



# **THE ANALYSIS OF SUSTAINABLE FOREST MANAGEMENT IN LATVIA AND FINLAND**

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## ABSTRACT

One of the most discussed questions in past decades has been the climate change issue. This has affected policies within industrial sector and the economic by itself. Forest deforestation counts for one fifth of the total emissions worldwide, which leads to the need for better forest management. Finland and Latvia are countries in Europe that have relatively high shares of forest and other wooden land areas. This raises the value of sustainable forest management in these countries to provide the local industries with continues supply of resources, and to prevent the transiency of other values in forests, as biodiversity, health and vitality of forests, non-wood products, cultural and spiritual values, protective and others functions, also related to the climate change.

In this paper, the six pan-European Sustainable Forest Management criteria and their indicators are used as quantitative measurement and valuation tool to characterize sustainable forest management in Finland and Latvia more specifically. Finally, a *Strength, Weaknesses, Opportunities and Threats* (SWOT) analysis is conducted to give better comprehensive view on sustainable forest management, and to propose what would be the focuses for the future in each of the countries.

The brief conclusion is that both countries have implemented sustainable forest management practice in their policies; however, the results differ. Each country has its strong and weak factors, e.g., Finland still is not able to capture the carbon stock in volumes that are generated by deforestation and shifting agriculture, but Latvia still has high levels of damaged forests and tree defoliation in recent years. At the same time, each country has its opportunities and treats, e.g., in Finland 95% of forests are certified, while in Latvia still stay behind in the certification procedure and only half of all forest land areas are certified under international certification scheme. More conclusions can be found at the end of the paper, as well as discussion and suggestions.

## TABLE OF CONTENTS

Introduction .....	4
1. The Background of Sustainable Forest Management in Europe .....	6
1.1. European Forest Policies, Standards and Instruments in Meeting Sustainable Forest Management.....	8
1.2. The Criteria of Sustainable Forest Management .....	12
2. Implementation of Sustainable Forest Management in Finland and Latvia .....	23
2.1. Forest Policies in Relation to Reach Sustainable Forest Management.....	23
2.2. Correspondence to Sustainable Forest Management Criteria.....	27
3. The Comprehensive Analysis of Sustainable Forest Management and its Policies in Finland and Latvia .....	51
3.1. The SWOT Analysis for SFM and its policies in Finland and Latvia.....	51
3.2. The Comparison of Sustainable Forest Management between Finland and Latvia .....	62
Concluding remarks.....	64
Discussion and suggestions .....	65
Literature .....	66
Appendixes .....	69

## **Introduction**

Climate change has been one of the most discussed topics in past two decades. Even though the opinions on this question differ from person to person, everyone understands the importance of better resource management in nowadays, including forest management. Sustainability means to maintain the accessibility to the values of resource for future generations. Finland and Latvia are the countries in Europe that have relatively high shares of forest and other wooded land areas. This raises the value of sustainable forest management in these countries to provide the local industries with continued supply of resources, and to prevent the transiency of other values in forests, as biodiversity, health and vitality of forests, non-wood products, cultural and spiritual values, protective and others functions, also related to climate change.

Particularly these two countries are chosen for the analysis because they both have very similar weather conditions and nature, as well as main species that grow in forests and that are used for production within forest industry. At the same time, each country can be characterized by a different situation of forest management and forestry, as well as different approaches are applied in reaching both locally and internationally defined sustainability targets. This gives a comparison – how the sustainable forest management can be implemented through policies and regulations. But it is also important, how the importance of sustainability can be communicated to the society, so it is willing to take participation and become a direct member on reaching nationally nominated goals.

The research question of the paper is: what are the strong and weak factors, as well as opportunities and threats for sustainable forest management in Finland and Latvia; what are the similarities and differences in the way of reaching sustainable forest management. The analysis is based on six Pan-European criteria and their indicators that are developed by the FOREST EUROPE initiative. It also includes the brief analysis of the policy documents and instruments within each country.

By answering the main research question, paper introduces the comprehensive analysis of sustainable forest management within each country and stresses the positive and negative sides. In the result of analysis the issues that countries should focus on and that should be improved in the nearest future will be also underlined and discussed.

The paper consists of three chapters. The first chapter gives the historical review on internationally binding policies, to give the background understanding of sustainable forest management on international level. Further the description of six Pan-European sustainable forest management criteria and indicators follows and the general view on situation in European level is described under each criterion. This is important information to understand the trends and general importance of the sustainable forest management. The second chapter starts with the analysis on the topic and gives more specific information on the forest policies both in Finland and Latvia - what kind of policies have been implemented in each country and how they regulate the forestry sector. It is followed by each of the six criteria described and characterized by static data for both countries. Data are analysed whether there are fulfilments and achievements of sustainable forest management implementation on national level. The final third chapter is the comprehensive SWOT analysis for each country and their comparison. This final chapter gives concluding overview on the main parameters by both countries and underlines the most important either achievements or issues. There is analysed the sustainable forest management in a unifying way. Paper finishes with conclusions, discussion and suggestions.

The brief conclusion is that both countries have implemented sustainable forest management practice in their policies; however, these results differ. Furthermore, each country has its strong and weak factors, e.g., Finland still is not able to capture the carbon stock in volumes that are generated by deforestation and shifting agriculture and Latvia still has high levels of damaged forests and tree defoliation in recent years. At the same time, each country has its own opportunities and treats, e.g., in Finland 95% of forests are certified, while in Latvia only half of the forest land areas are certified under international certification scheme.

