SCANDINAVIAN FOREST ECONOMICS
No. 40, 2004

Proceedings
of the Biennial Meeting of the
Scandinavian Society of Forest Economics
Vantaa, Finland, 12th-15th May, 2004

Heikki Pajuoja and Heimo Karppinen (eds.)

Vantaa

This on-line version differs from the printed Proceedings 2004.
Ragnar Jonsson's paper is included in this version, but is missing from the paper copy.

IAS Fair Value and Forest Evaluation on Farm Forestry

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Summary

Forest evaluation causes the greatest problems in farm accounting because it requires exact, up-to date information concerning growing stock and bare forest-land. Moreover, the changes in forest property value caused by the fluctuation in stumpage prices affects both the balance sheet and even the profit and loss statement, and thus all forest profitability measures from annual net profit to various ROI measures. While the evaluation of merchantable stands can be based on market prices, the evaluation of unrealisable property, such as seedling stands, as well as young and middle aged stands, is imprecise.

In 2002, the European Union (EU) accepted the International Accounting Standards (IAS) –decree, which presumes that publicly quoted enterprises provide their concern financial statement according to the International Financial Reporting Standards (IFRS)[1] in 2005 at the latest. The forest industry corporations such as Stora Enso, UPM Kymmene and the M-real group are considerable forest owners, and have to apply IFRS decree and IAS regulations as well. The IAS 41 came into force at the beginning of 2003 (IAS 2002). This standard requires that the biological property of public enterprises on the stock exchange has to be evaluated by a 'fair value', which can be defined in terms of market prices at the time of felling and marketing expenses. However, evaluation by a 'fair value' must not be made if the value cannot be measured reliably. The value of seedling stands, as well as young and middle-aged stands can be based on yield value, such as net present value (NPV), which is calculated by discounting the incomes and costs. The interest rate used is defined in the IAS by the 'risk-free' rate. Although the IAS does not bind enterprises outside the stock exchange, there are reasons for other enterprises even on farms to adopt its practices.

The value of the whole growing stock has been divided into inventory and fixed asset in the balance sheet. The inventory value of the marketable stand is based on an allowable cut calculation that estimates the total number of felling opportunities when only forest law limitations have been included. The change in forest value also affects the profit and loss statement. The IAS therefore causes unrealistic fluctuations in net profit. The yearly fluctuations of property values are caused by fellings, as well as the change in the growing stock, but especially by the changes in stumpage prices. This profit and loss statement volatility suggests that it would be advisable to perform sensitivity analyses and to compare the evaluations obtained from different paradigms.

The forest management test material used in this research was collected from five bookkeeping farms. The farm profitability study is part of the EU's

[1] The Trustees of the IASC (International Accounting Standards Committee) has accepted in March 2001 a proposal to change the name of IAS-standards to IFRS-standards (IASC Foundation, Annual Report 2001).

Farm Accountancy Data Network (FADN). In Finland there are about 900 farms involved in this network. The economic data concerning forestry of the case farms comes from this bookkeeping. However, forest inventory data provided by the farms is based on their forest management plans (FMPs). Using up to date FMPs, the balance sheet can be calculated accurately enough, but over time the data will become obsolete. The value of the forest and its changes requires the growing stock to be updated. In addition to a FMP, knowledge of fellings and silvicultural activities is required. In this study, the applicability of a Finnish forest management planning software (MELA) is used for updating the forest inventory data.

Keywords: forest value, allowable cut, forest management plan, accounting, IAS (International Accounting Standards), farm accountancy data network (FADN)

1. Introduction

1.1 Agricultural bookkeeping farms and forestry

In Finland there were in 2001 roughly 72,500 farms with agricultural arable land exceeding one hectare, possessing altogether 4,490,000 hectares of forest. The average area of forest-land per farm was 48 hectares, an increase of some 6 hectares per farm from 1990. The agricultural profitability bookkeeping maintained by MTT Economic Research monitors the economic development of agriculture, horticulture, diversification business and forestry, based on the accounting data collected annually from the approximately 900 agricultural bookkeeping farms (Profitability bookkeeping 2004). Since 1995, profitability bookkeeping has been part of the farm accountancy data network (FADN) of the member states of the European union (EU). Profitability bookkeeping data and results is employed in research, agricultural administration, economic consulting, advising, interest supervision and agricultural education.

A bookkeeping farm can be disaggregated into different production lines (business areas): agriculture, horticulture, other diversification businesses and forestry. On farms income from timber sales can be used for production and investments in agriculture and other businesses. For each production line, closing the accounts, as well as ratios depicting profitability, liquidity and solvency, can be calculated using the data collected.

