

# The European Framework for integrated Environmental and Economic Accounting for Forests — Results of Pilot Applications



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## Preface

This publication summarises the numerical results and methodological findings of a first round of test applications of the European Framework for Integrated Environmental and Economic Accounting for Forests. This publication was only possible due to the essential contributions made by the members of the Eurostat Task Force on Forest Accounting created in 1995. The task force met in August 1995, May 1996 and April 1998 to discuss and further develop the European Framework for Integrated Environmental and Economic Accounting for Forests.

Special thanks are therefore due to the members of the Eurostat Task Force on Forest Accounting:

- L. Ritter and C. Grobecker (German Federal Statistical Office),
- V. Bergen, H. Schroeder and S. Gutow (Institute of Forest Economics – University of Göttingen),
- D. Desautly (IFEN – French Environment Institute) and A. Tessier (ENGREF – France),
- F. Battelini and F. Falcitelli (Italian Statistical Office),
- Gschwandtl and J. Hangler (Austrian Ministry of Agriculture and Forestry),
- B. Nikodem and W. Sekot (under contract with the Austrian Central Statistical Office),
- L. Koltola and J. Muukkonen (Statistics Finland),
- M. Eriksson and M. Wolf (Statistics Sweden).

Contributions to the work of the Task Force on Forest Accounting and to this publication also came from Martti Aarne, Hans Guenther Andresen, Ulrich Eidmann and Peter Pauli of Eurostat F1 (Economic and structural statistics for agriculture and forestry) and Rosemary Montgomery of Eurostat F3 (Environment statistics). This publication was prepared by Anders Nordin and Gerard Gie of Planistat Europe under the responsibility of Anton Steurer of Eurostat B1.

This publication is one of the outputs of Eurostat's Environmental Accounting work. It contributes to various EU-wide and international activities in the context of national accounts and of environmental accounting, including the implementation of the European System of Accounts (ESA 1995), the implementation of the new Economic Accounts for Forestry (EAF Rev. 1) and the revision of the United Nations' System of Integrated Environmental and Economic Accounting (SEEA).

Eurostat published a revised methodology for Economic Accounts for Forestry covering the output and production costs for forestry as part of the 'Manual on the Economic Accounts for Agriculture and Forestry (Rev. 1)' which is based on the ESA 1995. EU Member States are currently compiling economic accounts for forestry based on this revised methodology. Data according to EAF Rev. 1 will become available in 1999. It is hoped that the pilot exercises presented in this publication provide valuable practical input to this ongoing work in Member States.

As a result of the experience gained from the pilot exercises reported in this publication, a revised version of the methodological manual on European Framework for Integrated Environmental and Economic Accounting for Forests is being published in Series 2E of Eurostat. Both the pilot exercises and the development of the European Framework for Integrated Environmental and Economic Accounting for Forests benefited from substantial financial support provided by the European Commission's Directorates General DG XI (Environment, Nuclear Safety and Civil Protection) and DG XVI (Regional Policy and Cohesion), in the context of the Communication from the Commission to the Council and the European Parliament on "Directions for the EU on Environmental Indicators and Green National Accounting - The Integration of Environmental and Economic Information Systems" (COM(94) 670).

The work on forest accounting is continuing at Eurostat together with the Task Force on Forest Accounting. Work is focusing on further methodological refinements, on the physical description and monetary valuation of non-market environmental and protection services provided by forests and on collecting data more regularly from more Member States.

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# 1. Introduction

An important milestone for the sustainable development of societies was set at the United Nations Conference on Environment and Development (UNCED) in 1992, with the adoption of Agenda 21, the « Convention of Biological Diversity », the « Framework Convention on Climate Change », and the « Non-Legally binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of all Types of Forests ».<sup>1</sup>

At the second Ministerial Conference on the Protection of Forests in Europe, held in Helsinki 1993, the European Countries and the European Community expressed their support for the UNCED decisions by adopting two resolutions on the enhancement of sustainable forest management in Europe: Resolution H1 « General Guidelines for the Sustainable Management of Forests in Europe » and Resolution H2 « General guidelines for the Conservation of Biodiversity of European Forests ».<sup>2</sup>

In the follow-up of the Helsinki Conference pan-European criteria and indicators were defined for the gathering and assessment of information to monitor the development of European forests.

The criteria settled on were:

- Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles
- Maintenance of forest ecosystem health and vitality
- Maintenance and encouragement of productive functions of forests
- Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems
- Maintenance and appropriate enhancement of protective functions in forest management (notably soil and water)
- Maintenance of other socio-economic functions and conditions

In the « Directions for the EU on Environmental Indicators and Green National Accounting »<sup>3</sup>, the Commission calls for continuing and enlarging work on satellites to National Accounts (environmental expenditures, establishing natural resource accounts, improving knowledge of methodologies for environmental damage assessment and monetary valuation).

As an integral part of the development of Natural Resource Accounting, proposals for a 'European Framework for Integrated Environmental and Economic Accounting for Forests', hereafter called the 'Forest Accounting Framework' were developed<sup>4</sup> and tested by the Eurostat Task Force on Forest Accounting. The objective of the forest accounting framework is to consistently link forest balance sheets and flow accounts, forest-related economic activities and the supply and use of wood within the economy, in physical and monetary terms. Moreover, the forest accounting framework contributes to the issues of classification and valuation of forest-related assets within the European System of Accounts (ESA)<sup>5</sup>, the System of National Accounts (SNA)<sup>6</sup>, the new Economic Accounts for Forestry (EAF Rev. 1)<sup>7</sup> and the System for Integrated Environmental and Economic Accounting (SEEA)<sup>8</sup>.

In order to implement the forest accounting framework 10 main tables were drafted covering balance sheets for land and standing timber, economic accounts of forestry and supply-use tables. These tables have been the basis for pilot accounts completed by Sweden, Finland, Germany and France.

This report reviews the content of the pilot studies as concerns the classification and valuation of forest-related assets and their integration with the ESA, the SNA and the SEEA.

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<sup>1</sup> United Nations (1993a).

<sup>2</sup> Ministry of Agriculture, Rural Development and Fisheries of Portugal (1998).

<sup>3</sup> Commission of the European Communities (1994).

<sup>4</sup> Newson, B. and Gie, G. (1996).

<sup>5</sup> Commission of the European Communities (1996).

<sup>6</sup> Commission of the European Communities et al (1993).

<sup>7</sup> Commission of the European Communities (1997).

<sup>8</sup> United Nations (1993b).

The objective is to provide an insight into the experience gained and progress made in linking forest-related data to the national accounts. This should enable to pave the way for further integration of economic and environmental concerns about forests.

This report brings together experience in establishing forest accounts as a way of compiling comparable information on forest resources while respecting individual national differences. In this regard, it can be seen as a contribution to forest policy development and assessment of trends in forest conditions, as well as to the implementation of the resolutions mentioned above as regards indicators of sustainable forest management.

The presentation of the results of the pilot exercises is based on the authors' contributions and views (see bibliography) and does not imply the expression of any opinion of the national statistical institutes involved. The data set out in this report are the result of pilot applications and should not be considered as final.

Although far-reaching in many aspects, the present report does not cover all environmental issues dealt with in forest accounting. In particular, the integration of ecological and social functions of forests is an issue of on-going work within the Eurostat Task Force on Forest Accounting.

This report is organised as follows:

Section 2 provides a summary of the main findings from the pilot applications. This summary also illustrates the kind of indicators and accounting aggregates that can be directly derived from the tables of the forest accounting framework.

Section 3 describes the methodological issues that have been addressed in the pilot applications and provides conclusions and recommendations for future refinements.

Section 4 contains comparative tables that are based on the aggregation and analysis of the data provided by the pilot applications.

Section 5 gives the detailed forest accounts tables for each country in their original format.

A bibliography concludes this publication.

## 2. Summary of the main findings

Areas of forest and other wooded land are expanding in Europe. Wooded land covers more than 40% of the land surface of the European Union. The four Member States covered by this report represent 60 % of all wooded land areas in the European Union.

Based on the results of the pilot applications the following overview of the forests of the four reporting countries can be given:

- About half of the total land area of the reporting countries is covered by forest and other wooded land, i.e. 80.5 million hectares (ha), although this share varies between 31% (Germany) and 75% (Finland).
- On average there is about 0.5 ha of forest and other wooded land for each inhabitant in the reporting countries. Finland and Sweden have more than 1 ha of forest and other wooded land for each inhabitant.
- Nearly 85% of the forests are reported to be 'available for wood supply', ranging from 78 % (Sweden) to 94 % (Germany).
- Almost all forest 'available for wood supply' is more or less regularly managed. As could be expected, in European Union countries natural forests constitute very small areas and are normally situated in areas designated for protection reasons, i.e. 'not available for wood supply'.
- Between 4 and 11 % of the total forest area has some form of protection status. The proportion of protected areas increased significantly over the reporting periods (5 years). The absolute increase is about 760 000 ha for all reporting countries.
- The stock of standing timber is about 10 billion m<sup>3</sup>.
- The annual growth of standing timber (after deduction of natural losses) is about 360 million m<sup>3</sup> - i.e. about 3.5 % of the stock of standing timber.
- The annual fellings are about 220 million m<sup>3</sup> - i.e. about 2.2 % of the stock of standing timber.
- The annual growth exceeds fellings by about 140 million m<sup>3</sup>, which represents a net increase of about 1.4 % of the stock of standing timber per year.
- Changes due to catastrophic losses such as forest fires are very small in all reporting countries.
- The reported value of forests (land and standing timber) is on average 5 000 ECU/ha. The total value of forest assets is 280 billion ECU or 8.6 % in relation to annual GDP at market prices in these four countries.
- Output of forestry and logging related to GDP at market prices varies between 0.2% (France) and 2.2 % (Finland).
- The forests of the reporting countries are supplying most of the domestic demand for wood products. But whereas the total values of exports of wood products exceed imports in Sweden and Finland it is the contrary in Germany and France.
- The most important net exports for Sweden and Finland are paper and paperboard products.

### 3. Methodological description

#### 3.1 Definitions and classifications of forests

In primary statistics, forest and other wooded land are two categories of land classification. Definitions of the forest accounting framework are harmonised with the definitions of the UN-ECE/FAO Temperate and Boreal Forest Resources Assessment 2000.<sup>9</sup>

'Forest' is defined as land with tree crown cover of more than 10 percent and area more than 0.5 ha. Included are young natural stands and all plantations established for forestry purposes which have not yet reached a crown density of more than 10 percent, as are areas normally forming part of the forest area which are unstocked as a result of human intervention or natural causes but which are expected to revert to forest.

'Other wooded land' is land which has some forestry characteristics but is not forest as defined above. It includes:

- Open wooded land: land with tree crown cover of 5-10 percent of the area,
- Shrub or bush land: land with shrubs or stunted trees where the main woody elements are shrubs.

In order to integrate economic aspects, the forest accounting framework did initially propose to classify forests and other wooded land into:

- available for wood supply: "Forests and other wooded land on which there are no legal, economic or technical restrictions on wood production".
- not available for wood supply: "Forests and other wooded land on which there are legal, economic or technical restrictions on wood production".

Within forests available for wood supply the forest accounting framework proposed a distinction between:

- cultivated (including planted) forests,
- non-cultivated (natural) forests.

According to ESA/SNA rules, natural growth of cultivated forests is recorded as output which enters into gross domestic product. Natural growth of non-cultivated forests is not recorded as output, but as "other changes in volume of assets".

Within forests not available for wood supply a distinction is made between:

- protected forests, i.e. forest with severe legal restriction on wood production (e.g. national parks, nature reserves and other protected areas such as those of special scientific, historical or cultural interest).
- non-protected forests, i.e. forest where physical productivity is too low or harvesting and transportation costs are too high to warrant wood harvesting.

In a second step, the forest accounting framework focuses on the way in which the classification of forest-related assets in ESA/SNA and SEEA contributes to structure the existing information.

The ESA/SNA considers only economic assets. This means assets over which "ownership rights are enforced and from which economic benefits are derived by their owner(s) by holding them or using them over a period of time"<sup>10</sup>. In the ESA/SNA classification of assets, land is separated from biological assets (standing timber, animals etc.) on it. Land is always treated as a non-produced asset. Biological assets related to wooded land are considered as cultivated (i.e. produced) assets when their natural growth and/or regeneration takes place under direct control, responsibility and management of institutional units. If this condition is not met, they are considered as non-cultivated (i.e. non-produced) assets.

The SEEA introduces environmental amendments to the ESA/SNA classification by widening the asset boundary to recognise the whole eco-system. The SEEA covers in principle all natural assets affected by

<sup>9</sup> United Nations Economic Commission for Europe (1997).

<sup>10</sup> Commission of the European Communities (1996), § 7.10



environmental impacts caused by economic activities and not only economic assets. The SEEA land classification makes the same distinction as the SNA between cultivated and uncultivated land areas, and following UN-ECE, introduces forest and other wooded land as a category of land classification. As concerns forests, the SEEA classification of natural assets extends the scope of non-cultivated biological resources in the ESA/SNA to include all forest assets, including virgin forests, regardless of their potential for economic benefits.