## **1. The Background of Sustainable Forest Management in Europe**

Firstly the importance of the sustainable forest management is motivated in this first chapter. It is followed by the first sub-chapter with the overview of background on the development of sustainable forest management policies in Europe, and it gives knowledge of present treaties and policy documents that have an effect on daily actions within forest sector. The second sub-chapter gives more specific description on the scope of forest strategy and introduce the reader to six Pan-European sustainable forest management criteria, defined by FOREST EUROPE. Based on these criteria the Finland's and Latvia's forest policies and managements will be analysed in the second and the third chapters of the paper. It is important to have general introduction within Europe to have base line to which we can refer.

Climate Change is a change in the weather patterns over years and it is a main threat for the human being and the world as a whole in the future. Between 1970 and 2004, a noted increase of 70% in greenhouse gases (GHG) emissions was observed and they are expected to further increase over the next decades [Winkel *et al.*, 2009 p.24]. While most of the greenhouse gases come from the combustion process when using fossil fuels, about 20% induced CO<sub>2</sub> emissions come from land-use changes, where most of the net carbon dioxide contribution comes from permanent deforestation and shifting agriculture [Bortoluzzi B., 2000 p.7]. Land-use systems and particularly forests, depending on the applied management, can help to observe more emissions or be a source of new greenhouse gases within atmosphere. As for example, in Finland emissions output from deforestation and afforestation is higher than carbon storage by forests, at the same time, in Latvia forests are absorbing more than all other sectors emit. Therefore forests and their sustainable management are potentially playing an important role in the mitigation as well as in the adaption to climate change [Winkel *et al.*, 2009 p.24]. Forests have four major roles and they offer a wealth through ecosystem services to society, e.g., timber (economic value); recreation (cultural and spiritual value); biodiversity (environmental and natural value) and carbon storage (the solution for long-term weather patterns). Currently forests in global scale contribute about one-sixth of global carbon emissions when cleared. At the same time forests by themselves react sensitively to a changing climate. When managed sustainably, they produce wood fuel as a benign alternative to fossil fuel; and finally, they have the potential to absorb about one-tenth of global carbon emissions projected for the first half of this century into their biomass, soil and products and store them - in principle for infinitive time [FAO 2012/1]. We could implement several activities that either mitigates the climate change, as for example, to

increase stock by developing agro forestry or creating new plantations, or adapts to the climate change, that would be to implement and develop the usage of biomaterials or production of bio energy, or we can use other emission reduction options [USAID-CIFOR-ICRAF 2009]. It is estimated that in the European Union (EU), forests compensated for approximately 10% of the EU's overall emissions between 2000 and 2005 [MCPFE Liaison Unit Warsaw, UNECE and FAO 2007].

The combined impact of climate change, land shifting (mostly treated as land development), suppression of naturally generated periodic forest fires, air pollution etc. is leading to the changes in forests [United States Environmental Protection Agency 2009] that should be managed in a sustainable way to save the biodiversity (forests are home to more than 80% of the world's terrestrial biodiversity) and to maintain the protection to watersheds that are critical for the supply of clean water to most of humanity [FAO 2012/2, p.3].

The focus on Europe and particularly Finland and Latvia is chosen, because Europe and especially Northern and North-Eastern Europe have lands with evergreen forests; while the most central and the southern parts of Eurasia have high fluctuations during year [Welch C. 2013], which leads to higher potential of sustainable management of forests in North. Also both countries have similar natural conditions, weather, trees' species growing in forests, and the shares of forests, which gives similar meaning of the forest resource to national economy.

Based on definition, given by Food and Agriculture Organization of the United Nations, "sustainable forest management aims to ensure that the goods and services derived from the forest meet present-day needs while at the same time securing their continued availability and contribution to long-term development"<sup>1</sup>. Sustainable forestry addresses all the resources provided by the forest. This includes the option for timber or fibre production to industrial sector, the option for certain species, the option for employment, the option for clean water and non-wood products (as mushrooms, berries etc.), recreational resources, aesthetic qualities etc. SFM also includes the cultural services for the society and gives the wider knowledge of nature and environment, on effects of climate change, also how to live the way that the society is safe while the biodiversity is also protected - sustainability emphasizes the need to keep viable all the options and opportunities.

"A reasonable goal then is to use management activities in appropriate areas and at appropriate times to ensure we retain all our options in all stages of forest cycle, while producing our desired resources", has said Smallidge P. J. in 2002.

If forest is managed in a wrong manner, forestry can have a variety of negative impacts, as biodiversity loss, illegal hunting, illegal settlements, livelihood of forests dwellers,

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<sup>1</sup> Available online: <<http://www.fao.org/forestry/sfm/en/>>, last time accessed on 11-12-2013 19:55

worsening the climate change, increase in forest fires or other damages. So the issue is not only about optimizing the final product from timber that people are using daily to generate income, it is a complex system that is affected from the very beginning in the biological scale and environment up to needs of the society when the forest is protected from extinction.

The General Assembly of the United Nations (UN) adopted in December 2007 the most widely, intergovernmentally agreed definition of Sustainable Forest:

*Sustainable forest management as a dynamic and evolving concept aims to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations. It is characterized by seven elements, including:*

*1. Extent of forest resources; 2. Forest biological diversity; 3. Forest health and vitality; 4. Productive functions of forest resources; 5. Protective functions of forest resources; 6. Socio-economic functions of forests; 7. Legal, policy and institutional framework.*

At the same time the environment changes over time and this means that criteria for sustainable forest management must be constantly adapted to new circumstances. Then new planning documents, policy instruments, taxation or subsidiary systems etc. must be implemented. Also differences between countries or regions are significant, so the management should be adjusted to national and even regional (as i.e. emphasis on improving biodiversity in Southern-Finland region) context and the specific ecological and environmental conditions, as well as social, economic, political, cultural and spiritual dimensions that goes together with the mindset of national population and private forest owners<sup>2</sup>.

