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Challenges and Opportunities of Accounting for Harvested Wood Products

Background Paper to the Workshop on

Harvested Wood Products in the Context of Climate Change Policies

9-10 September 2008, Geneva, Switzerland

This background paper has been prepared for the workshop on "Harvested Wood Products in the Context of Climate Change Policies". Its objective is to simulate a lively and well informed discussion by providing the reader with background information and proposing questions which participants in the session may wish to address during the discussion.

The Workshop is jointly organized by the Swiss Federal Office for the Environment (FOEN), UNECE/FAO and MCPFE.

Challenges and Opportunities of Accounting for Harvested Wood Products

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Abstract

The background paper *Challenges and Opportunities of Accounting for Harvested Wood Products* (HWP) gives the reader an overview on the importance of HWP in climate change mitigation, different methods for accounting, and their challenges and opportunities.

Wood products can contribute to climate change mitigation in a number of ways. Long-lived wood products form a storage pool of wood-based carbon. As a raw material and energy source, wood can substitute for more energy-intensive materials and fossil fuels. So far, however, the international climate policy has only provided the possibility to account for carbon sinks in forests through the Kyoto Protocol. While the value of harvested-wood-products (HWPs) is recognized by many countries, the carbon storage effect of wood products will not be accounted for over the first commitment period of the Kyoto Protocol. Negotiations on the post 2012 period provide a means for possible inclusion of wood products. In this paper, we provide background information related to HWP, including an historical overview of the international HWP negotiations, measures to increase the role of HWPs in climate change mitigation, a description of the accounting approaches for HWP, a list of possible incentives and disincentives associated with the applications of these approaches, and the illustration of the potential scale of carbon sequestration by HWP for several countries and the different accounting approaches. The goal is to provide workshop participants with a common technical knowledge on HWP in order to provide a basis for broader discussion of the role of HWP in climate change mitigation. The paper closes with some leading questions in order to stimulate debate.

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List of Abbreviations

AOSIS	Alliance of Small Island States
CoP	Conference of the Parties (to the Kyoto Protocol)
FAO	Food and Agriculture Organization
GHG	Greenhouse Gas
HWP	Harvested Wood Products
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land Use, Land Use Change and Forestry
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change

1. Role of Harvested Wood Products in mitigating greenhouse gas emissions

As policymakers seek ways to reduce greenhouse gas (GHG) emissions to mitigate the effects of global climate change, the role of forests and forestry becomes an important discussion point. There is little disagreement that forests sequester carbon as they grow and convert atmospheric carbon dioxide (CO_2) to benign forms, such as carbon in wood and soil organic matter. While the value of HWP is recognized by many countries, the carbon storage effect of wood products will not be accounted for over the first commitment period of the Kyoto Protocol. Negotiations on the post 2012 period provide a means for possible inclusion of wood products.

HWP are defined as wood-based materials harvested from forests, which are used for products such as furniture, plywood, and paper and paper-like products, or for energy[1]. HWP exclude, however, logging residues that are left at harvest sites.

HWP form an integral part of the carbon cycle. They have an effect on the carbon cycle because, on the one hand, the CO_2 pool of long-lived wood products can stay at the same level, increase or decrease (by decay or combustion) within the accounting framework. Figure 1 shows carbon fluxes and stocks in wood products for Europe in 2000[2]. The carbon in HWP moves through different stages and storage levels until it is finally released back into the atmosphere. Harvested roundwood is manufactured into wood and paper products. After their use, which may last either days or centuries, the products are burned, recycled, or landfilled, where they slowly decay. Changing the demand for wood products can thus have an important role in the global carbon cycle and the fight against climate change.