## Experience from pilot exercises

**Finland** and **Sweden** consider that the separation of forests available for wood supply into natural and cultivated forests is not relevant since in these countries there are no substantial differences between the growth and management of cultivated (afforested) forests and naturally reproduced forests. The Nordic approach is rather to categorise forests as semi-natural (i.e. more or less cultivated) regardless of the intensity of forest management. The concept of natural forests would therefore mainly refer to protected areas, i.e. not available for wood supply.

The **Swedish** scope of 'forest and other wooded land not available for wood supply' reflects mainly mountainous forest that cannot be used economically and is characterised by a high share of old trees and sometimes regeneration difficulties, as well as strictly protected areas.

The **Finnish** definition of forests not available for wood supply comprises:

- areas strictly protected by legislation or other official measures where forestry is excluded (strict nature reserves, national parks, peatland reserves, wilderness areas).
- areas not strictly protected, e.g. reserved for area planning or protection, northern high forests. Some forestry actions and fellings are allowed but these areas are not economically sensible for wood production.

**Germany** applies the proposed classification of forest available for wood supply by distinguishing cultivated and natural forest. But as the German Forest Inventory provides neither a definition of natural forests nor data the category is only a memorandum item in the tables.

**Germany** also makes a distinction of forest not available for wood supply along the lines of the forest accounting framework, that is, protected and non-protected forests are distinguished.

The proposed division into cultivated and natural forests does not apply to **France** since all wooded land available for wood supply is considered as more or less cultivated. The sub-category 'plantations of poplars' within wooded land available for wood supply was done to emphasise its importance as a category of the TERUTI<sup>11</sup> land classification. Areas not available for wood supply comprise nature reserves and inaccessible areas; however these two subcategories could not be distinguished, thus no further distinction is made within areas 'not available for wood supply'.

The following table presents the classifications that were actually used in the pilot applications.

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<sup>11</sup> The annual French survey of land use.

### Classification of forest and other wooded land used in pilot applications

	Sweden	Finland	Germany	France
<b>Available for wood supply</b>	<p><b>Afforested forests:</b> forests on former agricultural land, afforestation less than 20 years ago</p> <p><b>Natural forests</b> forests 30 years older than final stand age and no intervention for the past 25 years</p> <p><b>Other forests</b> exploitable forest except afforested forest and natural forest</p>	<p><b>Afforested forests:</b> arable land afforested 1970-1995</p> <p><b>Mature forests</b> no intervention for the past 30 years but not necessarily strictly natural forests</p> <p><b>Other forests</b></p>	<p><b>Cultivated forests:</b> forest land used for wood production with regular intervention</p> <p><b>Natural forests</b> forest land used for wood production with no intervention (for memory item)</p>	<b>Cultivated forests</b>
<b>Not available for wood supply</b>	<p><b>Not protected</b> mountain forests, subalpine woodland, swamps and other waste land, rock surface</p> <p><b>Protected</b> strictly protected areas</p>	<p><b>Not strictly protected</b> e.g. reserved for area planning, etc.</p> <p><b>Strictly protected</b></p>	<p><b>Not protected</b> few possibilities of wood production</p> <p><b>Protected</b> protected forest not to be used for wood production</p>	<b>Nature reserves and inaccessible areas</b>

### Conclusions

The classifications of forest used by the pilot countries unveil some problems to conform to the classification proposed by the draft set of tables of the forest accounting framework. Seemingly, the bulk of Nordic forests display characteristics that make them neither cultivated nor entirely natural, i.e. more or less cultivated. Also France conceives all areas available for wood supply as being more or less cultivated. Although Germany does make the distinction between cultivated and natural forests, no data are available for natural forests.

The experience shows that the economic classification of forest available for wood supply needs to be refined to better highlight the degree of management or “naturalness” of the forests. The concept of “naturalness” should be defined on the basis of human intervention. If human intervention took place sufficiently long ago for certain natural processes and species composition to be re-established, a forest can be regarded as ‘natural’.

In accordance with these criteria, the Eurostat Task Force on Forest Accounting agreed on a new economic classification of forests of the forest accounting framework.

### Economic classification of forests of the forest accounting framework

Available for wood supply		Not available for wood supply	
(regularly) managed	<b>Over-mature</b> (without any human intervention for e.g. 30 years)	<b>Protected</b>	<b>Not protected</b>

The category available for wood supply is further broken down into forest more or less regularly managed, and/or exploited (thinning, fellings etc.) and forest which is over-mature (i.e. for which the age of the stand - or of a significant part of the stand - largely exceeds the economically optimal cutting age), **and** which is left without any "forestry" intervention for a long period. No strict definition is proposed, but classification parameters (regularity of management, overmaturity...) should refer to normal economic standards of forestry, taking into account the species, etc.

This gives the option to treat natural growth as output in the first sub-category but not in the second sub-category. Thus for ESA/SNA purposes, the distinction between (regularly) managed and over-mature forests enables one to distinguish, among forests available for wood supply, the part of forest growth that is cultivated (i.e. produced) from the non-cultivated (i.e. non-produced) part.

An approach for defining the area of cultivated forests is suggested by Norway<sup>12</sup>. The definition is based on how much of the forest is being actively managed to ensure regeneration of forests. This relies on the assumption that harvested areas must be planted or seeded with the same kinds of trees after being cut down. Following this definition about half of the Norwegian forest is cultivated, as compared to 76% of Norwegian forest being 'available for wood supply'.

In all pilot countries there are areas that enjoy some form of protection status. However, there are differences both as regards the definitions of protection and as regards the legal status of the protection measures. Thus the data on protected areas may not yet be fully comparable and a standardisation of the definitions may be necessary in future.

## 3.2 Physical stocks and flows

A structure of forest balances both for area of wooded land and for volume of standing timber is proposed by the forest accounting framework so as to describe in physical terms the stocks and changes in stocks (due to human activities, natural or accidental processes) as well as changes in classification of land and standing timber.

Categories of changes of wooded land are:

- Changes in land cover due to economic activities: afforestation, deforestation (for building of houses, roads etc.)
- Changes in land cover due to natural colonisation and environmental conditions
- Change in classification of land due to changes in use/status

Categories of changes of standing timber are:

- Natural growth
- Fellings and removals
- Catastrophic losses due to fires and storms
- Natural losses of standing timber
- Other changes in stocks of standing timber (conversion, deforestation)
- Change in classification of standing timber due to changes in use/status

The volume of standing timber is defined as the volume above-stump measured over bark to top. This includes tops of stems, large branches, and dead trees lying on the ground, which still can be used as fibre or fuel. Excluded are small branches, twigs and foliage.

The forest accounting framework also attempts to capture quality aspects, introducing health status of forest through defoliation classes in order to link the changes in quality of forests with human activities.

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<sup>12</sup> Statistics Norway (1998).

## Experience from pilot exercises

Data on area of forest and other wooded land and volume of standing timber are derived from National Forestry Inventories (NFIs) and forestry statistics which give wide-ranging information on forests and land use in all pilot countries. However, the inventory cycle of NFIs is generally several years and forest balances at a given date are usually calculated and not the direct result of the NFIs. Forest balances are thus the outcome of estimates or averages over certain periods of time. Any collection of forest data has this limitation (see FAO/ECE/Eurostat forestry statistics).

On the other hand, information on changes in stocks (e.g. fellings, afforestation, etc.) is usually available annually with a rather high statistical reliability, except however for natural growth which is based on estimations.

**Sweden, Finland and France** are unable to integrate defoliation into the forest balance. Data on defoliation are presented in complementary tables.

For **Germany**, calculations have been made separately for the 'old' and the 'new' Länder and then brought together, since no common data for the opening stocks were available. Germany manages to integrate defoliation into the forest balances.

In **France** the NFI does not give information about the volume of standing timber in 'areas not available for wood supply'. They decided not to make any estimation of the volume of standing timber in these areas.

## Conclusions

The physical data supplied on forest balances and flows are largely sufficient to enable comparison at pan-European scale, even though the accounting periods are different.

The results indicate that the area of forest and other wooded land of the reporting countries is expanding slowly: losses to urban infrastructure (by deforestation) is more than counterbalanced by expansion into agricultural and other land (by afforestation). These changes are relatively small. However, significant areas initially available for wood supply were transformed into protected areas.

As regards standing timber, natural growth (after deduction of natural losses) exceeds the removals. In all the reporting countries changes due to catastrophic losses e.g. forest fires are very small. Information on other changes e.g. conversion is often not available or indicates rather insignificant changes.

Experience shows that the reference period for detailed balance sheets should probably be extended to ten years (the forest accounting framework's initial proposal was 5 years) in order to exhibit more significant changes and improve the statistical reliability.

The data on land and standing timber resulting from the pilot exercises occasionally deviate from existing forestry statistics (Eurostat/UN-ECE/FAO). However, this is normal. Forest accounting requires the integration of data of different origins into a coherent and consistent forest accounting framework. This sometimes necessitates modifications and recalculations of forestry data to fit into such a framework.

It seems difficult to directly integrate qualitative aspects within the forest balances. However, due to their importance, it would be interesting to cross-classify defoliation classes with the economic categories of the classification, as a means of assessing the impact of changes in the health conditions of forests on economic activities. On this issue, the Eurostat Task Force on Forest Accounting agreed to further elaborate the data on defoliation and to integrate them into opening and closing stocks.

The definition of volume of standing timber probably needs further development in order to cover two aspects: the commercially useful part of the tree for economic accounting and the total wood biomass for carbon balance purposes.

### 3.3 Monetary valuation

The forest accounting framework describes in monetary terms the stocks and changes in stocks of land and standing timber. The description is made along the lines of the ESA/SNA classification of economic assets.

ESA and SNA distinguish land from the biological assets on the land (and in particular standing timber). These two categories of assets are in fact rather different from an economic point of view. While land rarely changes in quantity (area) due to production processes, it is the very nature of biological assets (measured by volume) to grow, to be harvested or depleted, etc.

The distinction between land and biological assets should give rise to separate valuations. However the SNA recognises that in some cases, "it is difficult to separate the value of land from the value of the (building, structure, or) plantation ... above it".

The SNA's general principles of valuation of assets<sup>13</sup> in balance sheets are well established:

- Assets are to be valued at current market prices on the date to which the balance sheet relates.
- In the absence of observable market prices, values have to be assessed indirectly by deriving prices from markets where similar assets are traded currently in similar circumstances. Values may also be obtained by accumulating and revaluing transactions over time (e.g. assets where initial acquisition costs are written off over the asset's expected life).
- In the case of assets for which the yields occur late or are spread over a lengthy period, the prices have to be estimated on the basis of the discounted present value of future proceeds from the asset. The rate of discount should be derived from information based on transactions in the particular type of asset under consideration.

In general, transactions in forests are few. When transactions do exist, they generally do not explicitly distinguish the value of the land and the value of the standing timber (and/or of other biological assets) which are located on the land. The first way to value the various components of forests, i.e. land and biological assets (mainly standing timber) is to "divide" the transaction value of forests between land and biological assets. To this end, one may use stumpage market prices for standing timber.

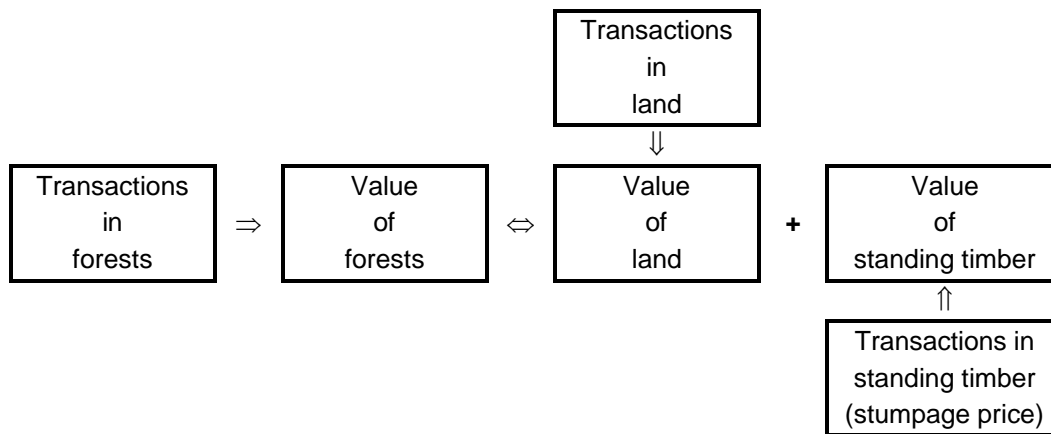
Transactions in standing timber do exist. In some countries, timber on e.g. publicly owned forests is sold while standing. Stumpage fees are paid for the right to fell a given quantity of wood. In this case the value of the standing timber which is ready to be felled during a given period is available. From stumpage prices or fees one may calculate the value of standing timber.