It has been difficult to calculate reliable accrual-based closing of accounts for forestry. The reason for this has been the lack of data as well as methodological deficiencies in estimating the values of the growing stock and the bare forest-land. The value of the growing stock fluctuates annually according to impact of the net increase and fellings. Moreover, changes in stumpage prices affect the value of the growing stock. The change in the value of the growing stock affects the profit and loss statement and, consequently, the profitability of forestry.

1.2 The international accounting standard (IAS) and forestry accounting

According to the Statement of Accounting Theory... (1977) research in accountancy can be divided into three approaches: (i) The **classic theory** attempts to create implicit accounting frameworks or to rationalise existing practices. (ii) **Decision-making and its benefits** emphasise investigating decision-making models and decision-makers. (iii) The **information economics** considers what information is needed in economic decision-making (Ikäheimo 1989). According to the **inductive approach** of the classic theory, profit is based on **realised** and **objective** values. The Finnish expenditure-revenue theory introduced by Saario (1968) is an **inductive approach of the classic theory**. The **normative-deductive** approach of the classic theory

sees profit as the change in value of the enterprise (Lukka 1989). Finnish bookkeeping practice and legislation has applied the expenditure-revenue theory, but EU membership has caused a considerable change in accounting. After the 1992 and 1997 reforms of the Finnish accounting legislation, the 4th and 7th Company Law Directives of the European Union were adopted in the accounting statutes (for a comparison between Finnish and EU norms, see Teränne 1993).

Forestry accounting has been studied and changes in the valuation of forest analysed by Davy (1987) and Openshaw (1980), among others. Davy emphasises that profits should not be recognised as revenue until they are realised, which is actually against the IAS requirements. Forestry accounting has a long tradition in Central Europe, where data collection has also been developed for small-scale forestry (Sekot and Hellmeyr 2000, Vereinheitlichung … 1980). Eriksson (1996) compared accounting in Germany, France, Switzerland and EU, and recommended harmonisation within the EU. Accounting for non-industrial private forestry has been developed from the German tradition and coping with continuous changes by Hyder et al. (1994, 1996). Accounting for the practical extension has been studied for jointly owned forests (Penttinen 1992), for ratio analysis (Penttinen and Hakkarainen 1998) and for cost accounting (Penttinen et al. 2001).

The international bookkeeping standard called International Accounting Standard (IAS) 41, for the evaluation of biological property, came into force on January 1, 2003 (IAS 2002). This standard requires that *publicly quoted enterprises* evaluate their biological property based on the 'fair value' according to market prices, from which the cost of the sales momentum will be deducted (Argilés & Slof 2001). Evaluation of the property is by the 'fair value' if the value cannot be measured reliably. In forestry, a stand ready for final felling can use the felling value minus sales costs. The market prices of plantings, young or middle-aged stands do not conform to the present state of the biological property. The present value of the expected net cash flow from the asset can be used as their fair value (IFRIC 2003). The used interest rate is either (i) a 'risk-free rate' or (ii) a rate that incorporates a risk premium for the systematic risk inherent in the exptected cash flows (FASB 2003). Here the market interest rate before the impact of taxation is used as the discounting interest rate.

The IAS brings many improvements, such as more transparency and, especially, comparability (Liebfried 2002). The impact of market fluctuations on profit still remains a problem, however. Market value driven pricing of forests and more generally the fixed assets may cause considerable fluctuation in profit, volatility which is not based on real business transactions as recognised by the accounting principles. Moreover, it forces market values based on evaluation of property, which may mean "lazy" capital in the balance sheet. One example of the effect of these pressures is Stora Enso, which sold its forests to its own daughter company Tornator. Moreover, the M-real group has announced that they will sell their forest, in all some 100,000 hectares.

1.3 The objective of the study

The aim of this study is to define the IAS 'fair value' of forest property and the yearly changes in its value for accounting purposes. There are various ex-ante and ex-post methods for the valuation. Ex-ante methods are based in general on a forest management plan and forest inventory data that are used for calculating the expected values of the forest property. Ex-post methods are based on the mean values of realised transactions of forest estate purchases. The values are calculated using econometric methods such as the ordinary least square method (e.g., Airaksinen 1988, Hannelius 1988).

Since the ex-post valuation methods are too general for the IAS 'fair value' estimation, the valuation of the forest property is investigated using existing forest management plans (FMPs) in this paper. The value of the growing stock and the annual timber balance are estimated using the FMP's field measurements. The site information for each stand is also available for the evaluation of the forest-land. The evaluation of the growing stock for each fiscal year requires the updating of the FMP's stand data according to the situation at the end of the fiscal year. All the factors affecting the amount of the growing stock, such as net increment and fellings, have to be updated until the end of the fiscal year. The evaluation of forest land-can be based explicitly on the Faustmann formula or implicitly using the forest land values based on the auxiliary tables of the sum-value method (Vehkamäki 1998).