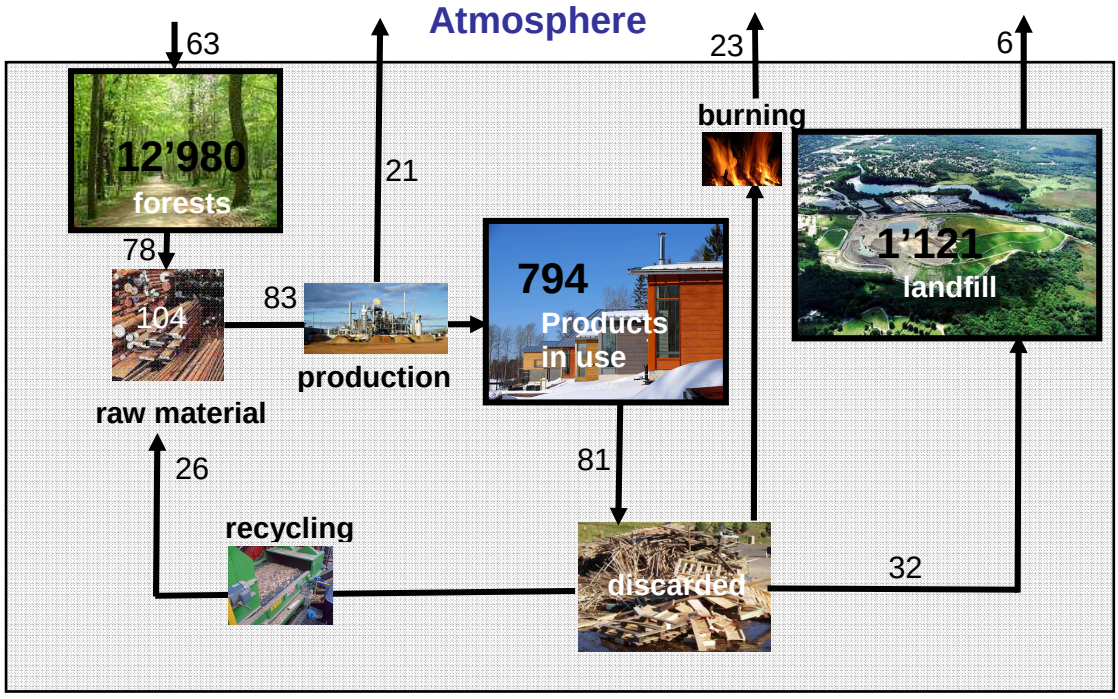

Figure 1. Carbon fluxes and stocks in wood products for Europe in 2000. Fluxes are indicated as arrows, stocks with boxes. The units are in teragrams (10^{12}) of carbon per year (Eggers, 2002)[2].

[1] UNFCCC (2003): Estimation, reporting and accounting of harvested wood products. Technical paper. FCCC/TP/2003/7. http://unfccc.int/resource/docs/tp/tp0307.pdf

[2] Eggers, Th., 2002: The impacts of manufacturing and utilization of wood products on the European carbon budget, European Forest Institute, Internal Report 9, 2002. http://www.efi.int/portal/virtual_library/publications/technical_reports/9/

The obvious climate mitigation provided by HWP and illustrated in Figure 1 is the formation of a **physical pool** of carbon. Another significant climate mitigation effect is obtained by using wood products as a **substitute for more energy intensive materials** or **to reduce fossil fuel use by substituting woody biomass**. The manufacturing and transport of wood products requires less fossil fuel than energy-intensive construction materials such as aluminium, steel, and concrete. Recent comparisons show that the production of steel and concrete as building material requires up to two times more energy than wood-based products, with concomitant greater generation of green house gasses (GHG)[3]. Ideally from a mitigation point of view, a combination of these two substitution effects should be aimed at wood products, which should first be used as building materials, where they store carbon and substitute for more energy intensive material, and then at the end of the wood product lifecycle to generate energy as a substitute for fossil fuel. This **cascade use of wood** would help to optimize the climate mitigation effect of the use of wood products[4]. However, there are also studies that do not see significant benefits from cascading e.g. energy and carbon balances of wood cascade chains[5].

2. Measures to increase the role of wood products for climate change mitigation

Harvested timber is converted into a wide variety of wood products. The carbon in the wood is fixed in products until they decay or are burned and the carbon is subsequently released back into the atmosphere. Incentives to use HWP are implicitly provided in the Kyoto Protocol because of the substitution effect**:** wood-based fuels can be used as a substitute for fossil fuels and solid HWP are being used as a substitute for more energy intensive materials, reducing CO2 emissions. As of now, however, carbon stock changes in HWP are not accounted for. In this section several options are introduced on how to increase carbon stocks in wood products. The implementation of theses options depends on national policies and measures.

Wood and paper products are among the most commonly used materials for **recycling** into the same or new products. For example, in Europe, recovered paper accounts for more than 40% of annual paper production and is predicted to increase[6].

Extending the lifespan of wood products not only brings longer service but also longer carbon storage and less energy consumption for replacement through new materials. The service life of wood products can be extended by using the appropriate timber species for particular end-uses, good specification and detailing, by applying wood protection against fungi and insect attack, and by wise use and maintenance of the products themselves

Building legislation can play a major role as an incentive for the use of wood; for example multi-storey wood buildings of more than two floors are becoming more common, following changes in national building regulations.

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[3] Taverna, R., Hofer, P., Werner, F., Kaufmann, E., Thürig, E., 2007: The CO_2 effects of the Swiss forestry and timber industry. Scenarios of future potential for climate-change mitigation. Environmental studies no. 0739. Federal Office for the Environment, Bern, 102 pp.

[4] See for example, Dornburg, V. and Faaij**,** A**.** Cost and CO_2-emission reduction of biomass cascading-Methodological aspects and case study of SRF poplar. IEA Task 38 – Greenhouse Gas Balances of Biomass and Bioenergy Systems - Workshop on: *Greenhouse Gas Aspects of Biomass Cascading Reuse, Recycling and Energy Generation*. Dublin, Ireland, 25 April, 2005

[5] Roger Sathre, and Leif Gustavsson, 2006: Energy and carbon balances of wood cascade chains. Resources, Conservation and Recycling. Volume 47, Issue 4, July 2006, Pages 332-355.

