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European forest accounting: general concepts and Austrian experiences

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Abstract Within the European Union there exist three different frameworks for forest accounting at the national level. For purposes of the national accounts, the regulations of the European System of Integrated Economic Accounts (ESA) have to be observed. They require a distinction between forestry and logging and provide specific guidelines for the valuation of standing timber. In recognition of the special character of forests and forestry production, two satellite accounts are devoted to forestry: the Economic Accounts for Forestry (EAF) and the European Framework for Integrated Environmental and Economic Accounting for Forests (IEEAF). Although they were designed as complementary to the national accounts and refer to the same basic methodologies, the guidelines for forest accounting provided by the three manuals are not fully compatible. Just recently, a further integration and harmonization of the concepts for forest accounting has been proposed. Austria has implemented the valuation of the increment as an output of forestry as requested by ESA and produces the EAF tables on a regular basis. The possibilities for extending forest accounting to natural resource accounts for standing timber and the IEEAF have been investigated in terms of pilot studies. The Austrian experiences and results exemplify the problems and possible solutions associated with the adoption of the different European schemes. Data deficits and valuation issues restrict the significance of respective results to some degree, especially as regards forestry-specific extensions of the accounting schemes.

Keywords Forest accounting · Economic accounts for forestry · Natural resource accounting · Forest valuation · Forest timber accounts · Austria

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Introduction

Forestry is a specific part of the national economy, defined by the production of wood in the rough and other forest-related products. The economic significance of any industry is assessed usually by referring to its contribution to the Gross Domestic Product. In most European countries, this indicator classifies forestry as a marginal element of the economy. However, the ecological and social significance of the forest resource and its utilization trigger considerable effects on other parts of the economy as well as on public welfare and are hence of great and still increasing political concern. In recognition of the peculiarities of forestry, special rules have been established and specific accounting schemes were developed for dealing adequately with forestry in the context of national accounting. On behalf of the FAO, Lange (2004) published a manual for environmental and economic accounts for forestry, based on the previous studies of FAO (1998) and Vincent and Hartwick (1997). At the Statistical Office of the European Communities (Eurostat), the Task Force on Forest Accounting developed respective schemes and analyzed the experiences gained by several national pilot studies. The possibilities for implementing

forest-related environmental accounting were explored, e.g. by Bombana and Femia (1998) for Italy, Eriksson and Wolf (1998) for Sweden, Muukkonen (1998) for Finland, Bergen et al. (1998) and Bormann et al. (2006) for Germany and Tessier and Peyron (1999) for France. Peyron (1998) and Gutow and Schröder (2000) investigated extensively the conceptual as well as practical problems associated with forest accounting at the national level.

European schemes for forest accounting

The European System of Integrated Economic Accounts (ESA) is the compulsory framework for national accounting in the European Union (Statistical Office of the European Communities 1999a). It is based on and closely related to the System of National Accounts (SNA) as proposed for general application by the United Nations. Data pertaining to the forest sector have to enter the National Accounts in compliance with ESA definitions and respective methodology. Although ESA is a general framework, it does provide also some regulations specific for forestry. The latest revision of ESA in 1995 brought about significant changes, some of which directly affecting the forest sector and respective statistics.

Apart from the necessity to differentiate forestry and logging and hence to evaluate the increment as output of forestry, a scheme for natural resource accounting has been introduced. Based on the concepts of Integrated Environmental and Economic Accounting (SEEA, United Nations 2003), accounting for the changes in value of natural assets shall allow for differentiating GDP into real output on the one hand and output due to depletion of natural resources on the other. It has to be kept in mind, though, that the valuation exclusively refers to the income generating potential of these resources, whereas any externalities are not to be accounted for. Forests and mineral resources have been quoted as priorities of natural resource accounting for several years already. Although its compulsory implementation had originally been envisaged for 2005 already, the concept is far from general application. There is still no legal basis for compulsory implementation and respective progress is not to be expected in the near future.

The Economic Accounts for Forestry (EAF) is a satellite account providing additional information and concepts adapted to the particular nature of the forest industry. The main purpose of the EAF is to analyse the production process and primary income generated by it. The forestry part being an extension of the original scheme of agricultural accounting, the Economic Accounts for Agriculture (EAA) and the EAF methodologies are jointly covered by one manual (Statistical Office of the European Communities 2000a).

In contrast to ESA, there is no legal basis which would compel the member states to provide respective data. The elaboration of the EAF is voluntary and respective commitments are of the character of gentleman's agreement. Results of the EAF are available to the public in the Newcronos database. However, EAF data are only partially provided by a number of countries. Regarding 2004, only six countries out of EU15 and one new member country sent EAF data to Eurostat at end of November 2005.

Starting from a comparatively low level of commitment, there are some indications for an increasing interest in EAF statistics. For instance, Germany elaborated respective tables for the period from 1991 to 2002 (Dieter et al. 2004). Some of the new member states obviously started to investigate the EAF concept and at least consider its implementation. Just recently, Eurostat recognizes an increasing interest in statistical data on forestry motivated especially by the elaboration of Sustainable Indicators (Rural Development, Sustainable Management of Forests).

The Integrated Environmental and Economic Accounting for Forests (IEEAF) is the second satellite account devoted to forestry. It aims at a more comprehensive documentation of the sector (Statistical Office of the European Communities 2002a). Inspired by the SEEA, the framework covers not only transactions but also addresses assets and residuals. The EUROSTAT Task Force on Forest Accounting refined the original concept in the second half of the 1990s and several countries participated in a series of IEEAF pilot applications (Statistical Office of the European Communities 1999b, 2000b, 2002b, c).

Like the EAF, the IEEAF lack any legal basis. Implementing this scheme is therefore voluntary and providing Eurostat with respective data is merely based on a gentleman's agreement. The IEEAF transmission programme is based on a questionnaire sent out every other year and inquiring data of the years n−4 and n−3, respectively. So far, the response as such, as well as the quality and comprehensiveness of the data transmitted has been rather poor. For that reason, Eurostat has not made the results available in Newcronos database yet. The latest round of data collection took place in 2004, requesting data of the years 2000 and 2001. This inquiry was answered by just five EU countries and one new member (Lithuania).

