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HEIKKI J. KUNNAS

FORESTRY IN NATIONAL ACCOUNTS

METSÄTALOUDEN KANSANTULO-  
OSUUDEN LASKENTA

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FORESTRY IN NATIONAL ACCOUNTS

Report of IUFRO Working Group 1, Section 31

Metsätalouden kansantulo-osuuden laskenta

Tiivistelmä sivulla 3

FOREWORD

The IUFRO Congress set up a working group for national accounting in forestry in 1967 in Munich. Active members of the group have been myself, HEIKKI KUNNAS, the writer of this paper, Professor ASBJÖRN SVENSRUD from Norway, ELIGIUS HROMADA, Czechoslovakia, PÄIVIÖ RIIHINEN, Finland and PROKOPEI VASILIEV, USSR. This report is written for that group, but the main parts of the study have originally been included in a thesis for the licentiate degree in economics by HEIKKI J. KUNNAS.

The first draft was discussed in December 1970 at the meeting of the working group in Oxford. The second draft was prepared for the

IUFRO Congress held in March 1971 in Florida. After the Congress, active or interested members of the working group were asked to criticize the study. We have received a number of remarks which we have tried to take into account in preparing this final version of the paper. I wish to thank all our colleagues for their remarks. I am specifically indebted to the late Professor EINO SAARI and Mr. PERTTI MARJOMAA from the Finnish Central Statistical Office, who spent much time with the preparation of this report.

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Helsinki, August 1971

Lauri Heikinheimo

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## TIIVISTELMÄ

Tutkimuksessa tarkastellaan metsätalouden tilinpitoa kansantalouden tilinpitojärjestelmän (System of National Accounts = SNA) puitteissa. Aluksi määritellään metsätalouden käsite, sen jälkeen tarkastellaan metsätalouden tuotantoa ja lopuksi esitetään tilipuitteet metsätalouden kansantulolaskentaa silmällä pitäen.

Metsätalouden käsitteen todetaan riippuvan luonnonolosuhteista ja maassa vallitsevista institutionaalisista oloista. Käsitteen määrittely on suoritettu lähinnä Suomen metsätaloutta silmällä pitäen. Tarkastelussa on pidetty tarpeellisenä jakaa metsätalous neljään alasektoriin: puun korjuu, metsänhoito, metsätalouden edistäminen ja keräily.

Puun korjuun tuotannon laskemiseksi todetaan olevan kaksi vaihtoehtoa. Tuotannoksi voidaan määritellä puuston kasvu tai korjattava puumäärä tilinpitokaudella. Jos puuston kasvu määriteltäisiin tuotannoksi, ei tuotannon arvon laskemiseksi olisi kuitenkaan käytettävissä tarpeellista tietoa puutavaran hinnasta. Kasvun määrittely tuotannoksi edellyttäisi samalla metsänhoidon (tuotannon) arvon käsittelemistä puun korjuun kuluna metsänhoidon poistojen muodossa. Lähinnä näillä perusteilla

on katsottu käytännöllisemmäksi ratkaisuksi määritellä puun korjuun tuotanto tilinpitokaudella korjattavaksi puumääräksi. Metsänhoidon ja metsätalouden edistämisen tuotannon arvo voidaan määrittää ko, toimintojen kustannustietojen avulla. Keräilyn arvo määritetään puolestaan keräilytuotteiden myynnistä saatavien tietojen perusteella.

Tuotantotilikehikot (A ja B) on esitetty siten, että ne vastaavat edellä mainittuja vaihtoehtoisia puun korjuun tuotannon käsitteitä. Tuotantotili B<sub>2</sub> sekä sitä seuraavat tulo- ja tulojen käyttötili sekä pääomanmuodostuksen tili vastaavat puolestaan pääosiltaan Suomen metsätalouden kansantulolaskennan menetelmää. Tilikehikkojen muuntaminen muiden markkinatalousmaiden metsätalouden kuvaimista silmällä pitäen ei kuitenkaan vaadi olennaisia muutoksia, sikäli kuin lähtökohtina käytetään esitettyjä tuotannon käsitteitä.

Liitteessä 1 käsitellään niitä suureita, jotka tulisi voida mitata metsätalouden kansantulolaskennassa. Liitteessä 2 esitetään Norjan ja liitteessä 3 Ruotsin metsätalouden kansantulolaskenta pääpiirteittäin.

## 0. SUMMARY

It is the purpose of this memorandum to examine the problems of national-income calculations in forestry and to put forward a model of production and income accounts, mainly according to the principles and recommendations of SNA concerning the present international practices in national-income accounting.

First comes a definition of forestry as the activity associated with the production of timber and other forest products for economic use.

The second chapter sets out the definitions according to which the determination and measurement of forest production ought to take place. These mainly relate to the handling of wood production in national-income calculations. Then follows a discussion of the various sub-sectors of forestry (Section 22): timber harvesting and floating, silviculture, forestry promotion, and the collection of non-wood forest products.