The standard approach would be to derive the present value of standing timber from the future receipts. In this case one should make assumptions about the future volume of timber felled, value them by the stumpage prices, deduct the costs of bringing the timber to maturity, and discount the receipts to the present period. This approach necessitates knowing the age structure of the standing timber, as well as the future expenses. One also has to deal with the issue of variation in prices over time and by type of wood products. As a simplification the value of standing timber is calculated by multiplying the present volume with the stumpage price. This approach is based on the approximation that the rate of discount is equal to the natural growth rate of standing timber.

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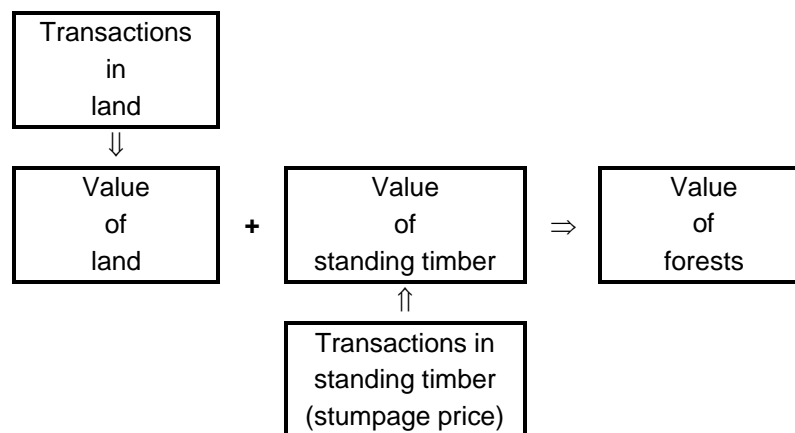
<sup>13</sup> Commission of the European Communities et al (1993), § 13.25

A general overview of the methods used in the pilot exercises is outlined in the scheme below. However, none of the pilot countries applied this general structure in its entirety. Detailed schemes of what countries did in practice are also set out below.



### Experience from pilot exercises

With minor variations, Sweden, Finland and France applied the following version of the scheme:

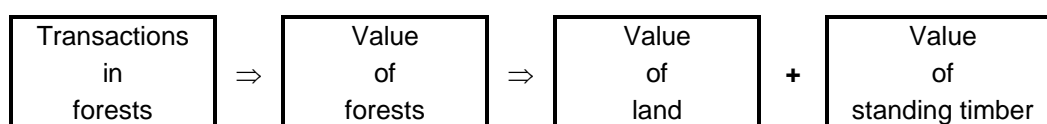


**Sweden** calculates the value of land as a percentage of the value of forests as derived from transactions in forests. Stumpage prices are used to value the standing timber.

**Finland** values separately (a) the land (on the basis of recommended value, which corresponds to the wood productivity of land) and (b) the standing timber (on the basis of stumpage prices).

**France** also values separately the land (on the basis of a survey) and the standing timber (on the basis of stumpage prices).

**Germany** starts from an analysis of some transactions in forests in order to determine (through a regression analysis – hedonic pricing) the value of the land and the value of the standing timber.



## Forest land

The **Swedish** method for the valuation of forest land is based on a ratio between value of land and value of forests. This ratio is taken from 1975 and has been modified in order to take into account the increase in timber volume per hectare. For the years under review, the ratio used is 7% (i.e. land is assumed to represent 7% of the value of real estates in forests), which gives for the land a value of 500 SEK/ha. This price is applied to the entire area of forest land without taking into account different types of forest species. The same price is used to value the changes in forests land areas and other changes in use/status.

The **Finnish** method for the valuation of forest land is based on recommended values for different wood productivity types of land in different areas of the country. The land values used for the pilot exercise are averages of 12 productivity types and 23 districts covering the whole country. Recommended values for forest land are developed by the National Board of Survey and the Finnish Forest Research Institute.

Factors taken into account in the recommended land values for different forest land types are:

- predicted growth of standing timber, timing and intensity of logging, and development of the structure of standing timber over the whole rotation period of the forest stand and for different species and mixtures of species,
- real long term average stumpage prices, and costs of silvicultural methods and logging,
- interest rates for forests.

In both Sweden and Finland monetary valuation concerns only forest land exploitable for wood production. No attempts have been made to value forest not available for wood supply, which is set to zero due to its very low economic use.

The valuation method retained in the **German** report is based on a model of market prices for forest real estates<sup>14</sup>. This model relies on 70 cases of effective transactions from the Lower Saxony forest planning office, which were judged to be suitable for an analysis of the market for forest real estates.

In a first step, the study examined to what extent changes in the demand for forest real estates (reflected by changes in prices over time) are due to changes over time in different determinants of the price level.

The determinants tested were:

- index of prices of raw wood. Increasing raw wood prices lead to an increased demand and higher prices for forest real estates.
- interest rate. Increasing interest rates lead to a reduction of demand for forest real estates.
- prices of agricultural land of marginal revenue. Rising prices for agricultural land of marginal revenue lead to an increased demand for forest real estates.
- 

The model was empirically tested by using linear multiple regression for simulating the data. This resulted in an estimated regression equation where the price level of forest real estate is rather well explained by the price of raw wood.

Secondly, in order to derive an analytical explanation of market prices for forest real estates, characteristics with a supposed impact on the price level were identified and tested:

- size of the forest area in hectares
- remaining life time of principal and secondary stand
- yield class of principal and secondary stand
- stocking degree of the principal and secondary stand
- trunk wood and industrial round wood price level
- timber volume per hectare

Out of these characteristics, a significant influence on price level could only be proved for standing timber volume. In addition, it was found that species have no significant impact on the price level, except for spruce.

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<sup>14</sup> Forest real estates include land and standing timber (and also non-wood private values).

A dummy variable was added for spruce, leading to a hedonic price function for the value of forest real estates. Of course results are only significant for the Lower Saxony region<sup>15</sup>.

The **French** valuation of forest land is based on a survey among the fiscal departments. From this survey an average hectare value for the entire forest in France was obtained.

Both **Germany** and **France** attached monetary values to forest land not available for wood supply.

### **Standing timber**

**Sweden** and **Finland** adopted methods where volume of standing timber is multiplied by stumpage prices. Stumpage prices are defined as delivery prices at forest roads minus felling and transportation costs (including the cost of the fixed capital used). The stumpage prices are used for valuing the volumes of standing timber as well as natural growth, fellings and natural losses.

The stumpage value used by Sweden is calculated for stem wood as an overall average and based on fellings of both immature and mature trees. No price information is available by species.

Finland also used stumpage prices defined as the Swedish ones. The stumpage values are distributed by species and by roundwood assortments.

**Sweden** also tested a second method for the valuation of standing timber, where the value of standing timber is derived from the value of forests real estates (based on actual transactions) minus the value of land. The resulting value is smaller than the 'stumpage price' value. As a consequence the values of the flows of standing timber also differ between the two methods.

For the valuation of standing timber, **Germany** used the hedonic price function described above.

**France** used a model similar to the Swedish and Finnish ones. Stumpage prices are available by species and diameter. Natural growth and fellings are valued at different prices, according to their physical description (species and diameter) and uses (logs, fuel wood etc.). On average the prices used for valuing the natural growth are higher than the prices used for valuing the fellings.

None of the reporting countries made attempts to value standing timber on forest land not available for wood supply.

In all countries the revaluation item that reflects changes in prices of forest land and standing timber during the accounting period was calculated.

### **Revaluation item in % of the value of the opening stock**

	<b>Period</b>	<b>Forest land</b>	<b>Standing timber</b>
<b>Germany</b>	1/1/1991 - 31/12/1995	-0.1%	- 0.1 %
<b>France</b>	1/1/1991 - 31/12/1995	-6.3%	-2.4 %
<b>Finland</b>	1/1/1990 - 31/12/1994	-14.3 %	-17.8 %
<b>Sweden</b>	1/1/1989 - 31/12/1993	+17.8%	+4.9 %

<sup>15</sup> Results were however used, as an illustration, for the valuation of the entire German forest.



During the period 1990-1995 prices of standing timber were volatile. Market prices fell with the economic downturn in the beginning of the 1990's and began to rise again in 1993. An index of the value of Finnish forests (base year=1990) illustrates this:

### Value of forests in Finland (1990=100)

Year	Index
1990	100
1991	87
1992	46
1993	70
1994	84
1995	97

Source: J. Hoffrén (1997), p.79

## Conclusions

The valuation of forest-related assets as required by the ESA and SNA requires a separation of land and standing timber. Forest land and standing timber are to be valued on the basis of actual transactions or the discounted net present value of expected future returns. However, this approach is complicated by a number of unresolved issues on valuation:

- Few transactions are made in 'pure' forest land (i.e. forest land without standing timber). This hampers a correct estimation of forest land prices,
- Observed transactions in forests are rarely representative of total forests in terms of locations (proximity to markets or settlements) and in terms of the age structure of standing timber,
- Stumpage prices apply to mature timber and do not give the value of standing timber;
- The method of discounting net future returns from standing timber includes components for which information rarely exists and, therefore, lends itself to uncertain assumptions about imputed values. Besides this, the long rotation periods (up to 100 years) make the choice of the discount rate crucial.

Finland, Sweden and France use about the same approach i.e. stumpage prices to value standing timber and separate assessment of land values. Germany uses a model based on a regression analysis of a sample of transactions in forest real estates. This gives rise to a hedonic price function that implicitly incorporates all ESA/SNA values of forests.

The forest balances allow to calculate average values of one hectare of forest land for each pilot country (see table below). The per-hectare values were calculated based on the quantities and values of the closing stocks 'available for wood supply' and the average exchange rates of the closing years applied in the pilot studies.

### Average values of forest land and standing timber

	Area available for wood supply (1000 ha)	Natural growth (m <sup>3</sup> /ha - five years)	Standing timber (m <sup>3</sup> /ha)	Value of land (ECU/ha)	Value of standing timber (ECU/m <sup>3</sup> )
Sweden (93)	21 667	22	126	58	16.2
Finland (94)	22 381	16	79	246	20.0
Germany (95)	9 870	48	287	3 405	26.5
France (95)	14 262	31	150	803	34.1

A comparison of the average values of one hectare of forest land shows substantial differences (see also table 5 in section 4). In Finland the value per hectare of forest land is about four times higher than the corresponding value for Sweden whereas the value for France is more than three times higher than the Finnish one. The German value is about four times higher than the French one. In total, the value per hectare of forest land in Germany is about 60 times higher than that for Sweden.

The differences do not only result from the different valuation methods used but are in part due to differences in the productivity of the land (e.g. natural growth in m<sup>3</sup>/ha), in the species composition and in the density of the standing timber. Natural growth per ha and the density of standing timber can partly explain the differences in the value of land (except for the difference between Sweden and Finland).

With regard to standing timber, results differ as well. France reports a value per m<sup>3</sup> nearly twice as high as the corresponding value for Sweden. Two factors may explain these differences: species composition and changes in (stumpage) prices: the share of broad-leaved trees in French forests is higher than in the other countries. Price fluctuations were high during the reporting periods, which were not the same for the four countries.

As a result the land value for Sweden appears to be very low and the land value for Germany appears to be very high. However in the case of Germany the price of the land refers to a specific area (Lower Saxony) and implicitly includes other values than just standing timber. As a whole, the results may also be seen as evidence for the difficulty to obtain prices that are really representative for forest land.

Nonetheless, there is a need for further harmonisation of the valuation methods in order to make the results fully comparable. Obviously, the choice is between a method incorporating factors of heterogeneity of forests (species, productivity of land, distance to markets, etc.) as well as uses other than wood production and a simplified method based on average stumpage price and an estimated land price. Two countries are currently testing the effects of such factors on the value of forests. These tests will allow for a better understanding of the effects that different levels of detail and different valuation methods have on the value of forest land and standing timber.

### 3.4 Economic accounts for forestry and logging

Monetary valuation of forests allows one to link the value of forest assets with the economic benefits of the different activities related to forests. This includes forest management as an activity involving the use of both variable inputs (labour, materials) and fixed factors (human-made capital).

A part of the forest accounting framework is thus dedicated to the establishment of economic accounts for all industries which use "wooded land" as a basis for their activity so as to record:

- a detailed output related to "wooded land"
- intermediate consumption, gross value added and capital transactions (gross fixed capital formation, changes in inventories) of the forestry and logging industries
- subsidies, investment grants and other transfers
- labour inputs and stocks of fixed assets and land

For those trees considered as cultivated (i.e. produced), natural growth of standing timber is to be recorded as output which enters into the stock of growing timber as changes in inventories (work in progress) in the capital account. When natural growth is recorded gross (i.e. including natural losses), natural losses have to be charged against output, or as losses in inventories. Felled standing timber (including silvicultural waste) is to be treated as intermediate consumption of the logging industry.

Consequently, the forest accounting framework proposes a separation between forestry and logging activities.