Due to organisational changes and shifting responsibilities at Eurostat, activities related to integrated forest accounting have been sparse since the latest publication

of IEEAF pilot studies in 2002. Even the work of the Task Force on Forest Accounting has been discontinued. Nevertheless, there seems to be a rising interest in this topic. In November 2003, the Statistical Programme Committee adopted a European Strategy for environmental accounting. Forest timber accounts have been defined as one of the priority modules for harmonised reporting. The Sixth Environmental Action Programme considers forests as a key natural resource and an important economic asset. The Programme asks for well-preserved and sustainably managed forests, as a contribution to biodiversity and rural development. The forest timber accounts were derived from the IEEAF, focusing on the wood supply function of forests. The module timber accounts also contributes to the climate change issue, describing CO_2 flows related to forest activities, use of wood and changes in land use. Other functions of forests are omitted, however. In fact, the IEEAF questionnaire sent out in 2004 addressed the forest timber accounts and hence did not comprise any more the Non-ESA elements: factors linked to biodiversity, recreational functions and protective functions. On this basis, Italy and Estonia elaborated IEEAF pilot studies in 2005. Germany followed in 2006 and Hungary, Latvia and Greece started working on these timber-focused IEEAF tables on a grant basis.

The full integration of the two forestry satellite accounts, namely the EAF and the IEEAF, under the heading of forest timber accounts is an issue recently proposed by Eurostat. This step shall help avoiding incoherence, double work for the member states and for the responsible working groups at Eurostat. Given the differences in scope and background, a respective harmonization is all but straightforward but should help to establish forest accounting on the national level throughout the European Union.

Even though the integrated concept of forest timber accounts addresses considerably less topics than the original scheme of IEEAF, responsibility for data collection was assigned to Eurostat Unit E3 'environmental statistics'. It is proposed to give up collecting the annual data every 2 years and to switch to a regular annual data collection instead. According to the delayed availability of some kind of data, the new set of IEEAF tables shall be split into two groups on the basis of the reference year. Whereas the standard deadline is t+12 months, supply and use tables are to refer to the year n−3.

Forest accounting in Austria

Austria being one of the most densely forested countries in Europe, forest statistics and respective developments are of considerable interest (e.g. Sekot 2000, 2004a). The EAF were implemented at an early stage. Austrian representatives contributed to the work of the Eurostat Task Force on Forest Accounting by co-designing and testing the concept of the IEEAF.

In response to the new requirements, especially those triggered by ESA 1995, specific projects—European as well as national ones—were launched in order to develop and test along with the different schemes of forest accounting. A series of pilot studies was elaborated at the University of Natural Resources and Applied Life Sciences, Vienna, investigating data sources and developing and testing approaches suitable for a routine application of ESA, EAF and IEEAF, respectively:

- Valuation of the increment as output of forestry (Sekot 1998)
- Natural resource accounting for standing timber (Sekot et al. 1996; Sekot and Nikodem 1999; Sekot 1999a, b; Statistical Office of the European Communities 1999b, 2000b)
- EAF (Sekot 2002, 2004b)
- IEEAF—annual set of tables for ESA-functions of forests. Austria 1999 (Sekot and Stefsky 1999; Statistical Office of the European Communities 2002b)
- Non-timber functions of forests, monetary values and carbon balances for Austria and Germany (Sekot et al. 1999; Statistical Office of the European Communities 2002c)

Statistics Austria, the national statistical office of Austria, is responsible for establishing the national accounts. The valuation of the increment being implemented already, the current standards should suffice as regards the forest-specific requirements for national accounting imposed by ESA 1995.

As concerns the EAF, there is a clear commitment on behalf of Statistics Austria. These tables are regarded as a relevant complement to the Agricultural Accounts and as a prerequisite for deriving sound data on the forest sector for purposes of national accounting. They help to avoid double counting or omissions. The EAF have been implemented according to the new guidelines, consistent time series being available from 1988 onwards. The tables are established and transmitted to Eurostat on a regular basis. Respective data are available at the homepage of Statistics Austria. Commented results have been published repeatedly (Sekot and Mayer 2004, 2005). The conceptual gaps between the standards of ESA and EAF are covered by means of the so-called bridge tables.

Although alternative concepts for establishing natural resource accounts for standing timber have been investigated, this non-obligatory extension of national

accounting has not been implemented on a regular basis yet. At least for the time being, any respective action would have to be triggered by specific legal obligations.

Also as regards the IEEAF, there was no follow-up to the initial pilot studies so far. The latest questionnaire sent out by Eurostat in 2004 was left unanswered. Neither the ministry nor Statistics Austria feels responsible for dealing with such non-compulsory statistics on their own account. The political focus lying on the requirements of the Ministerial Conference on the Protection of Forests in Europe (MCPFE), the IEEAF are no issue of any priority and will hardly be financed, additionally.

Based on this situation, neither Statistics Austria nor the ministry are very much in favour of Eurostat's intention to integrate the EAF into IEEAF under the heading of forest timber accounts. As compared to the current situation, where only the EAF are implemented on a regular basis, the integrated scheme would require additional efforts. On the other hand, it would be doubtful, whether and by what institution the elaboration of independent IEEAF-tables would be commissioned at all as there seems to be no specific interest in respective additional information, at least for the time being. Apparently, the potential of integrated timber accounts as regards issues such as to derive indicators for sustainable forest management or to establish the link between physical and monetary data has not been acknowledged yet, the monitoring of forest resources and multifunctionality being based on alternative schemes so far. Whereas IEEAF definitely belongs to environmental statistics at Eurostat, the department of environment at the Austrian ministry claims too few environmental indicators in the framework of the forest timber accounts for taking over responsibility and costs. Ultimately, the integrated concept may therefore elicit a maximum of commitment and data transmitted to Eurostat by at least complementing the EAF with any additional data readily available. At any rate, the new scheme would close the gaps between EAF and the national accounts and practically offset the need for bridge tables and respective explanations, other differences between the two schemes but the increment and the intermediate consumption of logging being not accounted for in the Austrian case.

