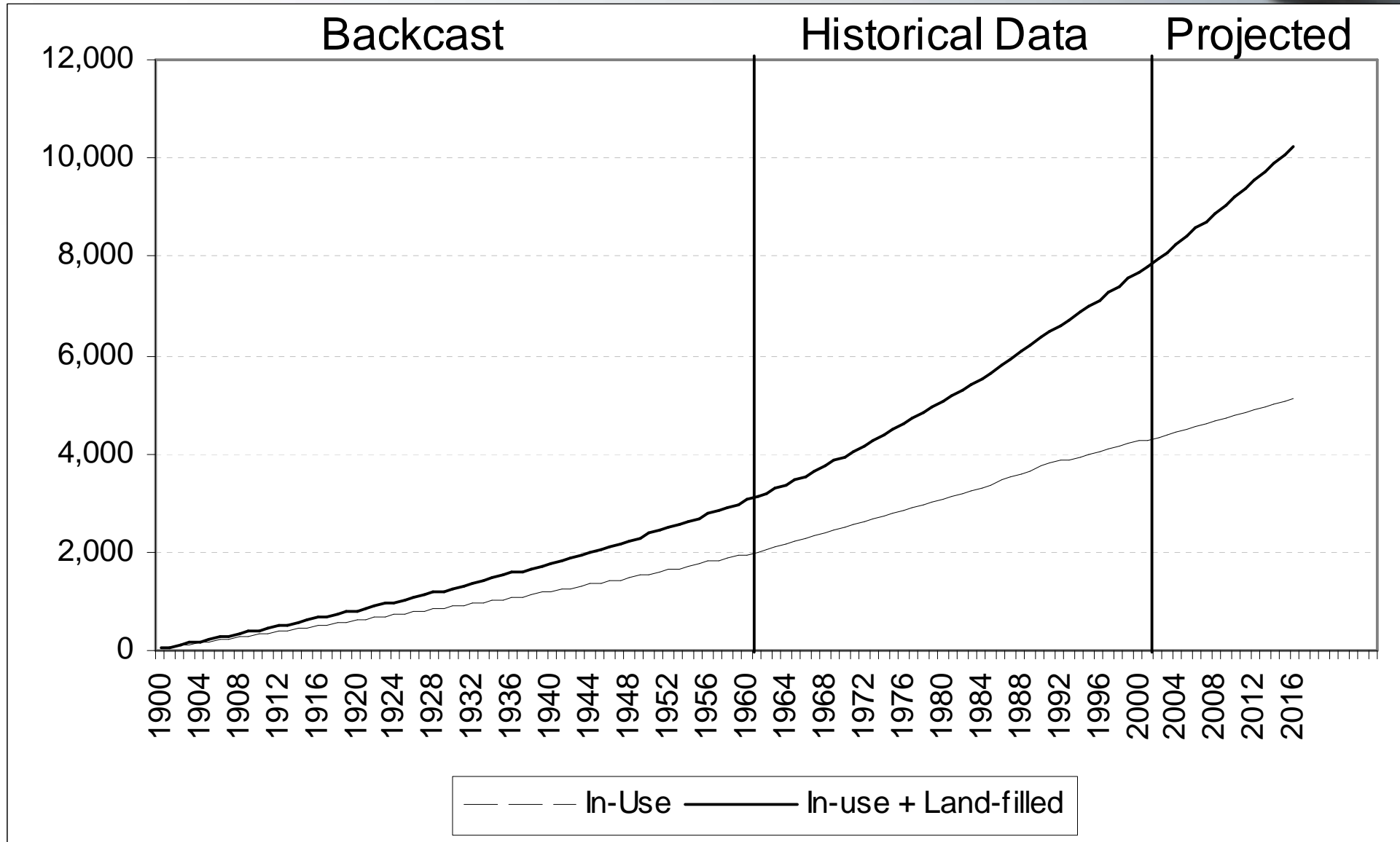
- *Fraction of domestically used wood of domestic origin*
= *(domestic production of roundwood - exports)*
/ *(domestic production + imports - exports)*
- *Production from domestically produced wood used domestically*
= *fraction of domestically used wood of domestic origin*
* *production volume*
- *Production from exported sawlogs and veneer logs*
= *fraction of domestically used wood of domestic origin*
* *fraction of log that ends up in final product*
* *fraction of product produced globally in 2003*

Atmospheric Flow

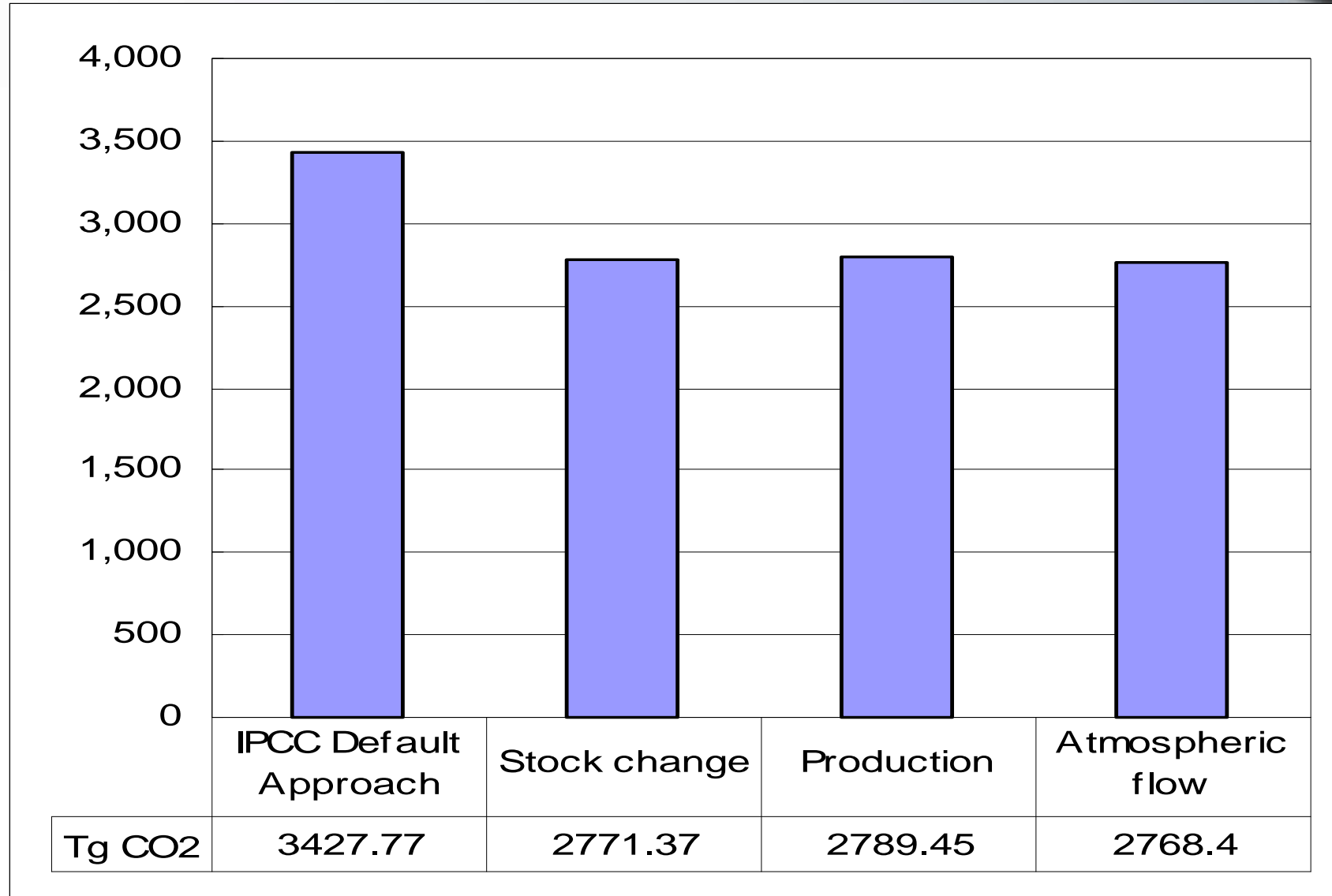


- *atmospheric flow emissions*
= *stock change emissions*
+ *all carbon in imports* – *all carbon in exports*
- *atmospheric flow emissions*
= *all carbon in imports* – *all carbon in exports*
– *stock change from previous year*