#### Experience from pilot exercises

The **Swedish** classification of industries does not make a distinction between forestry and logging activities. An estimation of output of forestry was provided based on stumpage prices. A part of this is recorded as fellings and the difference adds to the stock of standing timber as changes in inventories.

The output of other forestry products (see table 14 in section 5) is rather unimportant and consists of plants, seeds and Christmas trees. Services incidental to forestry and logging are mainly construction and maintenance of forest roads and ditches.

**Finland** makes a separation between forestry and logging industries. The output of forestry is based on stumpage prices.

For **Germany** the data are based on early results of a separate pilot project on economic accounts for forestry.

**France** makes a separation between forestry and logging but does not provide data on net operating surplus, capital transactions and stock of fixed assets.

## Conclusions

The separation of forestry and logging activities is important to properly identify forestry revenues and costs. This information can be used for the valuation of stocks of standing timber as well as for the valuation of natural growth. For example, the net present value method requires information about all costs of bringing the timber to maturity. In addition, information on costs of forestry would be important to assess the degree of management necessary to bring the timber to maturity. It would also be interesting to separate government costs involved in forestry production (construction of forest roads, forest inventories, protection of forests against fires, etc.). A Canadian study shows that these costs represent an important part of the forest 'surplus'<sup>16</sup>. Finally, the costs of growing standing timber are necessary to assess the net operating surplus and the return on capital for forestry.

In general, 'output related to wooded land', following ESA/SNA principles, almost entirely consists of 'wood values'. The ESA/SNA output of products other than wood is relatively unimportant (5-10 % of wood values).

The data on the economic accounts and forest balances, together with some additional assumptions, permit to estimate the rate of return on capital for forestry and logging (see table 7 in section 4).

Two calculations are made:

- the first is entirely based on values derived from the pilot exercises; it includes the value of changes in inventories of standing timber,
- in the second the value added and net operating surplus are based on data from the Eurostat Economic Accounts for Forestry (EAF)<sup>17</sup>.

The EAF data are based on the 1992 version of the EAF framework<sup>18</sup> which is consistent with the ESA 1979. Data according to the revised framework for Economic Accounts for Forestry (EAF Rev.1)<sup>19</sup> will become available for the first time later in 1999.

Therefore, this comparison illustrates the effects of moving from ESA 1979 (output of forestry based on fellings) to ESA 1995 (output of forestry based on natural growth of standing timber).

A comparison of the two tables shows that for Sweden, Finland and France the ratio of 'net operating surplus/mixed income' to total capital, when calculated on the basis of EAF data, is more or less similar in the three countries (ranging from 1.5% - 2.4%). For Germany this rate is negative: -0.7%.

When using the results of the pilot exercises, for France, the ratio increases heavily due to the importance of this part of the natural growth that accrues to the stocks of inventories (60% of the value of natural growth). For Sweden and Finland the respective percentages are 25% and 12%.

A future prospect would be to identify expenditure related to the management and protection of forest areas and forest-related assets.

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<sup>16</sup> This surplus is defined as the net operating surplus of wood-related industries less an average return on fixed capital. See Statistics Canada (1995).

<sup>17</sup> Commission of the European Communities (1998)

<sup>18</sup> Commission of the European Communities (1992)

<sup>19</sup> Commission of the European Communities (1997)

### 3.5 Supply and use of wood

The objective is to describe in physical and monetary units the transformation of wood from the stage "output of forestry" to the final products and to establish a link between the supply and use of wood, the forest balances and the economic accounts.

The use tables show the uses of wood products (by CPA category): intermediate consumption of industries (by NACE Rev.1 category) and final uses (final consumption, changes in inventories and exports). The supply tables show the supply of wood products: output of industries and imports. The supply and use tables are drawn up both in monetary and physical terms, leading to physical material balances.

A complementary use table serves to record residuals (wood waste, paper waste and other residuals containing wood, e.g. black liquors) which are not accounted for as intermediate consumption of industries. The table also includes waste treated by external recycling activities.

A complementary supply table records production of waste not counted as output of industries.

Monetary supply is generally established at basic prices and the uses are to be recorded at purchasers' prices. Columns for net taxes and trade and transport margins allow us to calculate the supply at purchasers' prices in order to reconcile the supply and the use of wood.

#### Experience from pilot exercises

The **Swedish** classification of industries conforms to the forest accounting framework except that no separation is made between forestry and logging. However no data is available for the uses by printing and recycling industries.

For Sweden both physical and monetary supply-use tables are balanced. However, the statistical discrepancy of the monetary use table generally captures large values due to redistribution of national accounts data to new product groups. Physical and monetary data are not quite comparable due to different sources used. Concerning output and intermediate consumption there is a relatively good link with the economic accounts for forestry and logging. Data for the complementary tables are derived from waste statistics. This does not contain information on black liquors.

As for Sweden, no data is available in **Finland** on the use of wood products by the recycling industry. Waste paper as a side product of the paper industry is not accounted for due to low reliability of both physical and monetary data. Information on the pulp and paper industry exists for separate pulp production, combined pulp and paper production and separate paper production. The data on combined pulp and paper industry is divided into pulp industry and paper industry by assuming that 2/3 of the joint value is produced by the paper industry and 1/3 by the pulp industry.

In general, the tables do not include data on taxes and subsidies and trade and transport margins. There are also inaccuracies in the monetary data on intermediate consumption due to strongly integrated forest industries resulting in internal transactions in wood commodities between different sites of the same enterprise.

The **German** classification of industries (SIO) and products differs from the forest accounting framework (NACE Rev.1) in the following manner:

- the wood processing industry includes the manufacture of furniture,
- the printing and publishing industry includes diazo production,
- products of forestry are disaggregated to show non-coniferous and coniferous wood (standing or as wood in the rough) separately,
- prefabricated building elements of wood are lumped together with construction and not with wood products.

For Germany physical supply and use tables are not fully balanced. This applies especially to primary wood processing products, pulp, paper and paperboard. Natural growth is recorded net of fellings. Monetary supply

and use tables are balanced. The use of different prices for the natural growth and intermediate consumption by logging industry poses problems of consistency between monetary and physical data.

The presentation of the uses side of residuals is different from that proposed by the forest accounting framework. A systematic cross-classification by kind of material (wood, paper) and by kind of disposal was introduced.

The **French** classification of industries and products corresponds more or less to the forest accounting framework but the information is not sufficient to break down the recycling industry by wood products.

The physical data are obtained from industrial statistics and are originally not expressed in homogenous units of measurement. Therefore, the basic information was converted by coefficients to be expressed in proper units (tons etc) and to cover the whole of France.

The monetary data are mainly derived from the national accounts and disaggregated to fit with the proposed tables. Because the pulp and paper industries are highly integrated they could not be separated in the monetary supply-use tables. The distribution of total intermediate consumption to sectors is done using physical data and a survey on purchases of wood products by industries.

For France physical and monetary supply-use tables are balanced. For output and intermediate consumption there is a good link with the economic accounts for forestry and logging.

## Conclusions

The data on supply and use of wood are somewhat inconsistent when comparing physical and monetary tables, and when matching them with the economic accounts. A general comparison between the countries is difficult, apart from certain wood products in physical terms.

There is a general need to improve the supply-use tables both as regards the balance between supply and use in physical and monetary terms and as regards the comparability between monetary and physical data. The link to economic accounts of forestry and logging will also need to be further verified.

## 3.6 Mass balances

Industry/mass balances are a way of integrating wood and wood products material balances into the forest accounting framework. Mass balances are disaggregated into two tables.

The use table shows the wood content (in tons of dry matter) of the intermediate consumption of industries in selected wood products. The make table shows the wood content (in tons of dry matter) of the output in selected industries. A complementary table shows the wood content of waste and residuals not accounted for in the output of industries.

Mass balances are also important to combine the wood content with the storage of carbon dioxide in standing timber and wood products. In this respect, the forest accounting framework allows linking mass balances to balances of carbon dioxide and activities in a NAMEA-type approach. These balances may be further allocated to global environmental themes (i.e. greenhouse effect), as in NAMEA.

From estimates of carbon dioxide emissions and absorption, a balance can be drawn. A part of carbon dioxide emissions is due to the incineration of waste containing wood materials. Some wood products only release their carbon contents after a long time (household durable goods, including furniture, books, and fixed assets including carpentry products, etc.). Increasingly, wood related products are recycled which extends the period of carbon binding.

### Experience from pilot exercises

The wood contents of the **Swedish and French** mass balances are derived from the physical supply-use tables using conversion coefficients. Thus the mass balances correspond to the physical supply and use tables.

In **Finland** wood contents of products (in tons of dry matter) are derived from industrial statistics.

In **Germany** there are relatively few data on the wood content of products. Thus it was not possible to draw mass balances.

## Conclusions

Undoubtedly, industry mass balances are very important to follow the wood content and the binding of carbon throughout the processes of production and intermediate consumption of wood and wood products. Moreover, mass balances will establish a link with physical supply and use tables in describing the wood contents in the different wood products produced or used by economic activities.

At present, it is difficult to draw conclusions from the data provided. For the same reason as for supply-use tables more work is needed to improve their comparability and the links with material flows.

### 3.7 General conclusions

The primary objective of the pilot exercises was to test the integration of forest-related data, in physical and monetary terms, in a consistent framework of forest stocks and flows, forest-related economic activities and supply and use of wood. The second objective was to examine the problems related to classification and valuation of forests in ESA/SNA and SEEA.

A major conclusion of the exercise is that integration is possible which enables us to provide a better insight into European forests. However, some methodological issues remain to be solved. This requires a further refinement of the methodologies of the forest accounting framework.

The distinction between cultivated and non-cultivated (natural) forests, according to ESA/SNA principles, is generally not relevant for European forests. Most forests are more or less cultivated. In order to determine whether natural growth is to be considered as forestry output or not, the classification needs to emphasise the degree of forest management. The separation between (regularly) managed and over-mature forests, according to national criteria, will allow countries to identify that part of natural growth that has to be treated as output.

The valuation of land and standing timber gives rise to differences in results uncovering differences in methods across the countries. Complementary work will be to test the applicability of the different valuation methods available with the purpose of reaching consensus on the valuation issue. The choice is between a more sophisticated method taking into account factors of heterogeneity of forests and uses other than wood production and a simplified method based on stumpage prices for calculating the value of standing timber, and for deriving a separate land value. In view of the fluctuations of prices of standing timber the issue of volatility of prices will be given special attention.

Most countries successfully separated forestry and logging activities. However, some information gaps remain to be filled. As the aim is to establish a link with forest stocks and flows, it would be useful to complete this part of the exercise. In particular it would be interesting to give a better view of the cost structure of forestry (government costs etc.).

The data on supply and use of wood are sometimes unbalanced and inconsistent when comparing physical and monetary tables. To treat properly flows of residuals, data for the recycling industry need to be elaborated. Complementary work will be to re-test the existing supply and use tables. Concretely, this means checking the balances and relationships between physical and monetary supply and use and also verifying the links to economic accounts of forestry.

In order to improve the description of the diversity of European forests, geographical breakdowns will be considered for the calculation of forest stocks and flows. A first attempt to set up regional forest accounts is under way in France.

At present, the integration of forest-related data is limited to ESA/SNA concepts. But increasingly, the focus is on issues of sustainable forest management. This requires going beyond the needs of ESA/SNA economic accounts and balance sheets and considering the “non-market, non-wood values” of forests. As a starting point, a list of ecological and social functions of forests was compiled. Based on national studies in these fields, a proposal will be worked out for the treatment of ecological and social functions, in physical and monetary terms.

## 4. Comparative tables

**Table 1. Forest and other wooded land (1000 ha, closing areas)**

	Sweden	%	Finland	%	Germany	%	France	%
<b>Total area</b>	<b>27 963</b>	<b>100.0</b>	<b>26 339</b>	<b>100.0</b>	<b>10 494</b>	<b>100.0</b>	<b>15 722</b>	<b>100.0</b>
<b>Available for wood supply</b>	<b>21 667</b>	<b>77.5</b>	<b>22 381</b>	<b>85.0</b>	<b>9 870</b>	<b>94.1</b>	<b>14 262</b>	<b>90.7</b>
Afforested	363	1.3	192	0.7	n.a.	n.a.	n.a.	n.a.
Other	20 545	73.5	19 805	75.2	n.a.	n.a.	n.a.	n.a.
Natural/mature	759	2.7	2 384	9.1	n.a.	n.a.	n.a.	n.a.
<b>Not available for wood supply</b>	<b>6 296</b>	<b>22.5</b>	<b>3 958</b>	<b>15.0</b>	<b>624</b>	<b>5.9</b>	<b>1460</b>	<b>9.3</b>
Protected	1 703	6.1	2 893	11.0	391	3.7	n.a.	n.a.
Not protected	4 593	16.5	1 065	4.0	233	2.2	n.a.	n.a.

