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Results and implications from a comparative study of Swedish and Finnish forest sectors

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Abstract

Sweden and Finland as two neighbouring forestry countries are compared. Despite the widely similar features of forestry sectors, some interesting differences are found. In Finland, the economic dependence on and the people's involvement in the forestry sector are wider than in Sweden. For instance, there are almost double as many family forest owners in Finland as in Sweden. Decision making is more centrally organised in Finland than in Sweden. On the other hand, more normative control and general enhancement of rural entrepreneurship is employed in Sweden, whereas Finland relies more on direct financial support for rural sectors. The structural change in forest industry has progressed further in Finland than in Sweden and the dependence on imported wood is greater in Finland. The financing of nature conservation increased during the 1990's strongly in both countries and was on average at a slightly higher level in Finland than in Sweden. Since 1999, however, the conservation financing level has increased remarkably in Sweden. Eight out of ten of the general public in both Finland and Sweden see that forests are very or rather well managed. The impression is that forestry is practised slightly more intensive in Finland than in Sweden. Also the forestry net revenues have been since the end of 1990's higher in Finland.

Keywords: *comparative study, forest policy, forestry, forest industries, nature conservation*

1. Introduction

Sweden and Finland are two neighbouring Nordic countries, which have similar competitive advantages in the global economy. One of these is the forest resources, which have played an essential role in the industrialisation process and in the development of the welfare state in both countries.

Although Sweden and Finland are in many forms similar countries, there are also differences. The objective of this article is to compare the Finnish and Swedish forest sectors in order to find out the factors, which can be argued to affect the relative forest sector competitiveness of the respective country. The aim of the study is to assist ongoing forest policy processes in both Sweden and Finland.

The article is organised as follows. In chapter "Materials and the working group" the main sources of information, certain conversion methods and the responsible working group as a "think tank" for the results are described. This is followed by the "Results of the comparative analysis", which is written in a rather brief straight-forward style according to topics chosen by the working group. The final chapter of the article is "Summary, conclusions and implications", which discusses on the selected differences between countries.

2. Materials and the working group

The materials of the study have been based mostly on the secondary information i.e. existing data and research results, which have been made as comparable as possible between the countries. The precise references are impossible to include in this article, but will be available in the final report. Therefore, the sources for information are described in a more general way in this chapter.

The most important sources of the forest resource and forest utilisation data have been the Statistical Yearbooks of Forestry of the both countries. These have been supplemented with other statistics from both countries. Conversions have been carried out e.g. in felling volume statistics, which differ between countries with regard to over and under bark practises and the extent of removal definition. In case of the financial terms, inflation unadjusted monetary conversion 1 euro = 9 SEK has been employed in all other subjects and times series except for in annual revenues and costs of forestry, where annual exchange rates, unadjusted to inflation, were used.

The primary data sources of participating organisations have also been essential. These organisations have been described with the working group. National legislations have been in an important role, when comparing normative control, public organisations, financial support and taxation. National budget propositions and reports have provided that state financial data, which have not been included to forest statistics. In addition, published and internal reports of organisations have been employed. For instance, data for financing nature conservation has been received from reports and datasheets of the Ministry of the Environment in Finland and the Swedish Environmental Protection Agency. Threatened species have been compared according to national red-listed reports. Forest certification data has been received from the national representatives of the certification systems.

The responsible working group as a "think tank" and as a responsible body for the results presented in this article has had representatives from four organisations. The Forestry Research Institute of Sweden (SKOGFORSK) has been the initiator and the coordinator of the project. The private METSÄTEHO research and development service company, the Finnish Forest Research Institute (METLA) and the Ministry of Agriculture and Forestry in Finland have been collaborating with Skogforsk from the Finnish side. The responsible working group has been as follows.

Jarmo Hämäläinen,	Metsäteho, Finland
Jussi Leppänen,	Metla, Finland
Pentti Lähteenoja,	Ministry of Agriculture and Forestry, Finland
Paul Nouro,	Metla, Finland
Lennart Rådström,	Skogforsk, Sweden (project coordinator)
Åke Thorsén,	Skogforsk, Sweden

In addition, there have been several researchers from the organisations involved during the project, when comparable data and respective calculations have been made. Curt Almqvist, Torbjörn Brunberg, Staffan Jacobson, Magnus Larsson, Sten-Gunnar Skutin and Johan Sonesson from Skogforsk and Jouko Örn and Kalle Kärhä from Metsäteho have been responsible of essential parts of the results.