The main body of the paper (Section 23) deals with two alternatives for determining

production and presents model accounts for both cases. First, growing-stock increment is taken as production (Section 231). In this case, it is possible in theory to develop a logical system for including wood production in national-income accounting. In practice, however, when using this definition of production many difficulties in measurement are encountered, particularly in the compilation of precise statistical data. In addition, it is impossible to determine quantitatively some of the most important items, such as price levels, which are essential for calculating the value of production.

In Section 232, wood harvested is taken as production. This definition seems more practic-

able. Using the structure of Finnish forestry as a basis, three sub-divisions have been set out: silviculture, ownership and harvesting. From these, national-income calculations have been made and basic accounting principles developed.

Appendix 1 discusses the most important concepts which must be taken into account when calculating the national-income share of forestry. Appendices 2 and 3 present, in broad outline, the account systems for forestry in national-income accounting used in Sweden and Norway. They also deal with the definitions used in these two countries concerning the most important items discussed in this memorandum.

## 1. DEFINITION OF FORESTRY

Forests differ in composition of tree species, in growth capacity of the site, etc. Furthermore, their importance to economies varies because they are situated at different distances from the points where timber and other forest products are processed and used. Chronologically the economic importance of forests has also been seen to change. It is therefore not surprising that there are several definitions of forestry. *In the present study, forestry covers the activity associated with the production of timber and other forest products for economic use.* A definition may be based on the products produced, e.g. according to the United Nations' "International Standard for Industrial Classification of All Economic Activities" (ISIC); forestry here comprises about 40 different activities.

It should be recalled, however, that production so defined excludes certain values of the forest: for example site protection, the prevention of water pollution, and recreation.

Another possible definition is based on woodworking and wood-processing enterprises. Here, however, forestry would comprise the manufacturing of a wide range of products. The idea behind this definition is that this "industrial sector" is based on its raw material, wood, and all production branches dealing with this raw material (by conversion or transport) belong to the same industry. If this principle were adapted in the whole national economy, it would mean that the flow of all basic raw materials should be followed from the place of origin to the final use. This seems impracticable because of the intricate mixture of raw-material inputs and because of the possibility that similar products may be based on wood and non-wood raw materials.

In defining the boundaries between industries, it is always important to know how detailed the desired information should be. Classifications are, after all, only conventions.

## 2. FORESTRY PRODUCTION AND ITS MEASUREMENT

### 21. Some general remarks

Opinions differ concerning the definition of forestry production, with the slow growth of standing timber leading to several alternatives. In SNA (The System of National Accounts and Supporting Tables) 1953 and 1968, forestry production has been given little attention, except in the clause specifying that increment is not to be considered an increase in stocks held and therefore not a component of fixed capital formation. SNA defines production as all that has a market value and, further, indicates that it must be possible to divide production into investment goods, consumer commodities and raw materials. Using these criteria, it becomes possible to decide what forestry production is and how it should be calculated.

The long development period of trees makes it difficult to define forestry production for purposes of production measurement, but it may be said to have features in common with certain industries for which recommendations concerning production measurement have been worked out. On one hand, forestry can be likened to mining in that both deal with natural resources. Thus, forestry production might be determined in the same way as mining production, in which case the value of forest products annually removed for use would constitute production. On the other hand, forestry production can be likened to grain (crop) growing since the growing stock, unlike mineral resources, can be regenerated. According to the current international (FAO) recommendations concerning national accounting in agriculture, grain production is spread over the growing season. If this method were accepted for forestry, it would mean that the annual increment and growth of other forest products would constitute production.

One can think that forestry production may be comparable to the production of manufacturing and service industries. Therefore, national accounting for forestry production (timber harvesting aside) may follow methods analogous to those applied to manufacturing and service industries.

### 22. Sub-sectors of forestry in national accounting

The boundaries of forestry in national accounting have usually been drawn according to the ISIC classification. The activities grouped under forestry can be further classified into the following sub-sectors: harvesting and internal transport, silviculture, forestry promotion, and the collection of non-wood forest products.

The harvesting sub-sector refers to the felling of standing timber and haulage to transport sites (and marketing in a quite narrow sense). It should be noticed that not all wood needs external long-distance transport. This is the case with timber used on farms since it usually comes straight from the forest to the place of final use. In addition, floating has here been classified as internal transport under forestry although in national accounting there is a separate industrial category for transport.

Silviculture is here intended to cover all work connected with keeping the forests in good condition and increasing the increment, except for forest drainage and the construction of permanent forest roads. Thus clearing the soil surface for planting, seeding or natural regeneration, broadcast burning, seeding, planting and thinning are included. Other jobs associated with silviculture are cone collection, seed extraction, sowing seeds in nurseries, and tending of seedlings. These last-mentioned jobs might, with justification, be separated from silviculture and placed in separate sub-sectors, but national accounting has yet to adopt this procedure because the jobs often are of relatively little importance. In addition, statistics on silviculture are relatively limited in scope for national accounting as a whole. Forest drainage and permanent forest-road construction are sometimes excluded from forestry and included under civil engineering, as is the case in Finland.

