3D1 Harvested Wood Products (HWP)

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Background

- Much of the wood that is harvested from Forest Land, Cropland and other types of land use remains in products for differing lengths of time. Harvested Wood Products (HWP) constitutes a carbon reservoir and has impact to delay carbon release to atmosphere.
- The Revised 1996 Guidelines suggests an assumption of instant oxidation of wood in the year of harvest.
- Three alternative approaches to estimate carbon stock change in HWP have suggested so far. In the context of preparing the GHG inventory under the convention, UNFCCC has not reached a conclusion which approach should be used. Thus, the 2006GL includes the three approaches and treats them as equal manner.
- In the context of Kyoto Protocol LULUCF, the negotiation agreed to use Production Approach for their accounting.

Stock Change Approach

- Stock change approach estimates changes in wood carbon stocks in the forest pool and wood-products pool in the reporting country, including imported wood-products.

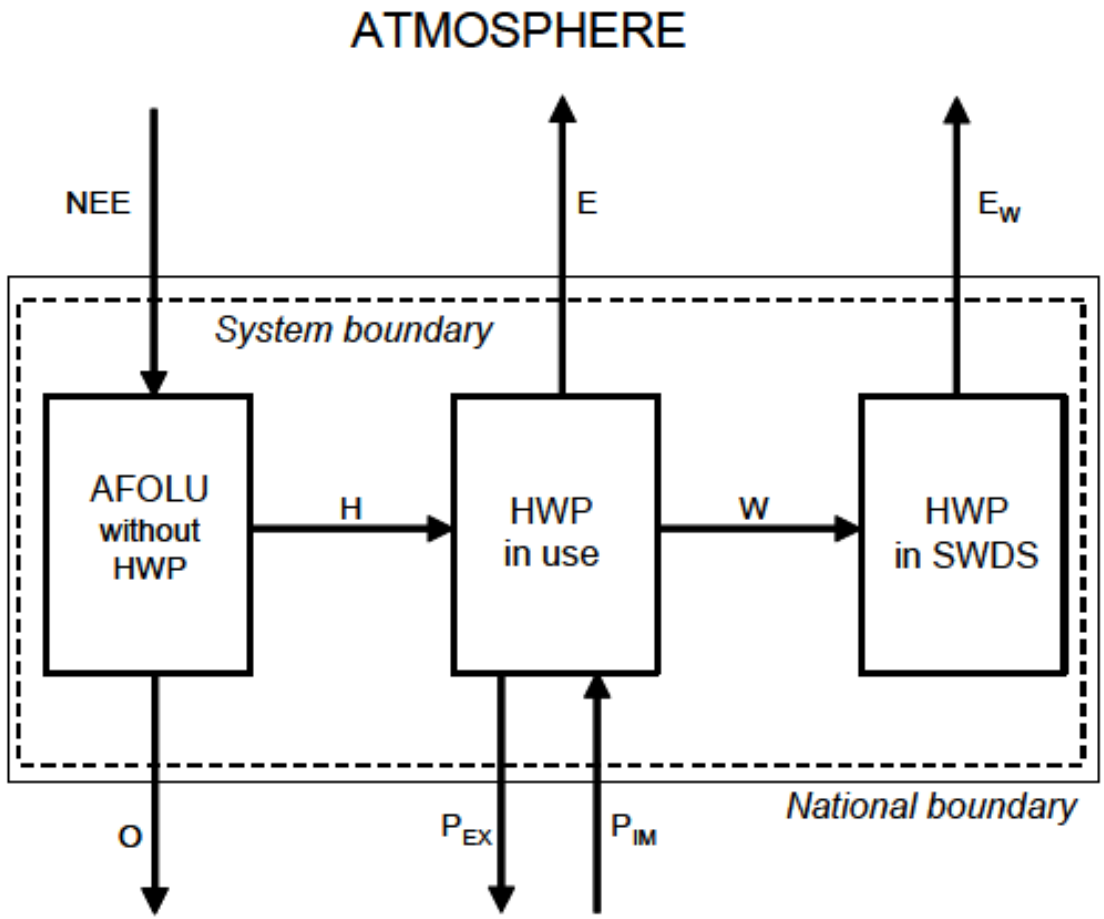


Figure 12.A.1 System boundary of the Stock-Change approach.