2. Material and methods

2.1 Evaluation methods

The approach of this study is that of the 'stand method' described by Beståndsmetoden för... (1988a, 1988b, 1988c), applied to determining the change in value the forest capital during the financial year by Hägg (1993) and developed by Bogghed & Jehander (1994). The IAS requires a market-based evaluation. In forest economics, stands have been grouped into three categories, in which the sapling stands such as plantations, seedling stands and natural regeneration have been evaluated using the cost value. In this study the cost value approach is replaced by the expected revenues approach.

The calculations were made using a Finnish forest management planning software package, MELA (Siitonen et al. 1996, Redsven et al. 2002). The MELA system consists of a stand simulator and a linear programming package. The stand simulator is based on individual tree models (see Hynynen et al. 2002, Nuutinen et al. 2000, Redsven et al. 2002). The simulator part automatically creates a finite number of feasible alternative management schedules for each stand. The linear programming package in MELA is the JLP (Lappi 1992).

The growing stock can be perceived both as means of production and product in the accounting framework (e.g. Keltikangas1969). The disaggregation of the value of the growing stock in the assets of the balance sheet requires a special calculation, which distinguishes the proportion of the immediately merchantable growing stock from the remaining growing stock. This split can be performed by the allowable cut calculation of MELA that maximises the immediate cutting opportunity (so-called cutting potential). The remaining share of the growing stock consists of the plantings, young and middle-aged stands, which contain no merchantable wood. In the balance sheet, the growing stock, which can immediately be cut according to the forestry law, the so-called allowable cut belongs to the current assets. The remaining portion of the value of the growing stock belongs to the fixed assets, i.e., tangible assets as an item called 'growing stock of forest'.

The allowable cut calculation yields the volume of the merchantable growing stock as well as the allowable output by roundwood assortment divided into logs and pulpwood. The allowable cut calculation is based on a ten-year calculation period, and the simulated felling is placed in the middle of the period. When the NPV's of the first planning period are maximised, the net incomes of the future periods are also taken into consideration. The allowable cut can also be calculated by maximising the net income of the first period and ignoring the impact of the net income of the future periods.

The annual entrepreneurs profit of a forest enterprise consists of three different parts. (i) The realised net income - the difference between felling incomes and expenditures - required to produce them, (ii) timber balance change, i.e., the change in the growing stock volume, and (iii) the change in the growing stock value caused by changes in stumpage prices. One can therefore talk about a dualistic value change that consists of a dynamic portion, i.e., the property value change based on the volumes, and an economic cycle portion, i.e., the property value change based on stumpage prices (Niskanen ym. 2002). The bare values have been estimated stand-wise using the Faustmann formulae and a long term forecasting horizon.

The annual change in the value of the growing stock will be included even in the profit and loss statement. The annual turnover of forestry can fluctuate dramatically between fiscal years because of the timber sales. However, the change in the value of the growing stock due to the stumpage price fluctuations may be the dominant part of the total income if timber sales income has been small or no wood has been sold during the year in question. This price volatility can cause significant changes in the value of the growing stock between fiscal years. All these annual changes affect the profitability of forestry from entrepreneurs profit to different ROI figures.

2.2 Material and calculations

Information supplied by bookkeeping farms consists of cash-based revenues and expenditures obtained from taxation bookkeeping as well as data of crops and animals, production amounts, changes in property and working hours. In order to be able to calculate accrual-based total operating income and costs, both cash revenues and cash expenditures have to be corrected in FADN-bookkeeping. In order to get turnover and expenditures belonging to that particular accounting year, accounts receivables and advances received have to be taken into account when correction of turnover is done. In correction of expenditure the trade payables and advance payments have to be taken into account. In order to obtain accrual-based items changes in product and purchase inventories must also be taken into account. After these corrections, the accrual-based profit and loss statement and balance sheet can be calculated.

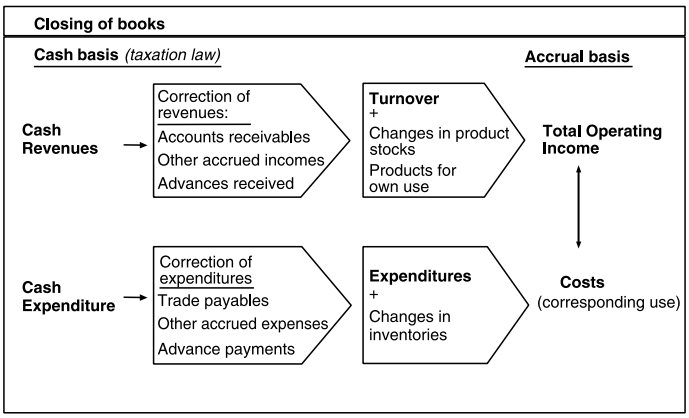

Figure 1. Transformation from cash based transactions to an accrual based one in profitability bookkeeping

In calculating changes of inventories of bookkeeping farms, the value of growing stock

in the balance sheet and the changes in forest growing stock also have to be taken into account in the profit and loss statement. The forest management plans (FMPs) of bookkeeping farms for the years 2001 and 2002 formed the research data for studying those changes. In addition, inquiries concerning fellings and other silvicultural activities after the FMPs were sent to farms. The volumes of harvested wood were also sought by timber assortment and tree species for each stand. Moreover, the basal area of the remaining growing stock after the felling was sought, if possible.