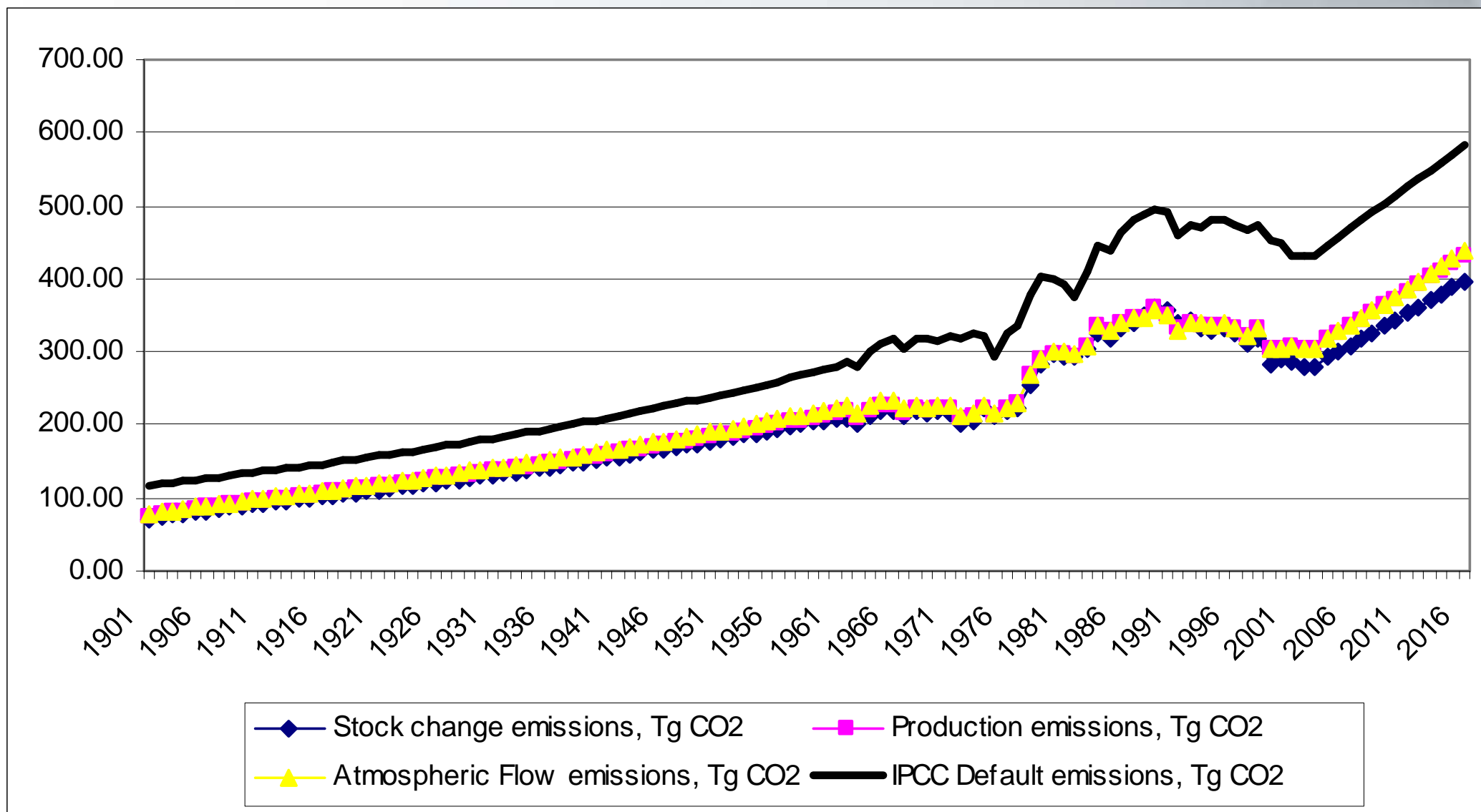
Global HWP Sink in Tg C



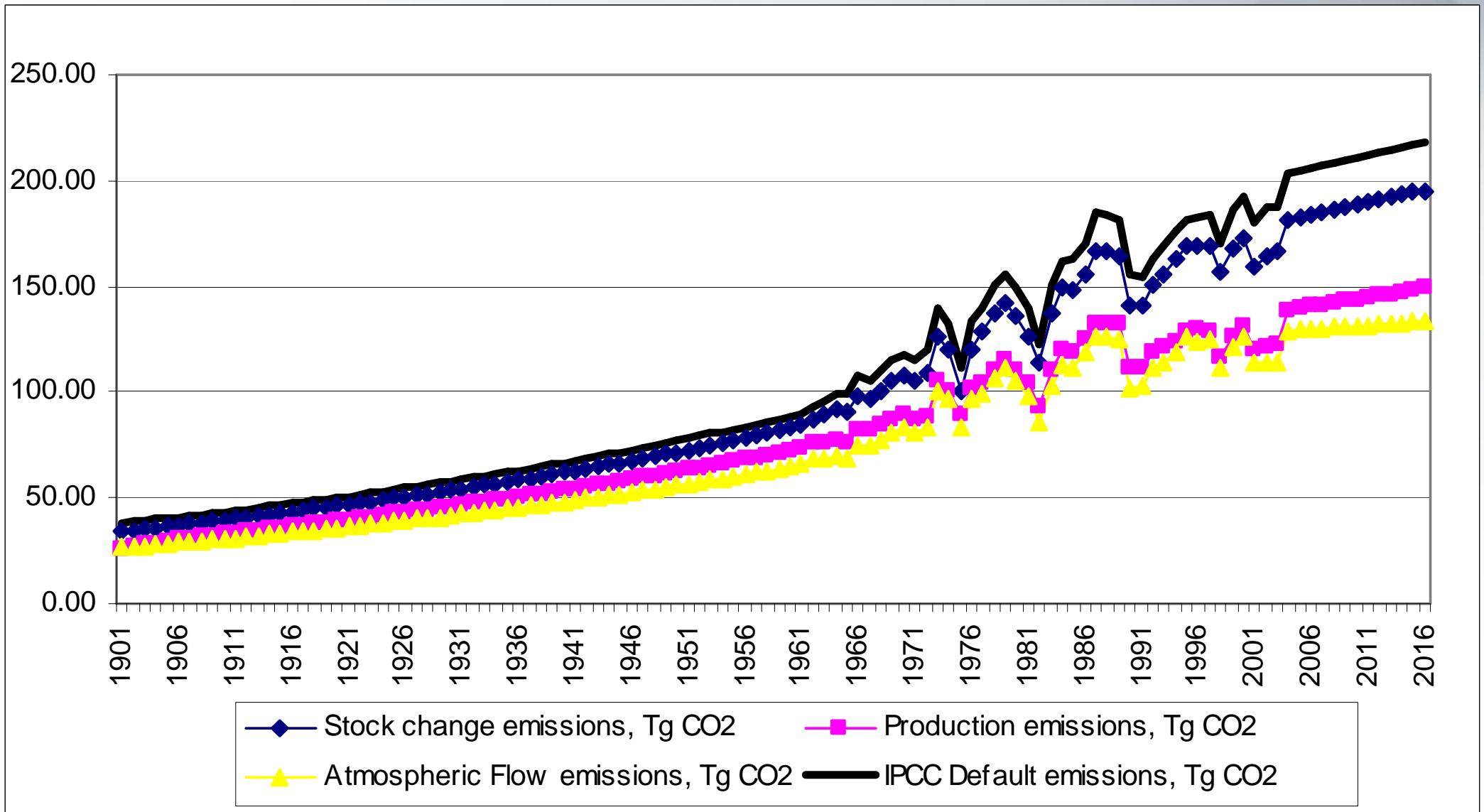
Emission for the Globe in 2016 under Alternative Approaches



