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Harvested wood products (HWP) in the Swiss GHG inventory

Description of time series modelling methodology and results used for accounting HWP under the Kyoto Protocol.

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Paolo Camin and Nele Rogiers
Forest Division, Federal Office for the Environment

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1. Executive summary

CO_2 emissions and removals from Harvested wood products (HWP) have to be reported under the UNFCCC and accounted for by Parties to the Kyoto Protocol in the second commitment period (2013-2020). This report explains the data sets and methods applied by Switzerland to calculate yearly carbon stock changes in HWP and shows detailed results used for accounting under the Kyoto Protocol.
Carbon stock changes in the HWP pool were calculated for three semi-finished wood product categories: i) sawnwood, ii) wood-based panels and iii) paper and paperboard. For the latter, however, the assumption of “instantaneous oxidation” was applied since quantitative estimates for this category are not available yet. Activity data were collected from international database (FAOSTAT) as well as from surveying the Swiss wood industry (Tier 2 and 3 methodologies).
For calculating carbon stock changes in HWP, Switzerland applied the default first order decay (FOD) model using the corresponding default half-lives (35 years for sawnwood, 25 years for wood-based panels and 2 years for paper and paperboard; Tier 2 methodology). Following the provisions of the Kyoto Protocol, HWP originating from imported wood were excluded from the accounting and HWP originating from deforestation activities were accounted for on the basis of instantaneous oxidation.
The total inflow of carbon to the HWP pool in 2016 amounted to 640 kt C (39% from sawnwood, 26% from wood-based panels, 36% paper and paperboard). The outflow from the pool was reported to amount to 582 kt C in 2015 (43% from sawnwood and 23% from wood-based panels, 34% paper and paperboard). Thus, there was a net carbon gain in HWP of 58 kt C or 213 kt CO_2 in 2016.

2. Introduction

Forests have a significant impact on the global carbon cycle and therefore on the climate. On the one hand, they help improve local climates by moderating temperature and humidity, while on the other hand, they absorb atmospheric carbon (CO_2) through photosynthesis, forest growth and forest expansion and store it on the long term (sequestration). When wood is used in furniture or construction, for example, the sequestered carbon remains stored in the wood product.

The role of HWP in mitigating greenhouse gas (GHG) emissions has been recognized only recently by the Kyoto Protocol (KP). For accounting in the first KP commitment period (2008–2012), it was assumed that the annual amount of carbon leaving the HWP pool equals the annual carbon inflow to the pool. This means that all carbon in harvested biomass was oxidized at the time of harvest. In reality, wood-based materials may emit carbon over a long time frame. Depending on the balance between carbon inflow and outflow, and the corresponding carbon stock change, the HWP pool may indeed act as a sink or as a source of CO_2. For this reason, for the second KP commitment period (2013–2020) accounting rules were changed. At the 17th Conference of the Parties (COP17) to the UNFCCC and the 7th Session of the Conference of the Parties (CMP7) to the Kyoto Protocol in Durban it was decided that CO_2 emissions and removals from HWP should be accounted for under the Kyoto Protocol from 2013 (Decision 2/CMP.7).

The following accounting rules were agreed upon through Decision 2/CMP.7, are described and explained in detail in IPCC (2014) and were implemented for the calculation of HWP:

- Imported HWP and exported round wood shall not be accounted for.
- Definition of default half-lives for the HWP categories: sawnwood, wood-based panels and paper. Exported HWPs should be accounted for using default half-lives.
- HWP originating from deforestation shall be accounted for on the basis of instantaneous oxidation.
- Rejected HWP in solid waste disposals and HWP used for energy production shall be accounted for on the basis of instantaneous oxidation.
- Each country using a projected Forest management reference level (FMRL) can decide whether or not to include HWP produced prior to the start of the second commitment period.
- Accounting for HWP originating from Afforestation and Reforestation under KP Article 3.3 and from Forest management under KP Article 3.4 should be treated separately.

In climate reporting, the effects of substitution are recorded as CO_2 reductions within the industry and energy sectors and are, therefore, not recognized as a contribution of the forestry and wood products industries. To fully assess the forestry and wood products industries' impact to climate, an integrated study of the forestry and wood products industries which accounts for all storage and substitution effects would be needed.

3. Description of HWP pool

HWP are defined as wood-based materials that, following harvest, are transformed into commodities such as furniture, plywood, paper and paper-based products, or used for energy. After a period of time (lifetime of the product), which can vary considerably depending on the product itself, the wood product might be recycled (especially in the case of paper), used for wood energy, or be disposed of in a landfill.

In order to estimate the changes in the HWP pool the inflow and outflow from the pool must be quantified. The inflow can be estimated directly from data on the production of HWP. However, a direct quantification of the outflow from the pool can only be based on successive inventories of products in use – this is quite resource-demanding and requires extensive data. In Switzerland no such inventories were made. An alternative way for the quantification of the outflow is the calculation with a theoretical model using a "First Order Decay", as stipulated in Decision 2/CMP.7 and described in IPCC (2014). This model estimates the outflow from the pool based on the size of the pool and the product life expectancies (half-lives).