Note: NEE = net ecosystem exchange of carbon, E = carbon release to the atmosphere from HWP in use, E_W = carbon release to the atmosphere from HWP in SWDS, H = carbon transfer in the form of harvested wood biomass transported from harvest sites, W = carbon transfer in the form of wood waste into SWDS, P_{EX} = carbon transfer in the form of HWP exports, P_{IM} = carbon transfer in the form of HWP imports, O = possible other cross-border carbon transfers from rest of AFOLU (assumed zero here).

Atmospheric Flow Approach

- The Atmospheric Flow Approach estimates fluxes of carbon to/from the atmosphere for the forest pool and wood products pool within national boundaries, and reports where and when these emissions and removals occur.

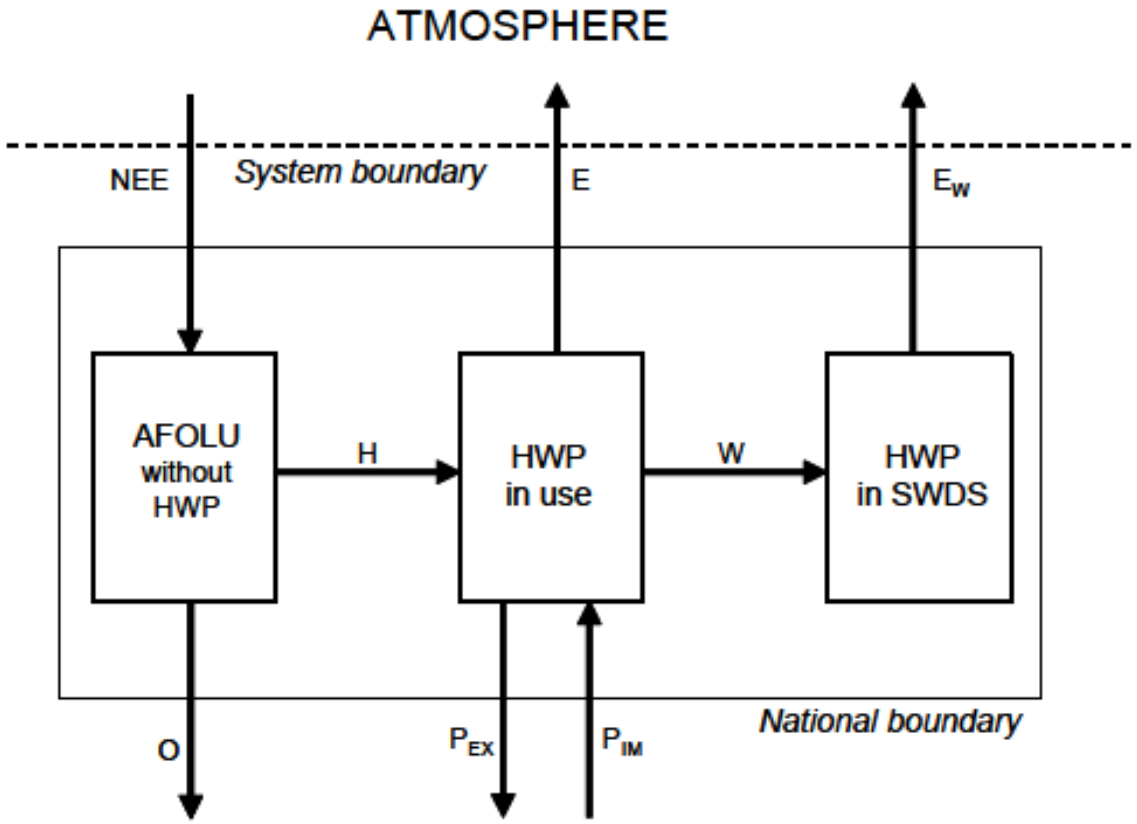


Figure 12.A.2 System boundary of the Atmospheric Flow Approach.