[6] European Commission, Entreprise DG Unit E.4, 2003. Comprehensive report 2002-2003 regarding the role of Forest products for Climate change mitigation, Available online at http://ec.europa.eu/enterprise/forest_based/312_en.html

Certification of forest products can contribute to increase their market share, by informing consumers that the wood products come from sustainably managed forests.

Further measures to promote the use of wood also for climate change mitigation are **national, multinational, and regional initiatives**. Examples are the "Plan Bois-Construction-Environment" and its accompanying "Charter" in France, "Wood for good" in the UK, "Centrum Hout" in the Netherlands, "Promo_legno" in Austria and Italy, the "Swedish Wood Association", the "Danish Timber Information Council", "Wood Focus" in Finland, the "Centre Interfédéral d'Information sur le Bois" in Belgian, and the "Nordic Timber Council" in Finland, Norway and Sweden, the "German Timber Promotion Fund" (Holzabsatzfond), as well as regional Spanish initiatives.

Research plays a key-role in developing new applications, improving process efficiency, and product quality and extending product life spans, which could increase the market share of wood products.

Several countries are trying to include **specific clauses in public tenders** to encourage the use of wood because of climate change benefits (better insulation, energy efficiency, use of renewable material).

3. HWP and UNFCCC – the history

In 1992, the United Nations Framework Convention on Climate Change (UNFCCC) was opened for signature at the "Earth Summit" in Rio de Janeiro, Brazil, and came into force in 1994. Signatories to the UNFCCC (181 governments and the European Community) have to carry out and communicate inventories on GHG emissions and removals according to the inventory formats provided by the Convention. The Intergovernmental Panel for Climate Change (IPCC) also provides guidelines for the completion of national GHG inventories.

In the first set of IPCC guidelines, the *Revised 1996 Guidelines for National GHG Inventories*, wood products are dealt in the chapter "Land-use change and forestry" (LUCF)[7]. The guidelines provide an outline of how HWP could be treated in national GHG inventories. They recommend that storage of carbon in forest products be included in the national inventory only where the country can document that existing stocks of long-term products are in fact increasing. The default assumption is that the HWP pool in not changing, which means that the inflow to the pool is the same as the outflow of the pool. The guidelines do not provide any specific methods for estimating and reporting emissions or removals due to carbon stock changes in HWP.

In 1998, the IPCC held a special meeting in Dakar, Senegal, where experts reviewed and evaluated four different HWP accounting approaches, differing in where and when the carbon is accounted for:

- the IPCC default approach,
- the atmospheric-flow approach,
- the stock-change approach, and
- the production approach[8].

[7] IPCC (2006): Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.html

[8] Brown, Sandra; Lim, Bo; and Schlamadinger, Bernhard (1998): IPCC/OECD/IEA Programme on National Greenhouse Gas Inventories: Evaluating Approaches for Estimating Net Emissions of Carbon Dioxide from Forest Harvesting and Wood Products. Meeting Report. Dakar, Senegal. 5-7 May 1998.

These approaches and their implications on the carbon balance are presented in section 4 of this paper.

In 2001, parties including Australia, Canada, Japan, New Zealand, Norway, the Russian Federation, Samoa, Sweden, Switzerland, and the USA, submitted their *views on approaches* for estimating and accounting for emissions of carbon dioxide from forest harvesting and wood products[9]. In 2003, Argentina, Australia, Canada, Denmark (on behalf of the EU and its Member States), Japan, Mexico, New Zealand, Samoa (on behalf of AOSIS[10]), USA, and Uruguay submitted their *views on the implications* of harvested wood products accounting, including views on different approaches and methodologies[11]. This information was then summarized into a technical paper on HWP[12], which contains a set of definitions relating to wood products, global data on stocks and trade of wood products and descriptions of methodologies for estimating HWP contribution to emissions/removals in the "Land Use, Land-Use Change and Forestry" (LULUCF) sectors.

In 2003, the IPCC published the Good Practice Guidance for Land Use, Land-Use Change and Forestry (LULUCF), based on the IPCC Guidelines (2000), in order to guide Parties in preparing inventories related to LULUCF as outlined in Articles 3.3, 3.4, and 3.7 of the Kyoto Protocol, and subsequent agreements under the Marrakech Accords. HWP were covered under an Appendix, which presented the different accounting approaches as a basis for future methodological development[13]. In 2004, Parties including Australia, Canada, India, Ireland on behalf of the EU and its Member States, Japan, and New Zealand submitted their views on the information contained in the 2003 technical paper and this appendix on harvested wood products to the Good Practice Guidance for LULUCF[14].

In order to increase the understanding of issues relating to HWP, a workshop was organized in Lillehammer in 2004[15]. Participants at the workshop exchanged views on definitions and scope of estimation, reporting and accounting of harvested wood products; methods for estimation and reporting of emissions and removals relating to harvested wood products; and approaches for accounting of harvested wood products and the socio-economic and environmental implications of different approaches.