The sales income figures of the bookkeeping material are based on realised accounting transactions. The stumpage prices used in the evaluation of the growing stock are average prices for 2001 and 2002 obtained from local forest centres.

The oldest FMPs of the five farms were from the year 2000 and so the values of growing stock do not include growth and fellings, which have taken place during recent years. Thus the growing stock information on the FMPs were updated until the end of 2001 and 2002 using the MELA system. Two different methods were used to simulate the felling information. Fellings were simulated both (i) based on the new updated field measurements and (ii) by using the activity control of MELA, which is based on simulation of silvicultural activities. The value of the growing stock was calculated manually in some cases. Then in both methods the sum value method was used and the forest stand information updated. The total value of the growing stock was then reduced by 30% according to the principle of the sum value method (see. Hannelius 1988, Vehkamäki 1998).

3. Results

3.1 The forest value and the allowable cut

The growing stock of farms were disaggregated in the balance sheet into current assets and fixed assets using the allowable cut calculation of the MELA system. The immediately merchantable growing stock belongs to inventories of the current assets. The value of the remaining growing stock is obtained by subtracting the allowable cut from the NPV of the net incomes of the whole growing stock.

The allowable cut was defined here using two alternative methods: (i) The calculation was based on the maximisation of the net present value (NPV) using a notional interest rate, say, 5%. This NPV calculation also takes into consideration the net income of the following periods. (ii) The calculation was based on the maximisation of net income of the first ten-year period without any consideration of the income from the following periods.

The MELA calculations have been classified as follows:

0) no cuttings = the calculation of the value of the growing stock was performed and based only on the forestry data of the FMP

1) MELA RSU = the calculation was based on the original FMP updated by the field measurements concerning harvested amounts and estimated basal areas of harvested stands

2) MELA SMU = the MELA has an implied activity control that automatically simulates the given harvesting and other silvicultural activities for the years determined, and these simulated activities, removals and stand figures (e.g., basal area), are used as such in the calculations

3) Sum-value = The value of the growing stock has been defined using the sum-value

method, in which no cuttings have been taken into consideration

The calculation methods have been grouped according to different allowable cut calculations so that method 'A' maximises the PV of the net incomes and 'B' maximises the net income of the first 10 year planning period only.

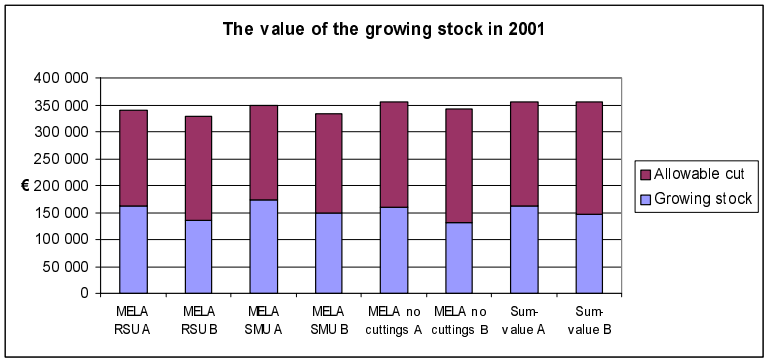

Figure 2. The value of the growing stock in 2001 divided into the allowable cut for the first 10 year period and the remaining growing stock by different methods in 2001

In 2002, the total value of the growing stock increased; on average, by 30,600 €, using method A and 29,700 € using method B. Both alternatives A and B are liquidation options. However, alternative A also takes into account the incomes of the future periods.

The RSU methods are the best in the sense that they have the actual basal area measurements available. However, the difference and the error when using SMU methods are reasonable, and the MELA SMU method would be the best choice or the only choice because of the measurement requirements of the MELA RSU.