Note: NEE = net ecosystem exchange of carbon, E = carbon release to the atmosphere from HWP in use, E_W = carbon release to the atmosphere from HWP in SWDS, H = carbon transfer in the form of harvested wood biomass transported from harvest sites, W = carbon transfer of wood waste into SWDS, P_{EX} = carbon transfer in the form of HWP exports, P_{IM} = carbon transfer in the form of HWP imports, O = possible other cross-border carbon transfers from rest of AFOLU (assumed zero here).

Production Approach

- The Production Approach estimates changes in carbon stocks in the forest pool of the reporting country and the wood products pool containing products made from wood harvested in the reporting country.

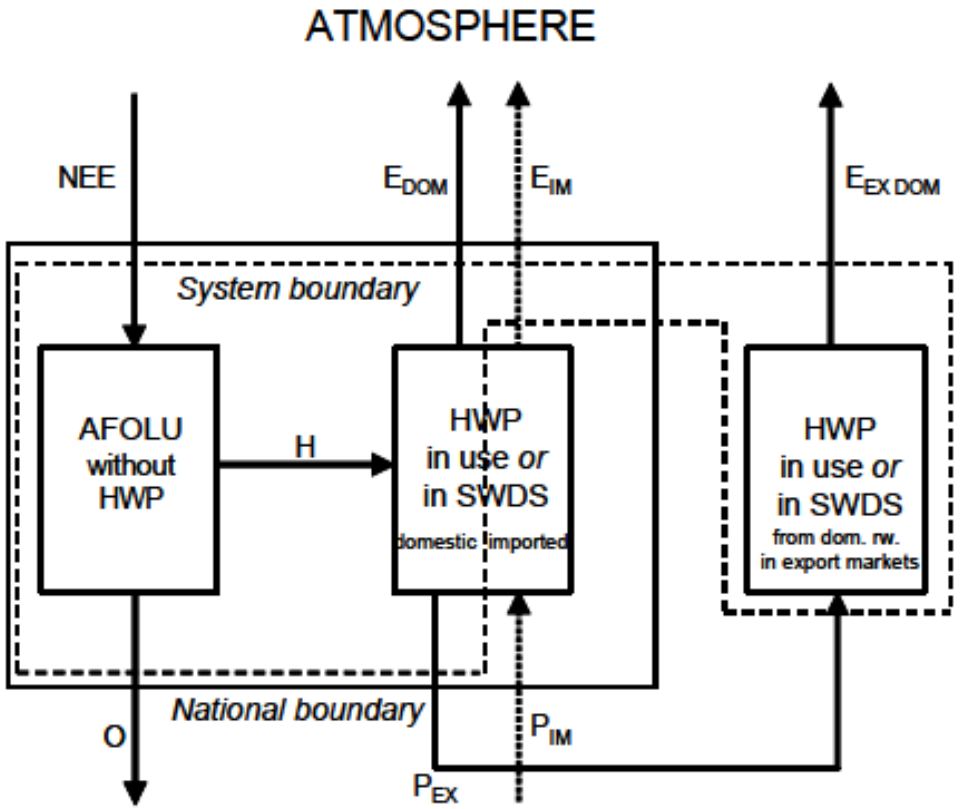


Figure 12.A.3 System boundary of the Production Approach.

Note: NEE = net ecosystem exchange of carbon, E_{DOM} = carbon release to the atmosphere from the pools of domestically grown HWP in use and in SWDS, E_{IM} = carbon release to the atmosphere from the pools of imported HWP in use and in SWDS, $E_{EX\ DOM}$ = carbon release to the atmosphere from the pools of domestically grown but exported HWP in use and in SWDS, H = carbon transfer in the form of harvested wood biomass transported from harvest sites, P_{EX} = carbon transfer in the form of HWP exports, P_{IM} = carbon transfer in the form off HWP imports, O = possible other cross-border carbon transfers from rest of AFOLU (assumed zero here). Note: Only those HWP in the export markets that are produced from domestic roundwood are within the system boundary, not those only processed in the reporting country but made from imported roundwood. The transfer P_{EX} can in principle include both.