3. Results of the comparative analysis

3.1 Forest land, production and harvesting

The productive forest land, i.e. land producing more than 1 m³o.b. wood during the rotation, is in Finland 20 million ha. In Sweden forest land covers 23 million ha, i.e. 12% more than in Finland. In Finland, the growing stock remained rather stable at 1.5 milliard m³o.b. since 1920's until the middle of 1970's. Since then, during the past three decades, the growing stock has been increasing up to over 2.0 milliard m³o.b. In Sweden, the growing stock has been increasing steadily during the century, from ca 1.7 milliard m³o.b. in 1925 up to today's 3.0 milliard m³o.b.

The annual growth on forest land in the shift of millennium was 95 million m³o.b. (4.7. m³/ha) in Finland and 106 million m³o.b. (4.6 m³/ha) in Sweden. Scots pine (*Pinus sylvestris*) is the dominating species (50%) in Finland, whereas Norway spruce (*Picea abies* [L.] Karst.) is the most common species in Sweden (42%). The share of birch (*Betula pendula* and *B. pubescens*) is greater in Finland (16%) than in Sweden (11%).

Felling volumes have during the past 50 years increased by 25% in Finland and by 65% in Sweden. The annual fellings have been on the average during first years of 21st century 53 million m³u.b. in Finland and 66 million m³u.b. in Sweden. In Finland, saw logs have comprised 45% and pulpwood 43% of the total felling volume. The respective proportions in Sweden have been 52% for saw logs and 38% for pulpwood. Relatively, relative felling of the growing stock has been little higher in Finland (3.3%) than in Sweden (2.7%).

Since 1970 until the 21st century the annual final felling areas have varied in Finland between 100,000 and 150,000 ha with a tendency to increased areas. In Sweden, the final felling areas have decreased from 300,000 ha down to 175,000 ha during the same period. Annual thinning areas have increased in Finland since 1975 until 21st century from 100,000 ha up to 300,000 ha. During the same period, in Sweden the annual thinning areas have varied between 200,000 ha and 300,000 ha, with a tendency to increase during the past two decades.

The extent of the harvesting is constrained partly by the age-class distribution of forests. The impression is that in Finland harvesting can be carried out slightly more intensively than in Sweden, and the production capacity of the forest land has been utilised little better. However, this impression cannot be scientifically confirmed, because of the insufficient data. For, instance, the site type classification systems are different in both countries. However, both Finland and Sweden have a great potential for increased roundwood production.

3.2 Silviculture and forest tree breeding

Methods for forest regeneration are similar in Finland and Sweden. In Finland ca 55% of the forest regeneration areas are artificially planted compared to ca 60% in Sweden. Seeding is carried out on ca 20% of the regeneration areas in Finland, but insignificantly in Sweden. Further, natural regeneration is employed on 24% in Finland and on 37% in Sweden. During the period of 1990-2003 planting areas have been rather constant in Finland, 80,000-100,000 ha annually, whereas in Sweden they have been decreasing from annual ca 190,000 ha down to 140,000 ha. During the same period, soil preparations have stayed in both countries at relatively constant levels, ca 130,000 ha in Finland and 150,000 ha in Sweden.

Tending of young stands has varied between 150,000 ha and 250,000 ha annually in Finland. In Sweden, tending of young stands collapsed from ca 360,000 in 1990 down to

200,000 in the middle of 1990's. Since then, tending of young stands has gradually increased in Sweden, and was 340,000 ha in 2003.

The extent and development of forest fertilisation has been over time relatively similar in both countries. In both cases the growth of fertilisation activities culminated at the end of 1970's. The decrease of fertilisation has been since then dramatical. The extent of fertilisation in Finland is nowadays ca 50% of the amount carried out in 1990. In Sweden, the respective extent is ca 20%. Today, the annual fertilisation area is ca 20,000 ha in both countries. In Finland, peatlands constitute about half of the all fertilised forest lands. In Sweden, the share of fertilised peatlands is insignificant. In Sweden, fertilisation has been carried out mainly by the large-scale forestry and in the family forestry fertilisation has had only marginal importance (ca 1 % of the total fertilisation). In Finland, the family forest owners have had a very high fertilisation activity (ca 60% of the total fertilisation).

Forest ditching has overall been carried out more extensively in Finland, and the intensive use of the peatlands in Finland depicts for its own part the differences in the intensity of the timber production. Cleaning of existing forest ditches has been carried out in Finland on average 75,000 ha annually. The ambition of today is to increase the annual area. In Sweden, cleaning of forest ditches has had a very small extent, only 500-1,000 ha annually, although from the wood production point of view the need for this activity would be probably greater.

The elk damages with serious consequences for the roundwood production and economy are principally located in pine-dominated young forests. Such damages are found more than double as much in Sweden (28.2% of the young pine stands) as in Finland (13.1%). The major reason is that elk population is significantly greater in Sweden than in Finland.