Only semi-finished wood products (SFWP), i.e. sawnwood, wood-based panels and paper and paperboard, can be accounted for (see Figure 2.8.2 in IPCC 2014). Finished products (e.g. furniture, floors, beams, books etc.) do not enter into the estimations.

4. Reporting of HWP

Presently, two sets of guidelines for estimating the carbon stock in the HWP pool exist:

- The 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines; IPCC 2006) and
- The 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol (2013 KP Supplement; IPCC 2014).

In the latter it is specifically stated that it is "…consistent with the 2006 IPCC Guidelines but does not revise or replace the 2006 IPCC Guidelines" (IPCC 2014). Theoretically, the 2006 IPCC Guidelines can be used for reporting under the UNFCCC. However, for accounting under the Kyoto Protocol, the 2013 KP Supplement must be used, because it was developed in accordance with Decision 2/CMP.7 and 2/CMP.8. Since the 2013 KP Supplement (IPCC 2014) also encourages parties to harmonize UNFCCC and KP calculation in order to increase transparency, accuracy and consistency, this HWP reporting has been prepared on the basis of the 2013 KP Supplement.
Thus, methods used for reporting under the UNFCCC and accounting under the Kyoto Protocol are the same.

4.1. Choice of the approach

The 2013 KP Supplement (IPCC 2014) provides three tiers to calculate the carbon stock changes in the HWP pool from domestic harvest (i.e., the trees harvested in the reporting countries) in the second commitment period:

- Instantaneous oxidation (Tier 1): This approach does not quantify the changes in HWP stock under the assumption that all wood is instantaneously oxidized. This method was used by default in the first commitment period.
- Default method (Tier 2): This method applies a first order decay function based on default half-lives differentiated between the main semi-finished wood products (i.e. sawn wood, wood panels, paper and Paperboard) as defined by the international classification system of forestry products. All countries using the accounting method with a "reference level" for forest management in the second commitment period (i.e., all EU member states) have to use at least the Tier 2 approach.
- Country-specific methods (Tier 3): If more detailed data and methodologies are available, a country-specific method can be used.

Switzerland applied a combination of a Tier 2 and Tier 3 approach for the product categories sawnwood and wood-based panels. The IPCC default method for estimating the HWP carbon stock was used in combination with country-specific activity data as well as data from FAOSTAT.

For the product category paper and paperboard Switzerland applied the Tier 2 approach, activity data are derivate from FAOSTAT.

HWP in solid waste disposal sites were calculated with this Tier 1 method.

The 2013 KP Supplement Tier 2 method is basically a flux data method where estimates of net emissions are derived from a stock change calculation applied to products derived from domestic harvest, excluding imported HWP. To implement this method, it is necessary to estimate:

1) the annual fraction of the industrial roundwood (sawn wood and wood-based panels) and wood pulp commodities (paper and paperboard) from domestic harvest;
2) the share of HWP originating from Afforestation/Reforestation and Deforestation under Article 3.3 and Forest management lands under Article 3.4 of the Kyoto Protocol.

In accordance with the IPCC guidelines, the carbon stock included in fuelwood is immediately released into the atmosphere.

4.2. Method for calculating carbon stocks in HWP

Changes in carbon stocks in year i were estimated on the basis of information on the inflow of wood products into the stock and of assumed lifetimes and decay factors of these products. In accordance with the 2013 KP Supplement a first order decay (FOD, i.e. exponential decay) function (equation 2.8.5 in IPCC 2014) was used to estimate the carbon stock and the annual changes for each of the SFWP categories.

$$C_{i+1} = e^{-k} \cdot C_i + \left[\frac{(1 - e^{-k}}{k}\right] \cdot \ Inflow_i$$

$$\Delta C_i = \ C_{i+1} - \ C_i$$

Where:

C_i is the carbon stock for the given HWP category at the beginning of year i (variables are written with index i, as the equation is used in the discrete form); in Gg C

k is the decay constant of first-order decay depending on the HWP category ($k = \ln(2)/HL$ where HL is the half-life of the HWP pool in years.)

$Inflow_i$ is the inflow to the given HWP category during year i; in Gg C yr^{-1}

ΔC_i is the carbon stock change during year i; in Gg C yr^{-1}

The starting year used to estimate the delayed emissions from the existing pools (inherit emissions) was 1900. In accordance with the 2013 KP Supplement and IPCC 2014, the calculations started in 1900 with a carbon stock $C_{(1900)}$ equal to 0.

The choice of expected lifetimes and thus of the half-lives for the HWP influences the size of the stock and thus the stock changes. However, the influence on the stock changes may be relatively small (depending on the pool characteristics), as the applied lifetimes influence both the size of the stock and the size of the outflow. Since these two are opposing effects, they may cancel each other out.