Difference of the three approaches

Type of wood products	Stock Change	Atmospheric	Production
Domestically Produced and Domestically Consumed	Accounted with it's lifetime	Accounted with it's lifetime	Accounted with it's lifetime
Domestically Produced and Exported	Accounted as carbon loss	Accounted as implicitly carbon gain	Accounted with it's lifetime
Imported	Accounted as carbon gain	Accounted as implicitly carbon loss	Not accounted

Two situation

- HWP in-use (HWP IU)
  - Used as wood products

- HWP SWDS
  - Disposed at solid waste disposal site (SWDS) after completing its usage.
  - HWP SWDS is considered at higher tier, when the contribution of this pool is considered significant.

Valuables used HWP estimations

- Valuable 1 : Annual change of carbon in HWP of Domestic Consumption (including both domestically produced wood and imported wood)
  - Valuable 1A: ΔC_HWP_IU_DC
    - Carbon stock change in HWP in use for domestically consumed
  - Valuable 1B: ΔC_HWP_SWDS_DC
    - Carbon stock change in HWP in SWDS domestically consumed and disposed

- Valuable 2: Annual change of carbon in HWP of Domestic Harvest (domestically produced wood only, including exported)
  - Valuable 2A: ΔC_HWP_IU_DH
    - Carbon stock change in HWP in use for domestically produced
  - Valuable 2B: ΔC_HWP_SWDS_DH
    - Carbon stock change in HWP in SWDS domestically produced and disposed

Valuables used HWP estimations

- Valuable 3, P_{IM}: Amount of imported wood to the reporting country
- Valuable 4, P_{EX}: Amount of exported wood from the reporting country
- Valuable 5, H: Carbon in annual harvested roundwood for product in the reporting country

Methodological choice

- If the annual change in HWP stocks is insignificant, a party can report HWP contribution as zero.
- If contribution of SWDS is insignificant, set valuables 1B and 2B as zero
- If country specific data is not available, use FAO data with default parameters.
- Of course using CS data, methods are welcome.

- If Production approach is used (seems the most common approach now), a domestic production ratio must be estimated (Equation 12.3)

Calculation of annual change

- Default methods uses First Order Decay Function to represent HWP in use with the information of Half-life (30yr for solid waste, 2yr for paper as default) .
- Annual change is calculated by the comparison of previous year and current year.
- Since 1961, FAO data is available. Sometimes much later.
- The 2006GL suggests the starting year of estimate HWP stock since 1900. Need to back casting by the proposed method in the 2006GL. (U=0.0160 for USSR, 0.0151 for Europe)

EQUATION 12.6
EQUATION TO ESTIMATE PRODUCTION, IMPORTS OR EXPORT VARIABLES IN TABLE 12.5 FOR YEARS BEFORE 1961

$$V_t = V_{1961} \bullet e^{[U \bullet (t-1961)]}$$

Where:

V_t = annual production, imports or exports for a solidwood or paper product for year t, Gg C yr^{-1}

t = year

V_{1961} = annual production, imports or exports for a solidwood or paper product for the year 1961, Gg C yr^{-1}

U = estimated continuous rate of change in industrial roundwood consumption for the region that includes the reporting county between 1900 and 1961 (see Table 12.3), yr^{-1}

Calculation of annual change

EQUATION 12.1
ESTIMATION OF CARBON STOCK AND ITS ANNUAL CHANGE IN HWP POOLS OF THE REPORTING COUNTRY

Starting with $i = 1900$ and continuing to present year, compute

$$(A) \qquad C(i+1) = e^{-k} \bullet C(i) + \left[\frac{\left(1-e^{-k}\right)}{k}\right] \bullet Inflow(i) \qquad with \quad C(1900) = 0.0$$

$$(B) \qquad \Delta C(i) = C(i+1) - C(i)$$

Note: For an explanation of technique used in Equations 12.1A to estimate first-order decay see Pingoud and Wagner (2006).

here:

$i =$ year

$C(i)$ = the carbon stock of the HWP pool in the beginning of year i, Gg C

$k =$ decay constant of first-order decay given in units, yr^{-1} ($k = \ln(2) / HL$, where HL is half-life of the HWP pool in years. A half-life is the number of years it takes to lose one-half of the material currently in the pool.)