Promotion of forestry comprises instruction and guidance by central forestry boards, local forest management associations and district forestry boards (extension service). The collection of non-wood products, according to the industrial classification, should include the gathering of all non-wood forest products.

## 23. Timber harvesting

### 231. Increment as production

#### 2311. *Some theoretical aspects*

The definition of wood production holds the key position for the whole definition of forestry production. In principle, there are two alternatives: increment is considered to be the production, or production consists of the harvested timber (volume). The relationship between silviculture and timber harvesting is the focal point of such a theoretical review. However, the goal here is to determine forestry production for national accounting; therefore, practical reasons make it necessary to disregard some of the theoretically ideal connections between silviculture and timber harvesting.

Silviculture is intended to maintain or increase the productive capacity of a forest, or to create new forests and so increase wood production beyond the level where it would remain without silviculture.

Distinguishing afforestation from other silvicultural work because of its investment character seems contradictory. Capital depreciation of afforestation investment during the effective interval of this capital does not mean that an investment of equal amount will be made after the effective interval on "other silviculture".

The connection between silviculture and harvesting is such that increased harvesting may lead immediately to increased silviculture. Many areas require increased harvesting in order that silviculture can be intensified. In this case, silviculture has been said to represent an outlay for harvesting which would otherwise be smaller. This, however, is not true since the purpose of silvicultural, even in this case, is to increase the increment and thereby the wood production.

From the foregoing, it may be concluded that the purpose of all silviculture is to increase or maintain the supply of wood available for use. Silvicultural work cannot be divided into investment-type and current work solely on the basis of the type of work done. Nor does a division on the basis of the working site seem sensible. Since, in principle, the effect of all silviculture is longer than one year (the accounting period), all silviculture should be classified as investment. If it is desired to depreciate investment evenly over the growing period,

forestry production and income must be considered to arise in the form of growth.

#### 2312. *Measuring the value added when increment is defined as production*

One of the basic problems in national accounting is how to determine the value of increment. In what ratio do changes in growing stock and changes in silvicultural and forest-management investments affect the property value of forest owners?

Increment has been assumed to constitute both production and income. According to SNA, all that has a market value is production. To determine the market value it is necessary to know, or be able to determine, the price of the products. The price is chiefly determined (depending on conditions of competition) by supply and demand.

The price of timber intended for use is determined (in Finland) by timber assortments. The prices include the cost of harvesting and a payment for the wood itself, the latter being received as income by forest owners (as stumpage revenue). In this case, the price is derived from the total volume bought by the harvesting sector.

The volume bought by the harvesting sector is divided, according to the timber assortments in demand, into a given composition of tree species. The tree-species composition can be determined both from growing stock (forest-owner sector) and increment, but the composition of timber assortments cannot be determined from either. Hence it seems that no market price exists for a given tree species. Such a price can, however be derived from the prices per timber assortment. What is crucial here is that these derived prices do not pertain to the increment per species. Increment, therefore, cannot be considered to have a market price.

It is evident that, if increment is to be classed as production, species prices derived from prices per timber assortment will vary according to changes in the assortments of any one tree species. This produces unexpected capital gains and capital losses which so far have not been entered in national accounts at all. An example is birch removals in Finland, which in the early 1950s were lower than the increment. According to the attached account-

ing procedure, the price of fuelwood should have been used to calculate the yield value and change in stocks. At present, however, birch loggings exceed the increment and the birch price is determined largely by the price of pulpwood. This obviously represents an unexpected capital gain (cf. SNA).

### *2313. Changes in stocks and in growing stock*

A closely related problem is the ratio of change in stocks to change in growing stock (in capital). In practice, the problem does not concern timber volumes but, rather, the values of the changes in stocks and capital.

The basis for this might be that data on forest investments, although obtained by inquiries at widely separated times, gives a sufficiently reliable picture of both the growing stock and increment, nationally and regionally (as within a forestry board district). But if the value of increment is calculated in the same way as changes in stocks, using "market prices" as above, the resulting apparent changes in the capital holdings of forest owners will not equal those really taking place in total capital (value). In other words, the value of a forest usually does not change in the same way as could be expected from changes in growing stock. Although market prices might define the changes in growing stock precisely enough, their use would not establish the desired connection between the capital account and the profit and loss account.

When increment is considered as forestry production, an argument often advanced is that removal not equalling the increment produces a change in the forest capital, the growing stock. This cannot be denied. But on the other hand, silviculture is undertaken in order to increase increment. The combined effect of silviculture and the removal-increment differential on capital in forestry needs to be considered.