4.3. Allocation of HWP to activities

The calculation and accounting of HWP depends on its activity of origin.

- Decision 2/CMP.7 stipulates that HWP originating from Deforestation activities must be accounted for on the basis of instantaneous oxidation.
- HWP originating from Forest management and Afforestation shall be included in the HWP pool. HWP from Forest management is accounted for using a FMRL, HWP from Afforestation is accounted with a gross-net approach.

HWP originating from Deforestation was excluded from the pool by determining the fraction of the feedstock (roundwood for production of HWP) originating from deforestation using equation 2.8.3 in IPCC (2014):

$$f_j(i) = \frac{harvest_j(i)}{harvest_{total}(i)}$$

Where:

$f_j(i)$ is the share of the harvest originating from activity j in year i

$harvest_j(i)$ is the harvest originating from activity j in year i

$harvest_{total}(i)$ is the total harvest from all activities in year i

As total harvesting data could not be separated, no data on harvest originating specifically from Afforestation activities was available. It was assumed, in accordance with IPCC (2014) that all wood entering the accounting framework originated from Forest management. This is a realistic assumption because, taking into account the average age, species composition and growth rates of Afforestations since 1990 in Switzerland, the wood originating from thinnings of Afforestations is used as energy

wood and the present production of industrial roundwood on afforested areas is expected to be minimal.

4.4. Estimation of annual fraction of HWP from domestic harvest

Decision 2/CMP.7 stipulates that only HWP produced domestically may be included in the HWP pool of the reporting country, i.e. the HWP must originate from trees harvested and processed in the reporting country. This means that the domestic production must be divided: one part produced from domestically harvested wood, and one part produced from imported roundwood. Furthermore the share produced from domestically harvested wood must be divided into domestically used HWP and exported HWP, as it is only the former that may be accounted for.

In order to estimate the annual fraction of HWP originating from domestic harvest equation 2.8.1 in IPCC (2014) was used for the categories sawnwood and wood-based panels:

$$f_{IRW}(i) = \frac{IRW_p(i) - IRW_{EX}(i)}{IRW_p(i) + IRW_{IM}(i) - IRW_{EX}(i)}$$

Where:

$f_{IRW}(i)$	is the share of domestically harvested and consumed industrial roundwood (feedstock) to the total domestic consumption of industrial roundwood in year i
$IRW_p(i)$	is the production of roundwood in year i; in Gg C yr^{-1}
$IRW_{IM}(i)$	is the import of roundwood in year i; in Gg C yr^{-1}
$IRW_{EX}(i)$	is the export of roundwood in year i; in Gg C yr^{-1}

$f_{IRW}(i)$ was estimated separately for sawnwood conifer and non-conifer. For wood-based panels an average share of domestic feedstock based on the determined roundwood consumption was used. The share was calculated for the period after 1961; for previous years (1900-1960) an average of the first 10 years (1961-1970) was applied.

Using equation 2.8.4 in IPCC (2014), the produced amount of HWP of each category ($HWP_p(i)$) was be multiplied with this ratio in order to obtain the part of HWP produced from domestic harvest ($HWP_j(i)$).

$$HWP_j(i) = HWP_p(i)\ x\ f_{DP}(i)\ x\ f_j(i)$$

Where:

$HWP_j(i)$	is the HWP amount produced from domestic harvest associated with activity j in year i; in Gg C yr^{-1}
$f_{DP}(i)$	is the share of domestic feedstock for the production of the particular HWP category originating from domestic forests in year i
$HWP_p(i)$	is the production of the particular HWP commodities (i.e. sawnwood, wood-based panels, and paper and paperboard) in year i; in Gg C yr^{-1}

5. Data

5.1. Model parameters

5.1.1. Emissions factors – half-life

In accordance with the Tier 2 approach default values on half-lives are used (Table 2.8.2 in IPCC 2014):

- Sawnwood 35 years
- Wood-based panels 25 years
- Paper and Paperboard 2 years

5.1.2. Carbon conversion factors

For the conversion of wood volume or weight into carbon the following conversion factors, including IPCC default values (Tier 2; Table 2.8.1 in IPCC 2014) are used:

- Sawnwood conifer 0.225 Mg C/m^3
- Sawnwood non-conifer 0.280 Mg C/m^3
- Fibreboard compressed 0.315 Mg C/m^3
- Hardboard 0.335 Mg C/m^3
- Insulating Board 0.075 Mg C/m^3
- Medium density fibreboard MDF 0.295 Mg C/m^3
- Particle Board 0.269 Mg C/m^3
- Plywood 0.267 Mg C/m^3
- Veneer Sheets 0.253 Mg C/m^3

5.2. Activity data

Historical data on production, import and export of roundwood and SFWP were available from two sources:

- FAO forest product statistics (FAOSTAT) for the period 1961-2014, that cover data on production, import and export of roundwood and SFWP;
- National statistics: saw mill statistics (production of sawnwood), surveys of the wood processing industries (production of wood panels), felling statistics (production of roundwood), foreign trade statistics (share of industrial roundwood and wood products).