### **1.1. European Forest Policies, Standards and Instruments in Meeting Sustainable Forest Management**

Totally in 2010, there were just over 4000 million hectares of forests in the world, equivalent to approx. 31% of the world's land area. Even though the European Union (EU) only contains less than 5 percent of the world's forests, the forests and other wooded land covered 42% in the EU-27 at the end of the year 2012 [Forestry Statistics by Eurostat<sup>3</sup>], which is above the average in world and makes it one of the most important resources for EU. When comparing to forests on other continents, Europe's forests are intensively managed, rather young and dominated by even-aged stands. They are regionally diverse in terms of tree species composition, growth, and biodiversity. Neither natural forests, nor very intensively

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<sup>2</sup> Available online: <<http://www.pefc.org/standards/sustainable-forest-management>>, last time accessed on 11-12-2013 20:00

<sup>3</sup> Available online: <[http://epp.eurostat.ec.europa.eu/statistics\\_explained/index.php/Forestry\\_statistics](http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Forestry_statistics)>, last time accessed on 04-12-2013

used plantations are frequent. Semi-natural forests, shaped by a variety of social demands and management types, are most present of EU forests [Winkel G. et al. 2009, p.10].

In the early 1980s an increasing defoliation and severe deterioration of the forest condition was observed in large areas of Europe. Growing concern that the observed damage was caused by air pollution led to establishment of the “International Co-operative Programme on the Assessment and Monitoring of Air Pollution Effects on Forests” (ICP Forests), in 1985. ICP Forests was established under the Convention on Long-range Transboundary Air Pollution (CLRTAP) of the United Nations Economic Commission for Europe (UNECE). This was one of the first initiatives and experience. The final agreement provided an institutional framework that brought together science and policy by means of an international scientific cooperation and political negotiation platform [UNECE]. In 1990 there was a first ministerial conference in Strasbourg *Ministerial Conference on the Protection of Forests in Europe (project called FOREST EUROPE)*, which was first pan-European political initiative with regard to forest protection. This conference involved 46 European signatory states in and outside of the European Union. Under this conference the first insides on joint activities on technical cooperation and on the development of criteria and indicators for Sustainable Forest Management (SFM) were given [Winkel G. et al. 2009, p.37], these criteria are also the basic pillar for the analysis of this paper and they have been the origin for previously defined SFM by General Assembly of UN. The importance of protecting forests and manage them sustainably has been stronger acknowledged globally since the “principles of forest management” were adopted in the United Nations Conference on Environment and Development in 1992, Rio de Janeiro [Green Paper 2010, p.2]. In 1993, in the second Ministerial Conference on the Protection of Forests in Europe and it was stated that the sustainable forest management is “the stewardship and use of forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, on local, national and global levels, and that does not cause damage to other ecosystems” [Green Paper 2010, p.3].

The Intergovernmental Panel on Forests (IPF), 1995 - 1997, and the Intergovernmental Forum on Forests (IFF), 1997 - 2000, both under the auspices of the United Nations Commission on Sustainable Development were the main intergovernmental forums for international forest policy development. 100 negotiated proposals for action on a number of issues related to sustainable forest management were developed under IPF, including national forest programmes, forest assessment, criteria and indicators, traditional forest related knowledge, and underlying causes of deforestation. IFF met four times between 1997 and

2000 and provided 120 proposals for actions on topics including: financial resources and the transfer of environmentally sound technologies; trade and environment; underlying causes of deforestations; traditional forest-related knowledge; forest conservation and protected areas; forest research; valuation of forest goods and services; future supply of and demand for wood and non-wood forest products; and assessment, monitoring and rehabilitation of forest cover in environmentally critical areas [IISD 2010]. In total more than 270 proposals for action towards sustainable forest management were deliberated under these two processes and were presented in the final reports of IPF4 and IFF4. They were summarized collectively as the IPF/IFF Proposals for Action. Although the IPF/IFF proposals for action are not legally binding, participants of these processes are under a political obligation to implement the agreed proposals for action. Each country must conduct a systematic national assessment of the IPF/IFF proposals for action and to plan for their implementation forward in a long term perspective [UNFF 2013].

Although in nowadays the Treaties for the European Union do not give any strong provision for a common forest policy for the EU member states, The EU Forest Strategy puts forward the development and implementation of sustainable forest management and the multifunctional role of forests in the member states. The EU Forestry Strategy also defines common principles of the EU forestry, on which the EU Forest Action Plan is built. This also works as a coordination tool for forest related activities and policies on the EU level and member states [Green Paper 2010, p.3]. Among the instruments to promote sustainable forest management, National Forest Programmes (NFP) is one of the most relevant. NFP are used to develop forest policy framework on national levels, however, there is still necessity to keep them dynamic, flexible and able to respond quickly to changes in needs and issues both by forest sector and the society. They must encourage substantive participation of key stakeholders and strengthen the link from industrial level to overall national development goals, as well as to create more network based performance with forest-related sectors. Global markets and “green thinking” of societies are placing different and more demands, which leads to national forest-related policies being more influenced by international processes, as well as having this linkage to other sector policies, e.g. on energy, climate change, agriculture and biodiversity <sup>4</sup>.

