

Submission under the United Nations Framework Convention on Climate Change and the Kyoto Protocol 2023

National Inventory Report for the German Greenhouse Gas Inventory 1990 – 2021



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Table 432:Comparison of area data [kha] for the Other Land category as reported in the
current and previous year's submissions

CRF No.	Area [kha]	Submission	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
4.F	Other Land	2022	67.59	62.36	57.14	46.06	41.22	38.66	38.16	37.66	37.16	36.66	36.16
		2023	66.80	61.46	56.31	46.64	41.96	39.69	39.22	38.78	38.34	37.91	37.50
		Difference	-0.80	-0.91	-0.83	0.58	0.74	1.03	1.06	1.12	1.18	1.25	1.34
		in %	-1.2%	-1.5%	-1.5%	1.2%	1.8%	2.6%	2.7%	2.9%	3.1%	3.3%	3.6%

6.9.6 Category-specific planned improvements (4.F)

Not applicable, since no greenhouse-gas sources and sinks are reported in this category.

6.10 Harvested wood products (4.G)

6.10.1 Category description (4.G)

КС	Category	Activity	EM of	1990 (kt CO ₂ -eq.)	(fraction)	2021 (kt CO ₂ -eq.)	(fraction)	Trend 1990-2021
L/T	4 G, Harvested Wood Products		CO2	-1,330.4	-0.1 %	-8,651.3	-1.1 %	550.3 %
	Gas	M	ethod used	Sourc	ce for the activ	vity data	Emission fac	tors used
	CO ₂		CS/Tier 2		IS/NS		D	

The source category Harvested Wood Products (HWP) is a key category in terms of emissions level and trend.

The contribution of HWP in land-use sectors in Germany, in terms of greenhouse emissions by sources and removals by sinks, was estimated with the WoodCarbonMonitor model (Rüter, 2017), via an approach based on production data for wood products, and using the prescribed calculation approach. The estimate covers all HWP that are produced in Germany and which consist of wood originating from domestic harvest that is used as material (not energy).

For reasons of consistency, the calculation conforms to the methods prescribed in Chapter 2.8 of the 2013 IPCC KP Supplement (IPCC et al., 2014a) since, pursuant to Footnote 12 in CRF Table 4.G-s1 in Annex II of Decision 24/CP.19 on revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention¹²⁹ (UNFCCC, 2014b), the approach chosen (approach B) may refer either to the 2006 IPCC Guidelines (IPCC, 2006b) or to any other IPCC methodological guidance reflecting this approach. The system boundaries described in the rules of the 2013 IPCC KP Supplement (IPCC et al., 2014a) for estimating the HWP contribution are consistent with the system boundaries of the approach referred to in Table 12.1 of the 2006 IPCC Guidelines (IPCC, 2006b) as "variable 2A" (production approach for wood products for material use).

In the interest of transparency, pursuant to CRF Table 4.Gs1, wood products for material use are divided into products that, following their production, are consumed in Germany, and products that have subsequently been exported. The carbon storage effect of wood in solid waste disposal sites is not taken into account. The biomass from short-rotation plantations is used exclusively for energy purposes in Germany (cf. category 1.A, Chapter 3.2), and is thus not reported under Harvested Wood Products (HWP).

At the time this report was prepared (09/2022), the defined routine inventory-preparation procedure (cf. Chapter 1.2.3) had not yet reached the point at which the activity data needed for

¹²⁹ Footnote 12 of CRF table sheet 4.G-s1

calculation of HWP would be available (cf. (FAO, 2022a)). For this reason, the time series for CO₂ emissions and removals in HWP were carried forward for the year 2021 (cf. Figure 83).



Figure 83: Net CO₂ emissions and removals in HWP (in kt CO₂)

(Domestically produced and used HWP; Domestically produced and exported HWP; Total)

Figure 84 presents an overview, of the 2020 report year, of the carbon flows linked to forest and wood use that are reported as "gains" and "losses" in the defined carbon pools for forests (here: only living biomass (3); cf. Chapter 6.4.2.2) and harvested wood products (4). The atmospherically relevant CO_2 emissions, and their removals (living biomass 1 and harvested wood products 2), are determined on the basis of the changes in these defined stocks.