The activity data (production and trade of sawnwood, wood-based panels and paper and paperboard) were derived principally from the FAOSTAT. This data set, including also outliers, was verified and corroborated with data from national statistics. To estimate the HWP contribution for the period prior to 1961, historical production data and data from national statistics were used, rather than data going back to 1900 to avoid overestimation of the HWP pool.

5.2.1. FAOSTAT

FAOSTAT is the statistical office of the FAO. Its database includes statistical data on production, import and export of roundwood and SFWP as reported by member states. Therefore using FAOSTAT data for the calculation of inflow to the HWP pool would be an obvious choice - if the data meets the requirements on transparency and validation as outlined in IPCC (2014). Swiss data in the FAOSTAT database is mostly based on primary data from the Federal Statistical Office. As production data on SFWP are not available from the Federal Statistical Office, FAOSTAT data on SFWP originates from other sources like national historical data research.

5.2.2. National statistics

The Federal Statistical Office produces primary statistics both in monetary value and physical units. Relevant for HWP estimates were the statistics on harvest in the forest, on the sawnwood production, and statistics on international trade of roundwood and SFWP. The statistics on the production of wood based panels are collected and managed by the Federal Office for the Environment.

5.2.2.1. Felling statistics – production of roundwood

The statistics on the annual harvest in the forest is based on a questionnaire sent out by the Federal Statistical Office (SFSO) to all forest owners (FOEN 2016b). The data are considered quite reliable, although the collection method results in an underestimation of the harvest. Since there is a methodological discrepancy between the SFSO felling statistics and the NFI wood harvest estimates, the harvest level reported in the NFI was considerably higher than the one reported by the felling statistics. A study was carried out in order to correct and improve the statistical data. Consequently, the results produced by the Federal Statistical Office were corrected, resulting in an increase of about 20% in the reported annual harvest figures (Hofer et. al. 2009).

5.2.2.2. Wood processing statistics – production of sawnwood

The wood processing survey covers all production data of sawmills over the marketing year (SFSO 2016a). Annual sawnwood production is reported in m^3. Also the utilization of the residual wood as energy wood (in own enterprise or by third parties), as paper, pulp and panels is calculated on the basis of these statistics. The wood processing statistics are not calculated on an annual basis, rather a full survey of sawmill production data is carried out every 5 years. The data quality is considered as good, and data are available since 1951.

5.2.2.3. The production of wood-based panels

The production of wood-based panels in Switzerland is shared by only two companies, one of which produces particleboard and the other various forms of fibreboard (FOEN 2017a). The Federal Office for the Environment sends a form to the companies annually in order to collect data on production and share. Since 2010, export figures are no longer published for data protection reasons and have to be estimated.

6. Results: HWP originating from Forest management

6.1. Carbon stock, inflow and outflow

In this section the development of the carbon stock in HWP originating from Forest management is described.

6.1.1. Production and share of roundwood from domestic harvest

Figure 1 shows the production and share of roundwood for Switzerland, 1990-2016. In 1990 (storm Vivian) and in 2000 (storm Lothar), storms ravaged Swiss forest. In 2000, the winter storm Lothar doubled total harvesting amount due to salvage logging. Since 2007, wood harvest is decreasing. The quantities of exported roundwood were closely correlated with those of production, as on average 30% of roundwood produced was exported. The import of roundwood in Switzerland played a marginal role, contributing approximately 8% of total roundwood production.

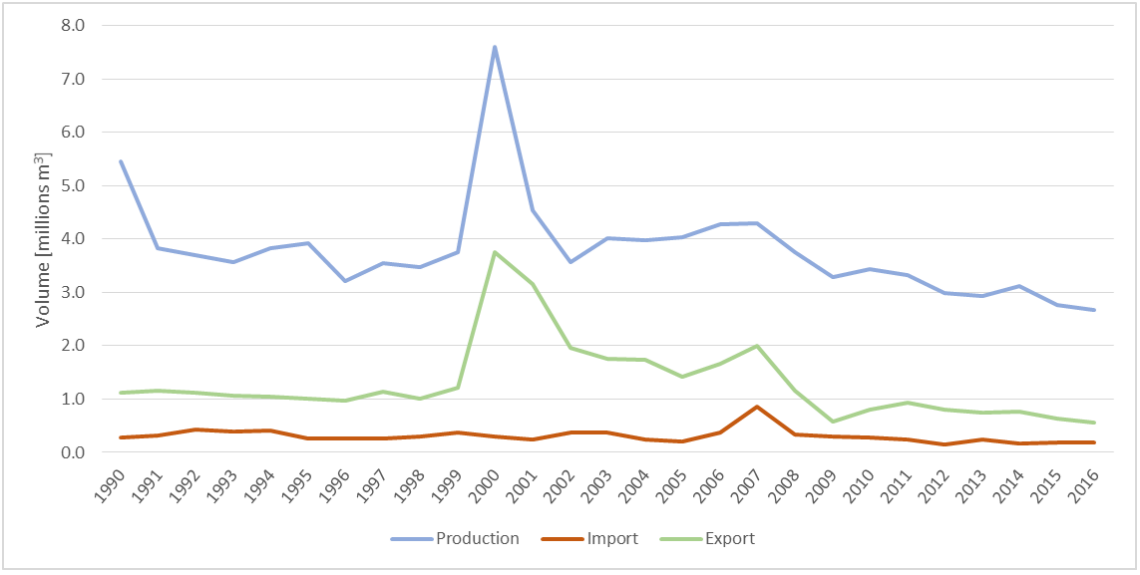

Figure 1: Production, export and import of roundwood; 1990-2016.