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<sup>4</sup> Available online: <<http://www.foresteurope.org/sfm/forest-policies-institutions-instruments>>, last time accessed on 11-12-2013 20:03

In the larger scale than for Europe there is United Nations Framework Convention on Climate Change and an international agreement lined to it, called The Kyoto Protocol. The Kyoto Protocol has set internationally binding emission reduction targets and commits all Parties (including EU member states) to take direct membership in goal reaching. The Kyoto Protocol was adopted in Kyoto, Japan on 11 December 1997 and entered into force on 16 February 2005. During the first commitment period (2008 – 2012), 37 industrialized countries and the European Community committed to reduce greenhouse gasses (GHG) emissions to an average of 5% against 1990 level. During the second commitment period (2013 – 2020), it was committed to reduce GHG emissions by at least 18% below 1990 level<sup>5</sup>.

Defined by [Zanchi G. et al. 2007, p.4 – 6], there are four main types of the forestry activities that have a positive effect on GHG mitigation and biodiversity in Europe Union:

1. Afforestation – conversion to forest land actively promoted through planting of trees;
2. Natural succession – conversion to forest land due to natural succession processes that take place after land abandonment;
3. Short rotation coppices – dedicated planting of trees for energy production in intensively managed plantations with fast growing species, for example, aspen, willows, eucalyptus;
4. Forest management – increase of carbon stock in forest land by changing management practices, e.g., increasing rotation length.

From personal perspective, this fourth type - *forest management*, seems to be the most important, as it can be defined as route cause for other previous types to be implemented or motivated to be developed by the private sector. This leads to necessary emphasizes on the management importance both nationally and worldwide, and stimulates the meaning of analysing sustainable forest management in more local (national) levels in this paper.

The global market by itself also shapes the demand towards sustainably managed forest products. In this case certification is one of the most important market-based tools, which defines the minimum standard of sustainable forest management and can measure if the actual management fulfils the requirements. The information to buyer can be delivered through certification process [CCFM 2008]. Programme for the Endorsement of Forest Certifications (PEFC) is the world's largest forest certification organization – an international non-profit, non-governmental organization, which has the main target to promote sustainable forest management worldwide. Right now the total areas of certified forests worldwide are low - only 10% of forests have been certified to any standard (by year 2010), which is under PEFC or other certificates as FSC (Forest Stewardship Council); SFI (Sustainable Forestry

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<sup>5</sup> Available online: <[http://unfccc.int/kyoto\\_protocol/items/2830.php](http://unfccc.int/kyoto_protocol/items/2830.php)>, last time accessed on 11-12-2013 20:05

Initiative); CSA (Canadian Standards Association); ATFS (American Tree Farm System) and others smaller in their scope. However, there are ongoing processes supported by 149 governments and covering 85% of the world's forest area. This shows the importance and increase in the understanding of sustainable forest management by global society. PEFC mainly develops the principles, criteria and indicators derived from these international processes and sets additional requirements. PEFC gives its certification when national systems meet or exceed all criteria<sup>6</sup>. These requirements then have been developed further through multi-stakeholder processes, so to make them operational as performance measures in the forests that are possible to observe.

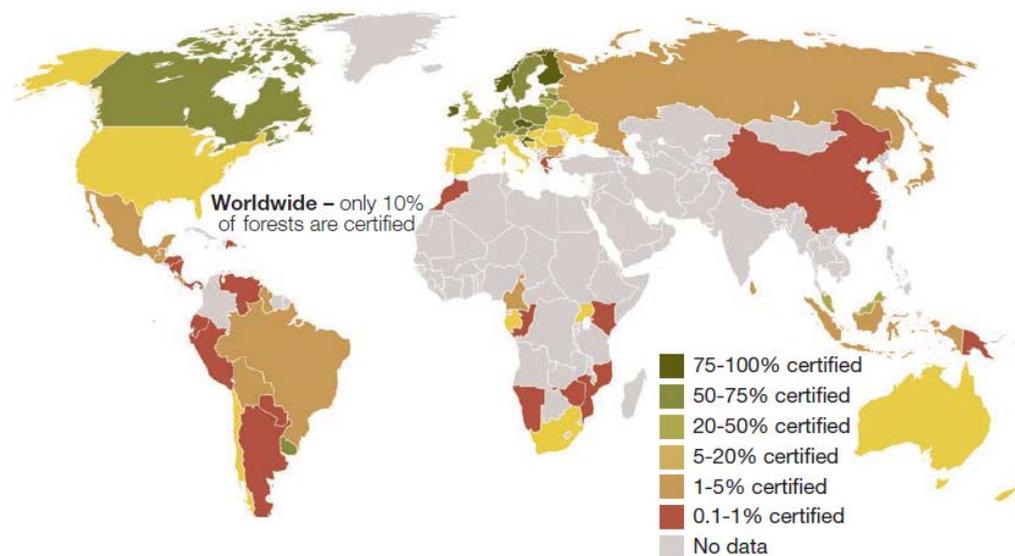


Figure 1.1. *Share of certified forests by countries*

*Source: 2009 Resources Planning Act Report; the Forest Stewardship Council; American Tree Farm System*

Two-thirds of all certified forests globally are certified to PEFC. Above the average certificated forest lands under any of internationally accepted certification standards are European Union and Canada, where the certification level is at least 20%, and it grows up to more than 75% of certified forests in Norway and Finland [FSC 2009].

## 1.2. The Criteria of Sustainable Forest Management

In wider perspective, Sustainable Forest Management can be seen as the influence chart between forest sector and all other sectors. The Scope of the Forest Strategy covers many aspects, main of them are defined as sustainable forest criteria. However, there are more aspects covered when sustainable forest management and forest strategy is going to be

<sup>6</sup> Available online: <<http://www.pefc.org/standards/sustainable-forest-management/requirements-criteria>>, last time accessed on 11-12-2013 20:07

developed, these are, for example, the research and innovation need for (any) industry to improve situation in as many states as possible, the effect in rural territories and their development etc. This Scope of the Forest Strategy also covers the connected areas where the policy and policy's instruments can have its effects and effort for restrictions/development.