$Inflow(i)$ = the inflow to the HWP pool during year i, Gg C yr^{-1}

$\Delta C(i) =$ carbon stock change of the HWP pool during year i, Gg C yr^{-1}

Data needed

TABLE 12.5
UN FAO ACTIVITY DATA NEEDED FOR TIER 1 VARIABLES, AND DEFAULT CONVERSION FACTORS

Aggregate variable	FAO database variables needed to compute aggregate variable (m^3 for wood Gg for pulp and paper)	Time period (Inv. Yr = Inventory reporting year)	Carbon factor (Gg carbon per m^3 for wood products or per Gg for paper & pulp) (see Table 12.4 for values)
Variable 1A – Consumption of solidwood or paper products			
Production of solidwood products	Other industrial roundwood	1961- Inv. yr.	A
	Sawnwood	1961- Inv. yr.	A
	Wood panels	1961- Inv. yr.	C
Imports and exports of solidwood products	Other industrial roundwood	1961 - 1989	A
	Sawnwood	1961- Inv. yr.	A
	Wood panels	1961- Inv. yr.	C
Production of paper and paperboard from wood [see note 1 below]	Paper and paperboard – production (P_{PAPER})	1961- Inv. yr.	D
	Other fibre pulp – production (OFP_P), imports (OFP_{IM}), and exports (OFP_{IM})	1961- Inv. yr.	D
Imports and exports of paper and paperboard	Paper and paperboard	1961- Inv. yr.	D
Variable 2A – Production of solidwood and paper products from wood harvested in the reporting country			
Production of solidwood products from domestic harvest [see note 2 below]	Production of solidwood products as for Variable 1A above (P_{SW})	1961- Inv. yr.	A
	Industrial roundwood harvest (IRW_H), imports (IRW_{IM}), exports (IRW_{EX})	1961- Inv. yr.	A
	Chips and particles imports (CP_{IM}), and exports (CP_{EX})	1961-Inv. yr.	A