The case in which a whole forest unit is clear cut and seedlings are planted immediately may serve as an example. Removal exceeds increment and therefore reduces fixed capital. The size of the reduction (expected value calculation) may be estimated on the basis of rotation, annual increment and prices. The result obtained may be that fixed capital is

reduced by 80 times the volume and value of increment. It is not difficult to see that the reduction in fixed capital value (depending on the growing stock) is relatively great (average growing stock, solid m<sup>3</sup>/ha) compared with the value change resulting from silvicultural measures (e.g. mk 0.15/seedling; 2000–2500 seedlings/ha). The conclusion arrived at may be, and usually is, that capital is reduced but its return increased. From this point of view, the value of the silviculture can of course be said to equal not only the cost of work, seedlings, etc. arising from the silvicultural work, but also some kind of a "surplus value".

### *2314. Conclusions*

On the basis of the above it may be concluded that, theoretically, all silvicultural measures – without distinction between afforestation and other work – may be classified as forestry investments. This solution presupposes that forestry production consists of increment and not the harvested volume of wood.

Another possibility would be to classify as production only that part of the increment obtained from silviculture, disregarding the increment created by nature. This division of increment, however, seems impossible in practice. Classifying increment as production would violate the SNA rule: increment is not considered a change in stocks (and hence not investment in production). Furthermore, another SNA rule, all that has market value is production, is not very well observed in this alternative. Increment takes place by tree species while timber is marketed by assortments which fetch certain prices. In price formation, furthermore, the important factor is the timber volume sold and bought on the market, not the volume of increment.

Since increment must not be considered a change in stocks, the alternative is to consider it as consumer goods and/or raw material. This possibility is excluded since a consumer commodity should be balanced by a corresponding item in consumption expenditure and raw material by a use of wood as raw material for other production, which seldom holds for one year (increment = use for consumption + use as raw material). Hence growing-stock increment

does not seem a suitable basis for calculating the value of forestry production.

On the basis of all this, it seems evident that increment cannot be considered forestry production. This being so, silviculture carried out to increase the increment cannot be considered to be forestry investment but must be termed forestry expenditure. This, admittedly, is against the SNA principle according to which the purchase of production commodities having a prolonged effect represents investment.

The following model account (Alternative A) has been drawn up on this basis. To illustrate the events, it uses two sectors as follows: the ownership sector owns the forest, obtains the income accruing in the form of growing-stock increment (stumpage price) and takes care of increasing the growing-stock increment; the utilization sector processes the timber bought into the timber assortments in demand on the market. In the ownership sector, a change in stocks held indicates a change in the growing stock arising from changes in the increment and from fluctuations in the quantities of timber bought by the utilization sector. Change in the stocks of the utilization sector, in turn, indicates a difference between the quantity of timber sold and that harvested.

The production of the ownership sector consists of increases in forest capital while that of the utilization sector consists of putting forest products into economic use. In the accounts of these sectors, investment can be distinctly separated from other forest-industry production. On the basis of the viewpoints presented above, it may not be advisable to refer forestry promotion to the investment sector. A better solution would apparently be to keep it as a special sector.

Considering the present Finnish forest-ownership conditions and the character of forestry, drawing a line between ownership and use is theoretical, but helps to better illustrate the investment problems.

### 232. Removal as production

Another possibility is to calculate as production the timber volume marketed per accounting period (Alternative B). On this basis, the output value of timber harvesting is obtained by calculating the value of removals either at the floating point or other transport route,

or at the final destination (farm, mill).

If removals are from the natural increment of a forest where no silvicultural measures have been undertaken, and disregarding depreciation and expenditures connected with machines used in harvesting, the gross output value and gross national product are equal.

If timber harvesting in a forest unit is based on increment partly produced by silviculture and forest management, the treatment of the outlays arising from these activities will present a problem. If the starting point is the connection between increment and investment, silvicultural work must be considered a production outlay assuming it has been decided to consider the volume of timber harvested from the forest as production. This solution, which allows for investment, is more serviceable than the first case (Alternative A), which, admittedly, was based on a strictly theoretical approach.

### 233. Forestry production in national accounting

Production covers both marketed production and the products the forest owner, or some other person entitled to their use, takes for his personal consumption.

Value added in forestry is determined according to the following principles. The value of transactions in kind is determined at the site of consumption. The value of marketed timber is determined prior to external transport, apart from floated timber, the value of which is determined at the end of the floating route. The value of silviculture and forestry promotion is calculated at the site where the work is performed. What these general principles mean in practice can be seen from the model accounts below which include the quantities to be measured in national accounting.

From this, we can move on to a somewhat more detailed study where attention is devoted to wood as a forest product. This study will omit the sub-sectors of forestry promotion and the collection of non-wood products. They would be included in the production account of the forest-ownership sector in the same form as under the increment as production alternative. The alternative illustrated by Alternative B<sub>1</sub> assumes that forestry is composed of three sub-sectors: silviculture, forest ownership and timber harvesting.