The development of the fraction of the roundwood feedstock originating from domestic harvest for producing HWP from 1990 to 2016 is given in Figure 2. For coniferous roundwood the fraction was steady between 90 and 95%, for non-coniferous roundwood it was lower; however since 2009 the fraction came close to 90%.

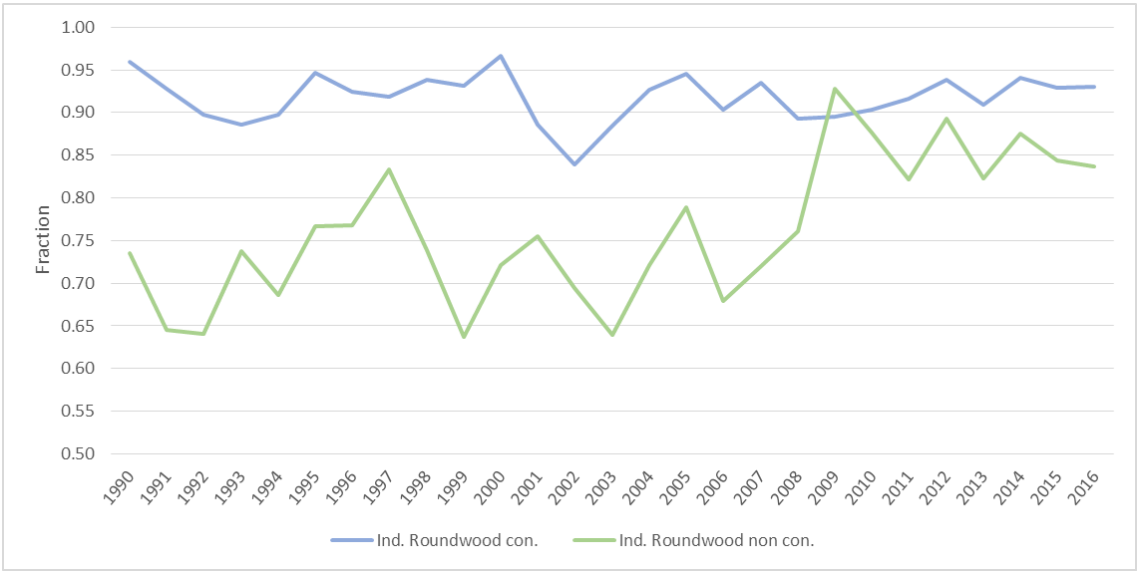

Figure 2: Fraction of the feedstock for production of HWP coming from domestic harvest; 1990-2016, specified for coniferous (industrial roundwood coniferous) and non-coniferous (industrial roundwood non coniferous).

6.1.2. Inflow and outflow

Figure 3 shows the production of sawnwood and panels from Swiss wood industries and paper and paperboard for the years 1900 to 2016. The production of sawnwood increased until 1990. Since then, an inverse trend of decreasing production started and remains until today. The two product categories had opposing trends over the last 26 years: while panel production continued increasing over this period by 2.8%, the production of sawnwood registered a decreasing trend of about 2.2%. The production of paper and paperboard remained stable over this period. The average total production modelled since 1990 is about 1'284'000 m^3 yr^{-1} for sawnwood, about 780'000 m^3 yr^{-1} for panels, and respectively for paper and paperboard about 435'000 tonnes yr^{-1}.