**Table 2. Changes in forest area (1000 ha)**

**Sweden (opening 1.1.1989, closing 31.12.1993)**

	Opening area	Closing area	Change		
			1000 ha	%	% per year
<b>Total area</b>	<b>27 994</b>	<b>27 963</b>	<b>- 31</b>	<b>- 0.1%</b>	<b>- 0.02%</b>
<b>Available for wood supply</b>	<b>22 012</b>	<b>21 667</b>	<b>-345</b>	<b>- 1.6%</b>	<b>- 0.3%</b>
Afforested	377	363	-14	- 3.7%	- 0.7%
Other	20 769	20 545	-224	- 1.1%	- 0.2%
Natural/mature	866	759	-107	- 12.5%	- 2.5%
<b>Not available for wood supply</b>	<b>5 981</b>	<b>6 296</b>	<b>+315</b>	<b>+ 5.3%</b>	<b>+ 1.0%</b>
Protected	1 447	1 703	+256	+17.7%	+ 3.5%
Not protected	4 534	4 593	+59	-1.3%	-0.3%

**Finland (opening 1.1.1990, closing 31.12.1994)**

	Opening area	Closing area	Change		
			1000 ha	%	% per year
<b>Total area</b>	<b>26 291</b>	<b>26 339</b>	<b>+48</b>	<b>0.2%</b>	<b>0.04%</b>
<b>Available for wood supply</b>	<b>22 852</b>	<b>22 381</b>	<b>-471</b>	<b>-2.1%</b>	<b>-0.4%</b>
Afforested	130	192	+62	+47.7%	+9.5%
Other	19 998	19 805	-193	-1.0%	-0.2%
Natural/mature	2 724	2 384	-340	-12.5%	-2.5%
<b>Not available for wood supply</b>	<b>3 439</b>	<b>3 958</b>	<b>+519</b>	<b>+15.1%</b>	<b>+3.0%</b>
Protected	2 670	2 893	+223	+8.4%	+1.7%
Not protected	769	1 065	+296	+38.5%	+7.7%



**Germany (opening 1.1.1991, closing 31.12.1995)**

	Opening area	Closing area	Change		
			1000 ha	%	% per year
<b>Total area</b>	<b>10 435</b>	<b>10 494</b>	<b>+59</b>	<b>0.5%</b>	<b>0.1%</b>
<b>Available for wood supply</b>	<b>9 893</b>	<b>9 870</b>	<b>-23</b>	<b>-0.2%</b>	<b>0.04%</b>
Afforested					
Other					
Natural/mature					
<b>Not available for wood supply</b>	<b>542</b>	<b>624</b>	<b>+82</b>	<b>+15.1%</b>	<b>+3.0%</b>
Protected	306	391	+85	+27.8%	+5.6%
Not protected	236	233	-3	-1.3%	-0.3%

**France (opening 1.1.1991, closing 31.12.1995)**

	Opening area	Closing area	Change		
			1000 ha	%	% per year
<b>Total area</b>	<b>15 311</b>	<b>15 722</b>	<b>411</b>	<b>2.6%</b>	<b>0.5%</b>
<b>Available for wood supply</b>	<b>14 048</b>	<b>14 262</b>	<b>+214</b>	<b>1.5%</b>	<b>0.3%</b>
Afforested					
Other					
Natural/mature					
<b>Not available for wood supply</b>	<b>1 263</b>	<b>1 460</b>	<b>+197</b>	<b>+15.6%</b>	<b>+3.1%</b>
Protected					
Not protected					

**Table 3. Standing timber (million m<sup>3</sup>, closing stocks)**

	Sweden	%	Finland	%	Germany	%	France	%
<b>Total stock</b>	<b>2 993</b>	<b>100.0</b>	<b>1 960</b>	<b>100.0</b>	<b>3 033</b>	<b>100.0</b>	<b>2 146</b>	<b>100.0</b>
<b>Available for wood supply</b>	<b>2 734</b>	<b>91.3</b>	<b>1 765</b>	<b>90.0</b>	<b>2 835</b>	<b>93.5</b>	<b>2 146</b>	<b>100.0</b>
Afforested	8	0.3	4	0.2	n.a.	n.a.	n.a.	n.a.
Other	2 572	85.9	1 225	62.5	n.a.	n.a.	n.a.	n.a.
Natural/mature	153	5.1	535	27.3	n.a.	n.a.	n.a.	n.a.
<b>Not available for wood supply</b>	<b>259</b>	<b>8.7</b>	<b>196</b>	<b>10.0</b>	<b>198</b>	<b>6.5</b>	<b>n.a.</b>	<b>n.a.</b>
Protected	94	3.2	95	4.8	122	3.7	n.a.	n.a.
Not protected	165	5.5	101	5.2	76	2.2	n.a.	n.a.

**Table 4. Standing timber (million m3)****Sweden**

	Available for wood supply	Not available for wood supply	Total	Change in % of opening stock	Average change in % per year
<b>Opening stocks: 1. 1. 1989</b>	<b>2 541</b>	<b>259</b>	<b>2 800</b>		
Natural growth	484	14	498	+17.8%	+3.6%
Fellings	-330	-11	-341		
Other	-19	-6	-25		
Changes in classification	-30	+30	0		
<b>Total change</b>	<b>+105</b>	<b>27</b>	<b>+132</b>		
Stat. Discrepancy	88	-27	+61		
<b>Closing stocks: 31. 12. 1993</b>	<b>2 734</b>	<b>259</b>	<b>2 993</b>	<b>+6.9%</b>	<b>+1.4%</b>

**Finland**

	Available for wood supply	Not available for wood supply	Total	Change in % of opening stock	Average change in % per year
<b>Opening stocks: 1.1.1990</b>	<b>1 724</b>	<b>130</b>	<b>1 854</b>		
Natural growth	349	18	367	+19.8%	+3.8 %
Fellings	-259		-259		
Other	-1		-1		
Changes in classification	-48	48			
<b>Total change</b>	<b>41</b>	<b>66</b>	<b>107</b>		
<b>Closing stocks: 31.12.1994</b>	<b>1 765</b>	<b>196</b>	<b>1 961</b>	<b>+5.8%</b>	<b>+1.1 %</b>

**Germany**

	Available for wood supply	Not available for wood supply	Total	Change in % of opening stock	Average change in % per year
<b>Opening stocks: 1.1. 1991</b>	<b>2 618</b>	<b>152</b>	<b>2 770</b>		
Natural growth	471	24	495	+17.9%	+3.6%
Fellings	-230		-230		
Other	-2		-2		
Changes in classification	-22	22			
<b>Total change</b>	<b>217</b>	<b>46</b>	<b>263</b>		
<b>Closing stocks: 31.12.1995</b>	<b>2 835</b>	<b>198</b>	<b>3 033</b>	<b>+9.5%</b>	<b>+1.9%</b>

**France**

	Available for wood supply	Not available for wood supply	Total	Change in % of opening stock	Average change in % per year
<b>Opening stocks: 1.1.1991</b>	<b>2 011</b>	n.a.	<b>2 011</b>		
Natural growth	443	n.a.	443	+22.0%	+4.4 %
Fellings	-266	n.a.	-266		
Other	-42		-42		
Changes in classification		n.a.			
<b>Total change</b>	<b>135</b>	n.a.	<b>135</b>		
<b>Closing stocks: 31.12.1995</b>	<b>2 146</b>	n.a.	<b>2 146</b>	<b>+6.7%</b>	<b>+1.3%</b>

**Table 5. Values of forests**

	Value per ha (National Currency)	Value per ha (ECU)	of which Land (ECU/ha)	of which Land (%)	of which standing timber (ECU/ha)	Value of standing timber (ECU/m <sup>3</sup> )
Sweden (93)	19 186 SEK	2 103	58	2.7%	2 046	16.2
Finland (94)	11 289 FIM	1 824	246	13.5%	1 578	20.0
Germany (95)	20 647 DM	11 019	3 405	30.9%	7 614	26.5
France (95)	38 695 FF	5 930	803	13.5%	5 127	34.1

**Table 6. Economic accounts for forestry and logging**

Sweden (millions of SEK)

1993	TOTAL
<b>Output (basic prices)</b>	30 502
<i>Natural growth</i>	11 417
<i>Wood in the rough</i>	17 613
<i>Logs, coniferous</i>	15 365
<i>Logs, non-coniferous</i>	1 605
<i>fuel wood and other logs</i>	643
<i>Other products</i>	1 472
<i>other forestry products</i>	132
<i>services incidental to forestry</i>	1 340
<b>Intermediate consumption</b>	12 818
<i>Standing timber</i>	8 566
<i>Other products</i>	4 252
<b>Gross value added</b>	17 684
<i>Compensation of employees</i>	4 087
<i>Taxes less subsidies on production</i>	69
<i>Consumption of fixed capital</i>	1 371
<i>NOS/mixed income</i>	12 157
<b>Gross capital formation</b>	4 220
Gross Fixed Capital Formation	1 816
<i>Construction</i>	1 268
<i>Equipment</i>	584
Changes in inventories	2 404
<i>of which work in progress</i>	2 851
<b>Public financing</b>	
<b>Supplementary data</b>	
Labour inputs (number of employees)	15 700
Stocks of fixed assets	58 201

## Finland (millions of FIM)

1994	Forestry	Logging	TOTAL
<b>Output (basic prices)</b>	10 242	9 611	19 852
<b>Intermediate consumption</b>	291	6 941	7 232
<i>Standing timber</i>		6 089	6 089
<i>Other products</i>	291	852	1 143
<b>Gross value added</b>	9 950	2 670	12 620
<i>Compensation of employees</i>	806	1 392	2 198
<i>Taxes less subsidies on production</i>	-20	-3	-23
<i>Consumption of fixed capital</i>	1 489	607	2 096
<i>NOS/mixed income</i>	7 676	674	8 350
<b>Gross capital formation</b>			
<i>Gross Fixed Capital Formation</i>	765	680	1 444
<i>Construction</i>	20	177	197
<i>Equipment</i>	56	502	558
<i>Other</i>	689	-	689
<i>Changes in inventories</i>			
<i>of which work in progress</i>	1 050		1 050
<b>Public financing</b>	358		
<b>Supplementary data</b>			
Labour inputs (number of employees)	2 160	3 524	5 684
Stocks of fixed assets	n.a.	n.a.	n.a.

## Germany (millions of DM)

1994	TOTAL
<b>Output (basic prices)</b>	4 949
<i>Natural growth</i>	1 983
<i>Wood in the rough</i>	2 828
<i>Other products</i>	138
<i>other forestry products</i>	
<i>services incidental to forestry</i>	
<b>Intermediate consumption</b>	1 555
<b>Gross value added</b>	3 394
<i>Compensation of employees</i>	3 493
<i>Taxes less subsidies on production</i>	-426
<i>Consumption of fixed capital</i>	234
<i>NOS/mixed income</i>	94
<b>Gross capital formation</b>	2 147
<i>Gross Fixed Capital Formation</i>	409
<i>Construction</i>	
<i>Equipment</i>	
<i>Changes in inventories</i>	1 738
<i>of which work in progress</i>	1 983
<b>Public financing</b>	na
<b>Supplementary data</b>	na
Labour inputs (number of employees)	
Stocks of fixed assets	

## France (millions of FF)

1994	Forestry	Logging	TOTAL
<b>Output (basic prices)</b>	18 419	18 138	36 557
<i>Natural growth</i>	17 677		17 677
<i>Wood in the rough</i>		18 138	18 138
<i>of which fuel wood</i>		4 792	4 792
<i>Other products</i>	742		742
<i>other forestry products</i>	163		163
<i>services incidental to forestry</i>	579		579
<b>Intermediate consumption</b>	1 260	7 319	8 579
<i>Standing timber</i>		6 800	6 800
<i>Other products</i>	1 260	519	1 779
<b>Gross value added</b>	17 159	10 819	27 978
<i>Compensation of employees</i>	933	1 867	2 800
<i>Taxes less subsidies on production</i>		265	265
<i>Consumption of fixed capital</i>	na	na	na
<i>NOS/mixed income</i>	na	na	na
<b>Gross capital formation</b>			
<i>Gross Fixed Capital Formation</i>	na	na	na
<i>Construction</i>			
<i>Equipment</i>			
<i>Changes in inventories</i>	na	na	na
<i>of which work in progress</i>	10 877	-	10 877
<b>Public financing</b>	458		
<b>Supplementary data</b>			
Labour inputs (number of employees)	5 000	10 000	
Stocks of fixed assets			

**Table 7. Return on capital for forestry and logging (national currency units)**
**First calculation based on the results of the pilot exercises (natural growth recorded as output)**

	Sweden 1993	Finland 1994	Germany 1994	France 1994
Gross value added	17 684	12 620	3 994	27 978
NOS/mixed income (1)	12 157	8 350	94	23 902
Fixed capital (2)	58 201	55 099	66 137	51 998
Standing timber	404 359	218 595	140 817	477 141
Land	11 370	34 066	62 964	74 734
Total capital	473 930	307 760	269 918	603 873
Ratio NOS/ Capital	2.6%	2.7%	0.1%	4.0%

Source: Eurostat pilot exercises, own calculations

- (1) For France, Net Operating Surplus/mixed income is not available in the pilot exercise; it was estimated using the Eurostat Economic Accounts for Forestry (EAF) data on consumption of fixed capital (1 011 million FF).
- (2) For Finland, Germany and France, the stock of fixed capital is estimated from Swedish data, as a ratio based on the volumes of logged timber.