The responsibility of forest tree breeding is in both countries given to a single organisation. In Finland, the responsible organisation is the state-financed Finnish Forest Research Institute Metla and in Sweden, the privately financed Forestry Research Institute of Sweden Skogforsk. In Finland, forest tree breeding is by 100% financed by the state. In Sweden, 1/3 of the total financing of forest tree breeding is indirectly from the state budget for forestry.

Forest tree breeding is carried out in both countries according to similar breeding strategies and the major tree species are Scots pine and Norway spruce. In Sweden, also breeding of Contorta pine is in the programme, but not in Finland, where a part of the resources are allocated to the breeding of Silver birch.

In Finland, state support up to 85% of the costs for establishing and management of forest seed tree orchards is available during the establishment process. In Sweden, no state financing is available for orchards. Since the 1950's Finland has established significantly greater areas of Scots pine seed tree orchards than Sweden. In Finland, there are plans to establish significantly greater area (3.8 times more) of Scots pine seed tree orchards than in Sweden. The use of qualified seed from orchards in nurseries is increasing in both countries, especially in Finland. In Finland, the proportion of the qualified seed for Norway spruce plants is greater and for Scots pine plants less compared to Sweden.

During the 1990's the plant production has been decreasing in both countries. In Finland, the production volume of forest plants is half of that in Sweden. The share of plants produced in pot plant systems is high. For Norway spruce the share of pot plants is less in Sweden than in Finland.

3.3 Forest owner groups, employment and size of sector

The non-industrial private family forest owners have ca 60% of the forest land in Finland, compared to ca 50% in Sweden. State has ca 25% in Finland and ca 20% in Sweden, and

companies ca 10% and ca 25%, respectively. The remaining forest land is in Finland in ownership of "other owners" and in Sweden of "other private and public forest owners". The number of private forest holdings in Finland is ca 445,000 (ca 300,000 over 5 ha). In Sweden the respective number of private forest holdings is ca 240,000 (ca 200,000 over 5 ha). The average area of a forest holding in Finland is 24 ha compared to 48 ha in Sweden. During the past three decades, the average area of a holding has decreased in Finland but increased in Sweden. The ownership structure and development can be assumed to effect both to the activity in forestry as well as to the wood supply to processing industries.

The forest sector is an important employer both in Finland and Sweden, but the relative importance of the sector has decreased in both countries. In 2003 ca 4% of the employees in Finland were working in the forest sector compared to ca 3% in Sweden. In the same year, the share of the forest sector of the GDP was ca 6% in Finland compared to ca 3 % in Sweden.

3.4 Industry and markets

Finland and Sweden are both significant forestry countries in the world. In the list of top export countries of forest industrial products, Sweden possesses the second and Finland the third place. However, there are clear differences in the forest industry structures between the countries. In Finland, forest industry is characterised by few big companies, which have a wide horizontal range of production in pulp, paper and sawmilling industries. In Sweden, forest industry companies are on average smaller. Pulp and paper industry and sawmills have also mostly separate owners. In addition, vertical integration in value chain is greater in Finnish than in Swedish forest industries. In Finland, the major line in pulp and paper production is high-quality printing papers, but also fine paper and paperboard are significant. In Sweden, instead, paperboard and different packaging papers are dominating products. Also newsprint has a great share in production in Sweden. The most important export markets are in both cases in Western Europe, but the significance of Asia, Japan and USA is increasing.

Annual investments in forest industries have increased up to ca 1 milliard euros during the period of 1990-2004 and the production has grown successively both in Finland and Sweden. This expansion of production has been to great extent built on the imports of roundwood. The net imports of roundwood in Finland are greater than in Sweden, and the imports have increased practically during the full period since 1970 until today. The net imports of roundwood to Sweden developed similarly until 2000, when the growth culminated. The Finnish forest industry is, to a greater extent than the Swedish, basing its production on imported wood. This applies especially to that part of the industry, which is focused on the high-quality printing papers.

3.5 Forestry organisations

In Finland, the Ministry of Agriculture and Forestry (MAF) is responsible for planning and implementation of the forest policy. The Ministry of Environment is responsible for biodiversity, nature conservation and environmental management. The fields of the MAF are extension in forestry, state forestry, forest research and international forestry. The National Forest Council is working as an advisory organ for MAF. There are 13 regional Forestry Centres (FC), which have extension and public authority tasks in forestry. The FCs supervises the Local Forest Management Associations (LMFA). The Regional Forest Councils are working as advisory organs for the FCs, which are juridical private organisations with public authority tasks. Forestry Development Centre TAPIO is nowadays a separate organisation, which sells services to FCs, MAF etc.