Figure 84: Carbon flows and carbon stocks, and their CO₂ emissions and removals throughout the Forest Land / harvested wood products chain



^c basierend auf der StBA-Holzeinschlagstatistik (Stamm- und Industrieholz) in Erntefestmeter (m³)

^d basierend auf Differenz zw. StBA-Holzeinschlagstatistik (Stamm- und Industrieholz) und inventurdatenkalibriertem Gesamtholzeinschlag in Vorratsfestmeter (Vfm) (vgl. Abb. 70)

^e am Ende des Berichtsjahres (WALD: basierend auf den Daten der Kohlenstoffinventur 2017 (Cl 2017), s. <u>www.bwi.info</u>) WoodCarbonMonitor © S. Rüter, 2021

Furthermore, both increases (5) of living biomass stocks in forests (i.e. on existing Forest Land and on forest lands subject to land-use changes) and their decreases are shown. The related carbon flows differentiate between roundwood harvest for the subsequent manufacturing of HWP (6) and b) removals of biomass which are primarily due to an energetic use (7) of wood.

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Carbon-stock decreases due to roundwood harvest for its material use are estimated on the basis of logging data (Statistisches Bundesamt, FS 3, R 3.3.1) on the production of stem-wood (i.e. sawlogs and veneer logs) and further industrial roundwood. The data are broken down into five main tree-species / wood-type groups and are reported in cubic metres of harvested timber. Carbon-stock decreases of the living biomass pool in forests that are primarily due to wood energy use and which are not reported under HWP (production approach), in addition to logging-statistics data on the production of fuel wood, also comprise data on non-commercialised wood and standing timber losses of reserve solid cubic metres that are not covered in this statistics. The latter (timber losses), which were determined within the scope of the 2017 Carbon Inventory (CI2017), serve as a basis for the calibration of the logging statistics, by main-tree-species groups, that is described in Chapter 6.10.2.1.

The calculation of the carbon flows (8 and 9) associated with the carbon stock in HWP as well as the resulting changes of the stock that are reported in CRF Table 4.Gs1 are described in the following Chapter 6.10.2.

6.10.2 Methodological issues (4.G)

6.10.2.1 Activity data

At the time this report was prepared (09/2022), the activity data necessary for calculation relative to HWP for the year 2021 were not yet available in the FAOSTAT database (FAO, 2022a). For this reason, the previous year's data were used in describing the method applied to the time series from that source.

Figure 85 shows the development of production quantities in the semi-finished product categories sawnwood and wood-based panels since 1990, broken down by the wood quantities remaining in Germany (production, less exports) and the quantities exported (exports) according to the data of the Food and Agriculture Organization of the United Nations (UN FAO) (FAO, 2022b). These time series correspond to the data proposed in the 2006 IPCC Guidelines (IPCC, 2006b) for estimation of the HWP contribution following the Tier 1 methodology (Chapter 12.2.1 IPCC (2006b): 12.9).



Figure 85: Sawn wood and wood-based panels produced in Germany [Mm³] (FAO, 2022b)

(Production of wood-based panels (in m³); Production of sawn wood (in m³); of this, quantity exported)

In line with the IPCC Guidelines, and in a first step, the feedstock fraction in HWP from domestically harvested wood was calculated. To this end, and in a first step, the national logging statistics covering the five main wood-type groups (Statistisches Bundesamt, FS 3, R 3.3.1) were calibrated with the Forest Inventory data on standing timber losses from forests (cf. Chapter 6.4.2.1.1), in accordance with the methodological guidlines of IPCC (2014a) (Figure 86), since

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the statistics underestimate the annual roundwood production by about 30 %. The reasons for this statistical underestimation of the wood harvest include the fact that some harvested raw wood is lost or is not used, and that some wood is used for firewood – for example, by private households (private, small-scale wood buyers). Such wood is not covered by the statistics. This calibration also ensures methodological consistency with the projected time series of the reported FMRL. Details on the further use of the time series on roundwood harvest calibrated with inventory data (which is expressed in millions of losses of reserve solid cubic metres), in keeping with the provisions of IPCC et al. (2014a), are provided in Rüter (2017).