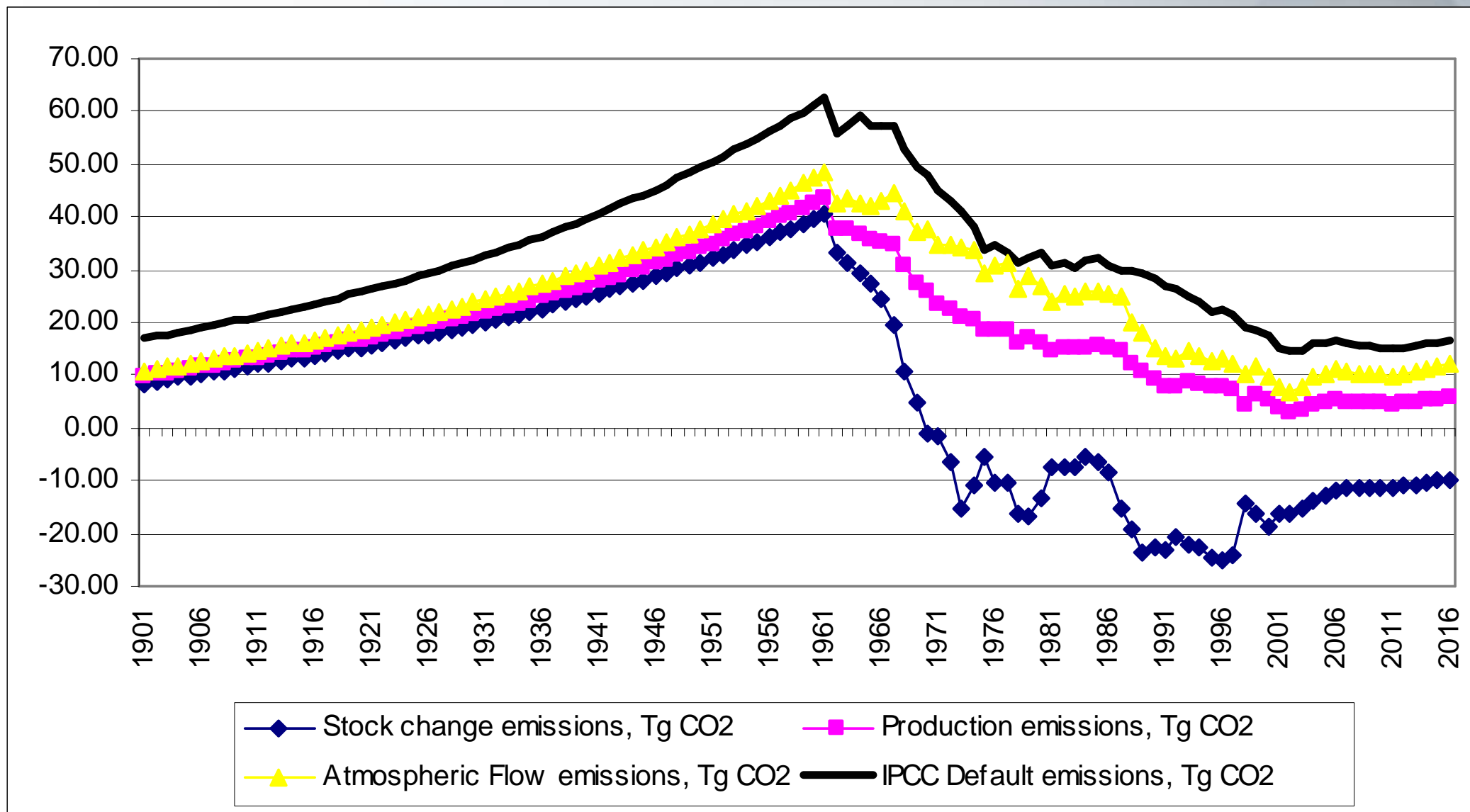
USA Estimated Emissions



Canada Estimated Emissions



Japan Estimated Emissions

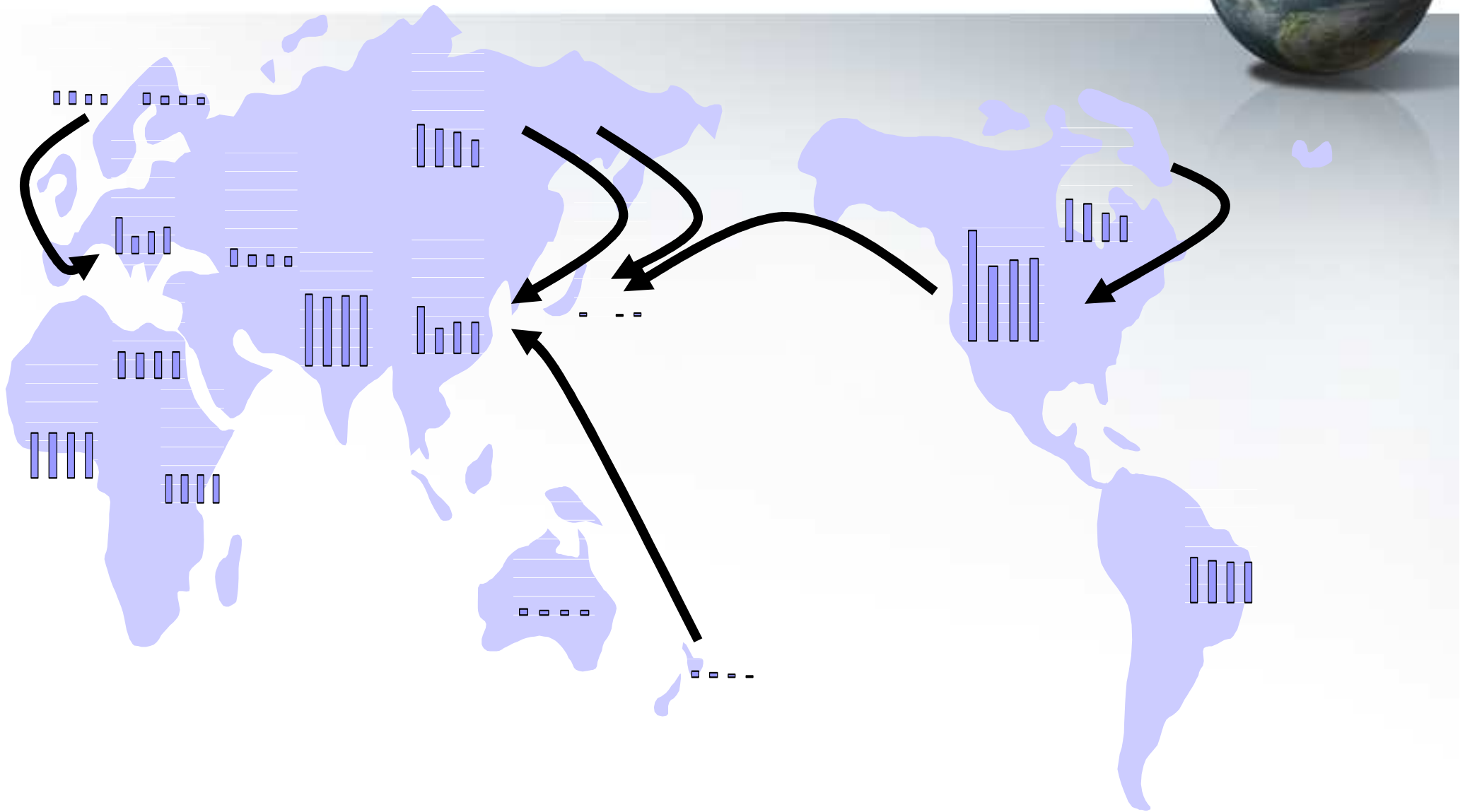


Emission by Global Regions



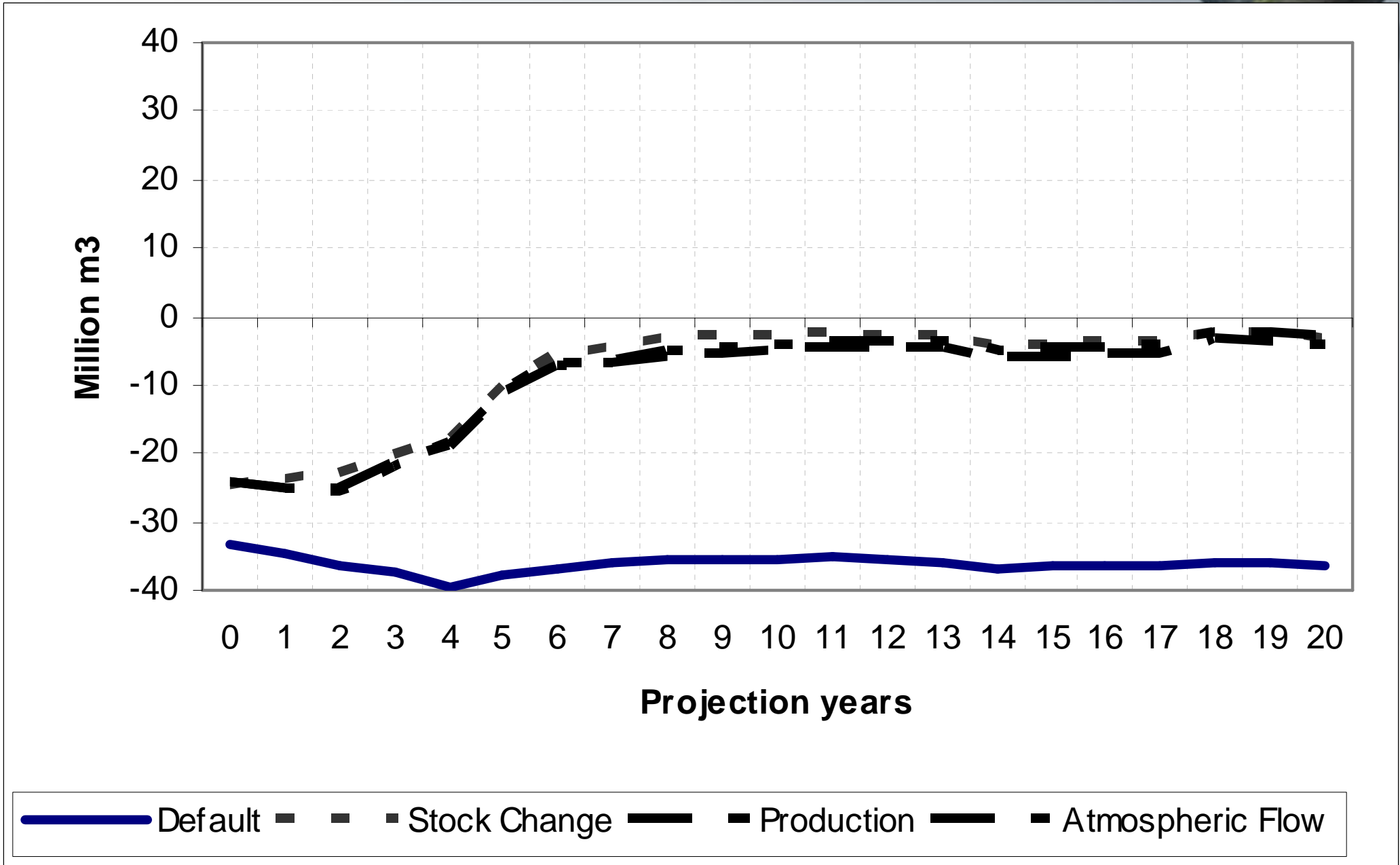
Bars from left to right are the Default, Stock Change, Production and Atmospheric Flow Approaches
The vertical height is measured in 100 Tg of CO2

Trade Effects

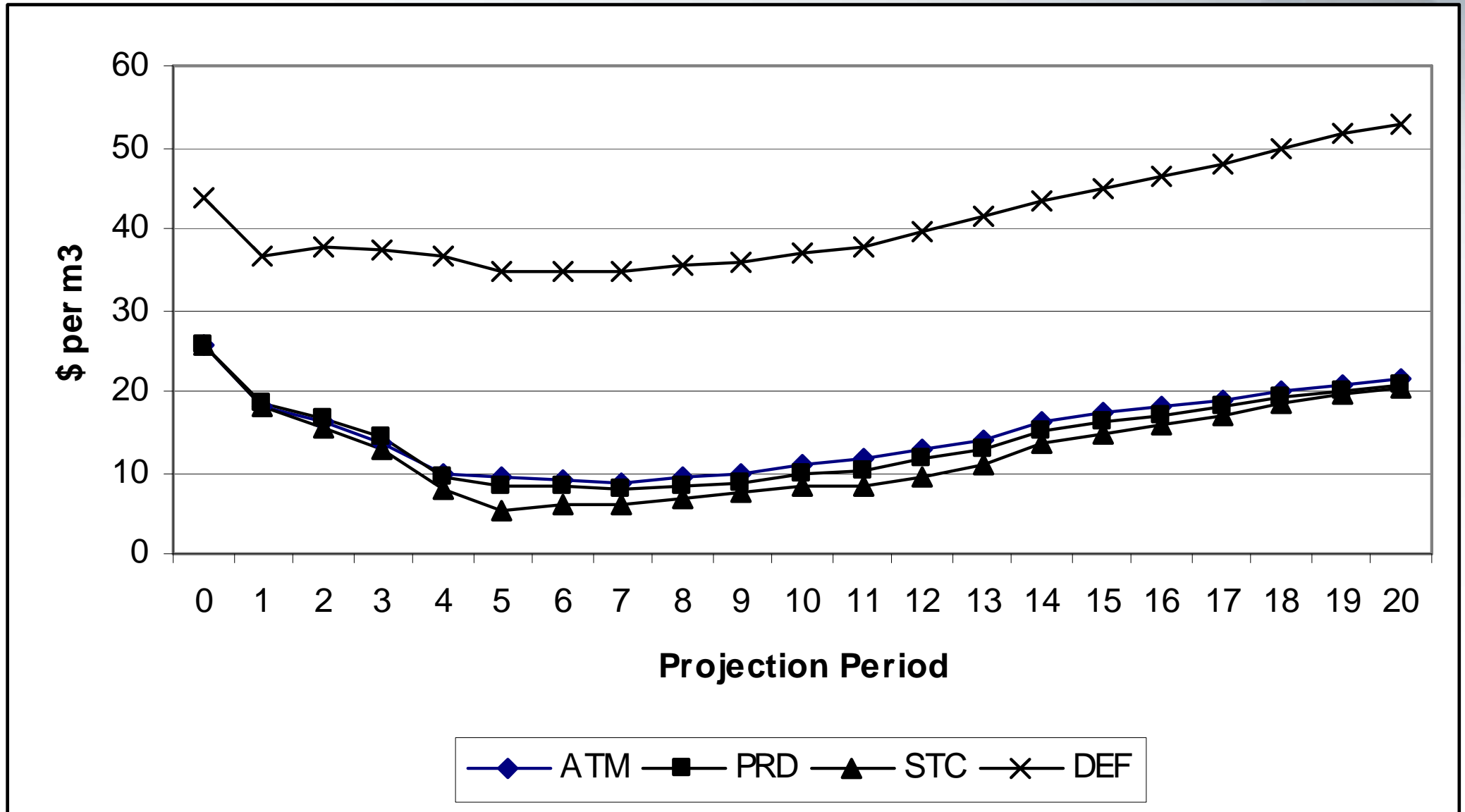


Bars from left to right are the Default, Stock Change, Production and Atmospheric Flow Approaches
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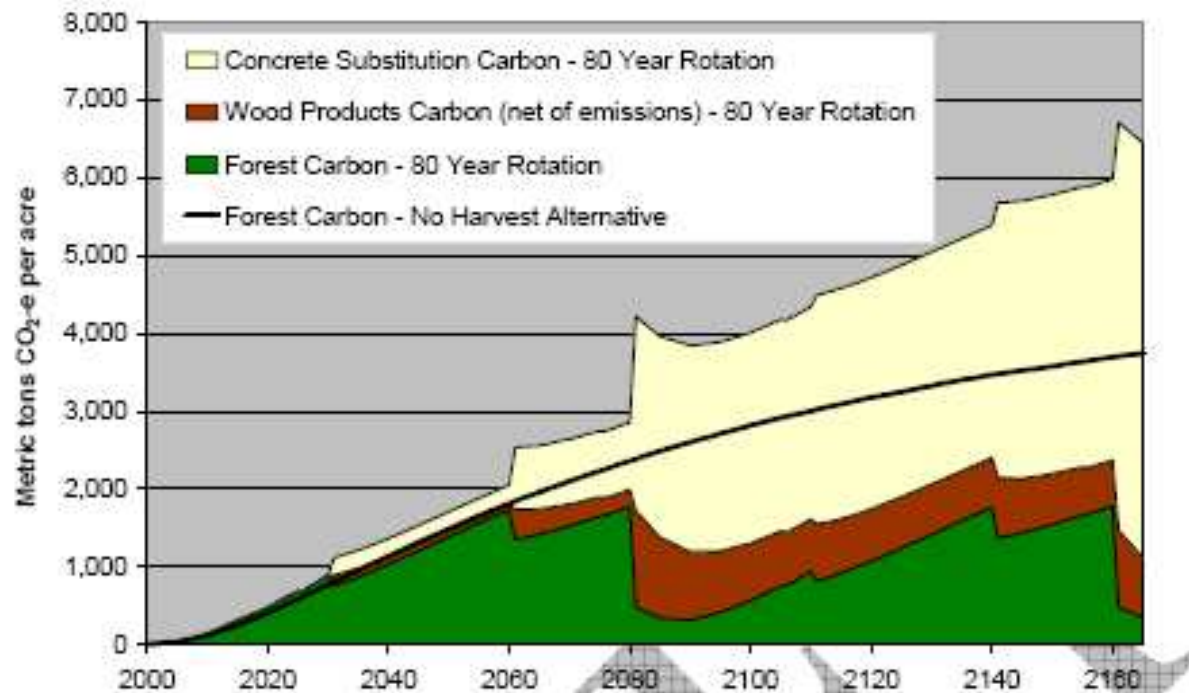
Changes in Projected Softwood Industrial Roundwood Harvest Levels