In Sweden, the Ministry of Industry is responsible for the business issues of forestry and the implementation of forest policy, whereas the Ministry of Agriculture is responsible

for forest research. Ministry for Sustainable Development has the responsibility over biodiversity as well as nature conservation and environmental management. The Swedish Forest Agency (SFA, formed through the merge of National Board and Regional Boards of Forestry) is organised under the Ministry of Industry. The SFA supervises that the forestry is developed according to forest policy set by the government and parliament. The SFA consist of five regions.

The Finnish Forest Research Institute METLA is a state organisation under the administrative sector of MAF with responsibility over forest research and statistics. In Sweden there is no comparable single organisation.

The Finnish Forest and Park Service METSÄHALLITUS is a state business enterprise under the administrative sector of MAF. In nature conservation issues Metsähallitus is administered by the Ministry of Environment. Metsähallitus manages state forests and nature conservation areas, and has certain public authority tasks. Business and societal activities are separated in the organisation. The Swedish SVEASKOG is a limited company in 100% state ownership. Its main task is to manage state forests in accordance to the objectives given by the state; one included task is also to develop the values of forests concerning nature experiences and recreation.

With regard to organisations of family forest owners there are great differences between Finland and Sweden. In Finland, the forest policy part is under the Union of Agricultural Producers and Forest Owners (MTK, which is the counterpart for the Swedish LRF), whereas the forest industrial part is in a countrywide co-operative company METSÄLIITTO Group. In Sweden, both of these parts are in regional Forest Owners' Associations, additionally to the forest policy activities by the Federation of Swedish Farmers (LRF). In Finland, the Unions of Forest Management Organisations (UFMOs) are unifying and supporting the activities of the Local Forest Management Associations (LFMAs). UFMOs are directly connected to the MTK, which results into an indirect connection of LFMAs to the MTK. Certain tasks of the LFMAs are financed through the legally stipulated membership and forest management fee of family forest owners, collected by the tax authority.

The Finnish roundwood markets are dominated by three big forest industry companies, of which one, as mentioned, is owned by the family forest owners. The co-operation between family forest owners has two separated roles with regard to a single forest owner. The officer of a LFMA is working as a consult for the roundwood seller (forest owner) and the officer of the Metsäliitto is working as a business partner (buyer). In Sweden, an officer of a Forest Owners' Association has the both roles as a consult and business partner.

In Sweden, there are six big forest industry companies, of which one is a part of a business concern owned by the family forest owners. In addition, there are three Forest Owners' Associations, which are both buyers and sellers of roundwood. Moreover, both in Sweden and Finland there is a number of independent sawmill companies.

The two central organisations of the forest industries, the Finnish and the Swedish Forest Industries Federations, have analogous tasks and objectives. The organisations include all the forest industrial branches. Their contribution is to improve the competitiveness of the member companies and to increase the use of the forest based products. The activities cover business life issues in a wide sense. The orientation is highly international.

3.6 Laws and norms for forestry

Normative framework for forestry is described not only in the forest laws, but in both countries also in the Constitution, especially concerning the ownership rights and in the general legislation, e.g. in the Land use and Construction Act in Finland and in Planning and

Construction Act in Sweden. In addition, forestry is regulated by Nature Conservation Acts, the Act on Land Purchase in Sweden, Real Estate Formation Acts as well as by provisions for the negotiation obligations in issues related to Sami people.

The forest policy objectives in the forest code are very well comparable in Finland and Sweden. Forests shall be managed and used in a sustainable way so that they will provide a good yield in the long term. The biological diversity of forests shall be safeguarded and the general social interests shall be taken into consideration. When considering the other forestry related legislation, the differences are related to fragmentation prevention control of a forest holding and to preference position of a local resident in forest real estate purchase, which are applied in Sweden, and to financing of sustainable forestry, which is applied in Finland.

Due to the historical background as a single country before 1809, the structure of the legislation is the same in Finland and Sweden. For instance, some sections of the Law of 1734 are still in force in Finland. Similarities exist also in the modern legislation. This applies e.g. to the provisions on the forest protection to reduce insect damage risks, which are almost identical in both countries.