Figure 86: National harvest statistics, and their calibration with forest-inventory data on solidwood losses [in millions of solid cubic metres], (Statistisches Bundesamt, FS 3, R 3.3.1) and Chapter 6.4.2.1.1



At the time this report was prepared (09/2022), the activity data necessary for calculation relative to industrial roundwood for the year 2021 were also not yet available in the FAOSTAT database. For this reason, a domestic feedstock factor $f_{DP}(i)$ for the semi-finished product categories sawnwood and wood-based panels was not determined.

In a second step, a domestic feedstock factor $f_{DP}(i)$ was then determined that, for the semifinished product categories sawnwood and wood-based panels, is based on FAO data on the feedstock category industrial roundwood. For the calculation of the fraction of the feedstock coming from domestic harvest in the product category paper and paperboard, the use of recovered paper in paper production was taken into account, in addition to the feedstock category wood pulp as proposed in the 2013 IPCC KP Supplement IPCC et al. (2014a), since the recovered paper-fraction in paper and paperboard that is produced in Germany exceeds 70 %. As in the previous reporting years, the fraction p of recovered paper used in paper products was determined by means of the proportion of the calculated consumption of wood pulp and recovered paper in Germany (cf. Chapter 6.10.5).

Along with the factors for industrial roundwood (fIRW) and wood pulp (fPULP), which were calculated using Equations 2.8.1 and 2.8.2 of the 2013 IPCC KP Supplement (IPCC et al. (2014a): 2.115), another factor for recovered paper was determined, via the same approach using FAO data (fRecP) (Figure 87). That factor was considered in the calculation of product fractions originating from domestic harvest by means of Equation 2.8.4 of the 2013 IPCC KP Supplement (IPCC et al. (2014a): 2.118) for the HWP category

$$f_{DP}(i) = \{f_{IRW}(i) * (1-p) * f_{PULP}(i)\} + p * f_{RecP}(i)$$

'paper and paperboard.'

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In a final step, the carbon contained in the products was allocated to the respective land-use classes from which the relevant feedstock originates (IPCC et al. (2014a): Chapter 2.8.1.2). For this purpose, the roundwood-harvest, calibrated with inventory data, can be assigned to Forest Land remaining Forest Land (source category 4.A.1, Chapter 6.2.1), and to those areas subject to land-use changes from Forest Land to other categories (cf. Table 433). In line with IPCC requirements, HWP from deforestation are taken into account on the basis of instantaneous oxidation (cf. Chapter 2.8.2. IPCC 2014a). In keeping with IPCC requirements, HWP from deforestation are taken into account on the basis of instantaneous oxidation (cf. Chapter 2.8.3. IPCC et al. (2014a)). Consequently, the annual share of harvest originating from managed forest areas fFM(i) can be calculated on the basis of the available inventory information for Germany and of Equation 2.8.3 (IPCC et al. (2014a): 2.116).

Table 433:	Annual wood-harvest fraction from Forest Land remaining Forest Land
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Time period	<i>f</i> _{FM} (<i>i</i>)
1990 – 2002	0.98989
2003 – 2007	0.99202
2008 – 2012	0.98881
2013 – 2017	0.98137

6.10.2.2 Emission factors

The carbon outflows from the carbon pool are calculated with the default values listed in Table 2.8.2 of the 2013 IPCC KP Supplement (IPCC et al., 2014a). Those values are based on the standard values given in Table 3a.1.3 of the 2003 IPCC GPG (IPCC, 2003).