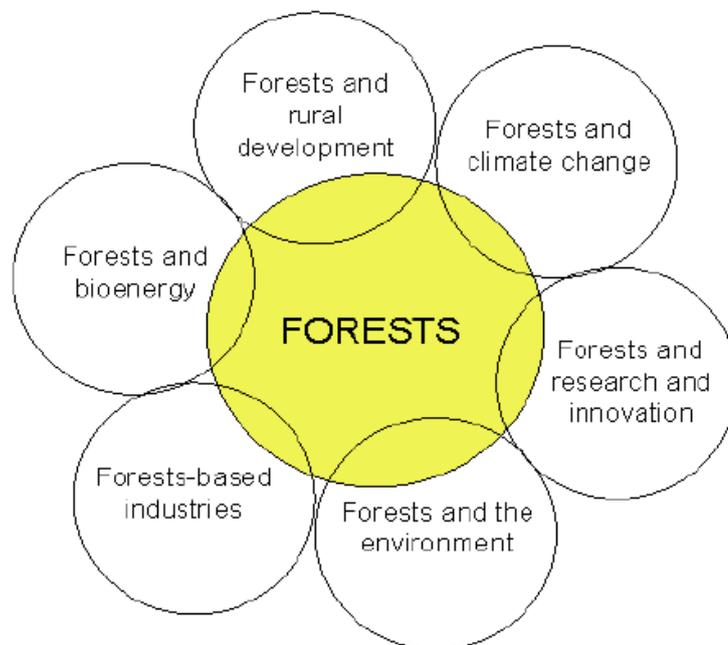


Figure 1.2. *Scope of the Forest Strategy*

*Source: Smith St. 2013, p.5*

Every framework, however, should have some measurements to be able to observe changes over time, different negative and positive effects of (human) actions etc. The six Pan-European Criteria and Indicators for sustainable forest management, defined by FOREST EUROPE, serve as a practical, science-based tool for interest of all stakeholders –federal and provincial resource regulators and policy makers, as well as, private forest companies, certification bodies and small woodlot owners. This gives the ability to define, assess, monitor and report progress in achieving sustainable forest management both on public and private lands. Criteria define the range of forest values as economic, social and cultural, and environmental; they describe the multiple aspects of sustainability (which is no longer just the optimal forestry in terms of resource optimization with maximizing profits over infinite time horizon). However, the indicators are the possible measurement approach - the tool of collecting and analyzing the information of particular criteria in quantitative way. It is possible to see the trends by recording the same indicator over time. Indicators will transform the qualitative term as criteria in quantitative term that gives the possibility to characterise the forests in comparable way in time or among different forestlands. Decision-making will also affect these trends, so it is possible to observe effects of policy instruments, as well as it goes in the other direction, when some changes are observed by indicators, the right policy

instrument could be implemented to improve the situation. As it was said by CCFM (2008), criteria and indicators can be used to improve national policies, regulations and legislations in forest management. Both in Finland and Latvia, forest policies have been based on implementing the best possible actions to improve the indicators of sustainable forest management.

Forest audits are another area where the application of criteria and indicators are being considered. Third – party audit assessments of forest sustainability by now still often rely on qualitative evaluations and professional judgment by individuals. Increased use of criteria and indicators is an effective way to bring more quantitative information to audit processes.

As previously mentioned, for my analysis I have chosen to focus on an approach created by the FOREST EUROPE (The Ministerial Conference on the Protection of Forests in Europe), which is, as previously mentioned and described, the pan-European political process for the sustainable management of the continent's forests and it defines six Pan-European criteria for sustainable forest management<sup>7</sup> and for each criteria there are indicators defined that are created for having quantitative evaluation and analysis to see if the criteria is fulfilled. These six pan-European criteria are:

The six Pan-European sustainable forest management criteria are:

1. Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles;
2. Maintenance of forest ecosystems health and vitality
3. Maintenance and encouragement of productive function of forests (wood and non-wood)
4. Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems
5. Maintenance, conservation and appropriate enhancement of protective functions in forest management (notably soil and water)
6. Maintenance of other socio-economic functions and conditions.

Please see appendix no.1 with all indicators and their explanations for each criterion.

Further in this chapter each criterion is characterized by their indicators, and short description for the situation on European level is given. To look on European level is important, so to understand better in upcoming chapters what are strong and weak factors and what are opportunities and threats on sustainable forest management for both analysed

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<sup>7</sup> Available online: <[http://www.foresteuropa.org/sfm\\_criteria/criteria](http://www.foresteuropa.org/sfm_criteria/criteria)> , last time accessed on 11-12-2013 20:12

countries - Finland and Latvia, also in terms of fulfilment of international and the European treaties mentioned before.

Criterion No.1: Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles

Forests cover 42% of Europe’s land area and continue to expand at a rate of 0.08% per year. In fact, Europe is the only World region having a positive net change in forest area for the past two decades and has gained 5.1 million hectares of forest since 2005. However, there are countries as Finland also, who has decrease in forest and other wood land areas. Europe also has the largest growing stock of commercial species in world by 2010. 75.5% of total growing stock of forests in Europe is available for wood supply.

Shown by the figure 1.3 below, Europe has the longest history of continuing trend of expansion of forest area; however, the speed of expansion has decreased over time. At the same time big gains are reached in Asia where large-scale afforestation in China of between 2 and 3 million hectares per year is contributing to net gains in Asia since year 2000. This gives a competitive disadvantage for Europe and European Union especially, as the shares in the forest product markets for countries with biggest forest industries will decrease over time and competition will be raised by Asian activities. It means that European Union needs even stronger international forest strategy to encourage member states for expanding forests and improve their sustainability and productivity.