**Second calculation based on the data from the Eurostat Economic Accounts for Forestry (output corresponds to felled timber)**

	Sweden 1993	Finland 1994	Germany 1994	France 1994
Gross value added	12 843	11 570	1 411	16 608
NOS/mixed income (1)	7 316	7 299	-1 889	12 532
Fixed capital	58 201	55 099	66 137	51 998
Standing timber	404 359	218 595	140 817	477 141
Land	11 370	34 066	62 964	74 734
Total capital	473 930	307 760	269 918	603 873
Ratio NOS/ Capital	1.5%	2.4%	-0.7%	2.1%

Source: Eurostat Economic Accounts for Forestry (value added and net operating surplus), Eurostat pilot exercises (value of capital), own calculations

- (1) For Sweden, Germany and France, the Net Operating Surplus/mixed income is not available in Eurostat EAF. The value was estimated starting from the gross value added at market prices in the Eurostat EAF and deducting the consumption of fixed capital (from EAF), the compensation of employees (from pilot exercises) and the taxes less subsidies on production (from pilot exercises).

Note on table 7:

The data from the Eurostat Economic Accounts for Forestry are based on the 1992 version of the EAF framework (see Commission of the European Communities (1992)) which is consistent with the ESA 1979. Data according to the revised framework for Economic Accounts for Forestry (EAF Rev.1) – consistent with ESA 1995 - will become available later in 1999. Therefore, this comparison essentially illustrates the effects of moving from ESA 1979 (output of forestry based on fellings) to ESA 1995 (output of forestry based on natural growth of standing timber).

**Table 8. Comparison of supply and use of wood (physical units)****Supply and use of pulp wood (1000 m3)**

	Sweden	Finland	Germany	France
<u>Use</u>				
Intermediate consumption by pulp industry	13 897	31 400	n.a.	8 335
Intermediate consumption by paper industry	20 709	800	n.a.	0
Intermediate consumption by other industries	338	0	n.a.	3 293
Changes in capital formation	-3 934	700	n.a.	0
Exports	392	300	n.a.	1 409
<b>Total use</b>	<b>31 402</b>	<b>33 200</b>	<b>n.a.</b>	<b>13 037</b>
<u>Supply</u>				
Logging industry output	27 200	24 300	n.a.	11 872
Output by other industries	46	0	n.a.	0
Imports	4 156	7 400	n.a.	1 165
<b>Total supply</b>	<b>31 402</b>	<b>31 700</b>	<b>n.a.</b>	<b>13 037</b>

**Supply and use of pulp (1000 tons)**

	Sweden	Finland	Germany	France
<u>Use</u>				
Intermediate consumption by pulp industry	0	0	0	4 252
Intermediate consumption by paper industry	1 490	8 700	5 627	0
Intermediate consumption by other industries	0	100	256	0
Changes in capital formation	190	-100	15	0
Exports	2 864	1 500	173	450
<b>Total use</b>	<b>4 544</b>	<b>10 200</b>	<b>6 071</b>	<b>4 878</b>
<u>Supply</u>				
Pulp industry output	3 671	10 000	2 439	2 787
Output by other industries	670	0	0	0
Imports	203	200	3 505	2 091
<b>Total supply</b>	<b>4 544</b>	<b>10 200</b>	<b>5 944</b>	<b>4 878</b>

**Supply and use of waste paper (1000 tons)**

	Sweden	Finland	Germany	France
<u>Use</u>				
Intermediate consumption by paper industry	1 203	500	5 734	4 063
Intermediate consumption by other industries	0	100	0	13
Changes in capital formation	169	-	0	0
Exports	137	0	1 398	669
<b>Total use</b>	<b>1 509</b>	<b>600</b>	<b>7 132</b>	<b>4 745</b>
<u>Supply</u>				
Recycling industry output	911	500	6 348	0
Output by other industries	56	0	0	3 517 <sup>(1)</sup>
Imports	542	100	784	1 228
<b>Total supply</b>	<b>1 509</b>	<b>600</b>	<b>7 132</b>	<b>4 745</b>

(1) not distinguished by economic activities



## 5. Country tables

The following tables are based on the data as originally supplied by the pilot countries. Tables include:

- Physical forest balances: forest areas and standing timber ;
- Monetary valuation of forest balances ;
- Output related to wooded land;
- Physical and monetary supply and use of wood.

**Table 9. Forest balances: area (1000 hectares)**
**Sweden 1 000 ha**

Opening area: 1.1.1989 Closing area: 31.12.1993	Forest and other wooded land																			Total	
	Available for wood supply									Total	Not available for wood supply										Total
	Afforested forests			Other forests			Natural forests				Protected				Not protected						
	Coni-ferous	Broad-leaved	Mixed	Coni-ferous	Broad-leaved	Mixed	Coni-ferous	Broad-leaved	Mixed		Coni-ferous	Broad-leaved	Mixed	Total	Coni-ferous	Broad-leaved	Mixed	Total			
Opening area	309	51	17	18 378	1 002	1 389	757	59	50	22 013	958	256	233	1 447	3 248	628	658	4 534	5 981	27 994	
Changes in cover																					
Due to economic activities																					
Afforestation																					
Deforestation 1)										-45											-45
Due to other causes																					
Natural colonisation																					
Environmental conditions																					
Changes in use/status										-300				300					50	350	50
Statistical discrepancy														-44					9	-35	-36
Closing area	291	55	17	18 014	1 000	1 531	664	50	45	21 668	1 127	302	274	1 703	3 268	659	665	4 593	6 296	27 963	

1) net land use changes

**Finland 1 000 ha**

Opening area: 1. 1. 1990 Closing area: 31. 12. 1994	Forest and other wooded land																	Total			
	Available for wood supply									Total	Not available for wood supply								Total		
	Afforested arable land			Mature forests			Other forests				Protected			Not protected							
	Pine	Spruce	Broadl.	Pine	Spruce	Broadl.	Pine	Spruce	Broadl.		Pine	Spruce	Broadl.	Pine	Spruce	Broadl.					
<b>Opening area</b>	85	34	11	1 782	711	232	13 079	5 219	1 700	22 852	1 746	697	227	503	201	65	3 439	26 291			
Changes in cover																					
Due to economic activities																					
Afforestation	41	16	5							63										63	
Deforestation	0	0	0	-1	-1	0	-9	-3	-1	-15											-15
Due to other causes																					
Natural colonisation																					
Environmental conditions																					
Changes in use/status				-222	-89	-29	-117	-47	-15	-519									519	0	
Statistical discrepancy																					
<b>Closing area</b>	126	50	16	1 559	622	203	12 953	5 169	1 683	22 381	1 892	755	246	696	278	91	3 958	26 338			

**Germany**      **1 000 ha**

Opening area: 1. 1. 1991 Closing area: 31. 12. 1995	Forest and other wooded land													Total	
	Available for wood supply						Total	Not available for wood supply							Total
	Cultivated forests			Natural forests				Protected			Not protected				
	Pine	Spruce	Broadl.	Pine	Spruce	Broadl.		Pine	Spruce	Broadl.	Pine	Spruce	Broadl.		
<b>Opening area</b>	3 018	3 512	3 363	..	..	..	9 893	93	109	104	72	84	80	542	10 435
Changes in cover															
Due to economic activities															
Afforestation	13	13	13	..	..	..	39	..	..	..	0	0	0	0	39
Deforestation	-4	-3	-3	..	..	..	-10	..	..	..	0	0	0	0	-10
Due to other causes															
Natural colonisation	7	13	11	..	..	..	31	0	1	0	0	0	0	1	32
Environmental conditions															
Changes in use/status	-26	-29	-28	..	..	..	-83	26	29	29	-1	-1	-1	81	-2
Statistical discrepancy															
<b>Closing area</b>	3 008	3 506	3 356	..	..	..	9 870	119	139	133	71	83	79	624	10 494

**France**      **1 000 ha**

Opening area: 1. 1. 1991 Closing area: 31. 12. 1995	Forest and other wooded land					Total
	Available for wood supply (cultivated)			Total	Not available for wood supply	
	Coniferous	Broad-leaved	Plantations of poplars			
<b>Opening area</b>	5 144	8 695	209	14 048	1 263	15 311
Changes in cover						
Due to economic activities						
Afforestation						347
Deforestation						-232
Due to other causes						
Natural colonisation						338
Natural regression						-38
Accidental perturbation						-5
Changes in use/status						410
Statistical discrepancy						
<b>Closing area</b>	8 751	5 282	14 033	14 262	1 460	15 722

**Table 10. Forest balances: volume of standing timber (million m3 incl. bark)**

Sweden million m3		Forest and other wooded land																		Total	
		Available for wood supply									Total	Not available for wood supply									Total
		Afforested			Other forests			Natural forests				Protected				Not protected					
		Total	Pine	Spruce	Broadl.	Total	Pine	Spruce	Broadl.	Total	Pine	Spruce	Broadl.	Total	Pine	Spruce	Broadl.	Total			
<b>Opening stock</b>	11	937	1 078	349	2 365	67	75	23	165	2 541	"	"	"	80	"	"	"	179	259	2 801	
Natural growth	2	181	209	78	467	5	7	3	15	484	"	"	"	3	"	"	"	11	14	498	
Fellings	0	-94	-190	-46	-330	-	-	-	-	-330	-	-	-	-	"	"	"	-11	-11	-341	
Catastrophic losses																					
Storms	0	-1	-5	-2	-8	"	"	"	-1	-9	"	"	"	-1	"	"	"	-3	-4	-13	
Natural losses	0	-3	-4	-3	-10	"	"	"	-1	-11	"	"	"	0	"	"	"	-2	-2	-13	
Other changes																					
Deforestation																					
Conversion																					
Changes in land classification	0	-8	-8	-4	-22	-4	-5	0	-9	-31	"	"	"	26	"	"	"	4	30	0	
Statistical discrepancy	-5	46	51	11	109	-12	-2	-5	-16	88	"	"	"	-14	"	"	"	-13	-27	60	
<b>Closing stock</b>	8	1 058	1 131	383	2 572	56	75	21	153	2 734	"	"	"	94	"	"	"	165	259	2 993	

Finland million m3		Forest and other wooded land																Total	
		Available for wood supply									Total	Not available for wood supply							Total
		Afforested forests			Mature forests			Other forests				Protected			Not protected				
		Pine	Spruce	Broadl.	Pine	Spruce	Broadl.	Pine	Spruce	Broadl.	Pine	Spruce	Broadl.	Pine	Spruce	Broadl.			
<b>Opening stock</b>	2	1	1	221	176	85	567	452	219	1 724	29	23	11	31	24	12	130	1 854	
Natural growth	0	0	0	45	36	17	114	91	44	349	4	3	2	4	4	2	19	367	
Fellings	0	0	0	-63	-50	-24	-55	-44	-21	-259				0	0	0	0	-259	
Catastrophic losses																			
Storms																			
Natural losses																			
Other changes																			
Deforestation	0	0	0	0	0	0	0	0	0	-1								-1	
Conversion				57	46	22	-57	-46	-22	0								0	
Changes in land classification				-15	-12	-6	-7	-6	-3	-48	11	8	4	11	9	4	48	0	
Statistical discrepancy																			
<b>Closing stock</b>	2	2	1	245	195	95	561	447	217	1 765	43	35	17	46	37	18	196	1 961	

## Germany

Million m3

Opening stock: 1. 1. 1991 Closing stock: 31. 12. 1995	Forest and other wooded land														Total
	Available for wood supply						Total	Not available for wood supply						Total	
	Cultivated forests			Natural forests				Protected			Not protected				
	Pine	Spruce	Broadl.	Pine	Spruce	Broadl.		Pine	Spruce	Broadl.	Pine	Spruce	Broadl.		
<b>Opening stock</b>	656	1 142	820	"	"	"	2 618	21	39	26	16	30	20	152	2 770
Natural growth	106	222	143	"	"	"	471	3	7	4	2	5	3	24	495
Fellings	-41	-138	-51	"	"	"	-230	0	0	0	0	0	0	0	-230
Catastrophic losses															
Storms	-1	0	-1	"	"	"	-2	0	0	0	0	0	0	0	-2
Natural losses															
Other changes															
Deforestation															
Conversion															
Changes in land classification	-5	-10	-7	"	"	"	-22	6	9	7	0	0	0	22	0
Statistical discrepancy															
<b>Closing stock</b>	715	1 216	904	"	"	"	2 835	30	55	37	18	35	23	198	3 033

## France

million m3

Opening stock: 1. 1. 1991 Closing stock: 31. 12. 1995	Forest and other wooded land			
	Available for wood supply			Total
	Cultivated forests			
	Coniferous	Broad-leaved	Plantations of poplars	
<b>Opening stock</b>	1 207	773	31	2 011
Natural growth	235	200	8	443
Fellings	66	101	17	267
Catastrophic losses				
Storms				
Natural losses				
Other changes				
Deforestation				18
Conversion				
Changes in land classification				
Statistical discrepancy	96	42	-14	22
<b>Closing stock</b>	1 280	830	35	2 146

**Table 11. Standing timber per hectare (m<sup>3</sup>/ha)**

	Forest and other wooded land												Total			
	Available for wood supply				Not available for wood supply											
					Protected				Not protected							
	Sweden	Finland	Germany	France	Sweden	Finland	Germany	France	Sweden	Finland	Germany	France	Sweden	Finland	Germany	France
Opening stock	115	75	265	143	55	24	281	n.a.	39	87	282	n.a.	100	71	265	n.a.
Closing stock	126	79	287	150	55	31	312	n.a.	36	115	325	n.a.	107	74	289	n.a.