*Alternative A (increment as production)*

**Production accounts**

*I Ownership sector*

<i>Expenditure</i>	<i>Revenue</i>
Intermediate consumption	Forest increment Wood Other products
Depreciation & repairs Tools Silviculture	Silviculture Promotion of forestry
Value added	Change in stocks seeds, plants, etc.
Gross input	Gross output

*II Utilization sector*

<i>Expenditure</i>	<i>Revenue</i>
Purchased from ownership sector Wood Other products	Sales Wood Raw material Domestic use Exports
Purchased from other sectors Horse haulage Fuels (imported) Packaging & tools Other	Consumption Domestic use Exports Other products Raw material Domestic use Exports
Depreciation & repairs Machines & equipment Buildings	Consumption Domestic use Exports
Value added	Change in stocks felled timber stocks, etc.
Gross input	Gross output

*Alternative B<sub>1</sub>* (removal as production)  
 Production accounts of forestry sub-sectors  
 I *Silviculture*

Collection of seed material

Tools	Sale of seed material
Value added	to extraction plants
Gross input	Gross output

Seed-extraction plants

Purchase of seed material	Sale of seed to growers
Other auxiliary material	Sale of seed to nurseries
Depreciation on machines & buildings	
Value added	
Gross input	Gross output

Nurseries

Purchase of seeds	Sale of seedlings to planters
Other auxiliary material & tools	
Depreciation on machines & buildings	
Value added	
Gross input	Gross output

Seeding and planting

Purchase of seeds	Seeding
Purchase of seedlings	Planting
Seeding and planting	
Value added	
Gross input	Gross output

Other silviculture

Operating costs of machines	Clearing & scarification
Other auxiliaries	Broadcast burning
Depreciation on machines	Thinning
Value added	Other works
Gross input	Gross output

*II Forest ownership*

Cost of silviculture	Sale of timber to harvesting sector
Clearing & scarification	
Broadcast burning	
Seeding	
Planting	
Thinning	
Administrative costs of ownership	
Cost of timber sales	
Value added	
Gross input	Gross output

### *III Timber harvesting*

Purchase of timber from ownership sector	Sale of timber for consumption
Harvesting equipment	Sale of timber for raw material
Operating costs of machines	
Operating costs of buildings	Change in stocks of felled timber
Other costs (horse haulage, fuels, etc.)	
Depreciation on machines & buildings	
Value added	
Gross input	Gross output

With the statistical data available, the closer we bring the accounting procedure to the actual transaction, the better our chances of describing forestry in the manner suggested. But, still, the value added for forestry cannot be determined as shown above, partly owing to the type of forest ownership and the number of owners.

From the point of view of statistical production, forestry promotion is better off than the other sectors mentioned since the relevant data can be obtained from the accounts of the organizations engaged in forestry promotion. However, it is difficult, and in some cases inaccurate, to draw a line between promotion and other work done by the organizations. The collection of non-wood products apparently is one of the sectors where quantitative data is hardest to obtain. But it is in most cases of little importance, and the data can be accepted with relatively broad confidence limits.

The need for an economic description of silviculture and timber harvesting can be illustrated by the account schedules on p. 10. The silviculture section of national accounting has been further divided into sub-sectors which cannot be described systematically enough by means of the currently available statistical data.

The expenditure side of the production account is supposed to contain, for all sectors, a cost item arising from non-specified auxiliaries and tools of short duration required for production. In addition, the cost items balanced by revenue items of the other forestry sectors have been separately indicated under the various sectors. This is meant to show that basic data can often be obtained by two methods. (Sale of cones to extraction plants = purchase of cones, sale of seed = purchase of seed, etc.)

Depreciation in forestry can hardly be estimated by any means other than using supply data concerning capital equipment, the assumed periods of depreciation, and data on the relevant purchase prices. Besides using fairly approximate information on the production and sale of equipment, the investment in equipment is hard to estimate except by means of investment inquiries. Since forestry and agriculture are closely interdependent, inquiries covering both seem preferable. The difficulty, in any case, is how to allocate between these branches the capital equipment serving both.

The balancing item in the accounts, the "value added", is a theoretical concept. It is the same as the grand total of the income-outlay account. Value added plus the sum of input expenditures is the gross output value. Gross output value can also be obtained from the revenue side, where the total sale of products and services plus the change in stocks shows the same thing.

The above statements have been made primarily with a view to determining the share of forestry in the national product. As is known, economic planning and forecasting need data on the quantity of commodities. Construction of volume series in national-income accounting also requires data on production volumes. Considering the availability of statistical data, attention must be focused on the revenue side of the model accounts as this reveals the groups for which data is required.

The necessary detail should be decided both with respect to national accounting and with a view to the need for volume data in the different fields of forestry research.