In 2005, Parties including Canada, Japan, UK on behalf of EU and its Member States, and the USA reported on their experiences with the use of the IPCC Revised 1996 Guidelines for National GHG Inventories and the Good Practice Guidance for LULUCF.[16]

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[9] UNFCCC/SBSTA (2001): Issues related to Emissions from Forest Harvesting and Wood Products. Submissions from Parties. FCCC/SBSTA/2001/MISC.1. SBSTA, 14th session. Bonn, 16-27 July 2001.

[10] Alliance of Small Island States: 43 States and observers from Africa, Caribbean, Indian Ocean, Mediterranean, Pacific and South China Sea.

[11] UNFCCC (2003) Methodological issues. Good practice guidance and other information on land use, land-use change and forestry. Implications of harvested wood products accounting. Submissions from Parties. FCCC/SBSTA/2003/MISC.1

[12] UNFCCC (2003): Estimation, reporting and accounting of harvested wood products. Technical paper. FCCC/TP/2003/7.

[13] IPCC (2003): IPCC Report on Good Practice Guidance for Land Use, Land-Use Change and Forestry. Institute for Global Environmental Strategies (IGES) for the IPCC. Hayama, Japan.

[14] FCCC/SBSTA/2004/MISC.9

[15] UNFCCC/SBSTA (2004): Report on the workshop on harvested wood products. FCCC/SBSTA/2004/INF.11. Buenos Aires, 6–14 December 2004.

[16] IPCC (2006): Guidelines for National Greenhouse Gas Inventories. Volume 4: Agriculture, Forestry and Other Land Use. Institute for Global Environmental Strategies (IGES), Hayama, Japan.

Currently, Parties still do not have to prepare estimates for HWP. They may do so if they wish, and report in row 5.G 'Other' in Table 5 of the common reporting format for LULUCF. Four Annex I Parties[17] have reported emissions and removals relating to HWP in their National Inventory Reports: Australia, Canada, United Kingdom of Great Britain and Northern Ireland, and the USA. However, the substitution effect of HWPs is already implicitly included in the current accounting framework, in the same way as emissions from bioenergy, since emissions are reported but not accounted for in the energy sector.

If HWP reporting is established in the national GHG emission inventories under the UNFCCC, HWP could in principle also be incorporated in the GHG accounting system under the Kyoto Protocol framework, provided such a decision is made by the Conference of the Parties (CoP). HWPs are not referred to in the Kyoto Protocol, but they could be included, for example, as an additional human-induced activity under Article 3.4. This could happen during the period post 2012, and HWP are under currently discussion in the AWG process[18].

4. HWP accounting approaches

Several approaches have been suggested for estimating CO_2 emissions and 'removals' from HWP. The approaches differ mainly in when and where emissions and 'removals' are allocated.

4.1. IPCC default approach

The 1996 guidelines suggest the default assumption that "all carbon removed in wood and other biomass from forests is oxidized in the year of removal", which is "based on the perception that stocks of forest products in most countries are not increasing significantly on an annual basis".[19] This conservative assumption has also been referred to as the IPCC default approach, though, according to the definitions of approach and method, it constitutes more of an estimation method than an approach.[20]

However, where HWP stocks are increasing and sufficient data are available, the guidelines recommend the inclusion of HWP in the national inventory reporting, and they describe a range of approaches and methods on how to estimate their contribution to emissions and removals in the LULUCF sector. Overall there are two different ways of construing emissions and 'removals' in the context of HWP.[21]

One interpretation is to see emissions and removals approximated by *changes in selected pools* (e.g. carbon stock in wood products), as is the case for estimating emissions/removals from forests (LULUCF reporting), and in the stock change and the production approaches.

On the other hand in the atmospheric approach and the simple decay approach, emissions and removals are considered as *gross fluxes* between the atmosphere and the land and wood products system.

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[17] Annex I Parties include the industrialized countries that were members of the in 1992, plus countries with economies in transition, including the Russian Federation, the Baltic States, and several Central and Eastern European States.

[18] UNFCCC/AWG (2008): Round table on the means to reach emission reduction targets. FCCC/KP/AWG/2008/CRP.1. Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol. 5th session. Bangkok, 31 March to 4 April 2008, and Bonn, 2-12 June 2008

[19] IPCC (1996): Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Reference Manual (Volume 3), p. 5.17

[20] IPCC (2003): IPCC Report on Good Practice Guidance for Land Use, Land-Use Change and Forestry. Institute for Global Environmental Strategies (IGES) for the IPCC. Hayama, Japan.

[21] Cowie, A. et al. (2006). Stock changes or fluxes? Resolving terminological confusion in the debate on land-use change and forestry. *Climate Policy* 6: 161-179.

4.2 Stock change approach

The stock-change approach is used in case where the estimation of net changes in the carbon pool is confined to domestically consumed solid wood and paper products. Thus, the approach accounts for emissions and removals based on stock changes within national boundaries, where and when they occur. Hence, exports of wood products count as emissions and imports as an increase of carbon stock, similar to removals from the forest (figure 2).