**Table 12. Forest balances: wooded land (monetary values)**

<b>Sweden</b>		<b>million SEK</b>
Opening area: 1. 1. 1989	Forest and other wooded land	
Closing area: 31. 12. 1993	available for wood supply	
Opening area	9 979	
Changes in cover		
Due to economic activities		
Afforestation		
Deforestation	-23	
Due to other causes		
Natural colonisation		
Environmental conditions		
Changes in use/status	-152	
Revaluation	1 748	
Closing area	11 370	

<b>Finland</b>		<b>million FIM</b>			
Opening area: 1. 1. 1990	Forest and other wooded land available for wood supply			Total	
Closing area: 31. 12. 1994	Afforested Land	Mature forests	Other forests		
Opening area	232	4 853	35 626		40 710
Changes in cover					
Due to economic activities					
Afforestation	112	0	0		112
Deforestation	0	-3	-24		-27
Due to other causes					
Natural colonisation					
Environmental conditions					
Changes in use/status	0	-604	-320		-924
Revaluation	-33	-692	-5 079		-5 804
Closing area	310	3 353	30 203		34 066

<b>Germany</b>		<b>million DM</b>					
Opening area: 1. 1. 1991	Forest and other wooded land					Total	
Closing area: 31. 12. 1995	Available for wood supply		Total	Not available for wood supply		Total	
	Cultivated forests	Natural forests		Protected	Not protected		
Opening area	63 184	0	63 814	1 957	1 497	3 454	66 638
Changes in cover							
Due to economic activities							
Afforestation	248	0	248	0	6	6	254
Deforestation	-62	0	-62	0	-2	-2	-64
Due to other causes							
Natural colonisation	195	0	195	6	5	11	206
Environmental conditions							
Changes in use/status	-523	0	-523	535	-12	523	0
Revaluation	-78	0	-78	-3	-2	-5	-85
Closing area	62 964	0	62 964	2 495	1 492	3 987	66 950

**France** million FF

Opening area: 1. 1. 1991 Closing area: 31. 12. 1995	Forest and other wooded land				Total	
	Available for wood supply		Plantations of poplars	Total		Not available for wood supply
	Coniferous	Broad- leaved				
Opening area	28 728	48 561	1 167	78 456	7 055	85 512
Changes in cover						
Due to economic activities						
Afforestation						1 868
Deforestation						1 249
Due to other causes						
Natural colonisation						1 819
Environmental conditions						-232
Changes in use/status						
Revaluation						-5 424
Statistical discrepancy						88
Closing area	27 678	45 856	1 200	74 734	7 648	82 382

**Table 13. Forest balance: standing timber (monetary values)**
**Sweden** million SEK

Opening stock: 1. 1. 1989 Closing stock: 31. 12. 1993	Forest and other wooded land available for wood supply
<b>Opening stock</b>	358 281
Natural growth	71 535
Fellings	48 774
Catastrophic losses	2 808
Fires	1 182
Storms	1 626
Natural losses	
Other changes	4 434
Deforestation	
Conversion	
Changes in land classification	4 434
Revaluation	17 553
Statistical discrepancy	13 006
<b>Closing stock</b>	404 359

**Finland** million FIM

Opening stock: 1. 1. 1990 Closing stock: 31. 12. 1994	Forest and other wooded land available for wood supply			Total
	Afforested Land	Mature forests	Other forests	
<b>Opening stock</b>	607	73 205	187 954	261 766
Natural growth	121	11 826	30 207	42 154
Fellings	0	-16 673	-14 631	-31 303
Catastrophic losses				
Storms				
Natural losses				
Other changes	-17	-2 080	-5 358	-7 455
Deforestation	0	-52	-152	-204
Conversion	-17	-2 028	-5 206	-7 251
Changes in land classification				
Revaluation	-107	-13 025	-33 345	-46 566
<b>Closing stock</b>	605	53 253	164 738	218 595



**Germany** million DM

Opening stock: 1. 1. 1991 Closing stock: 31. 12. 1995	Forest and other wooded land						Total
	Available for wood supply		Total	Not available for wood supply		Total	
	Cultivated forests	Natural forests		Protected	Not protected		
<b>Opening stock</b>	130 870	0	130 870	0	0	0	130 870
Natural growth	21 907	0	21 907	0	0	0	21 907
Fellings	-10 762	0	-10 762	0	0	0	-10 762
Catastrophic losses	-83	0	-83	0	0	0	-83
Storms							
Natural losses							
Other changes	-941	0	-941	0	0	0	-941
Natural colonisation	69		69				69
Deforestation	75		75				75
Conversion							
changes in land classification	-1 076	0	-1 076	0	0	0	-1 076
Revaluation	-174	0	-174	0	0	0	-174
<b>Closing stock</b>	140 817	0	140 817	0	0	0	140 817

**France** million FF

Opening stock: 1. 1. 1991 Closing stock: 31. 12. 1995	Forest and other wooded land					Total
	Available for wood supply			Total	Not available for wood supply	
	Coniferous	Broad-leaved	Plantations of poplars			
<b>Opening stock</b>	138 599	294 132	6 828	439 559	0	439 559
Natural growth	28 864	50 798	1 749	80 805	0	80 805
Fellings (1)	15 999	13 981	3 466	38 030	0	38 030
Catastrophic losses						
Storms						
Natural losses						
Other changes						
Deforestation				1 022	0	1 022
Conversion						
Changes in land classification						
Revaluation				-10 693	0	-10 693
Statistical discrepancy				6 522	0	6 522
<b>Closing stock</b>	148 892	320 061	8 188	477 141	0	477 141

(1) Total fellings includes 4 583 millions FF (non-market output), which are not distributed by species

**Table 14. Output related to “wooded land”**
**Sweden 1993 (million SEK)**

	Industries					Total
	Agriculture	Forestry & Logging	Manufacture of wood and wood products	Recreational, cultural & sporting services	Other	
<b>Products of forestry, logging, and related services</b>						
<i>Market and own account output</i>						
<u>Natural growth</u>		11 417				11 417
Resinous						
Broad-leaved						
<u>Wood in the rough</u>		17 613	554		211	18 738
Logs of coniferous wood		15 365	45		131	15 541
Logs of non-coniferous wood		1 605				1 605
Logs of tropical wood						
Fuel wood		607	509			1 116
Other wood in the rough		36			80	116
<u>Other forestry products</u>					115	247
Natural gum						
Natural cork						
Other forestry products		132			115	247
<u>Services incidental to forestry and logging</u>		1 340			102	1 442
Plantation, etc.		1 340			102	1 442
Forest inventories, etc.						
Protection of forest against fires, etc.						
<b>Other products related to forest and other wooded land</b>	427					427
Agricultural products growing in forests	93					93
Forest growing animals	223					223
Meat, as hunting sub products	111					111
Charcoal						
Recreational services in forests						
<b>Other products</b>						
<b>Total output</b>	427	30 502	554	0	428	31 911

## Finland 1994 (million FIM)

	Industries				Total
	Agriculture	Forestry & logging	Mining and quarrying	Forest industries	
<b>Products of forestry, logging, and related services</b>					
<i>Market and own account output</i>					
<u>Natural growth</u>		7 139			7 139
Resinous		6 040			6 040
Broad-leaved		1 099			1 099
<u>Wood in the rough</u>					
Logs of coniferous wood					
Logs of non-coniferous wood					
Logs of tropical wood					
Fuel wood					
Other wood in the rough					
<u>Other forestry products</u>					
Natural gum					
Natural cork					
Other forestry products					
<u>Services incidental to forestry and logging</u>					
Plantation, etc.					
Forest inventories, etc.					
Protection of forest against fires, etc.					
<b>Other products related to forest and other wooded land</b>					
Agricultural products growing in forests	577				577
Forest growing animals					
Meat, as hunting sub products	262				262
Charcoal					
Recreational services in forests					
<b>Other products</b>			1 327		1 327
<b>Total output related to wooded land</b>	839	19 852*	1 327		22 018
<b>Total output (basic prices)</b>	23 093	19 852*	3 584	75 325	121 854

\*The output from logging is 12 713 mill. FIM

## France 1994 (million FF)

	Industries					Total
	Agriculture	Forestry & logging	Manufacture of wood and wood products	Recreational, cultural & sporting services	Other	
<b>Products of forestry, logging, and related services</b>						
<i>Market and own account output</i>						
<u>Natural growth</u>		17 677				
Resinous		6 323				
Broad-leaved		11 354				
<u>Wood in the rough</u>		18 138				
Logs of coniferous wood		6 122				
Logs of non-coniferous wood		7 482				
Logs of tropical wood						
Fuel wood		1 270				
Other wood in the rough		3 265				
<u>Other forestry products</u>		163				
Natural gum		9				
Natural cork		6				
Other forestry products		148				
<u>Services incidental to forestry and logging</u>		157				
Plantation, etc.		121				
Forest inventories, etc.						
Protection of forest against fires, etc.		36				
<b>Other products related to forest and other wooded land</b>						
Agricultural products growing in forests	222					
Forest growing animals						
Meat, as hunting sub products	210					
Charcoal						
Recreational services in forests						
<b>Other products</b>						
<b>Total output</b>	432	36 917				

**Table 15. Supply and use of wood****Sweden: physical supply and use tables 1993**

SUPPLY	Output by industries						Imports	Stat. disc.	Total
	Forestry	Logging	Sawing	Pulp ind	Paper	Other			
Standing timber (Mio m <sup>3</sup> )	83.7								83.7
Saw logs (Mio m <sup>3</sup> )		30.0	0.1				0.7		30.8
Pulp wood (Mio m <sup>3</sup> )		27.2					4.2		31.3
Fuel wood (Mio m <sup>3</sup> )		4.3							4.3
Sawn wood (Mio m <sup>3</sup> )			15.8			0.1	0.2		16.1
Paper pulp (Mio t)				3.6	0.6		0.4		4.6
Paper & paper board (Mio t)					9.2	0.7	0.5		10.4
Waste wood (Mio m <sup>3</sup> )			14.3	0.1		0.2	0.5		15.1
Waste paper (Mio t)						1.1	0.5		1.5
Residuals									
Waste wood (Mio m <sup>3</sup> )		2.3	2.3	0.3	0.8	0.2			5.9
Waste paper (Mio t)						0.1			0.1
Silvicultural waste/Stat. disc.		5.0							

USE	Intermediate consumption by industries					Exports	Capital form.	Final cons.	Stat. disc.	Total
	Logging	Sawing	Pulp ind	Paper	Other					
Standing timber (Mio m <sup>3</sup> )	63.8						19.9			83.7
Saw logs (Mio m <sup>3</sup> )		32.3			0.7	0.6	-2.8			30.8
Pulp wood (Mio m <sup>3</sup> )		0.2	13.9	20.7	0.2	0.4	-3.9			31.3
Fuel wood (Mio m <sup>3</sup> )								4.3		4.3
Sawn wood (Mio m <sup>3</sup> )										n.a.
Paper pulp (Mio t)				1.5		2.9	0.2			4.6
Paper & paper board (Mio t)										n.a.
Waste wood (Mio m <sup>3</sup> )			3.1	3.4	0.9				7.7	15.1
Waste paper (Mio t)				1.2		0.1	0.2			1.5
Residuals										
Waste wood used as fuel (Mio m <sup>3</sup> )		1.6	0.2	0.8	0.1					2.8

**Sweden: monetary supply and use tables 1994 (millions SEK)**

SUPPLY	Output by industries						Imports	Trade & transp.	Total
	Forestry	Logging	Sawing	Pulp ind	Paper	Other			
Standing timber	11 417								11 417
Saw logs		8 902	9			10	811	1 163	10 895
Pulp wood		8 104	26			2	597	1 105	9 834
Fuel wood		1 392	490			1	6	79	1 968
Sawn wood			20 077			267	724	1 273	22 341
Paper pulp				10 006	1 824		503	1 034	13 367
Paper and paper board					42 639	518	2 777	6 061	51 995
Waste wood			2 507			64	160	154	2 885
Waste paper					1	27	263	35	326
Total	11 417	18 398	23 109	10 006	44 463	889			