### 234. Model accounts

The foregoing was a list of the most important data that must be known when trying to build up the three basic SNA accounts: production account, income and outlay account, and capital finance account. All these will be reviewed here. The form of the accounts has been greatly influenced by the basic statistics available in Finland. The accounts are constructed for accounting periods of one year and the accounting system is based on transactions. A transaction may be said to take place when goods and/or claims in one way or another change owner, site or functional quality, and/or when a service is rendered.

The four sub-sectors (Alternative B<sub>2</sub>) embrace essentially different activities. Timber harvesting and the collection of non-wood products are two sectors producing raw material and consumer goods. The latter is assumed not to keep any stocks since the products are perishable. For timber harvesting, stocks (of felled timber in the forest) are shown in the account although they usually cannot be estimated in practice. The changes in stocks of seeds and seedlings, recorded on the revenue side of the production account for the forest-management sector, are entered in this sector because the gathering of seed material is not included elsewhere in Alternative B<sub>2</sub> nor is there any special nursery sector.

The sum of the balance items (value-added items) on the expenditure side is the value added for forestry. The combination of the production accounts gives the total production account for forestry. It is obvious that the accounting detail can be increased enough for accurate expression of the desired aspect; the

sale of timber can be classified by timber assortments, depreciation on machines and equipment determined by articles, and so on.

The nature of the various sub-sectors is expressed with adequate clarity by the production accounts (Alternatives B<sub>1</sub> and B<sub>2</sub>) presented. For this reason, the income account and capital formation account should be shown with the same division into sectors. In this connection, however, it will be sufficient to show them *in toto* for all forestry.

The income account embraces revenue arising from production. In the *income and outlay account*, revenue is distributed according to the general practice in national accounting. According to the production theories of national economics, it would be justified to use the main classification into work income and capital revenue. If this is done, the dividing line between the classes would run between the work income and capital revenue of the private entrepreneur. On the revenue side, other income is composed of payment from other sectors for property belonging to forestry plus revenue transfers from governmental administration. It may be pointed out, however, that so far it has been impossible to determine these items in the national accounting of forestry in Finland. Hence, the grand total of the income account equals the net national-income item.

The revenue side of the *capital-formation account* consists of the saving and depreciation and repairs from the income account plus borrowing from other sectors. The expenditure side shows the value of gross investment. The weakness of this account in practice is that the financial flow data required for it is not available.

*Alternative B<sub>2</sub>* (removal as production)  
 Production accounts for forestry sub-sectors

**Harvesting**

<i>Expenditure</i>	<i>Revenue</i>
Purchased inputs	Sales
Horse haulage	Raw material
Fuels (imported)	Domestic use
Silvicultural work	Exports
Forestry promotion services	Consumption
Other inputs	Domestic use
	Exports
Depreciation & repairs	
Value added (net)	Change in stock of felled timber
Gross input	Gross output

**Silviculture**

<i>Expenditure</i>	<i>Revenue</i>
Purchased inputs	Silvicultural works
Fuels (imported)	Change in stocks
Other	Regeneration material
	Seed & seedlings, etc.
Depreciation & repairs	
Value added (net)	
Gross input	Gross output

**Promotion of forestry**

<i>Expenditure</i>	<i>Revenue</i>
Purchased inputs	Services
Rents	Forestry promotion
Other	Change in stocks
	Raw material
Depreciation & repairs	
Value added (net)	
Gross input	Gross output

**Collection of non-wood products**

<i>Expenditure</i>	<i>Revenue</i>
Purchased inputs	<i>Sales</i>
Tools & packaging	Raw material
Value added (net)	Domestic use
	Exports
	Consumption
	Domestic use
	Exports
Gross input	Gross output

The sub-sector production accounts we can summarize as follows:

### Total forestry

<i>Expenditure</i>	<i>Revenue</i>
Purchased inputs	Sale of goods & services
Horse haulage	Goods
Fuels (from other sectors)	Timber
Tools & packaging	Raw material
Silvicultural work	Domestic use
Forestry promotion services	Exports
Other	Consumption
	Domestic use
	Exports
	Other products
	Raw material
	Domestic use
	Exports
	Consumption
	Domestic use
	Exports
	Forestry promotion services
	Silvicultural work
	Raw material
	Change in stocks
	Timber
	Seeds & seedlings
Gross input	Gross output

### *Income and outlay account*

#### Total forestry

<i>Expenditure</i>	<i>Revenue</i>
Compensation to employers	Value added (net)
Workers	Other income
Salary earners	
Other labour costs	
Social security benefits	
Other	
Private entrepreneurial income	
Work income	
Stumpage	
Interest	
Corporation profits	
State forests	
Private companies	
Communes & church	
Corporation's direct taxes	
Revenue available (savings)	
Total	Total