Methods

European concepts and regulations

The manuals for ESA, EAF and IEEAF provide the methodical framework to be observed when drawing up the respective tables. Although all of the concepts refer to definitions and general principles as defined by SNA and SEEA, there prevail significant differences as to the procedures proposed and their compulsory nature.

ESA 1995 introduced the compulsory distinction between 'forestry' (defined as growing timber and tending forests) and 'logging' (harvesting of timber and extraction of wood products). Nowadays, the increment is to be valued as the output of forestry, independent of any harvests. In non-commercial forests where the growth is not organised, managed and supervised by an institutional unit, the increment occurs in terms of 'economic formation', whereas in commercial forests the increment is to be treated as 'changes in stocks of work-in-progress', which is a special kind of gross capital formation. The production of standing timber provides an output which is not yet sufficiently processed to be in a form which is ready to be marketed. Only when the trees are felled, the process of production is completed and the work-in-progress is transformed into inventories of finished products ready for sale or other use.

The output of logging adds to the output of forestry and is to be assessed as the roadside value of the timber harvested. For the time being, there is no unanimous understanding, whether standing timber used for felling is to be recorded as intermediate consumption of logging or not. Alternatively, ESA regulation 3.71d could be applied, stating that goods produced and consumed within the same accounting period and within the same local kind of activity unit are to be recorded neither as output nor as intermediate consumption. Whereas gross value added is not affected by this debate, the values of output and intermediate consumption differ considerably between those two alternatives. The Austrian approach to record the total increment as output of forestry and standing timber harvested as input of logging contradicts the view maintained e.g. by Bormann et al. (2006, p. 62) and is based on the following considerations:

In the course of felling, standing timber is being used up and transformed into the output of the logging industry, i.e. timber assortments at the roadside. Consequently, standing timber used for felling bears the characteristics constituting intermediate consumption. Due to the differentiation between 'forestry' and 'logging', the production of standing timber and its use in the context of felling are performed by different types of local kind of activity units. According to ESA 1.35, respective output and input has to be recorded separately and hence ESA 3.71d is not applicable. Moreover, also the second condition postulated by ESA

3.71d is violated in the context of the forestry/logging interface: the timber harvested has not been produced in the same period but has accumulated in terms of work-in-progress over the whole lifespan of the tree harvested. Therefore, the total increment is to be recorded as output of forestry as requested by ESA 3.14.b. For reasons of consistency, the use of standing timber by the logging industry is to be treated as intermediate consumption. Hence, ESA 3.71d is applicable only for the trade in standing timber, whereas logging definitely involves intermediate consumption provided from within the sector. Consequently, the value of production is increased by the value of the increment, whereas the net increment (value of the increment minus value of standing timber harvested) adds to the gross value added of the sector. Conceptually, total output in forestry can be measured by the value of sales plus other uses plus changes in inventories including work-in-progress. The output should be recorded as being produced continuously over the entire period of production and not simply at the moment of time when the process is completed, i.e. when the trees are felled.

The balance scheme for forests comprises the following flow items as regards standing timber: natural growth, fellings, catastrophic losses, other changes, changes in classification and revaluation. ESA postulates the following rules for the valuation of standing timber in terms of work-in-progress:

- Flows as well as stocks are to be evaluated with reference to market values.
- Where market prices are not available, costs of production or discounted net revenues can be used as surrogates.
- As regards stock entries of work-in-progress, the price used should be the estimated basic price of the finished product at the pro-rata production costs incurred.
- The basic price corresponds to the amount received by the producer from the buyer per unit of good or service produced (=producer price; not including invoiced VAT) minus any taxes on products payable plus any subsidies on products due on that unit as a consequence of its production or sale.
- Standing timber is to be evaluated according to the future proceeds from selling the timber minus the cost of tending the forest till the harvesting age and the cost of harvesting, all these items to be discounted.
- Instead of applying any general rate for discounting (especially the social rate of interest), the respective factor should be derived from information on transactions concerning the very asset under investigation (forests).

Although EAF methodology is based on ESA regulations and was mostly adapted to ESA 1995, the two concepts are still not fully compatible. There do exist minor differences as to the delimitation of agriculture and forestry, e.g. as regards the production of Christmas trees in nurseries. The most important difference between ESA and EAF however, concerns the measurement of output. For practical reasons, the EAF manual states that: "...in cases, where standing timber stocks are relatively regular (i.e. their volume does not fluctuate substantially from one year to the next) timber output is to be recorded only at the time of felling." (Statistical Office of the European Communities 2000a, p. 33). Due to these differences, the figures on forestry deviate between the two concepts. So-called bridge-tables were introduced in order to document respective gaps.

The EAF comprise the production account, the generation of income account, the entrepreneurial income account as well as elements of the capital account. The production account records the outputs as well as the inputs of the industry. The output of the forestry industry comprises forestry goods, forestry services as well as inseparable non-forestry secondary activities. Production is to be valued at the basic price. Total output minus intermediate consumption gives gross value added. From this, fixed capital consumption is deducted. Final result of the production account is the net value added at basic prices.

The generation of income account considers other taxes as well as other subsidies on production. Net value added modified by these elements gives the factor income, which is differentiated into the compensation of employees on the one hand and the operating surplus or mixed income on the other. The entrepreneurial income is derived by further considering rents and interest. Finally, gross and net fixed capital formation, changes in stocks as well as capital transfers are documented as part of the capital account.