USE	Intermediate consumption by industries					Exports	Capital form.	Final cons.	Stat disc. & resid.	Total
	Logging	Sawing	Pulp ind	Paper	Other					
Standing timber	8 566						2 851			11 417
Saw logs		10 513			257	221	-148		52	10 895
Pulp wood		27	4 071	6 341	70	118	-823		30	9 834
Fuel wood		12	11	187	780	5	87	85	801	1 968
Sawn wood		1 496	56	595	7 828	14 475	-2 522	64	348	22 341
Paper pulp				5 043	224	8 731	-629			13 367
Paper & paper board				1 807	11 241	38 580	-192	6 143	-5 584	51 995
Waste wood		3	1 100	1 175		77			432	2 885
Waste paper				686		177			-537	326
Total	8 566	12 048	5 238	15 834						
Output basic prices	11 417	18 398	10 006	44 463						

## Finland: physical supply and use tables 1994

SUPPLY	Output by industries						Imports	Statist. disc.	Total
	Forestry	Logging	Sawing	Pulp ind	Paper	Other			
Standing timber (Mio m <sup>3</sup> )	73.5								73.5
Saw logs (Mio m <sup>3</sup> )		26.0					0.6	0.6	27.2
Pulp wood (Mio m <sup>3</sup> )		24.3					7.4	1.5	33.2
Fuel wood (Mio m <sup>3</sup> )		4.7							4.7
Sawn wood (Mio m <sup>3</sup> )			10.0				0.2		10.2
Paper pulp (Mio t)				10.0			0.2		10.2
Paper & paper board (Mio t)					10.9		0.2		11.1
Waste wood (Mio m <sup>3</sup> )			11.0	2.9		1.3	0.8		16.0
Waste paper (Mio t)						0.5	0.1		0.6
Residuals									
Waste wood (Mio m <sup>3</sup> )		5.4	0.5	0.7					6.6
Black liquors (Mio t)				10.5					10.5

USE	Intermediate consumption by industries					Exports	Capital form.	Final cons.	Stat. disc.	Total
	Logging	Sawing	Pulp ind	Paper	Other					
Standing timber (Mio m <sup>3</sup> )	60.4						13.1		5.1	73.5
Saw logs (Mio m <sup>3</sup> )		17.6	1.0		2.7	1.1	0.5			27.2
Pulp wood (Mio m <sup>3</sup> )		0.8	31.4			0.3	0.7			33.2
Fuel wood (Mio m <sup>3</sup> )								4.6	0.1	4.7
Sawn wood (Mio m <sup>3</sup> )		0.3			0.7	7.5	0.2	1.4	0.1	10.2
Paper pulp (Mio t)				8.7	0.1	1.5	-0.1			10.2
Paper & paper board (Mio t)					1.3	9.8				11.1
Waste wood (Mio m <sup>3</sup> )			9.1		1.0	0.2	-0.1		5.8	16.0
Waste paper (Mio t)				0.5	0.1					0.6

**Finland: monetary supply and use tables 1994 (millions FIM)**

SUPPLY	Output by industries						Imports	Trade & transp.	Stat. disc.	Total
	Forestry	Logging	Sawing	Pulp ind	Paper	Other				
Standing timber	10 241									10 241
Saw logs		5 195					85	1 647		6 927
Pulp wood		2 007					1 118	1 819		4 944
Fuel wood		185						376	369	930
Sawn wood			9 292			164	448		1 119	11 023
Paper pulp				11 580			489			12 069
Paper and paper board					32 894		905		4 221	38 020
Waste wood		35	1 368	163		193	74			1 833
Waste paper						20	53		159	232

USE	Intermediate consumption by industries					Exports	Capital form.	Final cons.	Stat disc & resid.	Total
	Logging	Sawing	Pulp ind	Paper	Other					
Standing timber	8 415						1 825			10 241
Saw logs		5 277	210		690	381	92		277	6 927
Pulp wood		61	3 718		35	54	59		1 017	4 944
Fuel wood						8 259		930		930
Sawn wood		298			2 282		184			11 023
Paper pulp				8 007	343	3 715	-88		92	12 069
Paper and paper board					4 326	33 360	234	100		38 020
Waste wood			1 199		85	41	-10	82	436	1 833
Waste paper				150	50	32				232
Other interm. cons.	852	2 466	7 878	13 331	243 703					
Total interm. cons.	9 267	8 092	13 005	21 488	251 514					
Gross value added	2 670	4 143	6 761	9 789	142 293					
Total	11 887	12 235	19 766	31 277	393 511					



## Germany: physical supply and use tables 1990

SUPPLY	Output by industries					Imports	Stat. disc.	Total
	Forestry	Logging	Wood work.	Wood proc.	Pulp & paper			
Standing timber (Mio m <sup>3</sup> )	40.3							40.3
Wood in the rough (Mio m <sup>3</sup> )		72.5				1.9		74.4
Prim. proces. prod. (Mio t)			12.6			4.3		16.9
Wood products (Mio t)				7.3		1.8		9.1
Paper pulp (Mio t)					2.4	3.5		5.9
Paper & paper board (Mio t)					12.0	5.9		17.9
Paper board prod. (Mio t)						9.7	1.0	10.6
Printing products (Mio t)						5.4	0.2	5.6
Waste wood (Mio m <sup>3</sup> )			4.3	0.8	0.2	0.8		6.0
Waste paper (Mio t)						6.3	0.8	7.1

USE	Intermediate consumption by industries					Exp.	Cap. form.	Final cons.	Stat. disc.	Total
	Logging	Wood work	Wood proc.	Pulp & paper	Other					
Standing timber (Mio m <sup>3</sup> )	72.5						-32.2			40.3
Wood in the rough (Mio m <sup>3</sup> )		20.7	13.5	5.4	26.2	4.5		4.2		74.5
Prim. Proces. prod. (Mio t)		1.6	6.3		8.9	2.0	0.2	0.5		19.5
Wood products (Mio t)			0.5		2.8	1.0	0.7	2.2		7.3
Paper pulp (Mio t)				5.6	0.2	0.2				6.0
Paper & paper board (Mio t)		0.1	0.1	0.3	13.9	4.0		0.1		18.5
Paper board prod. (Mio t)			0.1	0.1	7.6	1.3	0.1	1.0		10.3
Printing products (Mio t)					3.9	0.4				4.3
Waste wood (Mio m <sup>3</sup> )		3.5		1.4		1.0				6.0
Waste paper (Mio t)				5.7		1.4				7.1

**Germany: monetary supply and use tables 1990 (millions DM)**

SUPPLY	Output by industries						Imports	Total
	Forestry	Logging	Wood work.	Wood proc.	Pulp & paper	other		
Standing timber	3 275							3 275
Wood in the rough		8 991					561	9 552
Fuel wood		363						363
Prim. Proces. prod.			11 617				4 705	16 321
Wood products				45 741			6 868	52 609
Paper pulp					2 091		4 376	6 467
Paper and paper board					20 036		9 313	29 349
Paper & paper board prod.						30 906	3 134	34 040
Printing products						43 048	1 087	44 135
Waste wood			179	32	8		43	260
Waste paper						n.a.		255

USE	Intermediate consumption by industries					Exp.	Cap. Form.	Final cons.	Total
	Logging	Wood work	Wood proc.	Pulp & paper	other				
Standing timber	5 886						-2 611		3 275
Wood in the rough		3 271	17	673	14	531	4 724	322	9 552
Fuel wood		9	14	6	13			322	363
Prim. Proces. Prod.		1 798	4 983	161	5 937	2 078	949	417	16 323
Wood products		86	2 375	56	11 764	6 379	7 076	24 872	52 608
Paper pulp				6 148		270	49		6 467
Paper and paper board		106	68	7 744	14 493	6 582	161	195	29 349
Paper & paper board prod.		4	244	221	22 628	5 645	766	4 532	34 040
Printing products		23	180	11	40 212	3 378	126	205	44 135
Waste wood		100		40		125	1		266
Waste paper				n.a.		199			n.a.
Total interm. consumption	na	8 370	27 128	16 226	2331 796				
Cons. of fixed capital	na	660	1 272	1 134	299 944				
Net taxes		69	408	229	72 734				
Comp. of employees	na	2 736	16 933	4 536	1 844 595				
Gross value added	na	3 465	18 613	5 899	2 217 273				
Output	na	11 835	52 608	22 125	4 570 442				

## France: physical supply and use tables 1994

SUPPLY	Output by industries						Imports	Stat. disc.	Total
	Forestry	Logging	Sawing	Pulp ind	Paper	Other			
Standing timber (Mio m <sup>3</sup> )	88.2								88.2
Wood in the rough (Mio m <sup>3</sup> )		21.9					1.3		23.2
Primary wood prod. (Mio m <sup>3</sup> )		36.8					2.5		55.8
Pulp wood (Mio m <sup>3</sup> )		11.9					1.1		13.0
Fuel wood (Mio m <sup>3</sup> )		2.6					16.5		19.1
Sawn wood (Mio m <sup>3</sup> )			11.5				2.2		13.7
Paper pulp (Mio t)				2.7			2.1		4.8
Paper and paper board (Mio m <sup>3</sup> )						5.8	1.1		6.9
Paper and paper prod. (Mio t)					8.7		4.3		13.0
Waste wood (Mio m <sup>3</sup> )			5.0			0.3	0.8		6.1
Waste paper (Mio t)						3.5	1.3		4.8
Printing products (Mio t)									
Residuals									
Waste wood (Mio m <sup>3</sup> )		3.7	5.6			2.4			
Waste paper (Mio t)						3.5			
Black liquors									

USE	Intermediate consumption by industries					Exports	Capital form.	Final cons.	Stat. disc.	Total
	Logging	Sawing	Pulp ind	Paper	Other					
Standing timber (Mio m <sup>3</sup> )	57.0						26.1		5.1	88.2
Wood in the rough (Mio m <sup>3</sup> )		17.6			4.7	0.9				23.2
Primary wood prod. (Mio m <sup>3</sup> )		17.6	8.3	8.3	2.9			18.7		55.8
Pulp wood (Mio m <sup>3</sup> )			8.3	3.3	1.4					13.0
Fuel wood (Mio m <sup>3</sup> )							0.4	18.7		19.1
Sawn wood (Mio m <sup>3</sup> )					12.0	1.2		0.5		13.7
Paper pulp (Mio t)			4.3			0.5				4.8
Paper & paper board (Mio m <sup>3</sup> )					5.2	1.5		0.2		6.9
Paper & paper products (Mio t)					8.4	3.3		1.3		13.0
Waste wood (Mio m <sup>3</sup> )			2.7	2.7	0.7					6.1
Waste paper (Mio t)				4.1	0.7					4.8
Printing products (Mio t)										
Residuals										
Waste wood (Mio m <sup>3</sup> )		0.2			1.0					
Waste paper (Mio t)										
Waste treatment (Mio t)		0.3			0.1					

**France: monetary supply and use tables 1994 (millions FF)**

SUPPLY	Output by industries						Imports	trade & transp.	Total
	Forestry	Logging	Sawing	Pulp ind	Paper	Other			
Standing timber	17 677								17 677
Wood in the rough		11 125					1 607	925	13 657
Primary wood prod.		13 969				4 169	2 472	2 152	22 762
Pulp wood		2 134					742	452	3 328
Fuel wood		623				4 169	49	753	5 595
Sawn wood			18 779				4 328	2 477	25 584
Pulp and paper				6 986	104 842		37 135	15 735	164 698
Paper and paper board						12 125	2 593	1 272	15 990
Statistical discrepancy						1 471	-1	0	1 470
Other wood products						29 598	2 451	2 812	34 861
Printing products and publ.						189 168	14 372	34 601	238 141
Waste wood			623				263	401	1 321
Waste paper						2 050	644	253	2 947

USE	Intermediate consumption by industries					Exports	Capital format.	Final cons.	Total
	Logging	Sawing	Pulp ind	Paper	Other				
Standing timber	6 800						10 877		17 677
Wood in the rough		7 089			5 149	1 420			13 657
Primary wood prod.		7 089		2 199	5 881	2 028		5 565	22 762
Pulp wood				2 199	622	507			3 328
Fuel wood						30		5 565	5 595
Sawn wood					22 100	2 561		923	25 584
Pulp & paper			13 762		101 647	28 388	2	20 184	163 893
Paper & pap. board					12 360	3 227		403	15 990
Statistical discrepancy					1 621		-150		1 471
Other wood products					31 360	2 434	0	1 066	34 860
Printing products & publ.					148 675	11 334	-455	78 587	238 141
Waste wood			395		409	181			1 321
Waste paper				2 369		579			2 947

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