## Capital formation account

### Total forestry

<i>Expenditure</i>	<i>Revenue</i>
Gross fixed capital formation	Saving
Change in stocks	Depreciation & repairs
Lending	Borrowing
Gross accumulation	Finance of gross accumulation

## APPENDICES

### *Appendix 1*

The most important concepts to be measured in national accounting

The production of data as outlined above is concerned individually with each of the sectors proposed. But, in addition, it is necessary to produce statistics on forestry as a whole. Examples are statistics on prices, wages, and labour input. However, although price statistics are often presented independently, price determinations are correlated with statistics on volumes and values. When evaluating the need for forestry price statistics, the quality and detail of price statistics obtained as a by-product when information is collected on the value and volumes of the items on the revenue side of the accounts concerned should be taken into consideration. Only two of the three quantities (volume, price and value) need to be known for the third to be determined.

The value-added entry contains revenue of various types. Bookkeeping data cannot be used to determine these revenue items in forestry. For this reason, in order to determine the total payroll, information is required on labour input and average earnings (total payroll = number of working days multiplied by mean daily earnings). In compiling this data, it may be best to obtain the payroll estimates separately for salary earnings, hired workers and the forest owners' own labour inputs. Using the total payroll figures, the "other" income from work can be defined: i.e. the employer's social-security payments determined

on the basis of wage rates. Capital revenue from forestry may be said, at least for the time being, to equal stumpage income, which is most easily derived from timber volumes and the relevant price data. The detail required of this data can be varied according to the desired precision of the total figure for stumpage-income. But, a certain amount of detail concerning timber volumes is necessitated by the calculations made for research on the balance of allowable cut and removals. When a classification of the types of revenue for national accounting is sought, however, the essential thing is to obtain stumpage income separately for private forest owners, companies and the State. The composition of other revenue items in forestry apparently must, for the time being, be based on rough estimates.

### *Appendix 2*

National accounting in Norwegian forestry (Based on: JOHN EID, Problems and Principles in National Accounting for Forestry in Norway, 8 CFM/E/C,T.X/8 Madrid 1966)

The following model accounts show how national accounting for forestry is organized in Norway. In this presentation, capital formation is the only quantity in the accounts specified in detail.

In principle, depreciation is defined as the difference between gross and net capital formation at a given time. Net capital formation

equals the increase in real capital at this same time. Gross capital formation covers new buildings and the repair and maintenance of permanent production equipment. In actual cases, it is usually difficult to decide whether a given cost item should be considered a current expense or capital formation. This may apply to machines, other production equipment, and spare parts. Another difficult point is determining which of the capital objects should be classified under "transport". Gross capital formation in forestry comprises construction of haulage roads, construction of buildings, investment in silviculture, purchase of transport vehicles, purchase of other equipment, repair costs, and changes in standing forests. Transport and other equipment is always purchased from other sectors.

In Norwegian national accounting, both gross and net capital formation are estimated on the basis of independent calculations for many sectors, e.g. the manufacturing industry. Depreciation is determined as a residual.

In other sectors, gross capital formation and depreciation have been determined as independent elements; net capital formation appears as a residual. This alternative applies to forestry. Depreciation is calculated by adding together the repair, maintenance, wear and renewal costs for machines, roads, buildings, equipment, etc. This is done in the same way as for a private enterprise. The cost of wear is calculated with the aid of replacement expenses. Haulage roads, machines, and investment in regeneration are treated independently. Depreciation of re-

### I Production account in Norway

<i>Expenditure</i>	<i>Revenue</i>
Inputs purchased from other sectors	Supplied forest products
Horse haulage & tools	Marketed industrial roundwood
Other	Roundwood for the owner
Depreciation	Fuelwood for the owner
Value added	Christmas trees
	Change in stocks (felled timber)
	Change in forest capital (growing stock)
	Investment work
	Silviculture
	Haulage roads
	Logger's lodgings
<b>TOTAL</b>	<b>TOTAL</b>

### II Product utilization account in Norway

<i>Expenditure</i>	<i>Revenue</i>
Forestry products (at producer prices)	Sale of consumer goods
Cost of haulage	Fuelwood
Sales commission	Christmas trees
Taxes less subsidies	Roundwood sales
	Industrial roundwood
	Industrial fuelwood
	Exports
	Floated roundwood
	Other
<b>TOTAL</b>	<b>TOTAL</b>

generation work is set at a level presumed adequate to maintain the present yield of the forests.

The data currently available for calculating forestry depreciation is incomplete; calculations must largely be based on approximations. It may be useful to point out that depreciation, in the sense used here, differs from the depreciation concept used in taxation.

The complete list of accounts contains a revenue item called "changes in the value of growing stock". An increase in timber capital in a given year is considered an increase in the value added of that year. This is closely connected to the concepts of gross and net capital formation and depreciation in forestry as discussed above.