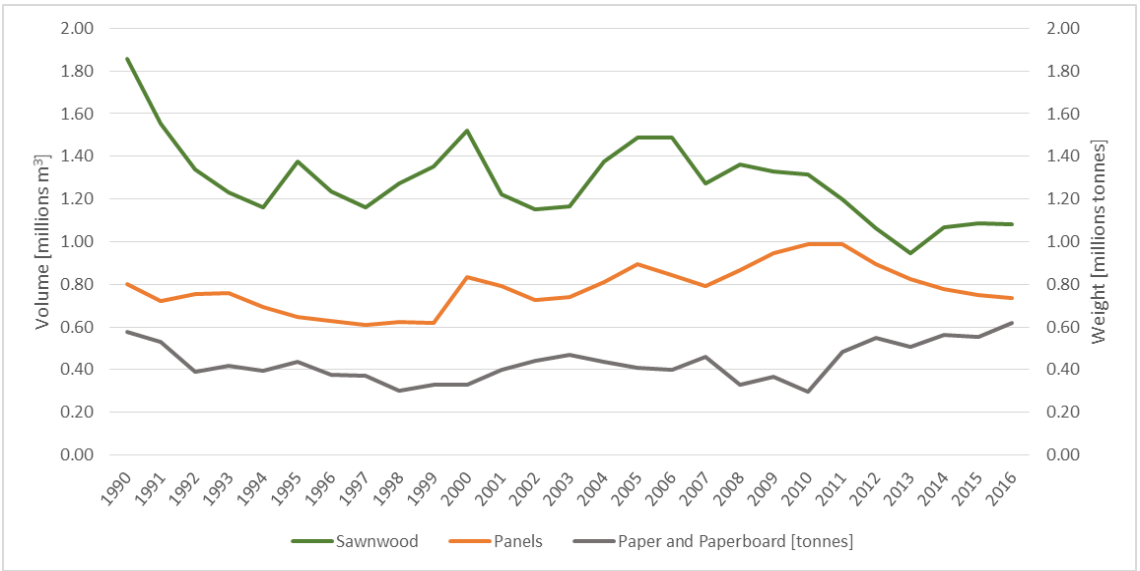

Figure 3: Production of HWP from domestic harvesting (sawnwood, panels and paper and paperboard); 1900-2016.

The inflow to and the outflow from the HWP pool for the two categories sawnwood and panels are shown in Figure 4. Similar to the trend in production, the inflow to the sawnwood pool was decreasing after 2005. Also the effects of the storms Vivian (1990) and Lothar (2000) can be distinguished. In 2012 the sawnwood inflow dropped below the estimated outflow and remained lower until 2016. The inflow rate for panels was slightly increasing from 1990 to 2010 and afterward there was a gradually decreasing trend but always higher than outflow. If the trend observed between 2011 and 2016 will continue, the inflow rate for panels is expected to drop below outflow in the near future.

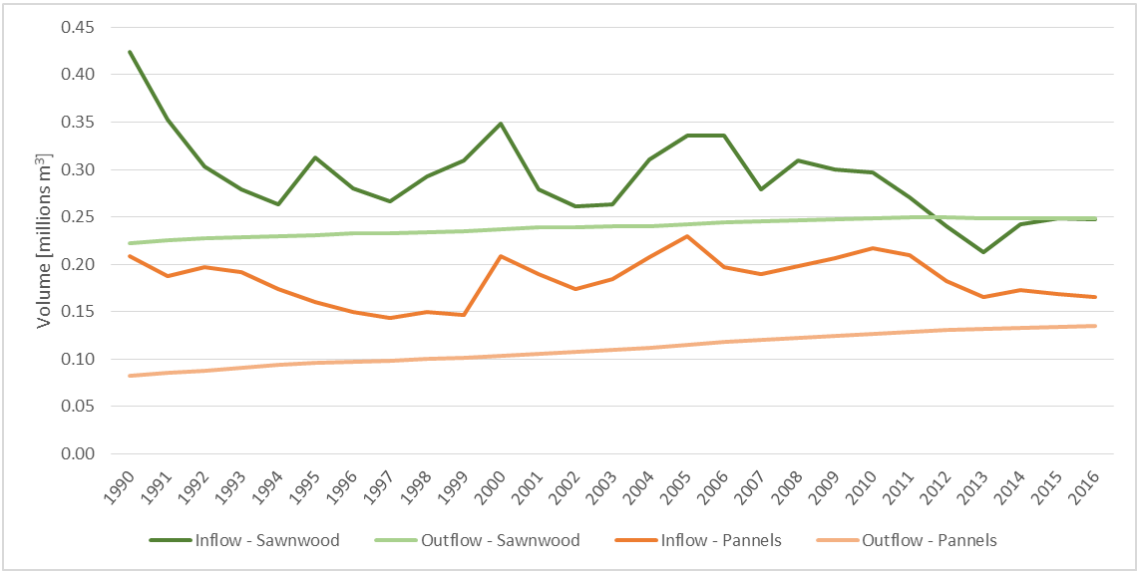

Figure 4: Inflow in and outflow from the HWP pool for the categories sawnwood and panels; 1990-2016.

Figure 5 and table 1 show the development of the carbon stock changes for the categories sawnwood, panels and paper and paperboard between 1990 and 2016. Until 1991, sawnwood was the dominant category for the HWP pool. However, wood-based panels *increased steadily* and since 2001 their contribution is higher than that from sawnwood. The value for paper and paperboard fluctuates and between 1990 and 2011 represents about 10-20% of the total HWP emissions/removals. Since 2012 the contribution of this category is becoming more important with 30 to 50% of the HWP total.