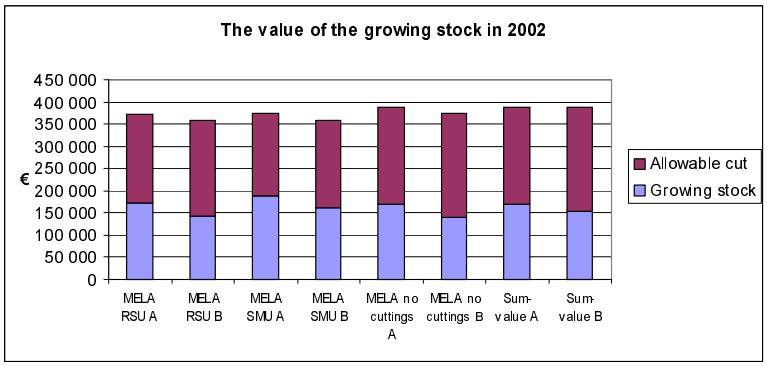

Figure 3. The value of the growing stock in 2002 divided into the allowable cut for the first 10 year period and the remaining growing stock in 2002

With both methods A and B, the allowable cut increased compared to the previous year on average by 10.5%.

3.2 The change in the growing stock value

The change in the growing stock value in 2001-2002 can be divided into the change in stumpage prices and the change in growing stock volumes. The change in volume means the difference between the net increment and fellings. The impact of the changes in stumpage

prices has been defined by calculating the value of the growing stock at the end of 2002 using the stumpage prices of 2001 and 2002. The remaining portion of the value change has been caused by the change in net increment and fellings.

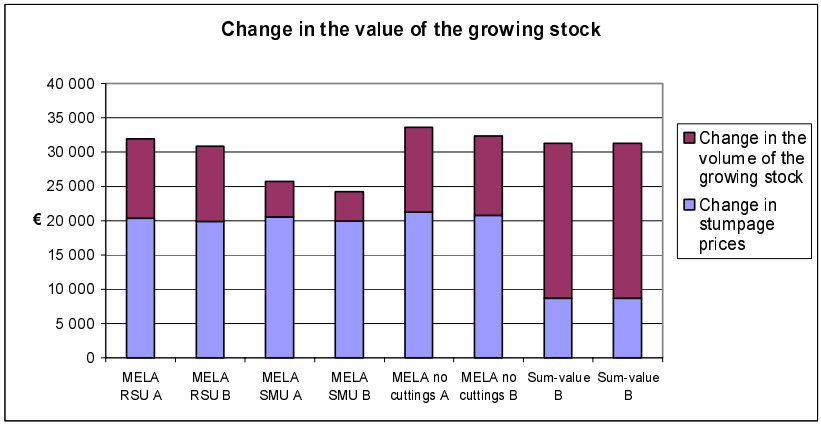

Figure 4. The change in growing stock value divided into stumpage price change and volume change impacts

The incomes of timber sales amounted to 17,500€ in 2002. The MELA RSU A and B methods, and MELA SMU A and B recognised the fellings and reduced the value of the growing stock. When Comparing these methods with methods MELA no cuttings A and B, it appears that the impact of the fellings on the change in the growing stock value is smaller than the sales income.

In this research five farms were used to test the accounting system. The average profit and loss statement and balance sheet of those farms are presented for the simulated felling option, which maximises the PV of the net incomes (SMU A) in frames of the Accounting Ordinance (2002) and the Committee for Corporate Analysis (2000) (see Appendices I and II). The allowable cut calculation is based here on a ten-year calculation period, and the simulated felling is placed in the middle of the period. These results and financial ratios were calculated from five cases (cf. Profitability bookkeeping 2004).

The net result, 39,000 € divided by the equity yielded the return on equity, of about 10 per cent. The profitability of forestry of these test farms was better than the average profitability of other businesses (agriculture, horticulture) in all of the bookkeeping farms. These financial statements and results of the forestry should not be generalised, because of the limited number of observations.

4. Summary

The amendment of the accounting of biological assets, IAS 41, inspired the development of the agricultural accounting network in order to implement an accrual-based accounting system to include forestry assets. The IAS 41 is based on the 'fair value' concept. The most recent interpretation of fair value focuses on the present value (PV) of the expected net cash flow from the asset. This PV requirement means that the forest stand data of the forest management plans (FMPs) and some FMP software are needed to evaluate these present values of future activities.

An inquiry among the circa 1000 bookkeeping farms revealed some 150 farmers who were interested in providing their FMPs for research purposes. Five forest holdings have been used in the analysis in this study. The rigorous input data requirements of the FMP software was very demanding, the estimation of the basal areas of stands after fellings constituting a particular challenge.

The change of the growing stock value and the felling income contribute the majority of the total operating income of the profit and loss statement. The value of the growing stock at the end of 2002 was nearly the same after the fellings performed by the 'measurement' based (RSU-) and by the pure 'simulation' based (SMU) methods. Recall that the basal areas after fellings were based on the actual measurements in the RSU-method and on software calculated fellings in the SMU-method. The measurement-based RSU method resulted in smaller and probably more realistic changes in the value of the growing stocks. The SMU method simulated the final fellings better than thinnings. The changes in stumpage prices were significantly smaller using the sum-value method than the forest management planning (FMP) software (MELA). The expectation values of the sum-value method are based on coefficients for each stand and a 30% reduction in the total calculated value that reduces the impact of the changes in stumpage price.