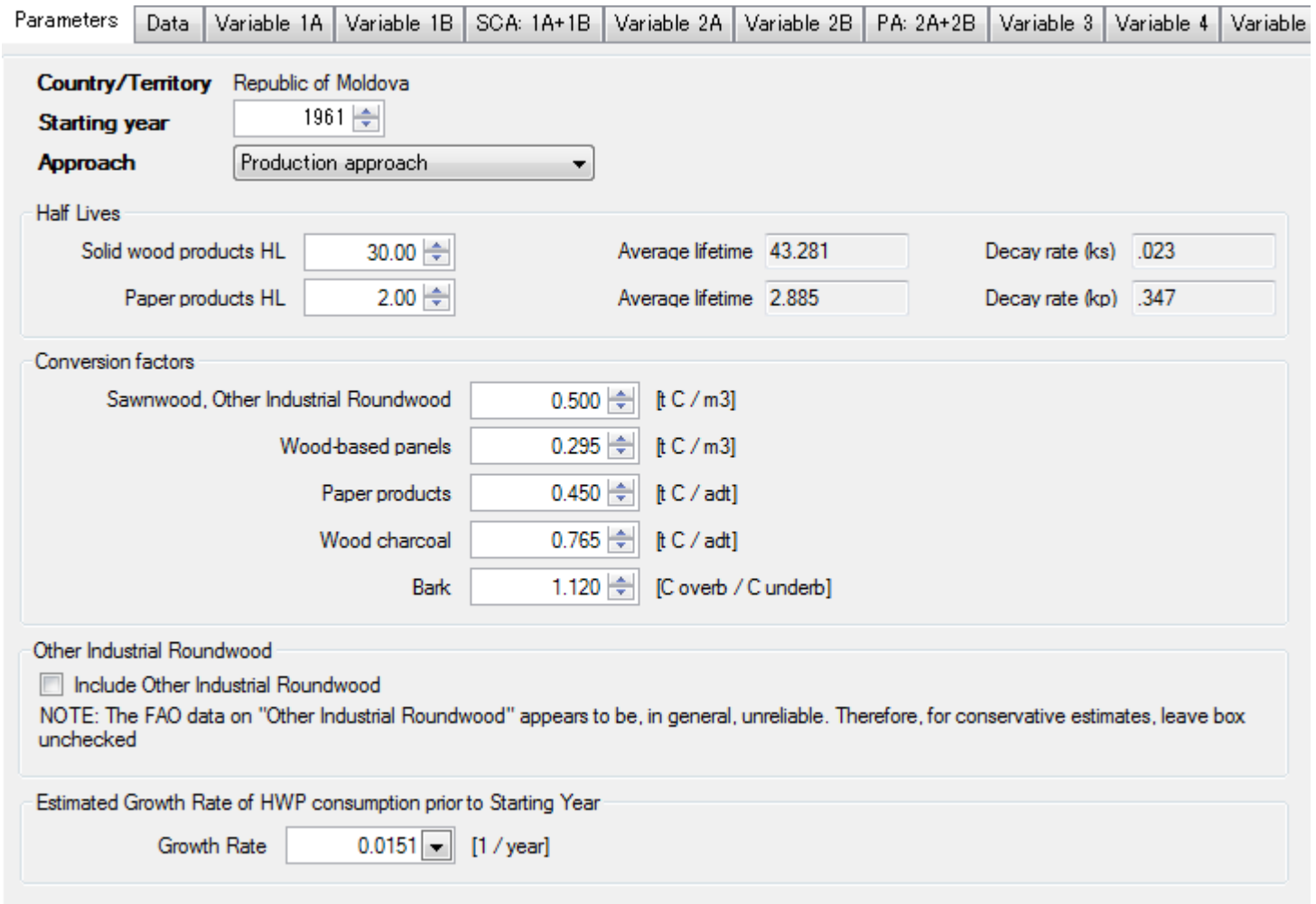
Data needed

TABLE 12.5
UN FAO ACTIVITY DATA NEEDED FOR TIER 1 VARIABLES, AND DEFAULT CONVERSION FACTORS

Aggregate variable	FAO database variables needed to compute aggregate variable (m^3 for wood Gg for pulp and paper)	Time period (Inv. Yr = Inventory reporting year)	Carbon factor (Gg carbon per m^3 for wood products or per Gg for paper & pulp) (see Table 12.4 for values)
Production of paper and paperboard from domestic harvest [see note 3 below]	Production of paper and paperboard products from as for Variable 1A above (P_{PAPER})	1961- Inv. yr.	D
	Industrial roundwood harvest (IRW_H), imports (IRW_{IM}), exports (IRW_{EX}) – same as above	1961- Inv. yr.	A
	Other fibre pulp – production (OFP_P), imports (OFP_{IM}), and exports (OFP_{IM})– same as above	1961- Inv. yr.	D
	Exports of wood pulp, recovered paper and recovered paper pulp ($PP_{EXPORTS}$)	1961- Inv. yr.	D
Variables 3 and 4 – Imports and exports of all solidwood and paper products and wood fiber			
Imports and exports	Roundwood (includes fuelwood)	1961- Inv. yr.	A
	Chips and particles	1961- Inv. yr.	A
	Wood residue	1961- Inv. yr.	A
	Charcoal	1961- Inv. yr	B
	Sawnwood	1961- Inv. yr.	A
	Wood panels	1961- Inv. yr.	D
	Wood pulp	1961- Inv. yr.	D
	Recovered paper	1961- Inv. yr.	D
Variable 5 – Harvest for products			
Harvest for products [see note 4 below]	Industrial roundwood (IRW_H), fuelwood	1961- Inv. yr.	A

IPCC inventory software

- Setting conditions in “Parameter “sheet.



IPCC inventory software

- In the “Data” sheet, input/import wood product data from FAOSTAT etc. Then, most of estimations are implemented by the soft ware.

Parameters | Data | Variable 1A | Variable 1B | SCA: 1A+1B | Variable 2A | Variable 2B | PA: 2A+2B | Variable 3 | Variable 4 | Variable 5 | AFA | Results

Worksheet

Sector: Agriculture, Forestry and Other Land Use
Category: Harvested Wood Products
Subcategory: 3.D.1 - Harvested Wood Products
Sheet: Data

Data

	Roundwood			Sawnwood			Wood-based panels			
Year	Production (m3)	Imports (m3)	Exports (m3)	Production (m3)	Imports (m3)	Exports (m3)	Production (m3)	Imports (m3)	Exports (m3)	Productio (metric-t)
1961										
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