Table 1. The most important provisions in the Finnish Forest Act (FFA) and in the Swedish Forestry Act (SFA)

Provision	FFA	SFA
Obligation to afforest	after regeneration felling	on unemployed land and when condition of forest is clearly unsatisfactory
Time limit for forest regeneration measures	3-5 years	3-4 years
Conditions for regeneration harvest	minimum age or minimum diameter or specific reason	minimum age or obligation to reforest
Max. proportion of forest area to be regenerated	no limits	limitations when forest area is over 50 ha
Fellings in protection forests	permission needed	permission needed
Harvesting on year-around pasture forests for reindeers	negotiation obligation on state lands	negotiations required with Sami hamlets
Noble hardwood trees (e.g. oak)	no provisions in forest law	provisions
Protection against insects	provisions (a separate law)	provisions
Harvesting on scrub and waste land	Allowed	principally prohibited
Habitats of special care	comprehensive list in Forest law	a list of examples as a general advise
Avoiding damage as a result of forestry activity	shall be avoided on stands and terrain	shall be avoided on terrain and waters
Building of forest roads	constraints for especially important habitats	constraints
Time limit for forest use declaration	2 weeks (all fellings)	6 weeks (only final fellings)
Settlement of forest and environment	no provisions	obligatory for forest holdings over 10 ha
Prejudgement on the legality of felling	can be applied for habitats of special importance	can be applied
Imposition and prohibition	also with fine	also with fine
Security for forest regeneration	may be required if earlier omissions	may be required in case of expensive measures of larger scale
Penalty	max 2 years sentence to prison	max 6 months sentence to prison

3.7 Taxation laws

In Finland, since the income year 2006 family forestry incomes are principally taxed as capital incomes with a fixed tax rate of 28%. Two out of three family forest holdings selected in 1993 to be taxed according to wood sales profits, whereas the rest chose to keep the area-based site-productivity taxation system (the old tax system) during the transitional period 1993 - 2005.

In Sweden, forestry incomes are principally regarded as business incomes, taxed with progressive rates. This includes, that certain allocation possibilities can be employed when calculating the annual taxable net income. In addition, a part of the business incomes can be taxed also in Sweden as capital incomes with a rate (30%), subject to a net property calculation.

For other forest owners than individuals, the company income tax rate is in Finland 26% and in Sweden 28%. In Finland, the excise duty for the diesel oil is applied for road transport, whereas forest machines are allowed to use lower duty fuel. In Sweden, also forest machines are obliged to use the higher taxed diesel oil.

The taxation levied in the ownership change of a forest holding is generally lower in Sweden. However, close family relationship combined with over 10-year ownership period and continued agricultural entrepreneurship can reduce substantially the tax burden levied in the ownership change in Finland.

Table 2. Important forest taxes in Finland and Sweden.

	Finland	Sweden
Company income taxation	Corporate income tax 26 % (since 2005, previously 29 %)	Corporate income tax 28 %
Individuals: Capital income taxation (proportional) of forest incomes	1. Yes, since 1993 2. No, until 2005 Capital income tax rate 28 % (since 2005, previously 29 %)	Yes, according to a calculation based on net property of business properties since 1994. Capital income tax rate 30 %
Individuals: Earned income taxation (progressive) of forest incomes	Partially, progressive taxation with marginal tax effects: 1. Yes, but only the value of self-employment in delivery sales 2. Yes, until 2005	Yes, progressive taxation with marginal tax effects
Social payments of entrepreneur	1. No, since 1993 2. Partially, until 2005 1. & 2. Yes, a separate obligatory social payment system for farm forest owners and ca 3000 non-farm forest owners.	Yes, calculated from the earned income
Excise duties (the most important)	– Light fuel oil (forest machines) – Diesel oil (road transport) – Petrol (chain saws etc.) – Vehicle tax (road transport)	– Diesel oil (forest machines and road transport) – Petrol (chain saws etc.) – Vehicle tax and road tax (road transport)
Inheritance and donation, forest holding	3. Yes, fair values, progressive 4. Yes, 40% of the tax values (100% of the tax values before 2004)	Cancelled since the income year 2005 (based on the tax values until 2004)
Property tax on the forest holdings	Cancelled since 2006, tax values until 2005	Forest holding: No Private house with its site: Yes
Real estate tax	Yes, but only applied to the forestry buildings and their sites	Forest holding: No Private house with its site: Yes
Value added tax (VAT)	Yes, since 1995 (22 %)	Yes (25 %)
Profit from assignment when selling the forest holding	Yes, capital income tax 28 % No, in case of closest relatives, if possession time exceeds 10 years	Yes, capital income tax 30 % applied to 90 % of the profit
Stamp tax when purchasing a forest holding	4 % of the value	1,5 % (individuals) 3,0 % (companies etc)
Possibilities for regulating the net income for forest taxation (delayed or decreased tax)	– Forest deduction – Depreciations – Expense and damage cost reserves – Pension insurance	– Capital taxation according to net property – Forest deduction – Forest deduction in rationalising holding structure – Periodisation reserve – Expansion reserve – Depreciations – Forest account – Payment schedule – Silvicultural expense reserve – Replacement reserve – Pension insurance
Special regulations	1. Capital income taxation – Net taxation of all capital incomes and interest costs including the interest costs	– Single income source, i.e. net taxation of all business activities of an individual (e.g.