The estimate of the change in timber capital is calculated as follows. The calculations are based on reports and the annual statistics of roundwood removal in the National Forestry Survey, which compiles information on the available increment of conifers and hardwoods. The difference between this estimate and total cutting volume is multiplied by the price which theoretically equals the main stumpage price of all roundwood. Usually the estimate is based on market values. The actual purpose is to produce an estimate of decrease or increase in the total market value of the timber capital.

This sector account, therefore, contains under revenue independent estimates of investments in haulage roads, silviculture, forest buildings, machines, etc. A separate estimate is given for changes in the market value of timber capital.

Theoretical objections may be raised to this method of estimating the changes in forest capital. However, the method is acceptable when considering the concept that revenue is the "value added available for consumption and capital formation". A method of estimating gross and net capital formation and depreciation might be the following, according to which gross and net capital formation are calculated independently. This method is widely used in Norwegian national accounting.

Gross capital formation comprises value increases in road construction, silvicultural measures, repairs and maintenance, machines, etc., whereas net capital formation has been defined as the increase in forest capital during a given period of time. Gross capital formation also covers the increase in the value of the

growing stock; this automatically places the value of roundwood removal under depreciation. A value increase appears as an increase in investments in international production factors, whereas changes in timber capital are not taken into consideration. The depreciation item increases by an amount equalling the investments. Gross national product for forestry also increases by the same amount. The net production, however, remains unchanged owing to the increased depreciation.

The argument in favour of this method is that it is more like the methods used in other industries. Including the value increase under gross capital formation and roundwood removal under depreciation results in an arrangement which better corresponds to the changes in real capital in practical forestry. The method evaluates value increase as a basic revenue element and timber removal as a decrease in capital, which is true if the two are considered separately. The method also emphasizes that forestry requires capital. This treatment of the changes in growing-stock value differs from that recommended by SNA. Instead it follows from the recommendation that increases in growing stock do not affect capital formation and are treated as capital gains. Accordingly, reductions in growing forests owing to cuttings or other reasons have been classified as capital losses and not as capital deterioration, i.e. depreciation.

### *Appendix 3.*

National accounting in Swedish forestry  
(Based on: FAO/ECE/STATS – F1/7/Add.1.,  
Conf. Eur. Stats./WG.29/3/Add.1 14. 3. 1968)

In Swedish national accounting, forestry is divided into two sectors: logging and silviculture. Silviculture is sub-divided into afforestation and timber management.

The gross output value of the logging sector is the gross value of timber cut. When the value of fellings based on stumpage price is subtracted, the result is the gross national product entry. The value of afforestation is classified as fixed capital formation. Timber management (including afforestation) is effected by the customary capital equipment and by an annual expenditure on administration and growing-

stock protection. The resulting forest increment is considered as a product and entered in the accounts as an addition to stocks. The current practice is illustrated by the account schedules below.

Among the methods of calculating the individual items, it seems fruitful to discuss how the stumpage price is calculated. Stumpage prices for the relevant years are obtained by subtracting from total sales revenue (at the site of use or at the point of transport) the expenses of timber preparation and, in connection with

a sale, the expenses incurred by the seller. From the stumpage prices and data concerning the true logging volumes, a correction factor indicating the change in forest capital is calculated.

If increment is to be classified as forestry production, the gross value of forest management must be calculated as equalling the annual growing-stock increment, whereas present practice supposes it to equal normal removal. But, according to the Swedish opinion, the stumpage-price data of the relevant year can nevertheless be used in calculating the value of production.

### Production accounts in Sweden

#### Logging

<i>Expenditure</i>	<i>Revenue</i>
—	Sales
—	Raw material
—	Exports
—	Industry
Value added	Consumption
Depreciated	
Gross national product item	
Stumpage prices	
Sales expenses	
Gross output value	Gross output value

#### Forest management

<i>Expenditure</i>	<i>Revenue</i>
—	Sale to logging sector (stumpage price for loggings)
—	Correction factor (normal removal less actual removal)
—	
Value added	
Depreciation (silviculture)	
Gross national product item	
Administrative expenses, etc.	
Gross output value	Gross output value

#### Silviculture

<i>Expenditure</i>	<i>Revenue</i>
—	Silvicultural works
—	= investment in forest management
Value added (= gross national product item)	
Cost of regeneration tools, etc.	
Gross output value	Gross output value

## Income account for forestry in Sweden

<i>Expenditure</i>	<i>Revenue</i>
Wages and salaries	Timber
Logging	Raw material
Forest management	Consumption
Social security	Silvicultural works (gross fixed capital formation)
Logging	Stumpage earnings for removals
Silviculture	(= raw material of loggings)
Entrepreneur income	Change in stocks (normal removal less actual removal)
Stumpage earnings	
Work income	
Operating surplus	
Value added	
Depreciation	
Silviculture	
Other	
Gross national product item	
Sales expenses in logging	
Stumpage earnings from removal	
Administrative expenses, etc.	
Silvicultural expenses	
Gross output value	Gross output value



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