Price Projections for the 4 Approaches



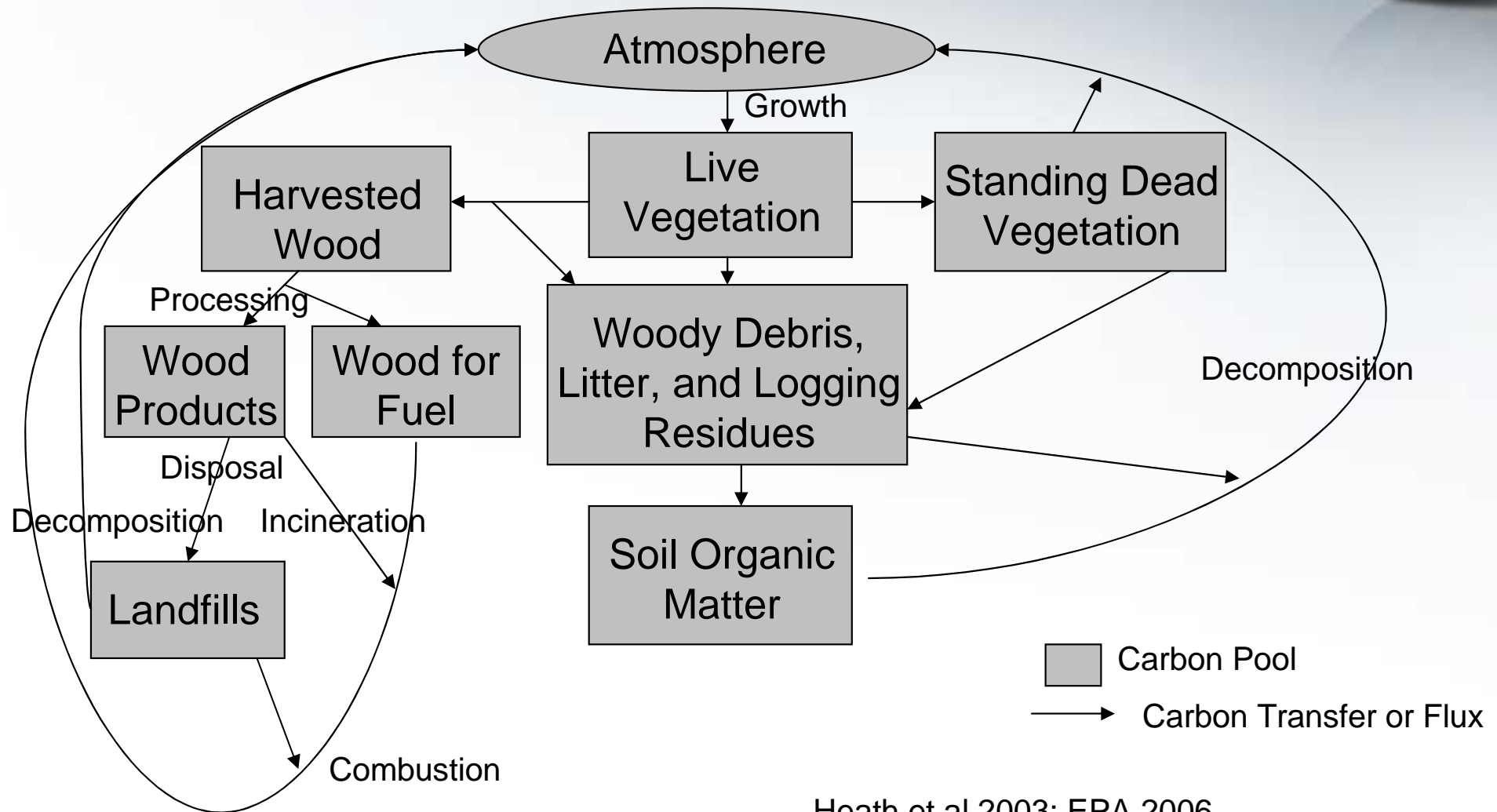
LCA: Integrating Sink-enhancing Policies Among Forest and HWP Sinks



(Wilson, 2006, from Perez-Garcia, et al. 2005)