- from own house.
 - In case of deficit, maximally a 10-year allocation period if a set-off against the earned income is not earlier possible.
 - Separate net taxation of profits and losses from assignments with a 3-year allocation possibility of losses from future profits.
2. Area taxation
In case of deficit, allocation to next year without restriction, but only until 2005
- forestry and agriculture)
 - In case of deficit, this can be allocated to next year and so on without any time restrictions.
 - Possibility for the deficit set-off against the earned income during the 5 first years of the new business activity

Symbols in Finnish column:

1. Wood sales profit taxation, 2. Area taxation, 3. Without active agriculture, 4. With active agriculture.

3.8 Opinions of the general public on forestry

In Finland, the Finnish Forestry Association has during 1993-2003 regularly surveyed the forestry opinions of the general public. In Sweden, the Federation of Forest Industries has since 1985 every second year surveyed how the general public sees the forestry and forest industries. The survey covers ca 1,000 persons in both countries. The questionnaire settings are not similar in both countries, but there are some questions which are comparable. One of these surveys how forests are managed. In Finland 85% of the general public sees that forests are managed very well or rather well. Also in Sweden a positive opinion on the forest management is dominating: 80% sees that forests are managed very well or rather well. These results have stayed quite well at the same levels during the period 1997-2003. The part of the general public, who see that forests are managed very badly is marginal, only some percents. In both countries a similar question is set on the reliability rank of the information providers. In Finland, the forestry professionals have the greatest reliability. This group of information providers does not exist in the Swedish survey. Of the comparable information providers, the environmental organisations have the greatest reliability, followed by representatives of the forest industries and journalists. In both countries the reliability difference between different environmental organisations is great. WWF has the highest reliability and Greenpeace the lowest, which in Finland is ranked after the representatives of the forest industries. The politicians both in Finland and Sweden have the lowest reliability as forest information providers. In wide sense, the general public relies similarly on the different information sources in both countries, both with regard to ranks and levels.

3.9 Public support

The public financing for the forestry is essentially greater in Finland than in Sweden. The Finnish forestry budget for 2005 was 162 million euros. The biggest inputs were financing for sustainable forestry 63 million euros, Forestry Centres and Tapio 44 million euros and Finnish Forest Research Institute Metla 39 million euros. Financing for sustainable forestry was allocated mostly to tending of young stands, and to some extent to regenerations. Financial support is allocated also to forest improvement works, including cleaning of forest ditches and construction and basic improvement of forest roads. In Sweden, the forestry budget for 2005 was 60 million euros. The Swedish Forestry Agency had 35 million euros and inputs for nature and cultural habitats protection and management in forests were 24 million euros. Forest research in Sweden was financed via an other budget section than forestry budget of Ministry of Industry. The most essential difference between Finland and Sweden was, therefore, that in Finland a great part of the forestry budget was allocated to wood production increasing measures, whereas in Sweden the weight point was on the nature and cultural habitats. The financing of silviculture and forest improvement was in 2005 ca 1.2 euros per harvested cubic metre in Finland. Another important difference is that in Finland there has been a tradition for processing the National Forest Programme. This is carried out in

co-operation between the state and forestry and the processing work is characterised by consensus.

3.10 R&D structure and education

Financial inputs for forest research are somewhat lesser in Finland than in Sweden. The most important research units are the Finnish Forest Research Institute Metla and the Swedish University of Agricultural Sciences (SLU). The state financing for forest research is, however, ca 20% higher in Finland. In Sweden, the private financing is ca four times greater than in Finland. The total financing has been increasing both in Finland and Sweden during the period 1995-2000, but since then the level has been rather stable. In 2004 the forest research investments were in Finland ca 62 million euros and in Sweden ca 70 million euros. The number of forest researchers is by 50% higher in Finland than in Sweden. The difference between financial inputs and number of man-years in research can partly be explained through the differences in research and wage costs. During the recent 15 years the number of researchers has increased in both countries, principally through the increased number of post graduate students, whereas the other non-researcher personnel has decreased essentially in number. The fields of research are relatively similar in both countries, but there is little more technological and economic research in Finland than in Sweden, and little more plant physiology, genetics and pathology research in Sweden than in Finland. The annual number of graduated from forest education is about double as great in Finland as in Sweden.