The evaluations were performed using a 4% interest rate. The critical point of the evaluation, the 'expected net cash flows' of seedling-, young- or middle-aged stands was performed using different methods, which also imposed allowable cut and forest value estimates. The maximisation of the net income of the first period, alternative B, represents a radical solution compared with the maximisation of the present values, alternative A, in the allowable cutting calculations. The A solutions, especially with the RSU and SMU methods were not close to each other, the first of these being considered the best estimate. Empirical measurements (of. the basal areas (RSU method) after felling by stand suggested that the measurements cannot be required in a larger production system. The present small number of test farms does not allow statistical tests. Further research requires more test farms and longer observation periods, so that even ex-post methods such as the capital asset pricing model (CAPM) (Capozza & Sick 1994 and Chavas & Thomas 1999) or option theory (Hughes 2000 and Duku-Kaakyire & Nanang 2004) can be applied.

Literature

ACCOUNTING ORDINANCE 2002. Accounting Act (30.12.1997/1336) and (30.12.1997/1339) Ordinance. KHT-Media Oy (KHT = Finnish Institute of Authorised Public Accountants). Fredrikinkatu 61 A, 00100 Helsinki, p. 101-146.

AIRAKSINEN, M. 1988. Metsän hinta Suomessa v. 1983-84 [The Price of Forest Land in Finland in 1983-84]. National Land Survey of Finland, Publications 61. Helsinki. 61 p (in Finnish).

ARGILÉS, J. M. and SLOF, E. J. 2001. New Opportunities for Farm Accounting. The European Accounting Review 19(2): 361-383.

STATEMENT OF ACCOUNTING THEORY AND THEORY ACCEPTANCE. 1977. American Accounting Association. Committee on concepts and standards for external financial reports. Sarasota, USA.

BOGGHED, A. and JEHANDER, P. 1994. Beräkning av skogskapitalets värdeförändring under räkenskapsåret – ett praktifall på Stora Skog. Swedish University of Agricultural Sciences, Department of Forest Economics, Working paper 207, 63 p. + app. (in Swedish

with English summary).
CAPOZZA, D. C. and SICK, G. A. 1994. The Risk Structure of Land Markets. Journal of Urban Economics 35(3): 297-319.
COMMITTEE FOR CORPORATE ANALYSIS. 2000. A Guide to the Analysis of Financial Statements of Finnish Companies. Gaudeamus, Helsinki, 85 pp.
CHAVAS. J.-P. and THOMAS, A. 1999. A dynamic Analysis of Land Prices. American Journal of Agricultural Economics 81(4): 772-784.
DAVY, A. R. 1987. Accounting for Forestry Activities in New Zealand. New Zealand Society of Accountants, Auckland, Research Bulletin R-117, 48 pp.
DUKU-KAAKYIRE, A. and NANANG, D. M. 2004. Application of Real Options Theory to Forestry Investment Analysis. Forest Policy and Econoimics, 14 pp. (Forthcoming).
ERIKSSON, L. 1996. Redovisningsprinciper i Tyskland, Frankrike, Schweiz samt EU. Swedish University of Agricultural Sciences, Department of Forest Economics, Working paper No 229, 34 pp. + app. (in Swedish).
FASB 2003. CON 7 Guidance. Board Meeting August 23, 2003. Financial Accounting Standard Board. 6 p. (http://www.fasb.org/board_meeting_minutes/08-27-03_fvm.pdf)
HANNELIUS, S. 1988. Metsälöiden kiinteistökauppa ja arvonmääritys. Summary: Forest real estate sales and assessment methods in forest valuations. Finnish Forest Research Institute, Research Papers 293. 95 pp.
HUGHES, W.R. 2000. Valuing a Forest as a Call Option: the Sale of Forestry Corporation of New Zealand, Forest Science 46(1): 32-39.
HYDER, A. S., LÖNNSTEDT, L and PENTTINEN, M. 1994. Outline of Accounting for Non-Industrial Private Woodlots. Silva Fennica 28(2): 115-137.
HYDER, A. S., LÖNNSTEDT, L. and PENTTINEN, M. 1996. Accounting as a Management Tool for Non-industrial Private Forestry. Scandinavian Journal of Management 15(2): 173-191.
HYNYNEN, J., OJANSUU, R., HÖKKÄ, H., SIIPILEHTO, J., SALMINEN, H. and HAAPALA, J. 2002. Models for Predicting Stand Development in the MELA System. Finnish Forest Research Institute, Research Papers 835. 116 pp.
HÄGG, A. 1993. A Model for Determining the Change in Value of the Forest Capital During the Financial Year. Swedish University of Agricultural Sciences, Department of Forest Products, Report No 240, 28 pp. + app. (in Swedish with English summary).
IAS. 2002. International Accounting Standard 41 Agriculture. European Union, Brussels, 24 pp.
IFRIC. 2003. IAS 41 Agriculture: Recognition and Measurement of Biological Assets. International Financial Reporting Interpretation Committee (IFRIC) of International Accounting Standard Board (IASB), Meeting September 30-October 1, 2003 (http://www.iasb.org.uk/).
IFRS 2002. International Financial Reporting System. International Accounting Standards Board (http://www.iasb.org).
IKÄHEIMO, S. 1989. Filosofisia mietteitä laskentatoimen tutkimuksen kehityksestä ja jaottelusta. The Finnish Journal of Business Economics 38(1): 47-61 (in Finnish).
KELTIKANGAS, V. 1969. Annual Net Income of a Woodlot. In: Svendsrud, A. (ed.) Readings in Forest Economics – on Selected Topics within the Field of Forest Economics. pp. 123-142.
Beståndsmetoden för skogsvärdering – tillväxt och avverkning. 1988. Lantmäteriverket & Lantbruksstyrelsen. 80 pp. Stockholm. (in Swedish)
Beståndsmetoden för skogsvärdering – sortimentsutbyte och kvalitet. 1988. Lantmäteriverket & Lantbruksstyrelsen. 39 pp. Stockholm. (in Swedish)
Beståndsmetoden för skogsvärdering – priser och kostnader. 1988. Lantmäteriverket & Lantbruksstyrelsen. 40 pp. Stockholm. (in Swedish)
LAPPI, J. 1992. A Linear Programming Package for Management Planning. Finnish Forest Research Institute, Research Papers 414. pp. 134.
LIEBFRIED, P. 2002. Accounting According to IAS: More Transparency and Better Comparability. Stahl und Eisen 122(3): 87-91.