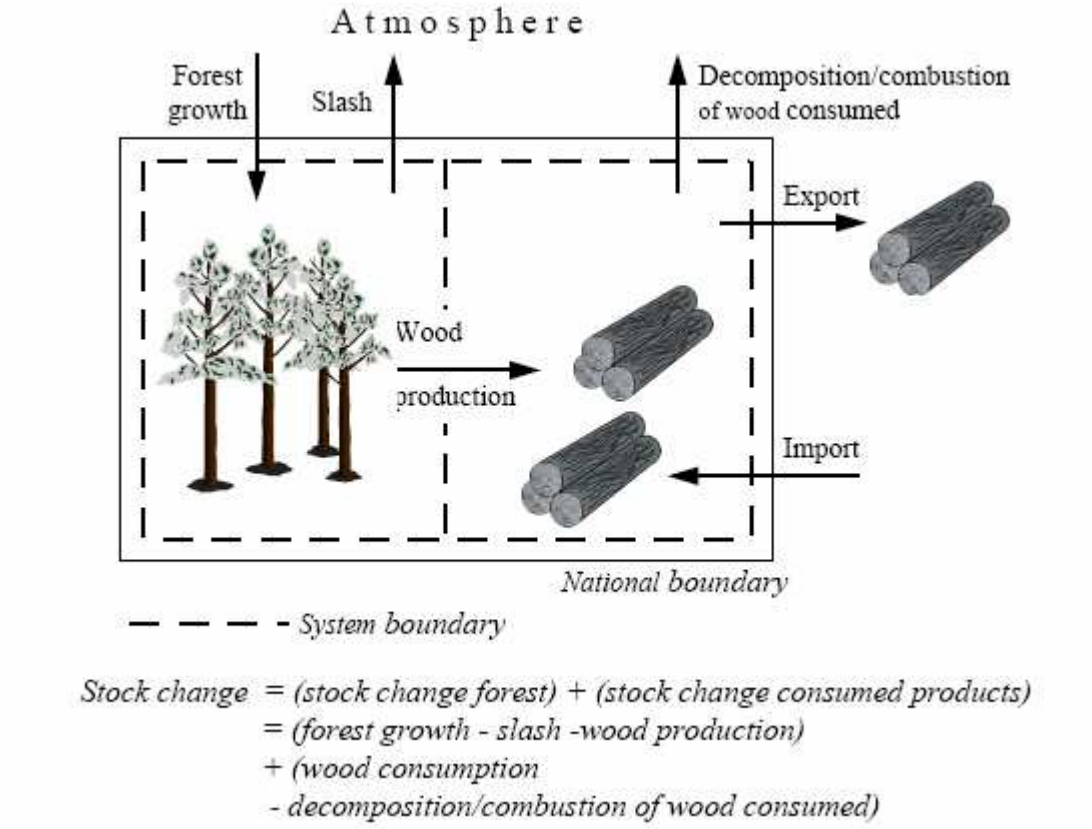

Figure 2. Schematic presentation of the stock change approach[22].

4.3 Production approach

For the production approach, the net change to the carbon pool from wood products is attributed to the producer country only. Contributions/removals of emissions from exported HWP is therefore credited to the HWP producing country (in contrast to stock-change approach, where exported HWP are included in the calculation of the importing country or in other words, where the HWP is consumed). Any stock of carbon that crosses a national boundary is not transferred from one country's inventory to another; the exported carbon remains in the inventory of the producing country. Effects for the consuming country are neutral in terms of reporting, but technical difficulties may arise, as there may be a need for the producing country to track exports when reporting emissions that occur outside its

[22] Lim , B., Brown, S., Schlamadinger, B. (1999). Carbon accounting for forest harvesting and wood products: review and evaluation of different approaches. Environmental Science and Policy, Volume 2, Issue 2, May 1999, Pages 207-216.

national boundaries. Consequently, stock changes are accounted for when, but not where they occur (figure 3).