Even the part of the so-called ESA-functions of forests within the IEEAF framework exceeds the scope of the EAF: the scheme comprises balances for forest land and standing timber as well as input–output tables, all of them in physical as well as in monetary terms. Furthermore, forestry-based outputs of other industries such as agriculture and tourism are taken into account and a differentiation between market and non-market output is introduced. Moreover, the economic accounts have to be split up into forestry and logging. Additionally, Non-ESA-functions are addressed.

These externalities of forestry are to be assessed by means of physical descriptors in the first place, monetary valuation of forest services being no part of the concept so far. The original framework addressed five different Non-ESA functions (carbon binding, factors linked to biodiversity, recreational functions, protective functions, health of trees) with a total of nine tables.

Unlike the strict rules defined by ESA which have to be obeyed in the context of national accounting, the IEEAF manual merely proposes alternative approaches for the valuation of forests, forest land and standing timber. In principle, transaction value methods (TVM) and net present value methods (NPVM) can be distinguished, each group comprising several variants (Statistical Office of the European Communities 2002a, pp. 101 ff):

Combined valuation of land and standing timber (stock):

- Market value based on transactions in forest real estates (TVM)
- Valuation based on forestry income (NPVM)

Separate valuation of land (stock):

- Transactions in bare forest land (TVM)
- Surrogate markets, e.g. marginal agricultural land (TVM)
- Recommended values (i.e. experts' opinions based on an empirical background of TVM- and or NPVM-data)

Separate valuation of standing timber (stock):

- Consumption value (TVM; stumpage prices of the various species and assortments being related to the respective volumes)
- Stumpage value (TVM; the average stumpage price of felling being generally applied to the total volume)
- Net present value (NPVM)

Fellings (flow):

- Stumpage value (TVM)

Natural growth (flow):

- Yearly costs of growing timber (transaction values of input factors)
- Net present value (NPVM)
- Consumption value or stumpage value (TVM)

Other changes in volume (flow):

- Net present value (NPVM)
- Consumption value or stumpage value (TVM)

When drawing up a national balance, however, the individual variables have to be valued in a consistent way. Eurostat concluded from a series of pilot studies, thereby highlighting the practical problems of forest valuation which prevail also in the national context (Statistical Office of the European Communities 1999b, p. 16): "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."

If at all, compliance with ESA-rules may be argued by interpreting transaction values as special kinds of net present values (Statistical Office of the European Communities 2002a , p. 102): "Both, the stumpage value and the consumption value methods may be seen as a simplification of the present value method. The rationale would be that the future increase in the volume of standing timber due to natural growth offsets the need for discounting the future returns. For the consumption value method, this 'implicit discounting' is higher and corresponds to both the future natural growth and the future increase in quality, e.g. due to the fact that higher diameters may receive higher prices per cubic meter."

Approaches investigated and adopted in Austria

The National Forest Inventory (NFI) is the main source for physical data on stocks and flows as regards forest land and standing timber. In contrast to the requirements of yearly reporting, however, results of the NFI become available with a periodicity of some 5–10 years only. Figures on stocks represent averages pertaining to the sampling period of between 2 and 5 years. Like all the other flow items derived from the NFI, the original data on increment cannot be related neither to a specific year nor to a certain period, as the individual years influence the average results with different weights. Consequently, the flow data available show a considerable time lag and represent mean values related to the time span of two consecutive inventories. So far, the approach has been to keep the latest data constant until new results of the NFI become

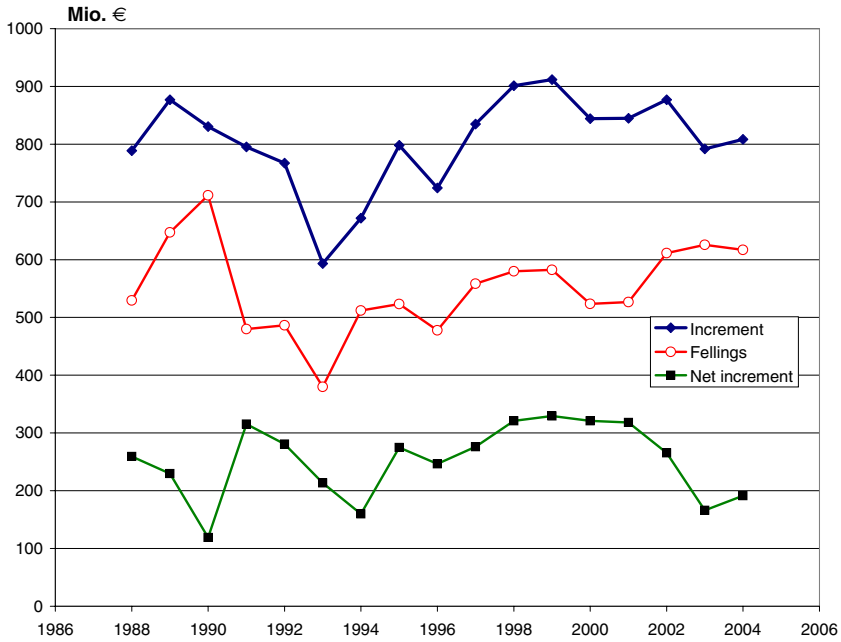

Fig. 1 Nominal values of increment, fellings and resulting net increment as acknowledged by the national accounts in addition to the EAF-figures on output, intermediate consumption and value added

available. For assessing the increment of the year 2005 for instance, data published in 2004 and representing natural growth of the years 1992 till 2002 are used as surrogates. Only in 2011, when the next results of the NFI are to be expected, the average increment derived from the measured natural growth of the years 2000–2009 will be adjoined to the reporting period 2005. In future, this problem might be tackled by means of specific models, which are being developed in order to assess CO_2 sequestration in compliance with the Kyoto protocol.