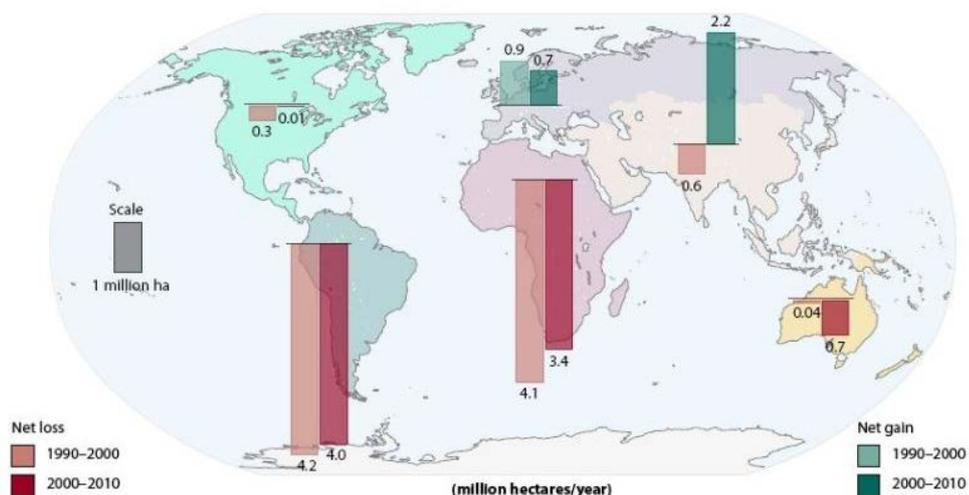


Figure 1.3. Annual change in forest area by region in millions of hectares per year

Source: Welch C. 2013

Based on Eurostat Statistical books (2011) [p.15], within the forest area available for wood supply, the growing stock in the EU reached an estimated 21 750 million m<sup>3</sup> in 2010. The increment in the EU’s growing stock was in excess of 700 million m<sup>3</sup> in 2010, around

1.6 times as high as the volume of fellings; the latter was in excess of 485 million m<sup>3</sup>, which was equivalent to 2.2 % of the growing stock. However, since only approximately 63 % of the increment is felled and forest area is increasing, the EU is using its wood supplies in a more than sustainable manner. Between 2000 and 2010, wooded area in the EU increased through natural expansion and afforestation by a total of 3.5 million hectares. Only four of the EU Member States recorded a fall in their areas of wooded land, with Denmark recording the largest reduction (by - 5.0%) ahead of Portugal, Slovenia and *Finland*. In relative terms, the largest expansions in wooded area were recorded in Ireland (21.4 %), while Bulgaria and *Latvia* both recorded increases in excess of 10% [Eurostat Statistical books 2011, p.13]. Sweden alone accounted for 17.6 % of all the wooded land in the EU in 2010, and the five largest wooded areas (Sweden, Spain, *Finland*, France and Germany) collectively accounted for well over three fifths (62.4 %) of the wooded land in the EU. This leads to approximate estimate that 15% of world's total forest and other wooded land are owned by Sweden, Spain, Finland, France and Germany. As the European Union is not large in its scale (comparing to Asia for example), a better forest management can lead to improvements in forest health and vitality, as well as to increase the productive function, that gives a growing value of forests in Europe and higher return of resource. The net gain of increasing forest land also helps to achieve other internationally set targets, as for example, carbon storage, biodiversity etc.

Europe is one of the areas of largest carbon storage in forests that in year 2006 slightly exceeded the level of carbon storage in North America.

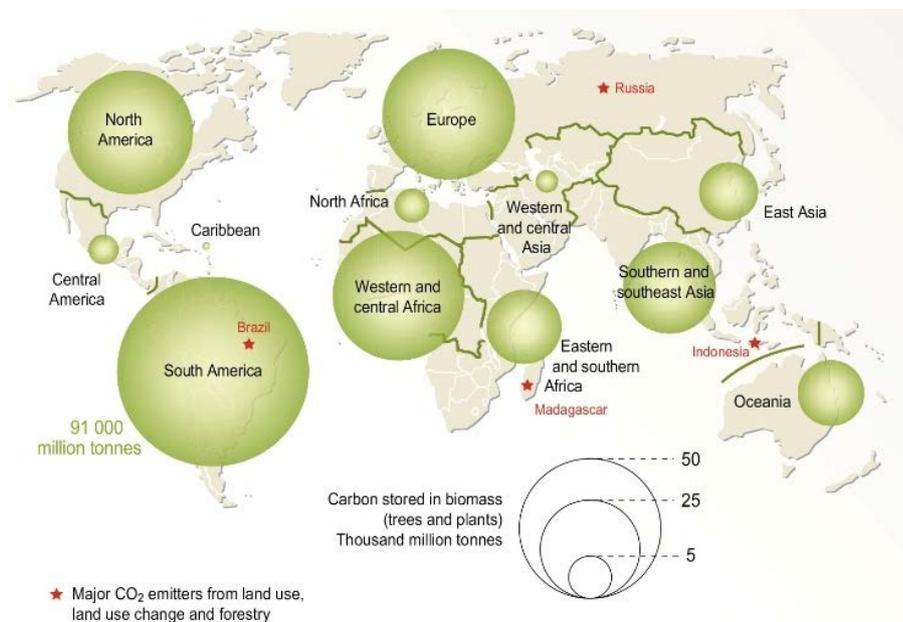


Figure 1.4. *Carbon stored by forests*

Source: Welch C. 2013

Between 1990 and 2010, Europe has covered more than Asia, North and Central America and Oceania each and it is the third largest area for carbon stocks in the world, as shown in the table below. Between 2005 and 2010, the average annual sequestration of carbon in forest biomass was about 10% of the greenhouse gas emissions and even more has been captures if solid and dead organic materials are included in analysis<sup>8</sup>. At the same time, there are still countries in Europe that emit more than they capture (including Finland), and the potential to improve the indicators in carbon storage is still available.