LUKKA, K. 1989. Laskentatoimen käsitteiden ontologia - esimerkkinä voiton käsitteen analysointi. The Finnish Journal of Business Economics 38(2): 94–116 (in Finnish).
NISKANEN, A., HAKKARAINEN, J., LEPPÄNEN, J., VEIJALAINEN, S., PYNNÖNEN, E., HYTTINEN, P. and KALLIO, T. 2002. Laskentatoimen perusteet metsätaloudessa [Basics of Accounting in Forestry]. Silva Carelia n:38. University of Joensuu. Faculty of Forestry 179 pp.(in Finnish).
NUUTINEN, T., HIRVELÄ, H., HYNYNEN, J., HÄRKÖNEN, K., HÖKKÄ, H. KORHONEN, K.T. and SALMINEN O. 2000. The Role of Peatlands in Finnish Wood Production - an Analysis Based on Large-scale Forest Scenario Bodelling. Silva Fennica 34(2): 131-153.
OPENSHAW, K. 1980. Cost and Financial Accounting in Forestry. A Practical Manual. Pergamon Press, Norfolk.188 pp.
PENTTINEN, M. 1992. Tulos- ja laskentamallien soveltuvuus yhteismetsätalouteen. Summary: Applicability of profit and cost accounting models to jointly-owned forests. Folia Forestalia 799. 60 pp.
PENTTINEN, M., AARNIO, J. and UOTILA, E. 2001. Kustannuslaskenta yksityismetsätaloudessa – perusteet ja suositus. Abstract: Cost accounting in non-industrial private forestry (NIPF) - basic and recommendations. Finnish Forest Research Insitute, Research Papers 798. 64 pp.
PENTTINEN, M. and HAKKARAINEN, J. 1998. Ratio Analysis Recommendations for Non-Industrial Private Forest Owners. University of Vaasa, Research Papers 221. 65 pp.
PROFITABILITY BOOKKEEPING 2004. Kannattavuuskirjanpito [Profitability bookkeeping]. Agrifood Research Finland, Economic Research (http://www.mtt.fi/mttl/kirjanpitotilat.html) (in Finnish)
REDSVEN, V., ANOLA-PUKKILA, A., HAARA, A., HIRVELÄ, H., HÄRKÖNEN, K., KETTUNEN, L., KIISKINEN, A., KÄRKKÄINEN, L., LEMPINEN, R., MUINONEN, E., NUUTINEN, T., SALMINEN, O. and SIITONEN, M. 2002. MELA2002 Reference Manual. Finnish Forest Research Institute. 585 pp..
SAARIO, M. 1968. Kirjanpidon meno-tuloteoria [Expenditure-revenue Theory of Book-keeping]. Kustannusosakeyhtiö Otava [Publishing Limited Otava], Helsinki (in Finnish).
SEKOT, W. and HELLMAYR, M. 2000. Forstliche Betriebsabrechnung für bäuerliche Statistikbetriebe. Universität für Bodenkukltur, 12 pp. + appendices (in German).
SIITONEN, M., HÄRKÖNEN, K., HIRVELÄ, H., JÄMSÄ, J., KILPELÄINEN, H., SALMINEN, O. and TEURI, M. 1996. MELA Handbook - 1996 edition. Finnish Forest Research Institute, Research Papers 622. 452 pp.
TERÄNNE, P. 1993. Comparison Between the Present Finnish Accounting Regulations and the 4th and 7th Directives. Commission of the European Communities, Brussels, 64 pp.
VEHKAMÄKI, S. 1998. Sum-value Method as an Institution of the Forest Estate Busi ness. In: Jöbstl, H, Merlo, M. & Vinzi, L. Proceedings of the International Symposium on Insititutional Aspects on Managerial Economics and Accounting in Forestry. Stabilimento Tipolitografico Agnesotti, 01100 Viterbo, Italy, pp. 181-201.
VEREINHEITLICHUNG DES FORSTLICHEN RECHNUNGSWESENS. 1980. Deutscher Forstwirtschaftsrat, Münstereifeler Strasse 19, 5308 Rheinbach be Bonn, 35 pp. (in German).