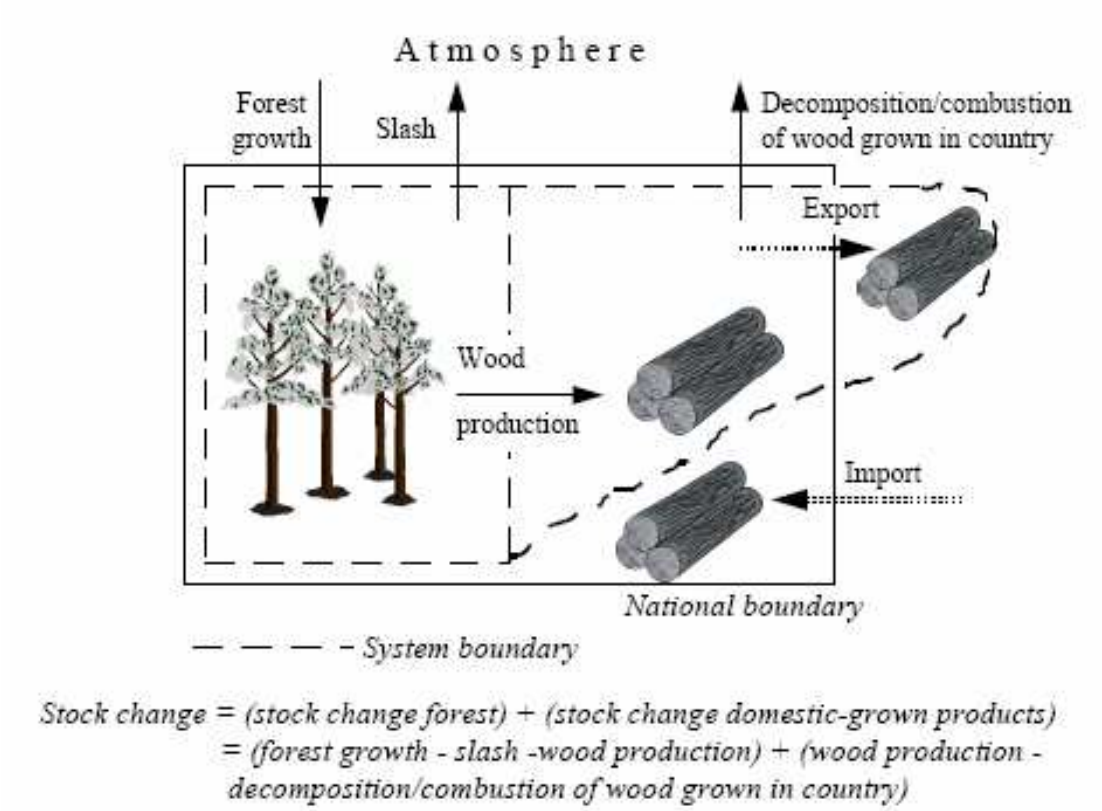

Figure 3. Schematic presentation of the production approach.[22]

4.4 Domestic origin stock change approach

In order to resolve some of the complications and allocation issues of these approaches, Cowie et al. suggested the "stock changes of domestic origin" approach. This hybrid between the stock-change and the production approach, suggests that each country should only account for those products that are produced and consumed domestically. [21]

4.5 Atmospheric flow approach

The atmospheric flow approach regards emissions and removals as gross fluxes between the atmosphere, the forest and the HWP pool and accounts for net emissions/removals of carbon to/from the atmosphere within national boundaries. Removals of carbon from the atmosphere due to forest growth are accounted for in the producing country, and emissions of carbon to the atmosphere from oxidation of wood products are accounted for in the consuming country (figure 4). This approach intends to cover all emissions along the forest wood chain within a country, where and when they occur.

The producing country will have to report only emissions resulting directly from harvesting, such as decay of slash. In contrast to the stock-change approach, the consuming country will not increase its pool of carbon in wood products but will have to report the emissions as imported wood products decay. Where the producing country is also the consuming country, this is translated into a direct delay of emissions from wood products.