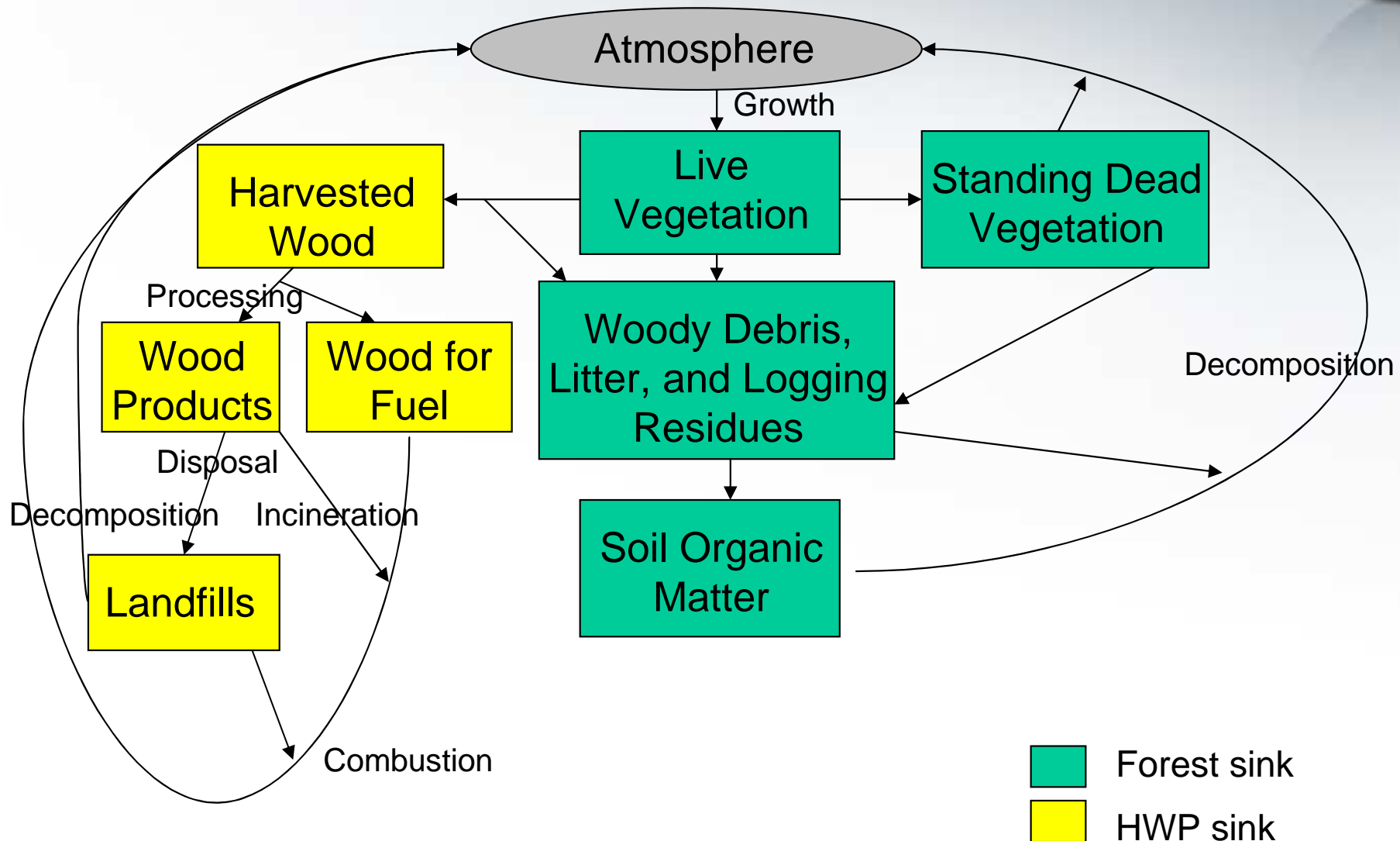


Carbon Pools and Flows



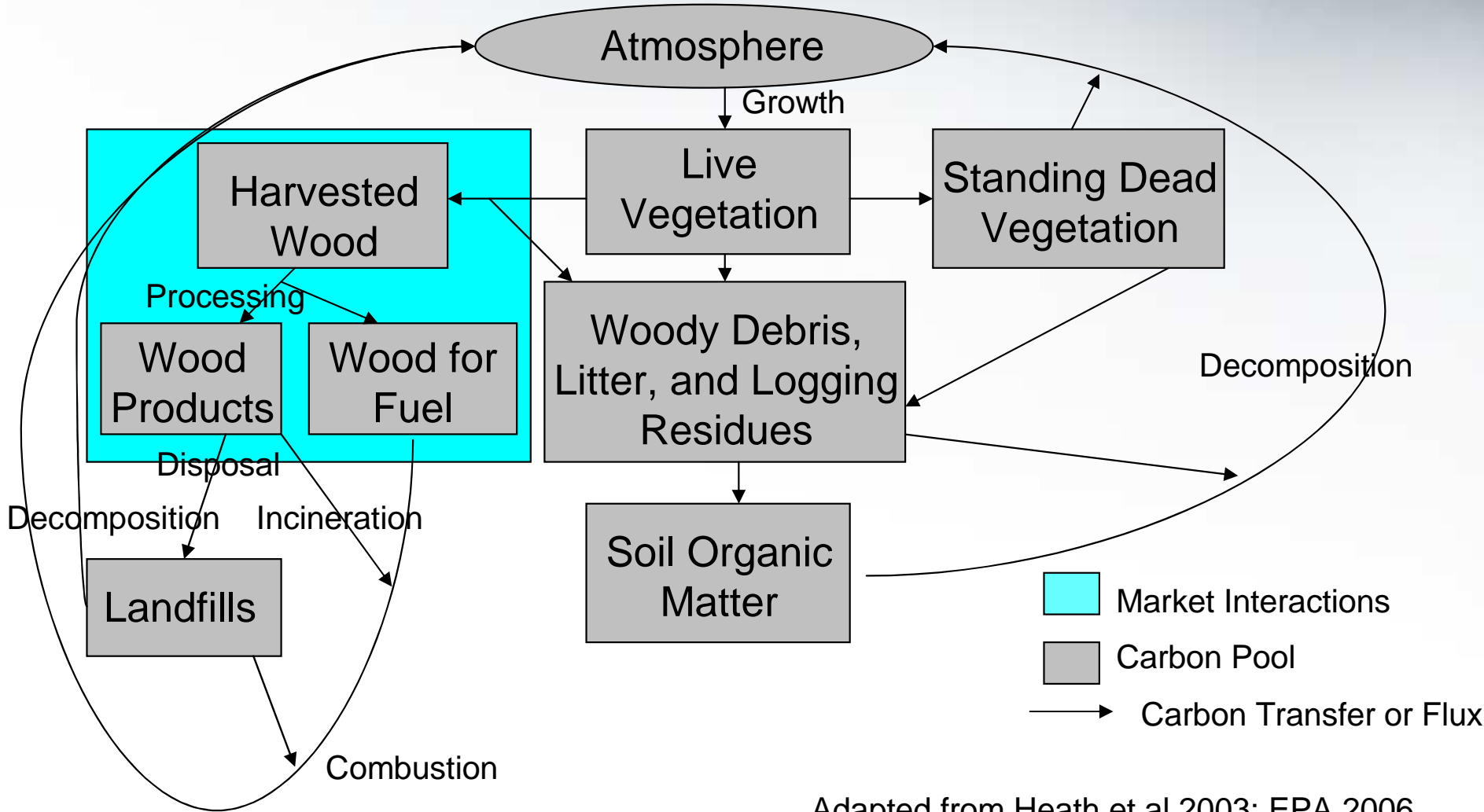
Heath et al 2003; EPA 2006

Forest and HWP Sinks



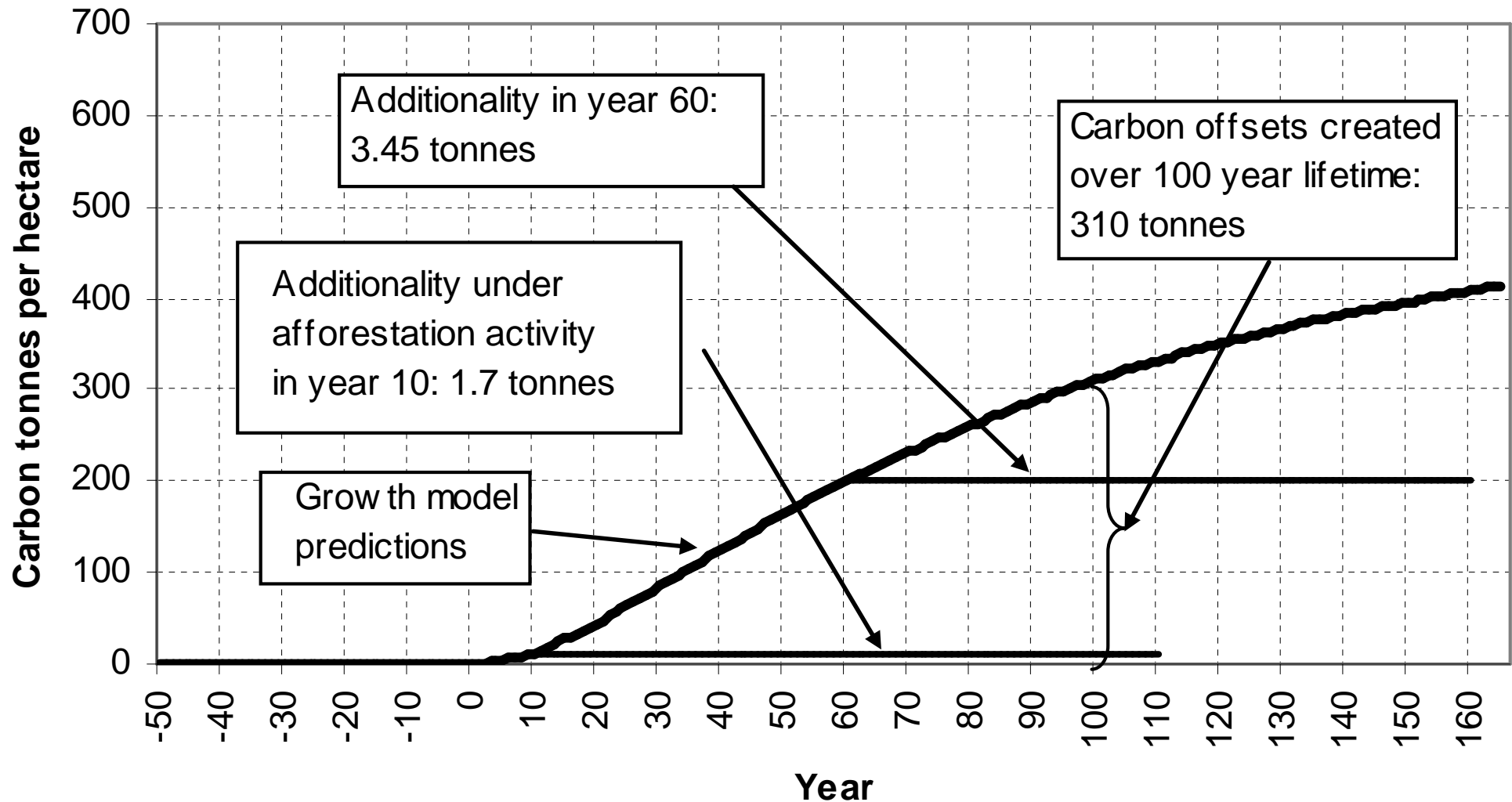
Adapted from Heath et al 2003; EPA 2006

Product Leakage

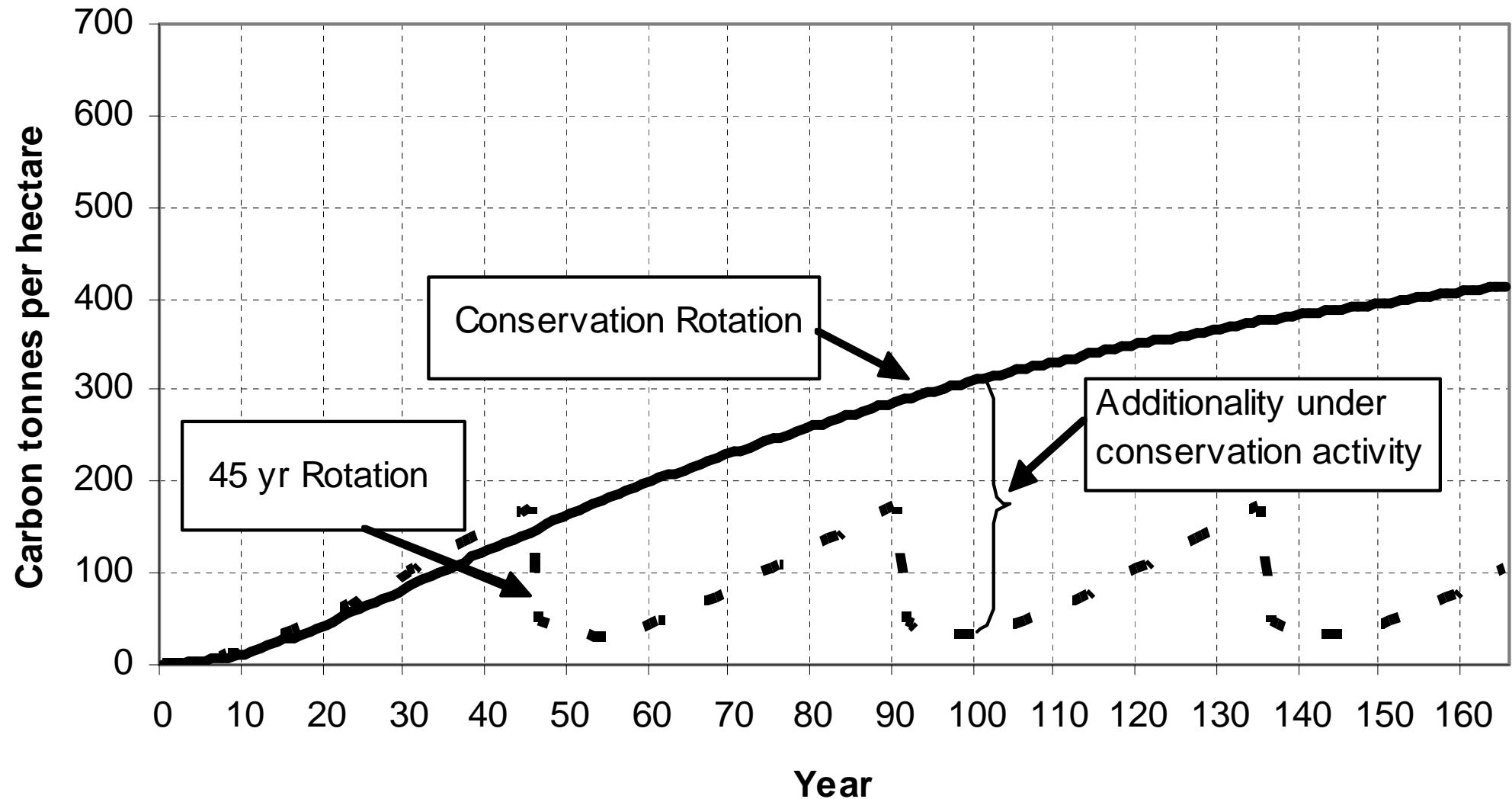