ADJUSTED PROFIT AND LOSS STATEMENT OF FORESTRY	**2002**	
	€	€/ha
Sales	17 547	122
Subsidies	201	1
Net turnover	17 748	124
Change in stocks of finished goods (+/-)	-42	0
Change in growing stocks	25 726	179
Production for own use	362	3
Other operating income	0	0
Total operating income	43 794	305
Raw materials and consumables purchases	-100	-1
Change in inventories (+/-)	0	0
External services	-1 042	-7
Wages and salaries	0	0
Other operating expenses	-28	0
Forest owners' own labour input	-1 620	-11
Rents	0	0
Other expenses	-1 072	-7
Depreciation, amoratisation and reduction in value		
Buildings	0	0
Machinery and equipment	-482	-3
Other depreciations	-261	-2
Operating profit (loss)	39 190	273
Financial income and expenses		
Interest and other financial income	326	2
Interest and other financial expenses	-167	-1
Profit (loss) before extraordinary items (=Net result)	39 349	274
Alternative interest cost of equity (5 % from below)	-19 192	-134
(Equity of the forest owner)	383 846	2 677
Entrepreneurs profit (economic value added)	20 156	141
Return on equity (ROE) (taxes not deducted)	10,25	
Return on total assets (ROA)	9,88	
Equity ratio, %	96,23	

ADJUSTED BALANCE SHEET OF FORESTRY	2001		2002	
	€	€/ha	€	€/ha
FIXED AND OTHER NON-CURRENT ASSETS				
Intangible assets				
Intangible rights	0	0	0	0
Other capitalised expenses	0	0	0	0
Tangible assets				
Land and waters	27 676	193	27 676	193
Buildings	0	0	0	0
Machinery and equipment	2 774	19	2 202	15
Non-merchantable growing stock of forest	174 145	1 215	189 694	1 323
Other tangible assets	2 084	15	2 347	16
Advanced payments and construction in progress	0	0	0	0
Investments				
Bonds and shares	5 843	41	5 835	41
Loan receivables	0	0	0	0
Other shares and similar rights of ownership	0	0	0	0
CURRENT ASSETS				
Stocks				
Raw materials and consumables	0	0	0	0
Work in progress (allowable cut)	173 984	1 213	184 162	1 284
Finished goods	587	4	5 447	38
Advance payments	0	0	0	0
Debtors				
Trade debtors	40	0	0	0
Loans receivable	0	0	31	0
Investments				
Own shares or similar rights of ownership	0	0	0	0
Other shares and similar rights of ownership	0	0	0	0
Cash in hand and at banks				
Cash in hand and at banks	0	0	0	0
TOTAL ASSETS	387 134	2 700	412 491	2 877

EQUITY AND LIABILITIES				
Capital and reserves				
Subscribed capital	0	0	0	0
Other	372 236	2 596	395 457	2 758
Provisions				
Voluntary provisions	1 464	10	1 464	10
Creditors				
Long term liabilities				
Bonds	285	2	251	2
Convertible bonds	0	0	0	0
Loans from financial institutions	9 906	69	8 814	61
Loans from pension institutions	0	0	0	0
Other loans and liabilities	379	3	294	2
Short term liabilities				
Loans from financial institutions	0	0	0	0
Advances received	706	5	2 960	21
Trade payables	0	0	0	0
Bills of exchange payable	0	0	0	0
Other loans and liabilities	24	0	0	0
Deferred income and accrued expenses	2 134	15	3 251	23
TOTAL EQUITY AND LIABILITIES	387 134	2 700	412 491	2 877