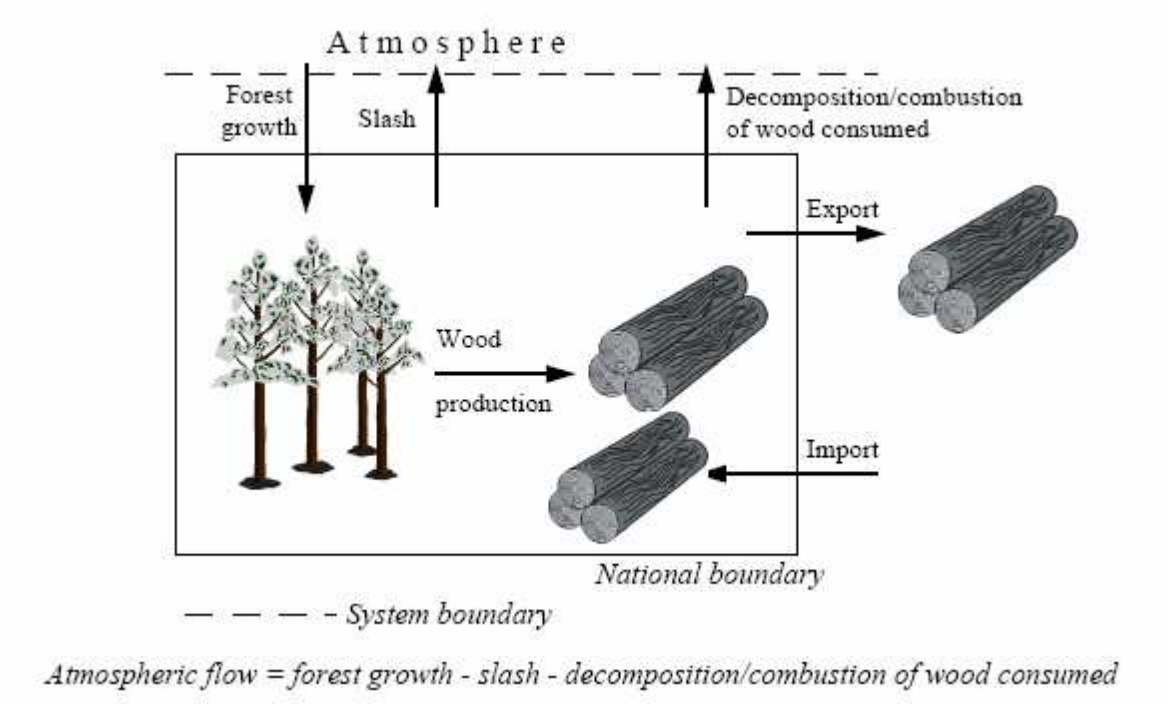

Figure 4: Schematic presentation of the atmospheric flow approach

4.6 Simple decay approach

Another approach is the simple decay approach or accounting for "harvesting emissions", which also sees emissions/removals as gross fluxes between the atmosphere and the land and wood products. This approach assumes that emissions from wood products are estimated over time as products decay. Rather than allocating emissions where they occur, as in the atmospheric-flow or stock-change approaches, the simple decay approach suggests that these emissions be allocated to the producer. Just like the production approach, it does not estimate emissions from existing HWP pools, but simply delays emissions from harvesting by a factor that reflects the decomposition rates of carbon in HWP.

5. Incentives/Disincentives of the different approaches

Although carbon stock changes in HWP are not currently accounted for, incentives to use HWP are in place, since HWP can substitute more energy intensive materials, and thus reducing the overall GHG balance of a country.

In this section, we give a brief introduction to the additional incentives/disincentives, which are mainly dependent on the underlying HWP accounting approaches.

5.1 Promotion of sustainable forest management

In general, the effects of HWP accounting on forest carbon stocks depend on whether forest in general[23] and forest management[24] are included in the country's GHG accounting system.

[23] Article 3.3 of the Kyoto Protocol

Regardless as to which approach is used, accounting for HWP but not accounting for forest management could create an incentive to pool carbon in HWP rather than the forest, thus possibly rewarding unsustainable forest management or possibly deforestation. Therefore, one prerequisite of HWP accounting is that the country should have elected forest management under Article 3.4

The *IPCC default approach* discourages harvesting in Annex I countries. It provides an incentive to maintain and increase the carbon stock in forests and to manage forests in a way avoiding damages through natural disturbances.

One possible shortcoming of *the stock-change approach* could be the inclusion of non-sustainably produced HWP, unless one was to exclude HWP from non-sustainably harvested sources. This option, however, may not be feasible due to lack of data and complexity of validation.

The *atmospheric-flow approach* does not account for depletion of forest carbon stocks to the extent that losses in carbon stocks are exported. In this case, sustainable management of forest carbon stocks is not encouraged. Furthermore, it could promote deforestation: If wood from deforestation is exported, the emission is accounted for in the importing but not the exporting country.

5.2 Trade

International trade is a key issue in HWP accounting. The accounting approaches could impact international trade of HWP, since they penalize or give incentives to forest harvesting, and importing or exporting wood, depending whether countries have emission reductions commitments under the Kyoto Protocol (Annex I).

Overall, however, it is unlikely that HWP reporting and accounting will have major influence on international wood prices, since this influence will be minor compared to the main driving factors, such as roundwood production costs, tariffs, subsidies, etc.

5.3 Impacts on reuse and recycling

All HWP accounting approaches may provide incentives for recycling of products, thereby further delaying emissions, and possibly reducing harvest. The atmospheric-flow approach may provide the greatest incentive for recycling as long as net imports decrease as recycling increases. The production approach may provide the least incentive, because recycling of imported products would not affect national stocks of wood products.

5.4 Use of wood fuels

There is an incentive for all countries to use wood for energy under the Kyoto Protocol, since emissions from wood energy are not accounted for. Thus, in general an incentive is provided to import wood fuels; except under the *atmospheric-flow approach*, since in this approach emissions from wood fuels are accounted for in the consuming country. Importing wood fuels would then even be penalized since the CO_2 emissions per unit energy output are higher for biofuels than for most fossil fuels. Countries exporting biofuels would benefit under the *atmospheric-flow approach* since this approach leads to a decrease in national GHG emissions accounting.

5.5 Internalizing the carbon value of wood and national planning

HWP accounting approaches, except the IPCC default approach, provide incentives to improve national wood products inventories and thus to track the effects of different policy approaches and measures.

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[24] under Article 3.4 of the Kyoto Protocol

Table 1. Summary of potential impacts of the main different HWP accounting approaches

	IPCC default approach	Stock-change approach	Production approach	Atmospheric-flow approach
Promotion of sustainable forest management	discourages harvesting of forests	incentive to import HWPs, possible inclusion of wood products from non-sustainably managed forests	possible increase in national production and exports of long-life products	wood exports might be promoted, imports reduced, possible focus on national wood production
Impacts on recycling	incentives for recycling of products,		least incentive for recycling of products	greatest incentives for recycling of products
Use of wood fuels	incentives to switch from fossil-fuels to domestically-produced wood fuels, and to import wood fuels			
Internalizing the carbon value of wood and national planning	no specific incentives	incentives to improve national wood products inventories		
Trade	minor influence on international wood prices			

6. Quantitative outcomes for some countries

In order to estimate possible effects of applying different accounting approaches, the outcomes (calculated with IPCC HWP Model, tier 1) of the three principal approaches, stock-change, production, and atmospheric-flow approaches are illustrated in Table 1 for some selected countries in Annex I of the Kyoto Protocol. The difference in CO_2 emissions due to HWP accounting under the IPCC default approach are expressed in Gg CO_2.