3.11 Forestry revenues and costs

The calculated forestry revenues and costs cover the period 1992–2003 and are based on the annual prices and costs. Total revenues from delivery and stumpage sales have increased more in Finland than in Sweden. In 1992 the revenues, calculated per under bark cubic metre, were 3.5 euros lower and in 2003 5.1 euros higher in Finland than in Sweden, respectively. The roundwood prices were at the end of the period higher in all roundwood assortments in Finland than in Sweden. The differences were greatest in saw logs and spruce pulpwood. On average, the wood sales revenues at roadside per under bark cubic metre were 45 euros in Finland and 40 euros in Sweden. Forestry costs have decreased in Sweden more than in Finland. Since the year 2000 the level of costs was equal in the both countries, ca 17.5 euros per under bark cubic metre harvested. In 2003 the logging and terrain transport costs were higher, but the costs for silviculture and other works were lower in Sweden than in Finland. Transport costs were also lower in Sweden. The difference between forestry revenues and costs at roadside was during the whole period, with an exception in 1997, greater in Finland than in Sweden. Since 1997 the net of the revenues and costs per under bark cubic metre harvested has stayed at the same level in Finland, but decreased by ca 5 euros in Sweden.

3.12 Forest fuels

In Finland, the national energy strategy is based on continuous introduction of renewable energy types. The target is to increase the share of renewable energy by 25% until 2015 and by 40% until 2025. In the National Forest Programme the target is to increase the annual use of forest fuels from 2.7 million m³ (2004) to 5 million m³ (2010).

In Sweden, the national energy strategy is not as concrete as in Finland with regard to the use of the forest fuels. The overall goal is "... an energy system, which is based on sustainable, preferably domestic and renewable energy sources...".

In Finland, financial support is available for harvesting of the forest fuels, in forms of supporting the collection of small-sized wood from young stands and extraction of stumps. The state support for harvesting the small-sized wood is given within the financing of sustainable forestry. The support is 7.0 euros per solid cubic metre for felling and terrain

transport and 4.25 euros for chipping. An area support for tending of young stand, varying between 100-300 euros per hectare, is independent from the forest fuel collection support. The state support for extraction of stumps is 0.44 euros per solid cubic metre.

In Sweden, state support is not employed as an instrument for harvesting of the forest fuels. Instead, general economic instruments, like CO₂ tax, emission allowance trade and green certificate for electricity, are used. In addition, Swedish Energy Agency (STEM) has R&D efforts to develop the use of forest fuels.

In Finland, the energy consumption was 411 TWh in 2004. The share of wood fuels was 84 TWh or ca 1/5. Of that the forest fuels were 23% and, further, the share of large-scale energy production of that 40%. In Sweden, the energy consumption was 493 TWh in 2003. The share of wood fuels was 92 TWh or ca 1/5, i.e. precisely the same share as in Finland. Of that the forest fuels were 25% and, further, the share of large-scale energy production of that ca 50%.

In Finland, the collection and processing of the wood residues after final harvest was carried out so that ca 50% of the residues were chipped at roadside in 2004, ca 30% were delivered in bundled form as "slash logs" and ca 20% in non-processed form. The respective collection and processing picture in Sweden is that today ca 85% of the wood residues are chipped at roadside and ca 10% on the logging area. Systems and methods for collecting and processing the wood residues after final harvest have not changed regardless of the great foundative investments on developing baler/bundler or other large-scale technology in Sweden.

In Finland, small-sized wood is collected for forest fuel in tending of young stands and from early thinnings. This is carried out mechanically and in a relatively large scale. In Sweden, this is not carried out in any practical scale. In Finland, also stumps are extracted for energy, but in Sweden this is only carried out at an experimental level.

Despite not regarded as a forest fuel, one related and a very significant domestic energy resource is peat. Peat is often also mixed with forest fuels in order to improve the burning process. In Finland, peat is used in large-scale energy production and regarded as the most important domestic energy resource. In Sweden, the consumption of energy peat is rather limited compared to Finland.

Both Finland and Sweden have a significant potential for increased removals of forest fuels. To come true, the forest fuel reserves should be made economically harvestable. This could be reached by a better integration of forest fuels in other raw material flows of forestry, as well as also by the activities of energy producers. For this, a new technological thinking is needed, development of the new information and decision systems as well as better utilisation of the production resources and the raw materials.

3.13 Environmental care and nature conservation

In Finland and Sweden, a significant set-aside of nature conservation areas has been carried out during the 20th century, especially in the northern parts of the countries. The share of protected forest land has been relatively low especially in the southern and middle parts of the countries. Both countries have since the beginning of 1990's invested significantly in increased nature conservation. Since 1990, the state financing of the new conserved areas, consisting of compulsory purchase of land, compensations and support, has been on average little higher in Finland than in Sweden. Since 1999, however, the financing level has been increasing strongly in Sweden (especially in 2005), whereas in Finland the level has been decreasing. This has been due to the implementation of the environmental goals in Sweden and the nature conservation programmes in Finland, respectively.