In view of these problems, it was decided to keep the approach for valuing the increment for purposes of the national accounts as simple as possible and to deviate explicitly from the ESA rules of valuation. Instead of referring to future prices and specific discount factors or to the costs of production, the increment is valued at stumpage prices. On that basis, a number of different approaches were investigated (Sekot 1998). The implemented version underlying the values entering the national accounts (Fig. 1) distinguishes between six main assortments (coniferous and broadleaved each differentiated into sawlogs, pulpwood and fuelwood). With reference to the model of the normal forest, it is assumed, that the shares of assortments associated with the increment correspond to the long term average shares of assortments harvested. The valuation is based on respective yearly average roadside prices of fir and beech, these two species together dominating the Austrian forests with a share of some 73% in terms of increment. The stumpage prices are derived by deducting the average harvesting costs per m^3 as documented by the network of bigger forest enterprises for the reporting year. For deriving the intermediate consumption as requested by the ESA scheme, the same stumpage prices per assortment are applied to the standing timber harvested, the shares of the assortments withdrawn being documented by the annual record of cuts.

Apart from the fellings, all physical data on stocks and flows for natural resource accounting as regards standing timber have to be derived from the NFI. Dependent from the availability of physical data, most of the elements quoted in the balance scheme suffer from a considerable time lag so far. Starting from the latest results of the NFI, the yearly figures of stocks are calculated by adding or deducting the various flow items. When new NFI data become available the calculated figure of the stock is adjusted to the empirical measure, the difference entering the balance under the heading of ‘other changes’. Five different approaches were tested for drawing up respective accounts (Sekot and Nikodem 1999; Sekot 1999b). Table 1 provides a concise characterisation of the respective methods. All of the variants refer more or less directly to current stumpage prices.

The conceptual framework for establishing the EAF follows a multi-stage approach (Sekot 2002): Wherever possible, aggregated data comprising the entire industry are adopted. Respective statistics are available especially as regards fellings, production of forest plants, plant protection products, real property tax, forestry subsidies and compensation of employees. Complementary data is derived from individual

Table 1 Identification of the different approaches (Sekot 1999b)

Approach	Characterisation
I	Consumption value method; growing stock assorted by age class
II	Stumpage value method; growing stock undifferentiated
III	Valuation based on age constants
IV	Consumption value method; growing stock assorted via grading models applied to the sample trees of the NFI
V	Calculation of net present value and deduction of management costs

enterprises, which are differentiated into three categories: Small-scale forestry with up to 200 ha is represented by the accountancy network of farm forests. The bigger forest enterprises (>200 ha) are characterized by data from the accountancy network of forest enterprises exceeding 500 ha. Statistical inferences are based either on the volume of fellings or on the area of forestland of the respective category. The national forests are considered as a separate category and provide some data based on their own accounting for EAF purposes. Remaining items are assessed in terms of expert opinion. This is the case as regards intermediate consumption of enterprises rendering forest services and those producing forest plants as well as for overcoming various other data deficits. Following this approach, it is possible to address most of the items listed in the EAF transmission table.

Like the EAA, also the EAF are elaborated not only at the national level but also for NUTS II categories (Nomenclature of Territorial Units for Statistics—coding of statistical regions in the European Union, level II in Austria corresponding to the provinces) and represent the sector in the regional accounts via bridge-tables. For deriving the EAF at provincial level a top–down approach is applied: the national results are split up by referring to the shares of ownership categories as well as to the respective fellings. Neither timber prices nor accounting data are differentiated, however. As the national averages are not truly weighted means of provincial data, coherence of the results could not be safeguarded by a bottom–up approach.

Results

On an average, the increment contributes some 800 Mio. € to the output of the forest sector as documented in the national accounts (Fig. 1). Thus, the increment makes up some 43% of the sector's total output. The value of the standing timber harvested averaging some 550 Mio. €€ per year, the national accounts show an additional annual gross value added due to net increment in the magnitude of 250 Mio. € as compared to the EAF. This increase of stocks of work-in-progress accounts for some 25% of the sector's gross value added and contributes almost 30% to the factor income.

In contrast to the routine application related to the national accounts, natural resource accounting for standing timber is stuck in an experimental stage. Depending on the methodical approach the tentative results obtained by Sekot and Nikodem (1999) differ considerably, not only between the variants investigated (Table 1) but also from the values nowadays acknowledged by the national accounts (Fig. 1). Typically, the revaluation item dominates the flows by far (Table 2). It is derived as the difference of value in the opening stock valued at price levels of the previous year and of the reporting year, respectively. Usually there is no data available on catastrophic losses, most of the damages due to, for e.g. windthrow or bark beetle being recovered in terms of sanitary fellings. Changes in classification might be captured on the basis of the NFI in intervals of several years only. In 1997, new data of the NFI became available. The adjustment of the calculated figure of stocks to the empirical one is recorded as 'other changes' and affects the balance almost twice as much as the increment.

Whereas the significance of the yearly results of this kind of natural resource accounting is quite limited due to the low reliability as well as poor accuracy of the various underlying data, respective developments may be of some interest in the long run. As shown in Fig. 2, the stumpage value of the growing stock has declined in real terms during the last 30 years despite a considerable increase in volume. Even such a simplistic approach, where the volume of the growing stock as recorded by the successive results of the NFI is confronted with respective real values as derived in terms of the stumpage value method, may lead to insights of some significance: the increase of timber production in physical terms could not compensate the declining trend of real timber prices and hence does not suffice for sustaining the economic potential of forestry.