Table 2. Excess emissions from HWPs in 2000 using the three main approaches and compared to reported base-year emissions (IPCC default approach).

Greenhouse gas emissions	Total without CO_2 from LULUCF	CO_2 from LULUCF	Excess emissions from HWP **Stock change approach**			Excess emissions from HWP **Atmospheric flow approach**			Excess emissions from HWP **Production approach**		
CO_2 equivalent (Gg)	Base year 1990	Base year 1990	2000	% of total base-yr	% of LULUCF base-yr	2000	% of total base-yr	% of LULUCF base-yr	2000	% of total base-yr	% of LULUCF base-yr
Australia	**425175**	78124	-2061	-0.5%	-3%	-443	-0.1%	-1%	-2117	-0.5%	-3%
Austria	**77388**	-9215	-3088	-4.0%	34%	-3355	-4.3%	36%	-1835	-2.4%	20%
Belgium	**142741**	-1600	-1443	-1.0%	90%	1342	0.9%	-84%	-694	-0.5%	43%
Canada	**607183**	-61498	-9207	-1.5%	15%	-91509	-15.1%	149%	-33848	-5.6%	55%
Denmark	**69360**	-916	-1892	-2.7%	207%	2286	3.3%	-250%	-106	-0.2%	12%
Finland	**77093**	-23798	-2381	-3.1%	10%	-23582	-30.6%	99%	-4484	-5.8%	19%
France	**559342**	-56232	-6707	-1.2%	12%	-2995	-0.5%	5%	-8077	-1.4%	14%
Germany	**1222765**	-33719	-10844	-0.9%	32%	-6725	-0.6%	20%	-12566	-1.0%	37%
Greece	**104895**	1441	-591	-0.6%	-41%	1536	1.5%	107%	-52	0.0%	-4%
Ireland	**53700**	-89	-879	-1.6%	991%	-225	-0.4%	254%	-932	-1.7%	1050%
Italy	**520571**	-23532	-6529	-1.3%	28%	13733	2.6%	-58%	-1310	-0.3%	6%
Japan	**1246724**	-83903	-1187	-0.1%	1%	29843	2.4%	-36%	5153	0.4%	-6%
Netherlands	**210347**	-1422	-966	-0.5%	68%	4792	2.3%	-337%	-458	-0.2%	32%
New Zealand	**73161**	-21845	-1178	-1.6%	5%	-9383	-12.8%	43%	-4025	-5.5%	18%
Norway	**51965**	-9765	-720	-1.4%	7%	-1409	-2.7%	14%	-182	-0.4%	2%
Portugal	**64948**	-3751	-1146	-1.8%	31%	-2690	-4.1%	72%	-660	-1.0%	18%
Spain	**286428**	-29252	-5512	-1.9%	19%	7848	2.7%	-27%	-1293	-0.5%	4%
Sweden	**70566**	-20292	-1051	-1.5%	5%	-18397	-26.1%	91%	-2808	-4.0%	14%
UK	**742492**	8791	-3434	-0,5%	-39%	15068	2,0%	171%	-3073	-0,4%	-35%
USA	**6130724**	-1097747	-72571	-1.2%	7%	-40302	-0.7%	4%	-46085	-0.8%	4%

Note: A negative emission means removal. Calculations were carried out with the EXPHWP model. The input data of the model, the production and trade data since 1961 are from the FAO database (FAOSTAT, 2002). [30]

[30] Pingoud, K., Perälä, A.-L., Soimakallio, S., and Pussinen, A., 2003, Greenhouse gas impacts of harvested wood products. Evaluation and development of methods, VTT research notes 2189, http://www.vtt.fi/inf/pdf/tiedotteet/2003/T2189.pdf

7. Outlook

The technical details and complexity of HWP accounting and its role in climate change mitigation have made the topic incomprehensible to anyone but "HWP experts". While this paper provides technical information, it aims at providing workshop participants with a common technical knowledge in order to raise the level of the workshop discussion to a more strategic level. Future approaches to HWP accounting will need to be discussed in the light of decisions about the broader climate change regime. Thus, this workshop will focus on showing how wood as energy source and construction product could be internalized in the Climate Change framework. Economic and socio-economic outcomes of promoting the use of HWP should be consistent with the desired environmental outcomes and be able to be accepted by all stakeholders.

In this light, the following questions are proposed as a way to facilitate discussions:

(1) How does accounting for HWP transmit economic signals supportive of environmental integrity (e.g. no negative impacts on forest ecosystems, biodiversity)?

(2) How can the climate change mitigation benefits (carbon storage and substitution effects) of HWP be recognized and accounted for?

(3) What specific measures and policies can promote the role of HWP to mitigate climate change?