Financing for the management of the conservation areas has been for a long time at rather constant level in Finland, but increased little since 2003. In Sweden, the financing has

been increased remarkably since 2001. Financial allocations for forest habitat protection (e.g. agreements for nature conservation) were introduced earlier in Sweden than in Finland. The financing has also been significantly greater in Sweden than in Finland. In Finland, the financing was until 2003 greater for the inventory and management of the forest habitats than for the compensations to the forest owners. Since 2004 increasingly more financing has been allocated to the compensations than to habitat inventory and management. In Sweden, this breakpoint was already in 1997-1998. Liming of waters and water systems has been since a long carried out in a large scale in Sweden, but insignificantly in Finland.

Concerning the forest certification there is a significant difference between the countries. In Sweden, the FSC has been all the time the dominating system for forest certification, even if PEFC has received an increased extent during the last years. If all certified forest lands in Sweden were summed, would the total of these two systems be 17.1 million ha. However, 3.8 million ha is double certified, which results into 13.3 million ha of the total certified forest land area in Sweden. Of the total forest land 22.7 million ha in Sweden ca 60% has a forest certificate.

In Finland, the FSC has not received any established position. Until recent, only 93 ha of forest land had the FSC certificate. In Finland, the PEFC system is extensively dominating. 22.4 million ha or 97% of the total forest and scrub land has the PEFC-certificate in Finland (scrub land means forest land with potential growth between 0.1-1.0 cubic metres per ha).

Relatively to the number of evaluated species, the share of threatened species in 2000 was equal in both countries (10%). Of the all red-listed species a number of species were found in forests even if these were not their primary habitats. The share of red-listed species, which in 2000 were found in forests, was almost the same in both countries, 47.8 in Sweden and 46.9% in Finland. This means that the picture of threatened species is similar in both countries.

4. Summary, conclusions and implications

The standing timber volume and the annual increment are higher in Sweden. However, the ambitions and level of activity in silviculture is higher in Finland. Relative harvesting volumes of the total growing stock are little greater in Finland than in Sweden, which indicates more intensive forestry in Finland than in Sweden. Also with regard to the regeneration methods, natural regeneration is more common in Sweden than in Finland, where seeding replaces a part of more uncertain natural regeneration. Elk damages in young forests are double as high in Sweden as in Finland.

The forest and environmental policies play a very important role in both countries. There are more regulations in the Swedish forest code than in the Finnish one. Forestry income taxation and diesel oil tax situation is more favourable in Finland than in Sweden, but the other taxes are mostly more favourable in Sweden. In Finland, there are special laws on the public financing of forestry, which are lacking in Sweden. One can well argue that in Finland, the society puts more financial efforts than in Sweden for developing the forestry. However, in Finland and Sweden the investments in forest research are relatively equal, ca one euro per harvested cubic metre, but in Finland there are essentially more forest researchers.

In Finland both family forestry and state forestry have more important roles in the country's economy than in Sweden. Even the net revenues from forestry have grown stronger since the end of 1990's in Finland than in Sweden. One of the important differences between Finnish and Swedish forestry organisations is also the institutional contact surface towards family forest owners and the strong position of Finnish family forest owners. However, the family forestry holdings are larger in Sweden. Another organisational difference is the division of the forest decision making in Sweden into more ministries than in Finland. The

coordination of forest policy is more centrally organised in Finland due to the National Forest Programme.

The forest sector has a more important role in the Finnish economy. The GDP share of total forest sector is in Finland double as high as in Sweden. The structural change in the forest industry has progressed further in Finland than in Sweden and the dependence on imported wood is greater in Finland. The general public values forestry practises high in both countries.

Eight out of ten of the general public in both Finland and Sweden see that forests are very or rather well managed.

The relative share of threatened species was in 2000 similar in both countries. Financing of nature conservation increased during the 1990's strongly in both countries and was on average at little higher level in Finland than in Sweden. Since 1999, however, the financing level has increased remarkably in Sweden. In Finland, almost all of the forest area has an environmental certificate (comes under the PEFC system) compared to 60% in Sweden (mostly coming under the FSC system).

The final conclusions could be as follows. The forestry sector and the wood market seems to be more market oriented in Sweden. This includes more simplifications in order to enhance rural entrepreneurship. On the other hand, in Finland, where the size of forest industrial enterprises are on average bigger than in Sweden, globalisation has affected domestic investments of forest industry more in than in Sweden.

The final implications could be that in Finland, more normative support and financial simplifications for rural entrepreneurship could be developed in order to open more markets for new private forestry enterprises. In Sweden on the other hand, the coordination of forest policy processes and the position of family forest owners therein could be strengthened and the role of forest policy and economic research increased.

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