Region	1990	2000	2005	2010
giga tonnes of carbon				
Europe	42.2	43.2	44.0	45.0
Africa	60.9	58.3	57.1	55.9
Asia	37.2	36.8	36.6	35.7
North and Central America	37.8	38.5	39.0	39.6
Oceania	10.9	10.8	10.7	10.5
South America	110.3	106.2	103.9	102.2
<b>World</b>	<b>299.2</b>	<b>293.8</b>	<b>291.3</b>	<b>288.8</b>

Table 1.1. *Carbon stocks in forest living biomass by region, 1990 – 2010*

*Source: FAO Global Forest Resources Assessment 2010*

However, the previous table gives the inside only about the storage in living biomass, where Europe is the third largest area of accumulated carbon stock, at the same time when the carbon storage is analysed in all three dimensions – carbon stored in biomass, litter and soil, and deadwood, Europe has the wood land areas where the main storage is in litter and soil. This even expands the Europe’s significance in terms of total carbon stored.

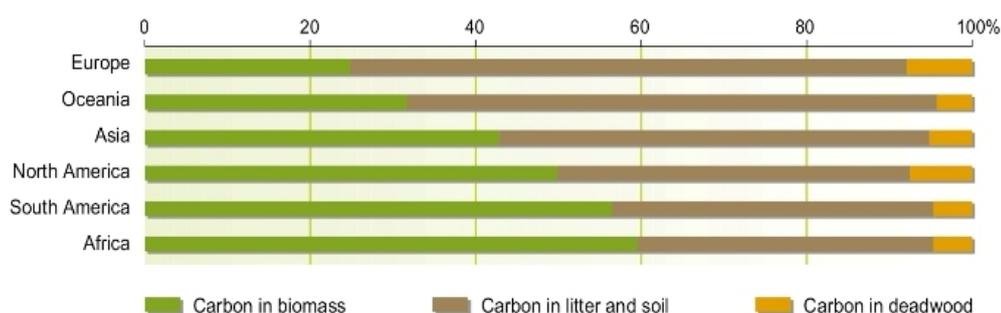


Figure 1.5. *Distribution of carbon inventory, as a percentage of average carbon inventory*

*Source: Welch C. 2013*

<sup>8</sup> Available online: < [http://www.foresteurope.org/sfm\\_criteria/criteria/carbon](http://www.foresteurope.org/sfm_criteria/criteria/carbon)>, last time accessed on 11-12-2013 20:15

## Criterion No.2: Maintenance of forest ecosystems health and vitality

Forests are subject to abiotic, biotic and human induced damaging agents. Around 20% of the European trees are considered to have a mean defoliation of 25% or more, what classifies them as damaged or dead (in the next chapter it will be shown, that this is one of the weak factors for Latvia, where these numbers are really high and provides with information that the health and vitality is low). Forest damages reduce trees potential to withstand adverse environmental impacts. The defoliation rates vary among regions and tree species being higher in Central Europe and along the Mediterranean coast in Croatia, Italy and France. Lower mean defoliation occurs in Northern Europe. The drivers of trees defoliation are insects attacked and fungal diseases, in combination with increased vulnerability caused are deposition loads, weather condition, and other anthropogenic factors.

Different criteria supplement each other in better forest management. Forest health and vitality is also highly dependent on air quality. Even though it has improved in Europe, forests are still under stress. Even air pollution and depositions have been reduced in the last decade, yet emissions of nitrogen compounds are still high. Both nitrogen and ammonia depositions indicate the need of further emission reductions to ensure forests health and vitality<sup>9</sup>.

In total 1% of Europe's forests (6% without Russia) are affected by forest damage, although the severity of the damage is often not recorded. This damage is most frequently caused by insects and diseases. Nevertheless storms, wind and snow are also damage drivers in Central-West, Central-East, North and South-West Europe, while fires have mainly been reported in the Russian Federation, and South-West and South-East Europe.

## Criterion No.3: Maintenance and encouragement of productive function of forests (wood and non-wood)

This criterion describes the economic and social utility of forest resources. It reflects the wish to maintain an ample and valuable supply of forest products and services, while at the same time ensuring this production and harvesting are sustainable and do not compromise the management options for future generations to have productive forests. This criterion is the most related to optimal forestry calculations, as well as, the most dependent on the productivity of the forest and related industries.

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<sup>9</sup> Available online: < [http://www.foresteurope.org/sfm\\_criteria/criteria/health](http://www.foresteurope.org/sfm_criteria/criteria/health)>, last time accessed on 11-12-2013 21:30

The figure 1.6 has shown that there are few countries in the European Union with large annual fellings (tree harvesting), as Germany, France, Finland and Sweden. But large numbers as these are also because of the countries sizes and the forestlands in absolute values (remember that these were countries that together with Spain counted for more than 60% of total the EU forest and other wooden lands). When Latvia is analyzed, even though the annual fellings in m<sup>3</sup> are small, it has grown twice from year 1990 to 2000. With few exceptions, in average the harvesting has increased in the EU.