Adapted from Heath et al 2003; EPA 2006

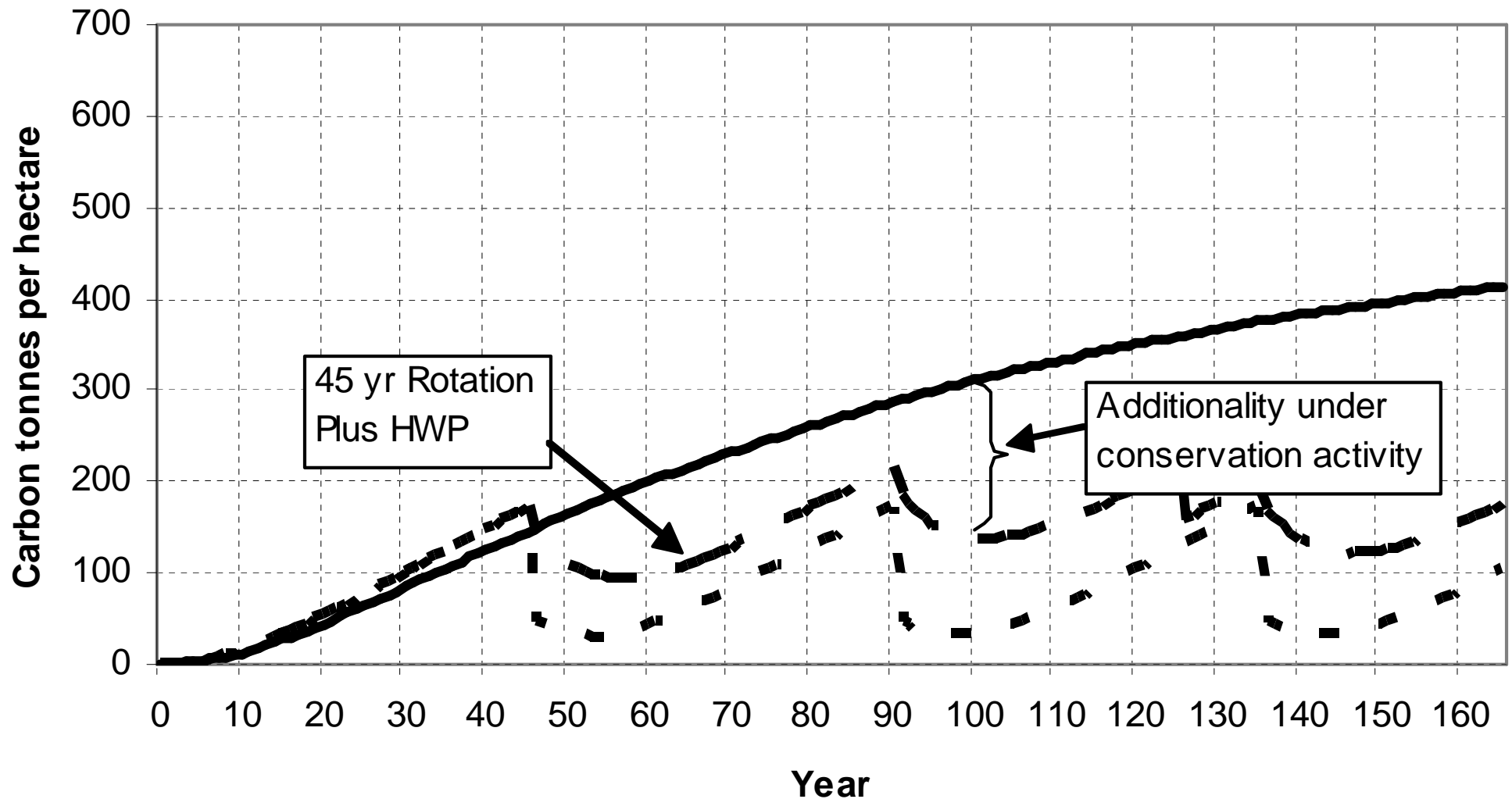
Sink-enhancing Activities : Afforestation



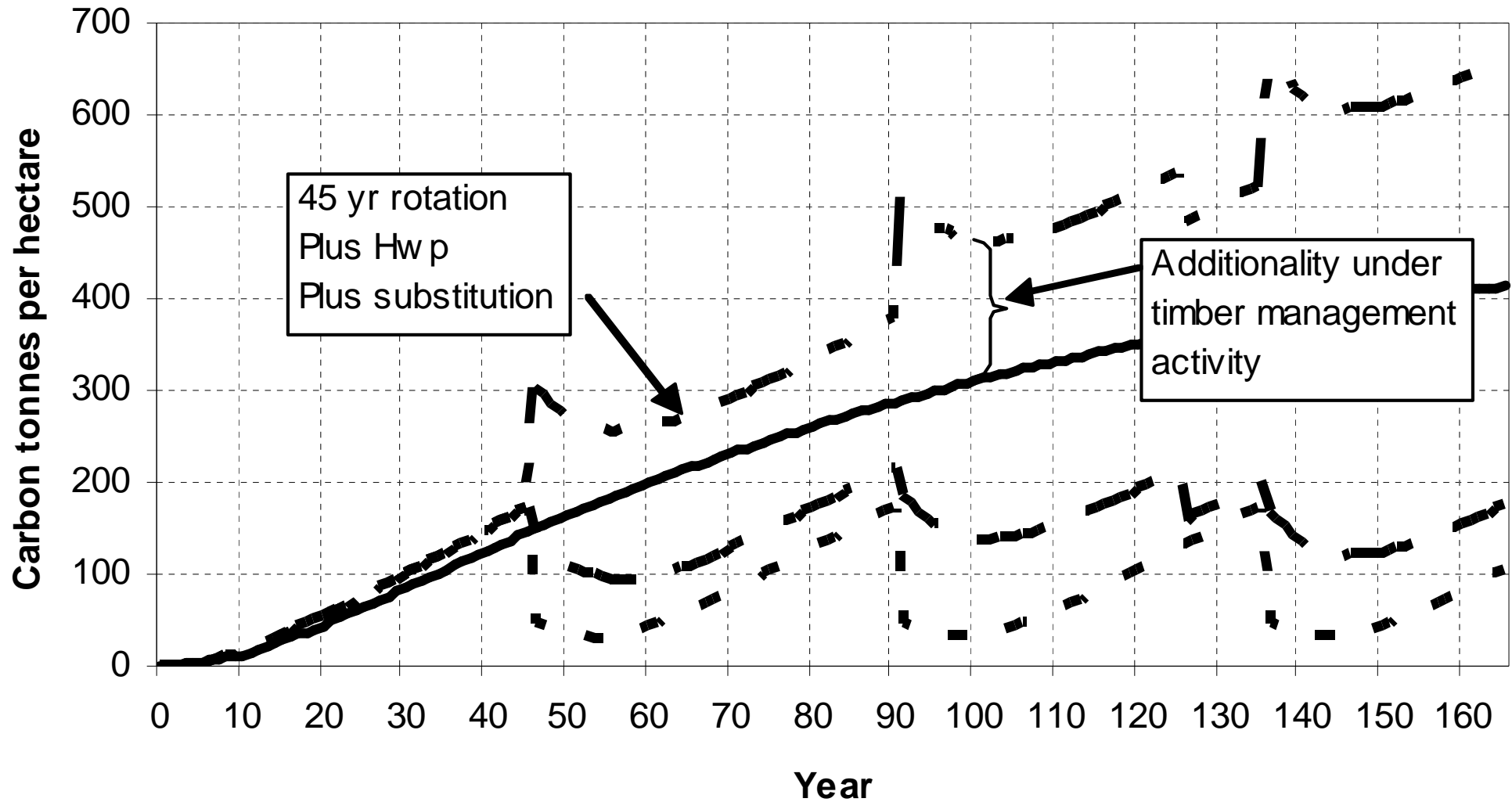
Sink-enhancing Activities : Conservation



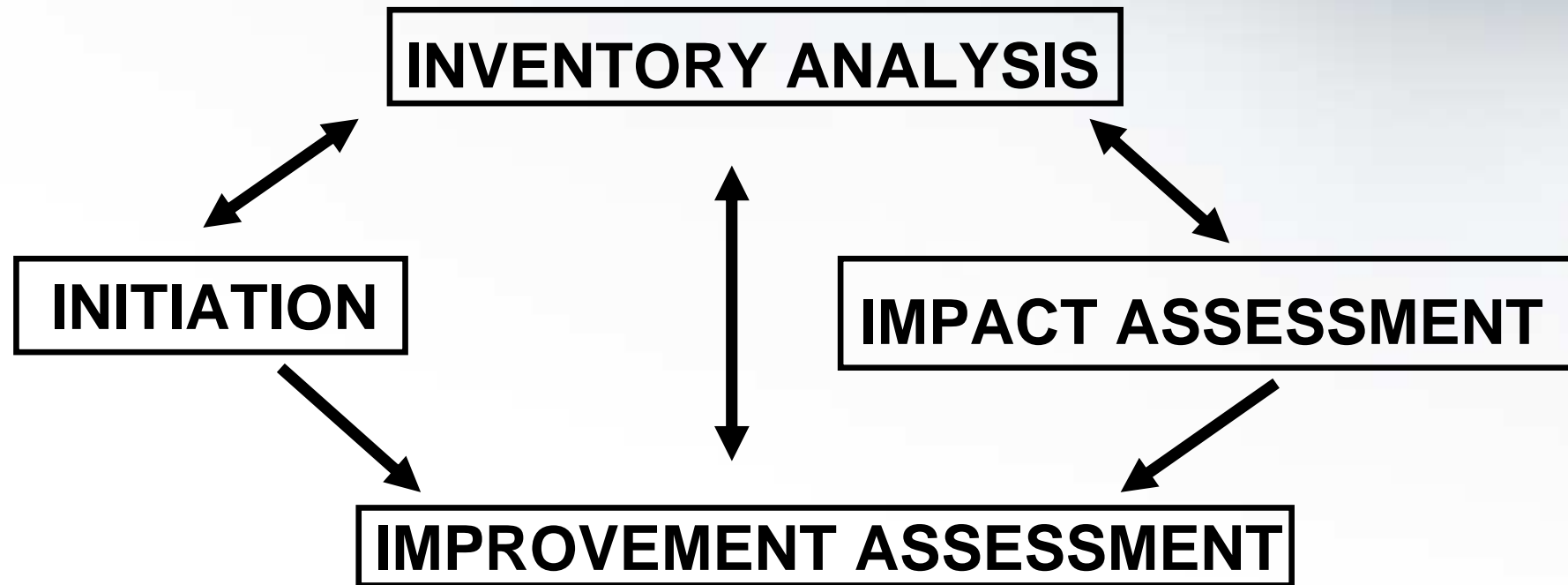
Sink-enhancing Activities : Conservation w/ Forest & HWP Sinks