According to the economic accounts for forestry, the output of the forest industry is usually in the range between 1.0 and 1.2 billion € per year (Fig. 3). Wood in the rough usually accounting for more than 80% of the output, the respective development is mostly driven by

Table 2 Forest balance for standing timber for the years 1996 and 1997 according to five different approaches of valuation (I to V; source: Sekot and Nikodem 1999, p. 93)

1996	Physical balance in Mio. m^3 o.b.	Monetary balance in Mio. €				
		I	II	III	IV	V
Opening stocks	1,014,678	20,843	22,906	28,880	21,642	29,062
Natural growth	+30,665	+516	+516	+516	+516	+516
Fellings	−23,588	−400	−400	−400	−400	−400
Catastrophic losses	.	.	.	.	.	.
Other changes	.	.	.	.	.	.
Changes in classification	.	.	.	.	.	.
Revaluation	–	−3,169	−3,597	−4,302	−3,532	−7,100
Closing stocks	1,021,756	17,790	19,425	24,694	18,226	22,078
1997						
Opening stocks	1,021,756	17,790	19,425	24,694	18,226	22,078
Natural growth	+26,778	+545	+545	+545	+545	+545
Fellings	−21,271	−436	−436	−436	−436	−436
Catastrophic losses	.	.	.	.	.	.
Other changes	−51,790	−1,054	−1,054	−1,054	−1,054	−1,054
Changes in classification	.	.	.	.	.	.
Revaluation	–	+3,343	+4,215	+5,974	+4,564	+11,024
Closing stocks	975,473	20,188	22,695	29,723	21,845	32,157

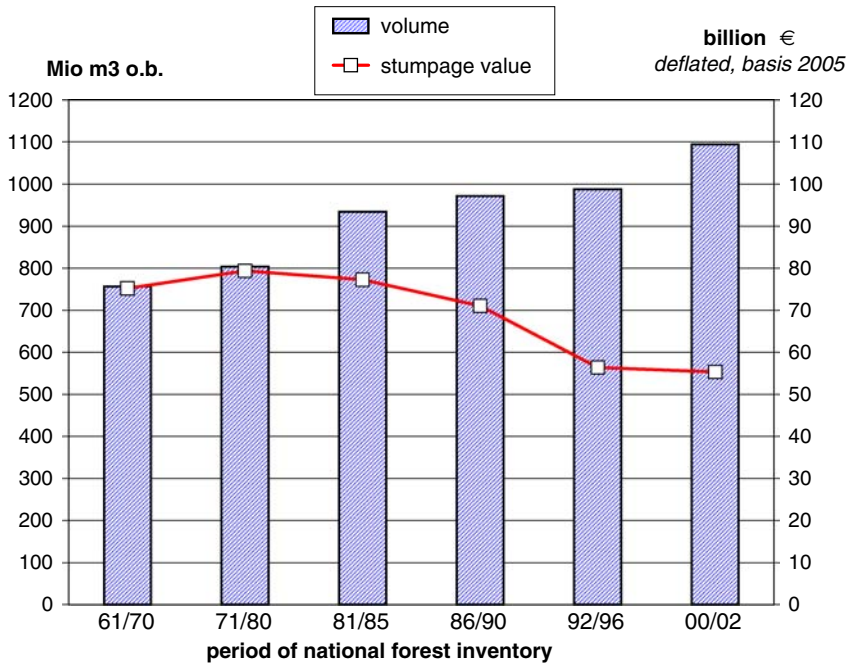

Fig. 2 Stocks of standing timber in physical and monetary terms (average values adjoined to the successive periods of data collection of the NFI; source: Sekot 1997, p.38, modified)

the fluctuation of timber prices on the one hand and by the intensity of harvests on the other. Due to the fact, that the 'practical rule' is applied and forestry output is measured in terms of timber harvested only, high levels of fellings due to calamities tend to trigger an increase of output, gross value added and entrepreneurial income as documented by the EAF. This was the case e.g. in the years 1990 and 2003. Conversely, the national accounts reflect also the associated reduction of net increment associated with excess fellings. Whereas EAF recorded an increase of gross value added from 2002 to 2003 in the magnitude of 7.2% as triggered by the extraordinary rise in felling volume, there was a decrease of 3.6% according to ESA rules due to the associated reduction of net increment in combination with declining timber prices.

On an average, 11% of the output is related to forestry services rendered by contractors. As this kind of output is consumed within the sector in terms of intermediate consumption, it does not affect gross value added. Other products and products from secondary activities contribute some 3% each to the sector's total output. Primary production requiring comparatively few inputs, the gross value added amounts to 71% of

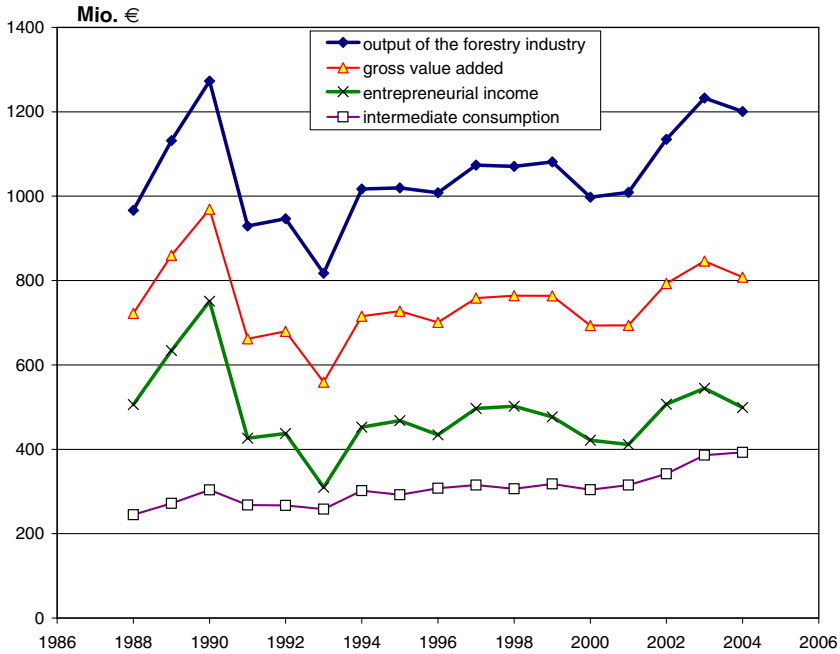

Fig. 3 Main results of the EAF for Austria in nominal values

Table 3 Regional structure of Austrian forestry at provincial level (NUTS II)