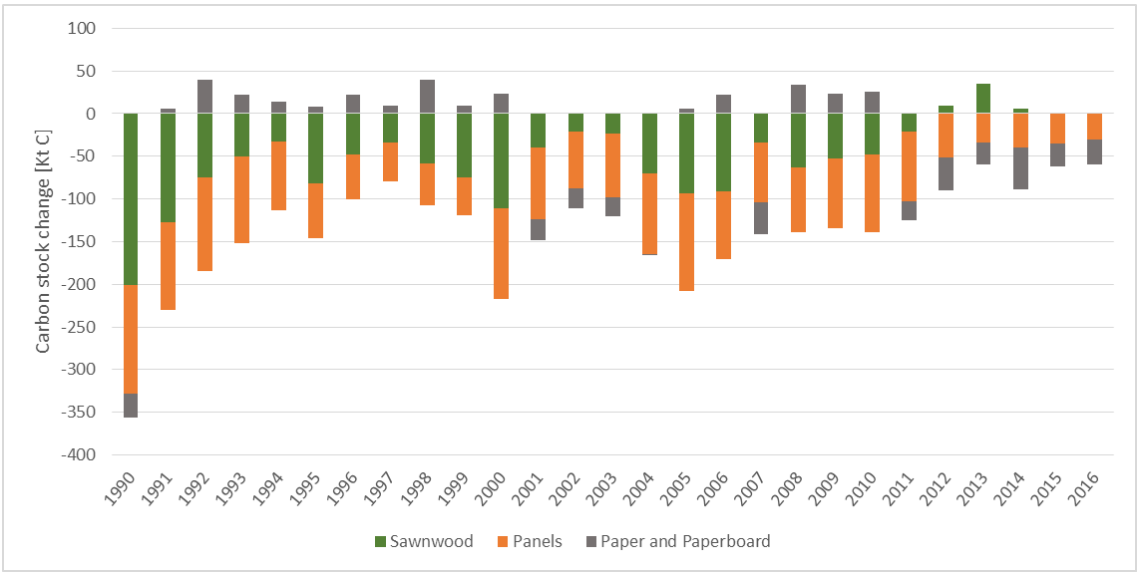

Figure 5: Carbon stock changes from HWP (positive values refer to emissions, negative values refer to removals) between 1980 and 2016 originating from land under Forest management.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	Kt C									
Saw nw ood	-201.4	-127.3	-75.2	-50.4	-33.2	-81.3	-47.5	-33.7	-58.2	-74.3
Panels	-127.0	-102.6	-109.3	-101.0	-80.3	-64.7	-52.9	-45.2	-49.4	-45.3
Paper and Paperboard	-27.5	5.4	39.8	21.7	14.4	8.5	22.3	9.3	39.2	9.4
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	Kt C									
Saw nw ood	-111.4	-40.0	-21.6	-23.6	-69.7	-94.0	-91.4	-34.1	-62.8	-52.6
Panels	-105.7	-83.5	-65.8	-74.3	-94.8	-114.0	-79.5	-69.5	-75.9	-82.2
Paper and Paperboard	23.7	-24.6	-23.9	-22.3	-0.9	6.2	22.5	-37.4	33.4	22.9
	2010	2011	2012	2013	2014	2015	2016			
	Kt C									
Saw nw ood	-47.9	-21.1	9.4	35.5	6.3	-0.1	1.0			
Panels	-90.6	-81.1	-51.3	-33.8	-40.0	-34.5	-30.0			
Paper and Paperboard	25.3	-22.9	-38.2	-26.2	-48.2	-27.3	-29.2			

Table 1: Carbon stock changes from HWP (positive values refer to emissions, negative values refer to removals) between 1990 and 2016 originating from land under Forest management. HWPs originating from Deforestation were calculated using instantaneous oxidation; there are no HWPs from Afforestation.

The inflow in 2016 was reported by including about 640 kt C, which is distributed between 247 kt C from the production of sawnwood, 165 kt C from the production of wood-based panels, and 228 kt C from the production of paper and paperboard. The outflow from the pool is reported to be about 582 kt C in 2016 which is distributed between 248 kt C from sawnwood, 135 kt C from wood-based panels, and 199 kt C from paper and paperboard. This means that the net carbon sequestration in HWP was about 58 kt C in 2016 divided into a net emission of 1 kt C from sawnwood, a net sequestration of 30 kt C from wood-based panels and a net sequestration of 29 kt C from paper and paperboard.

6.2. Uncertainty

This section provides an overview of the uncertainties related to the results of this reporting. The uncertainty related to the choice of SFWP to account for the HWP contribution to the overall carbon stock will not be discussed.

6.2.1. Uncertainty in methods

Uncertainty in methods relates to the choice of model to describe the development of the HWP pool over time. The Tier 2 method “first order decay” used is “assumed to be a good proxy for the decay of semi-finished wood products” (IPCC 2014 – page 2.132). However, the behaviour of the HWP pool may also possibly follow a different decay function.

6.2.2. Uncertainty of half-lifes

The 2006 IPCC Guidelines indicate an uncertainty of about 50% on the default half-life parameter (IPCC 2006, Vol. 4, Table 12.6).