Conservation and Product Leakage



LCA: Relationship between Main Components

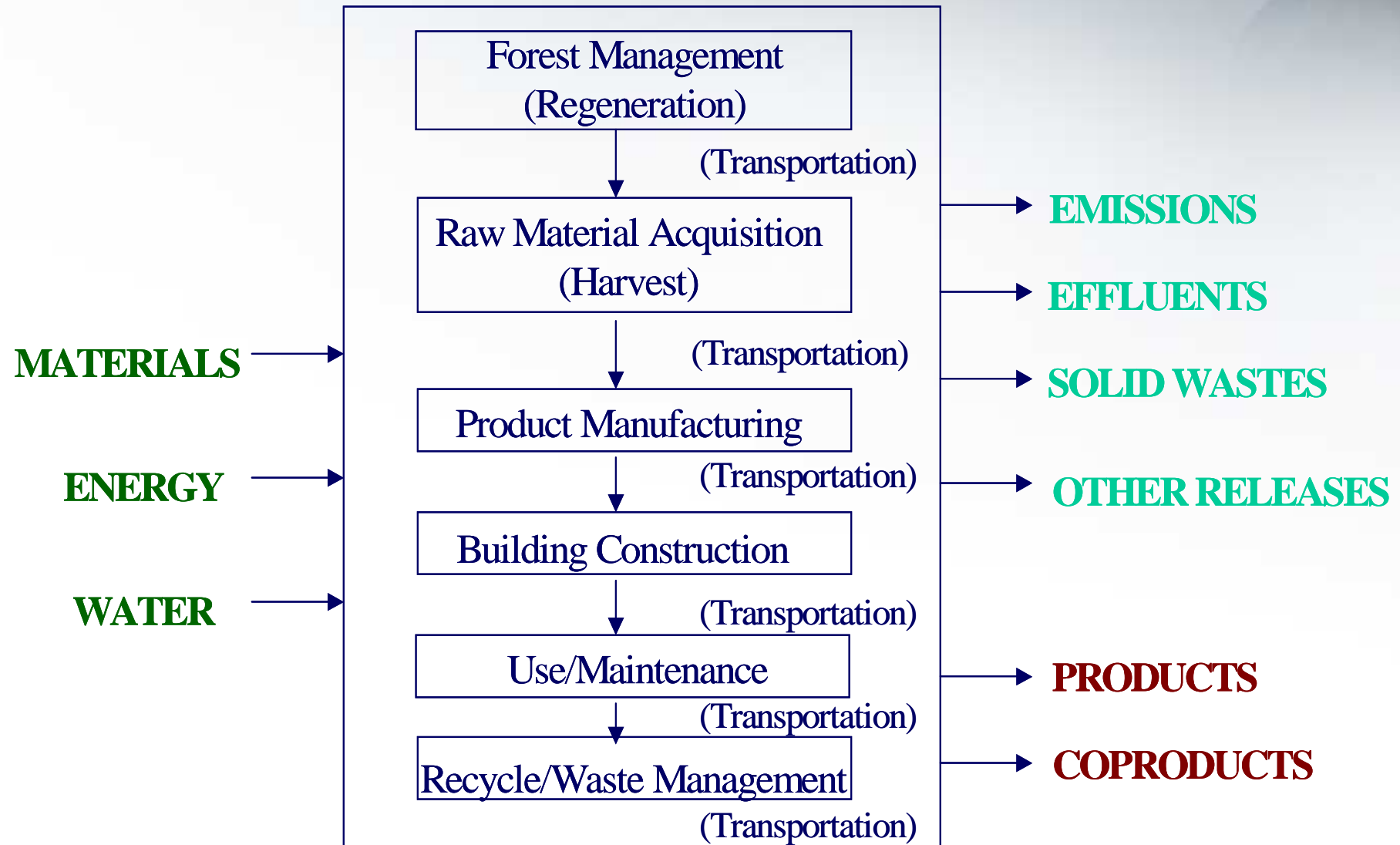


Initiation



- Purpose and scope
- System boundaries
- Data categories
- Review process

Life-cycle Inventory Analysis



Impact Assessment

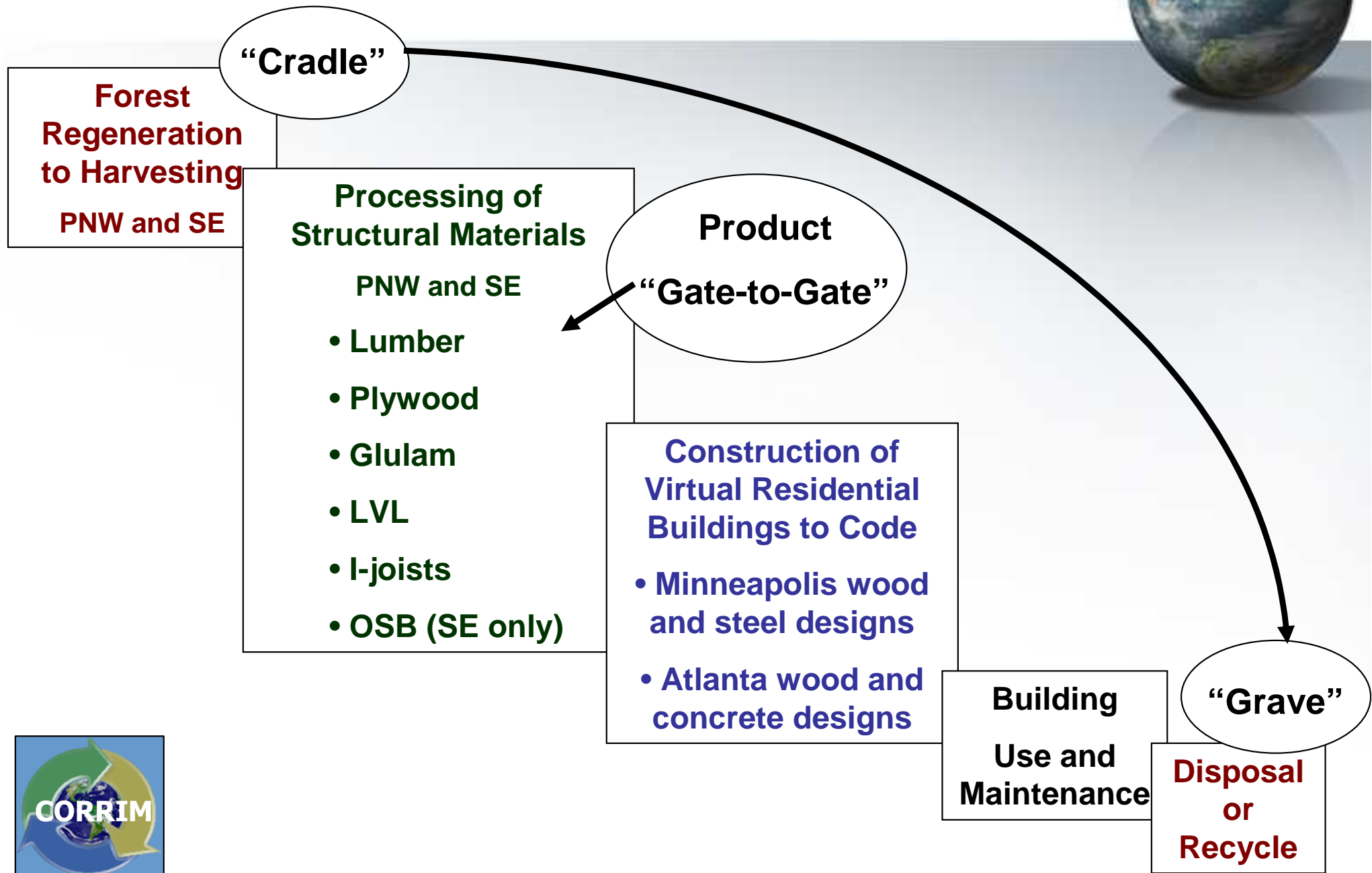


- Ecosystem Health
- Human Health
- Resource Depletion
- Social Health

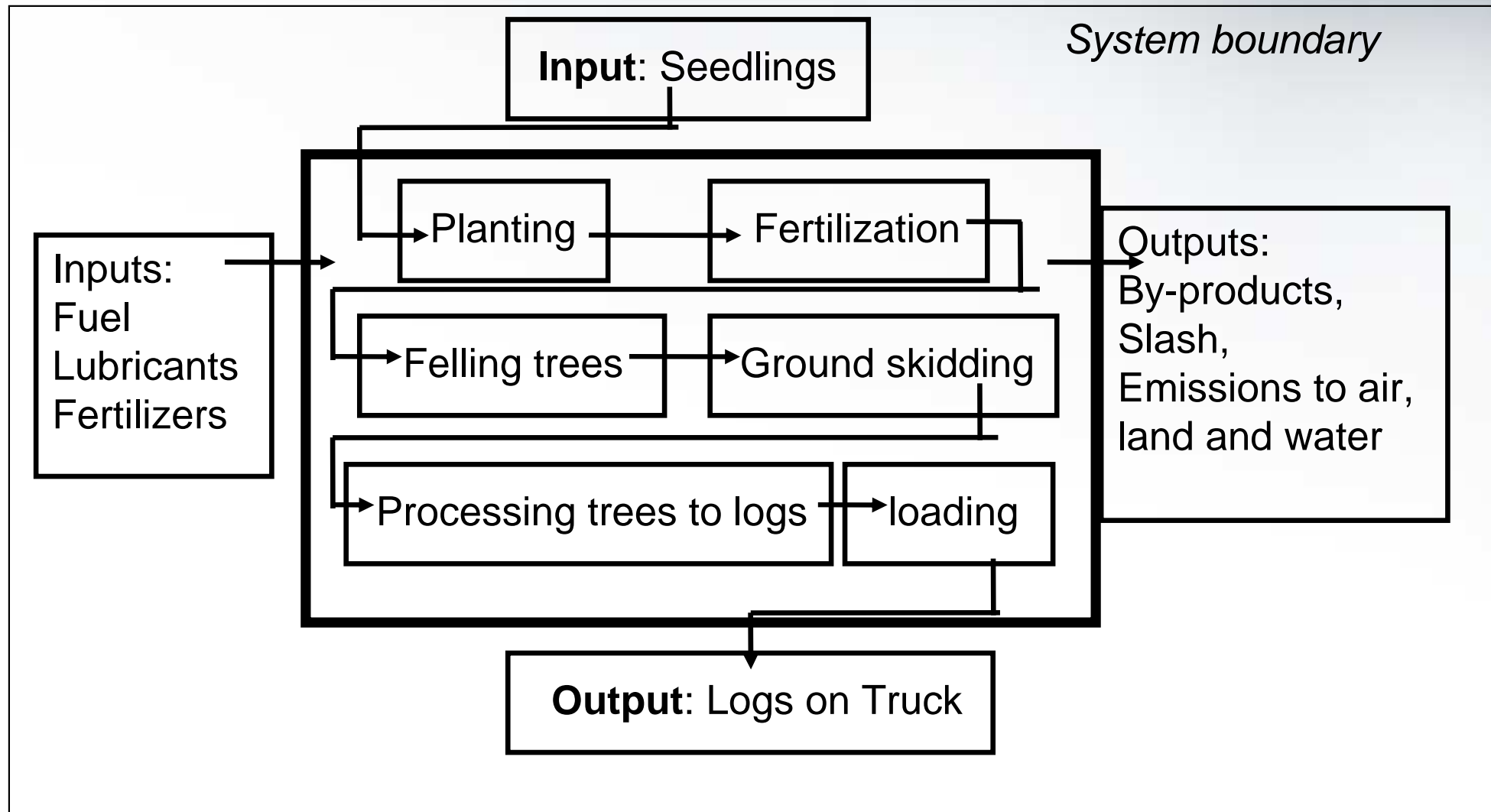
Improvement Assessment



- Extended product life
- Evaluate substitute materials
- Improve distribution
- Enhance use/maintenance
- Reduce energy consumption
- Improve process efficiencies
- Improve collection efficiencies
- Improve waste management