6.10.2.3 Calculation method used

In order to calculate the contribution of HWP used as material to the delayed release of CO_2 emissions on the basis of carbon-stock changes, Germany uses the exponential decay function described in the IPCC Guidelines, in combination with the HWP categories described in Table 2.8.1 of the 2013 IPCC KP Supplement. That approach is in line with the standard method described in the 2006 IPCC Guidelines (Equation 12.1 IPCC (2006b): 12.11), as well as with the standard Tier 2 method described in the 2013 IPCC KP Supplement (Equation 2.8.5). For the carbon conversion calculation of the HWP category wood-based panels, the detailed factors, and for the HWP category paper and paperboard, the aggregated conversion factors listed in Table 2.8.1 (IPCC et al., 2014a) are used. The carbon quantities in the product categories non-coniferous and coniferous sawnwood are calculated by means of the factors described in Rüter (2011) (cf. also UNFCCC (2011)), in order to represent the tree species that are typically used in Germany for the production of sawnwood correlating with the roundwood-harvest statistics (Statistisches Bundesamt, FS 3, R 3.3.1). For coniferous sawnwood, the factor amounts to 0.225 t C/m⁻³, while for non-coniferous sawnwood it is 0.335 t C/m⁻³.

Time series of adequate data quality for HWP and the relevant feedstock categories are available only for the period since German reunification in 1990. For that reason, and in order to reduce

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the uncertainties associated with the activity data, the initial value of the carbon stock in HWP is calculated on the basis of Equation 2.8.6 (IPCC et al., 2014a), with $C(t_0) = 1990$.

Further, detailed information on the method used is provided in Rüter (2017).

6.10.3 Uncertainties and time-series consistency (4.G)

The time series for HWP activity data from the UN FAO database are consistent. At the time this report was prepared (09/2022), the defined routine inventory-preparation procedure (cf. Chapter 1.2.3) had not yet reached the point at which the activity data needed for calculation of HWP would be available (cf. (FAO, 2022a)). For this reason, the time series for CO_2 emissions and removals in HWP were carried forward for the year 2021.

6.10.4 Category-specific quality assurance / control and verification (4.G)

General and category-specific quality control and quality assurance have been carried out, in conformance with the requirements of the QSE manual and its associated applicable documents, by the relevant involved experts and the Single National Entity.

The WoodCarbonMonitor calculation model was previously used in 2011 to determine the HWP contribution to the reference level for the second commitment period under the Kyoto Protocol, for other EU Member States as well. Following cross-checking against their national data and any existing models, 16 additional countries used the data for their submissions to the Climate Secretariat (Belgium, Bulgaria, the Czech Republic, Denmark, Estonia, France, Greece, Hungary, Italy, Latvia, Lithuania, the Netherlands, Poland, Romania, Slovakia and Spain). Then, an international team of experts at the Secretariat evaluated those data together with the model and its underlying assumptions (Rüter (2011) and UNFCCC (2011)).

The subsequent adjustment of the reported time series to the HWP calculation rules pursuant to Decision 2/CMP.7 was also facilitated with the model within the framework of preparation of Chapter 2.8 "Harvested Wood Products" of the 2013 IPCC KP Supplement (IPCC et al., 2014a) (Rüter et al. (2014) and Rüter (2017); cf. Chapters 3.2.2 and 4.4 and the Annex).

In the context of evaluation of the EU Member States' reference-value projections pursuant to Regulation 2018/841 (European Parliament and Council of the European Union, 2018), the model was repeatedly used in 2019 in combination with the G4M model, in order to cross-check, on behalf of the EU Commission, the country-specific HWP calculations and their underlying data and assumptions (Forsell et al. (2018) and Forsell et al. (2019)).

Additional general information about the quality control (QC) and quality assurance (QA) that have also been carried out for HWP is provided in Chapter 6.1.3.

6.10.5 Category-specific recalculations (4.G)

At the time this report was prepared (09/2022), the activity data needed for calculation of HWP were not yet available in the FAOSTAT database (FAO, 2022a). For this reason, no category-specific recalculations were carried out.

6.10.6 Category-specific planned improvements (4.G)

Chapter 10.4, Inventory Improvements (Table 471), presents an overview of the improvements that previous reports have listed in this chapter. Improvements that have been completed are listed in Table 470 in the same chapter.

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