6.2.3. Uncertainty on activity data

According to IPCC (2014, chp. 2.8.6) uncertainty on activity data is caused by: a lack of time series, definitional uncertainties, limited resources for data collection, reporting errors and missing subcategories. These points in general refer to different kinds of measurement uncertainty. In addition, statistical uncertainty may also be included if data acquisition is based on statistical sampling. According to the expert judgment of authors of the 2013 KP Supplement, uncertainty on the reported values on inflow may lie between -25% and + 5%. In other words underreporting is likely.
Regarding data from national Statistics (FOEN 2017b, SFSO 2017c) and FAOSTAT, the relevant uncertainty refers to the reporting of roundwood and the following conversion to sawnwood. Errors on reporting and limitations on data collection are probably the most important factors, as well as statistical uncertainty on the estimation of the annual harvest. Regarding the “Survey by the Wood Panels Industry” (FOEN 2017a), uncertainty is related to the companies’ ability to report correct

volumes and the overall coverage of the wood industry. This uncertainty can be limited by cross-validation on roundwood consumption and the results of the production.
Regarding the default conversion factors, the 2006 IPCC Guidelines (IPCC 2006, Vol. 4, Table 12.4) indicate an uncertainty of about +/- 25% on the conversion from volume to biomass and about +/- 10% on the conversion from biomass to carbon.

7. Planned improvements and considerations related to UNFCCC reviews

7.1. HWP from Paper and paperboard

In response to UNFCCC (2018/ID#KL.7), the available data from the FAOSTAT database will be used to calculate the contribution of paper and paperboard to the HWP pool and report in the next submission. However, for the calculation there are some methodological challenges, such as how to determine the amount of domestic pulp wood contained in recycled products. Therefore, a study will be carried out to obtain additional national activity data on paper and paperboard to improve the calculation of the contribution of this pool

7.2. Accounting of exported HWP

In response to UNFCCC (2018/ID#KL.8), the notation key “IE” for exported HWP instead of using “NA” will be entered in Table 4(KP-I)C.
Exported HWP are not quantified separately and thus included in total HWP from domestic harvest ($HWP_j(i)$ in chp. 4.4).

7.3. Exclusion of exported roundwood

In response to UNFCCC (2018/ID#KL.9), in order to estimate the annual fraction of HWP originating from domestic harvest 2013 KP Supplement Equation 2.8.1 (IPCC 2014) is used. By the application of this equation the amount of exported roundwood will be automatically excluded.

7.4. Uncertainty estimates of used values for half-lives

The 2006 IPCC Guidelines indicate an uncertainty of about 50% on the default half-life parameter (IPCC, 2006, Vol. 4, Table 12.6). In order to better understand the importance of the influence of the uncertainty on half-life, an assessment using a sensitivity analysis of the outflow from the HWP pool will be conducted in 2018-19.

7.5. TCCCA criteria and verification: specific information for UNCFFF/KP reviewers

This Chapter will be available for the next submission.

8. References

Hofer P., Altwegg J., Schoop A. 2009: Klären von Differenzen zwischen Holznutzungsmengen nach Forststatistik und Landesforstinventar. Studie im Auftrag des Bundesamts für Umwelt BAFU.

IPCC, 2006: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan.

IPCC, 2014: 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol, Hiraishi, T., Krug, T., Tanabe, K., Srivastava, N., Baasansuren, J., Fukuda, M. and Troxler, T.G. (eds) Published: IPCC, Switzerland.

UNFCCC, 2012: Report of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its seventh session, held in Durban from 28 November to 11 December 2011.

UNFCCC, 2018: Report on the individual review of the annual submission of Switzerland submitted in 2017. Note by the expert review team. FCCC/ARR/2017/CHE.

Data bases:

FAOSTAT: Forestry production and trade, [online], Food and agricultural organization of the United Nations - Statistics Division.
http://faostat3.fao.org/download/F/FO/E

FOEN 2017a: Industrieholzerhebung, Holzplattenwerke und Papier/Kartonfabriken. Federal Office for the Environment, Bern.

FOEN 2017b: Jahrbuch Wald und Holz 2017. Umwelt-Zustand Nr. 1718. Federal Office for the Environment, Bern. https://www.bafu.admin.ch/dam/bafu/de/dokumente/wald-holz/uz-umwelt-zustand/jahrbuch-wald-und-holz-2017.pdf.download.pdf/jahrbuch-wald-und-holz-2017.pdf [German]

SFSO 2017c: Eidg. Holzverarbeitungserhebung, Rundholzeinschnitt in m3. Federal Statistical Office, Neuchâtel.

SFSO 2017d: STAT-TAB: interactive database; data cube 07 – agriculture and forestry, Wood harvest in Switzerland, in m3. Federal Statistical Office, Neuchâtel.
https://www.bfs.admin.ch/bfs/en/home/statistics/catalogues-databases/data.assetdetail.3104447.html