Item	B	K	NÖ	OÖ	S	ST	T	V	W
Area of commercial forest	3.9	15.0	21.6	13.2	8.3	25.7	10.3	1.8	0.2
Increment	3.8	15.9	20.6	15.1	7.5	27.3	7.9	1.7	0.2
Fellings (1995–2004)	3.5	13.5	21.9	15.4	7.8	28.2	7.7	1.9	0.1
Gross value added ESA (1995–2004)	4.0	15.0	21.1	15.6	7.5	27.5	7.3	1.7	0.2
Gross value added EAF (1995–2004)	3.5	13.1	21.4	16.2	8.0	28.1	7.6	2.1	0.1
Fellings (2003)	3.4	11.1	18.5	15.5	13.0	29.2	7.4	1.8	0.1
Gross value added ESA (2003)	4.1	14.0	20.4	15.8	9.1	27.7	7.1	1,7	0,2
Gross value added EAF (2003)	3.3	10.6	17.8	16.4	13.6	29.1	7.2	1.9	0.1

Burgenland (B), Kärnten (K), Niederösterreich (NÖ), Oberösterreich (OÖ), Salzburg (S), Steiermark (ST), Tirol (T), Vorarlberg (V) and Wien (W) (all values in % of the Austrian total)

the total output in the period from 1988 to 2004. Almost 60% of the output remains as factor income. One fifth of factor income is related to the compensation of employees, whereas the remaining 80% accrue as operating surplus and mixed income. This result underpins the significance of forestry for self-employment and rural income. In Austria, about half of the forests pertains to small scale farm forests which mostly employ family labour.

The EAF are also established at regional level and enter the regional accounts via bridge-tables. On average, the share of fellings is a good proxy for the contribution to gross value added (Table 3). Usually, the results of ESA and EAF differ only slightly in terms of structure. Under extraordinary circumstances, however, significant differences may occur. This was the case in the year 2003, when Salzburg was especially affected by a severe windthrow.

Although it was not possible to cover all of the items requested, the IEEAF pilot applications produced quite a lot of numerical (physical as well as monetary) results for Austria (Sekot and Stefsky 1999; Sekot et al. 1999, Statistical Office of the European Communities 2000b, 2002b, c). However, the main outcome was an assessment of the problems associated with IEEAF implementation.

In regard to the so-called ESA-functions of forests, the main problems were related to the following issues:

- Establishing a sound yearly balance for and evaluation of forest soil and standing timber.
- Availability of data on forestry based outputs of other industries.
- Differentiation of ‘market output’ and ‘non-market-output’.
- Differentiation of ‘forestry’ and ‘logging’, the details requested exceeding respective requirements postulated by ESA.
- Statistical differences as regards output of timber.
- Hitherto unresolved questions as regards certain definitions and classifications.

Apart from carbon binding and health of trees, which are topics well covered by established statistics, there is a severe lack of data as regards the Non-ESA functions. In essence, it is not generally possible to relate directly the data available to forestry (e.g. red list species to be classified as ‘forest occurring’). The availability of data does hardly match the IEEAF-schedule

for reporting. In many respects, basic data are just missing. Especially several flow-items cannot be provided. Hence, full coverage of all items would necessitate a lot of 'guesstimates' even on behalf of experts in the respective fields.

Carbon binding

About 60% of the total Carbon stock of forest ecosystems in Austria are stored in the forest soil. Net accumulation is about 3.5 Mio. t C/year. Assuming a value of 5 €/t CO_2, the yearly output of Carbon storage was estimated by Sekot et al. (1999) to some 64 Mio. €. Lately, a value of about 20 €/t seems realistic in the light of Carbon trading. Thus, the value of net accumulation lies in the magnitude of some 15% of the ESA-output of forestry.

Factors linked to biodiversity

Identifying the 'forest occurring species' within the categories of IUCN would necessitate specific research. Information on protected areas of forests will be available according to MCPFE-classification, which deviates from IEEAF nomenclature, however. Furthermore, it will hardly be possible to assess all of the flow items as defined by the balance approach. Balances as regards 'forest regimes' may be provided at best according to a modified classification.

Recreational functions

Deriving unambiguous data on 'urban recreation areas' proves to be problematic. Based on the micro-census 1998, the number of visits to Austrian forests by Austrian residents of more than 15 years of age can be estimated to some 220 million. Any differentiation as to duration and purpose of visits to forests would have to rely on specific empirical research, however. Already at a threshold level of 5 € per visit, this partial value of forest recreation equals the output of forestry goods.

Protective functions

There are practically no data available for balancing the area associated with different protective functions. Due to the problems of delimitation of functional units and the overlapping of such units, the prospects for deriving such data are definitely poor. The newly introduced classification of protective forests in Austria does not comply with the requirements stipulated by the IEEAF tables. Depending from the method of valuation (e.g. production costs, replacement costs, damage costs), monetary values may vary to a great extent.

Health of trees

The basic question is, whether 'health of trees' is a forest service as such or just a feature influencing the provision of non-timber-functions in terms of quantity and/or quality. The physical documentation relies on an internationally standardized system so that the data are readily available. Alas, no additional information is generated by recording these data within the IEEAF framework.

Government expenditure

The public funds devoted to a specific 'forest function' shall indicate the social significance of the respective function. Subsidies, reimbursements, commissioned research, specific additional costs and revenues forgone of public forest enterprises were identified as potential elements to be assessed. Until recently, however, it was not even possible to procure unambiguous data on all kinds of forest subsidies, respective statistics on provincial and national level being susceptible to double counting and other distortions. Full coverage of all relevant items cannot be achieved, at least for the time being.