System Boundaries And Process Flow For Forest Stand Establishment And Harvesting



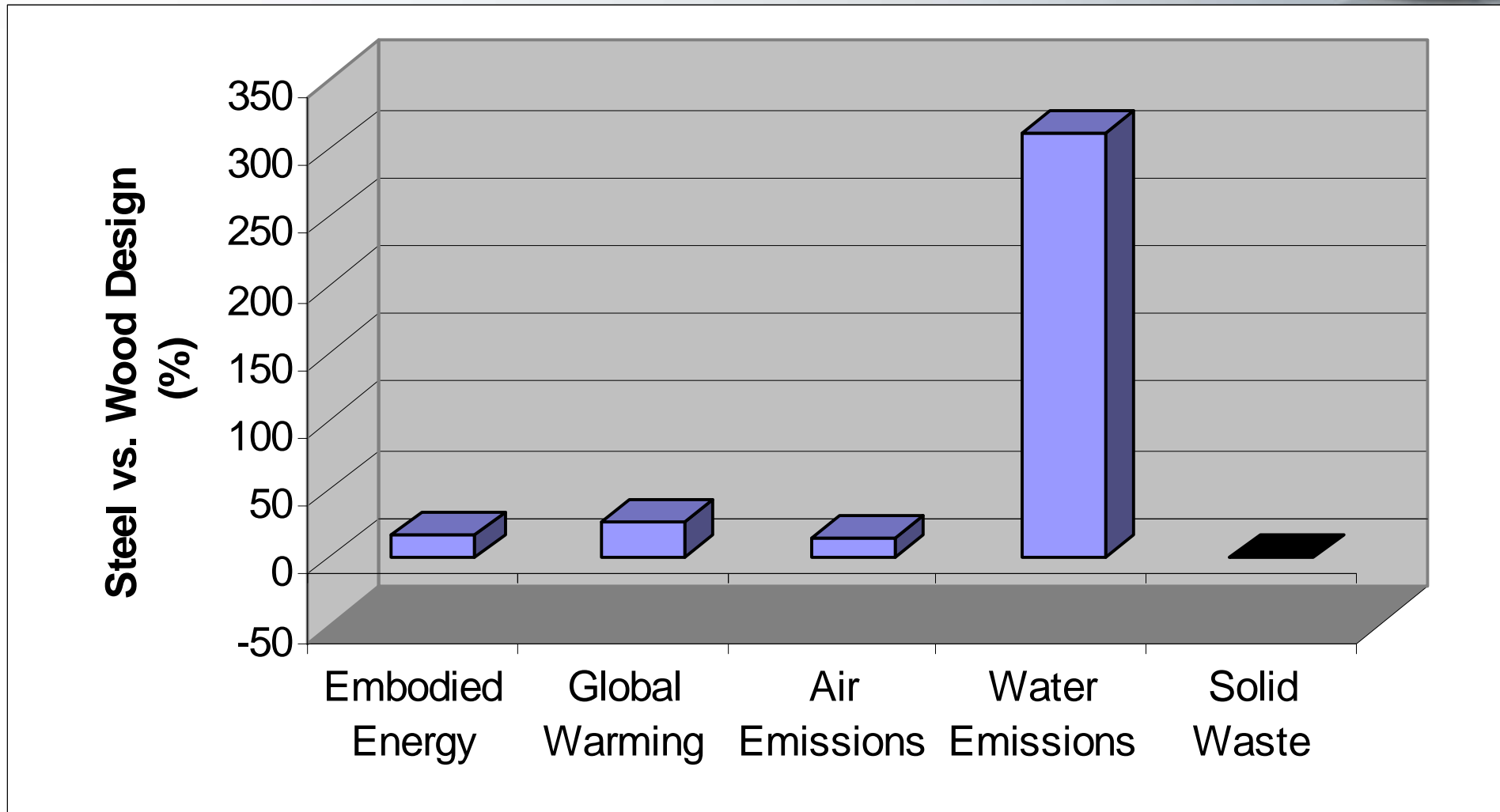


| INPUTS | | | OUTPUTS | | |
|-----------------------------------|--------------|----------------------------------|----------------------|--------------|----------------------------------|
| Materials | Units | Per MSF 3/8-in. basis | Materials | Units | Per MSF 3/8-in. basis |
| Wood/resin | | | Bark | | |
| Roundwood (log) | ft.3 | 6.56E+01 | Bark waste | lb. | 1.31E+01 |
| | lb. | 1.89E+03 | Bark ash | lb. | 7.75E+00 |
| Phenol-formaldehyde | lb. | 1.59E+01 | Total | lb. | 2.09E+01 |
| Extender and fillers ^a | lb. | 8.90E+00 | Products | | |
| Catalyst ^a | lb. | 1.11E+00 | Plywood | lb. | 9.91E+02 |
| Soda ash ^a | lb. | 3.30E-01 | Co-products | lb. | |
| Bark ^b | lb. | 1.98E+02 | Wood chips | lb. | 4.25E+02 |
| Dry veneer | lb. | 6.81E+00 | Peeler core | lb. | 4.62E+01 |
| Green veneer | lb. | 1.51E+01 | Green clippings | lb. | 3.10E+01 |
| Electrical energy | | | Veneer downfall | lb. | 3.44E+00 |
| Electricity | kWh | 1.39E+02 | Panel trim | lb. | 1.07E+02 |
| Fuel for energy | | | Sawdust | lb. | 9.63E+00 |
| Hog fuel (produced) ^b | lb. | 3.83E+02 | Solid dry veneer | lb. | 6.68E+01 |
| Hog fuel (purchased) ^b | lb. | 3.40E+01 | Total | lb. | 6.89E+02 |
| Wood waste | lb. | 5.00E-01 | Air emissions | | |
| Liquid propane gas | gal. | 3.59E-01 | Acetaldehyde | lb. | 1.12E-02 |
| Natural gas | ft.3 | 1.63E+02 | Acetone | lb. | 4.80E-03 |
| Diesel | gal. | 3.95E-01 | Acrolein | lb. | 4.95E-07 |
| | | | Benzene | lb. | 4.77E-04 |
| | | | CO | lb. | 1.91E+00 |
| | | | CO 2 fossil | lb. | 2.78E+02 |
| | | | CO 2 non-fossil | lb. | 2.78E+02 |
| | | | Dust (PM10) | lb. | 2.08E-01 |
| | | | Formaldehyde | lb. | 1.80E-02 |
| | | | Methanol | lb. | 1.28E-01 |
| | | | NO x | lb. | 2.34E-01 |
| | | | Organic substances | lb. | 2.20E-02 |
| | | | Particulates | lb. | 3.47E-01 |
| | | | Phenol | lb. | 8.27E-03 |
| | | | SO 2 | lb. | 7.74E-04 |
| | | | SO x | lb. | 1.01E-01 |
| | | | VOC | lb. | 6.26E-01 |

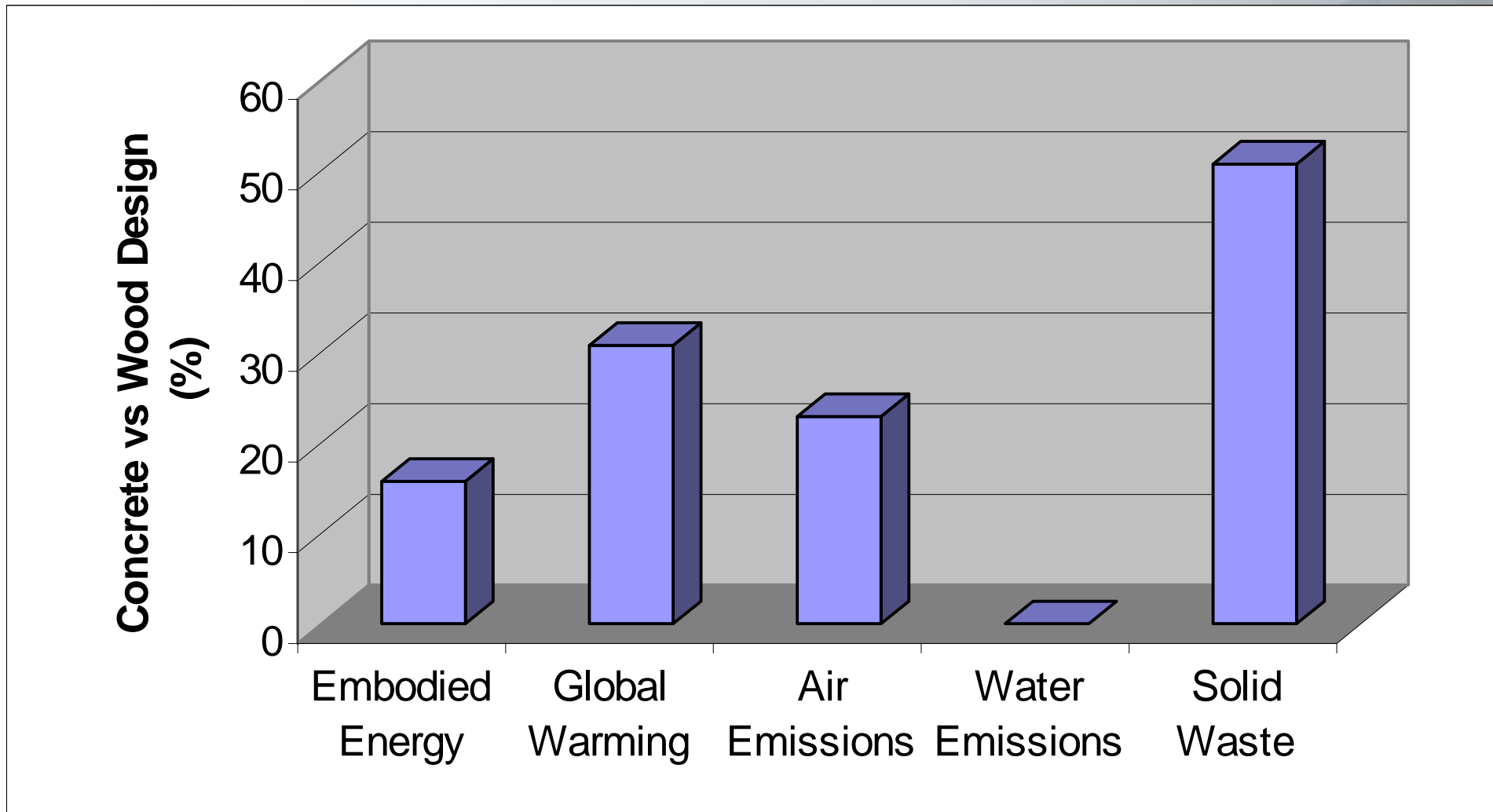
a These materials were excluded based on the 2% rule.
b Bark and hogged fuel are wet weights whereas all other wood materials are oven-dry weights; bark weight is included in the "hog fuel (produced)" weight.

Summary Performance Indices

Minneapolis House



Summary Performance Indices Atlanta House



General outlook for HWP accounting and inclusion of HWP in the post-Kyoto process



- HWP pools are increasing globally.
- Different accounting approaches lead to different national estimates of emissions, but are better than the default.
- If the forest products industry became financially responsible for the forest sinks, the selection of an accounting approach could significantly affect it.
- CORRIM and others have shown how forest and HWP sinks are related and have quantified product leakage.
- Sink-enhancing activities need to address their effects on both the forest and HWP sinks to avoid counterproductive outcomes.
- LCA has a role in protocols to measure product leakage