Discussion

The implementation of the various rules and schemes related to forest accounting on the national level is all but straightforward. For the time being, the situation is aggravated by a persisting lack of consistency between the individual schemes. Due to the different regulations of ESA and EAF as regards the output of forestry (ESA: increment of standing timber as output of forestry and value of harvests as output of logging; EAF: practical rule allows for valuing the timber harvested as the output of forestry), the respective figures vary to a considerable extent. Furthermore, a positive net increment leads to a systematically higher value in ESA also in terms of value added. Hence, there are obvious, though explainable, incoherencies.

Being just a satellite account loosely or not at all adjusted to the national accounts, the EAF bear a considerable potential for double counting. For instance, farm forestry could be recorded as inseparable non-agricultural secondary activity quite in line with EAA-regulations. In the Austrian case this would mean, that

roughly half of the industry could be captured by the EAA already. Due to the high significance of farm forestry, however, agriculture and forestry are strictly differentiated so that output as well as intermediate consumption related to forestry does not enter the agricultural accounts.

Whereas forestry as such has to be incorporated into the national accounts ever since, it may be presumed, that only few countries fully responded to ESA 1995 requirements and really have implemented the valuation of changes in inventories of standing timber yet. International comparisons of sector-specific data from national accounts may be severely misleading for that reason. As regards the forestry-specific concepts of EAF and IEEAF, the respective guidelines are just recommendations so that no direct compatibility of results at the international level must be expected.

The Austrian experiences from pilot studies and partly also from routine application exemplify the problems associated with the implementation of forest accounting. The valuation of the growing stock suffers from deficits of the physical database which have to be bridged by means of crude assumptions. For instance, problems such as a more strict delimitation of commercial forests and respective production have not been resolved in a satisfactory way yet. The following issues still have to be addressed:

- Unmanaged Forests and non-timber goals.
- Shifting economic accessibility of stocks.
- Losses and other non-recoverable increment.
- Overmaturity as indication of reserve or abandonment.

Apart from these problems concerning the physical database, the issue of valuation is also quite complicated. In practice, it is hardly possible to comply with the general guidelines for valuation as postulated by ESA so that alternative approaches have to be adopted. The following major obstacles hindering the implementation of ESA rules for valuation were identified:

- The effective harvesting age of trees differs in a wide range (e.g. thinning, short rotation) and there is no operational indication for terminated production before harvest or mortality. Hence, the status of production can be assessed by means of far reaching assumptions only.
- Only when assuming the unrealistic conditions of the 'normal forest', there is a direct and sustained connection between the current costs of production and the increment. Being a natural process, however, increment and hence output occur at very different levels of management activity.
- Due to the extremely long time horizons of several decades, the assumed future proceeds are highly speculative.
- Interest rates derived from limited time series of past transactions (in terms of number of years and number of cases) are hardly suitable for discounting long term projections.
- Current values of costs and prices are volatile and as such do hardly reflect long-term expectations. Hence, also the use of 3- or 5-years' averages is but a poor surrogate for expected values.

Nevertheless, the results are of some significance, value of production and gross value added being major indicators of the economy and triggering various political and economic consequences.

Although the elaboration of the EAF is more or less a routine procedure meanwhile, some shortcomings prevail, certain data still missing and the methodology being quite crude in some respects. For instance, use of data provided by the wood processing industry point to a considerable statistical difference as regards the fellings, the EAF referring to the figures of the annual record of cuts. Furthermore, it could not be clarified yet, to what extent inseparable non-forestry secondary activities are in fact captured or missed by other statistics. Comparisons of figures based on alternative sources of data point to a rather poor convergent validity as demonstrated by Sekot (2004b, p. 190 f).

Austrian experiences with pilot applications of the IEEAF underpin some of the typical problems associated with the availability of data requested as well as with valuation issues. Major problems pertain to the forest specific extensions, sound results requiring costly primary data collection. Hence, in the Austrian case it proved to be all but straightforward to meet the goals of the IEEAF.

Conclusions

For the time being, there are huge gaps between the idealistic concepts of forest accounting on the one hand and current European practice on the other. These gaps exist not only in terms of commitment and implementation but also as regards the basic data available, the methods applied for valuation and ultimately also the quality and significance of the results in those cases where respective accounting is being practiced. So far, the European systems for forest accounting have neither been unanimously esteemed nor generally implemented. Even a densely forested country with a huge forest industry, such as Austria, is

not ready to implement all respective concepts on a voluntary basis. There are hardly any incentives to provide Eurostat with such data. Coherence, comparability and hence also the political significance of the results are rather poor at the international level, especially due to the vagueness of the methodology to be applied for valuation.

As regards the prospects for natural resource accounting for standing timber, the concept might even be abandoned, the SNA itself suggesting such a decision (United Nations 1993, p. 136): 'There may be circumstances in which the uncertainties attached to the estimation of the value of work-in-progress in advance of the harvest are so great that no useful analytic or policy purpose is served by compiling such estimates.'

However, there are indications for an increasing interest in this field. General trends and recent developments in national as well as sector specific accounting enhance a respective awareness. In order to overcome the lack of national support, it has to be pointed out, what interests and purposes can be served by compiling such accounts. The new scheme of integrated forest timber accounts neither meets the requirements of comprehensive environmental accounting in regard to forests nor is it suitable for capturing the overall welfare effects associated with the forest resource and its utilization. At least, it is fully compatible to ESA standards and integrates some sector-specific extensions. Thus, the integrated forest timber accounts may serve as a new starting point for forest accounting in Europe.

As regards the non-timber aspects of forestry, the need for harmonization with other reporting schemes is more and more acknowledged. In general, the close relationship to the so-called Helsinki-criteria for sustainable forestry as defined by MCPFE strongly suggests an integration of respective definitions and approaches. So far, however, the latest IEEAF manual of 2002 just briefly investigates the possibilities of integrating the criteria and indicators of the Helsinki Conference into the IEEAF scheme (Statistical Office of the European Communities 2002a, p. 95). MCPFE being driven by political commitments, it would be advisable to strive for a harmonised scheme of forestry statistics in order to avoid more or less redundant extra work.

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