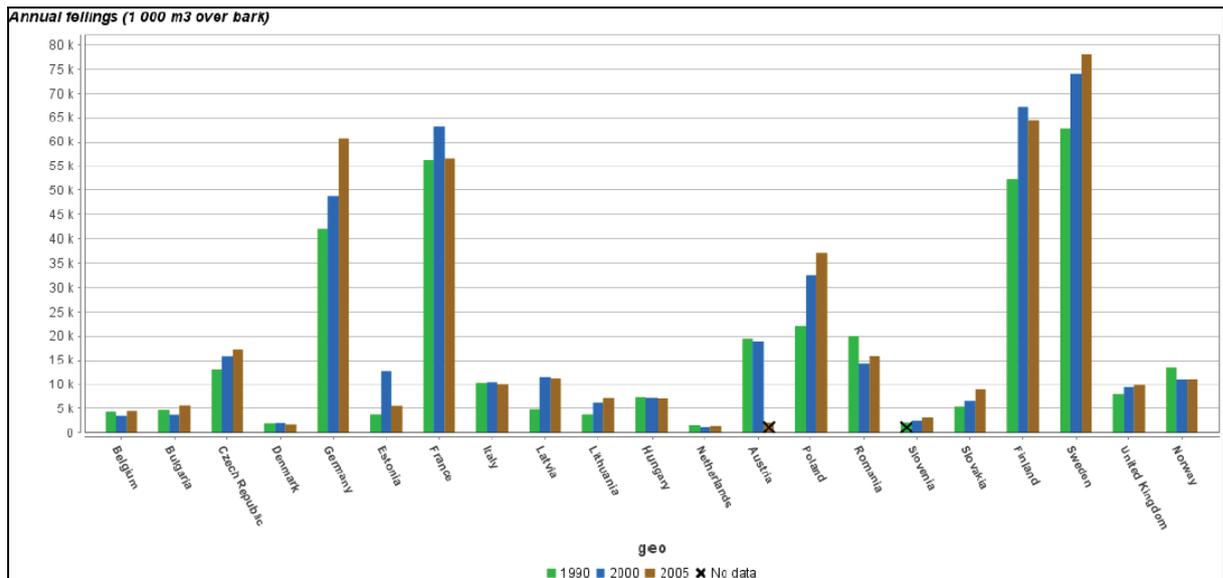


Figure 1.6. Annual fellings (1 000 m<sup>3</sup> over bark)

Source: Ministerial Conference on the Protection of Forests in Europe (MCPFE)

The net annual increment as shown in next figure 1.7 has slightly increased in average in the EU, meaning that the planting even exceeds harvesting more and more each year; which is good and corresponds to one of the main SFM principles, that forest land should be saved and expanding is even better, because it promotes other aspects to improved, as for example, total carbon storage, biodiversity, protective functions etc. Still, many countries have saved around the same net annual increment level every year, which gives a hint that planting plans are created accordingly to harvesting plan, to cover the tree cuts not more. To secure current and future wood availability and to shape a stable and growing stock from forests, the relation between net annual increment and fellings is decisive. In most European countries utilization rates do not exceed increment and thus comply with sustainable forest management.

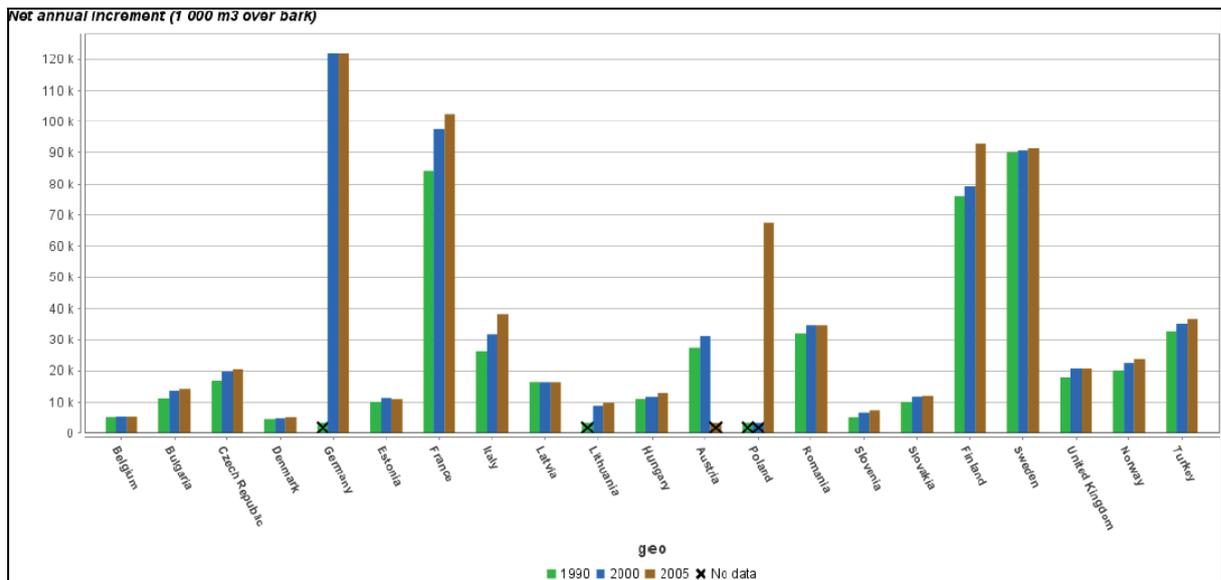


Figure 1.7. Net annual increment (1 000 m<sup>3</sup> over bark)

Source: Ministerial Conference on the Protection of Forests in Europe (MCPFE)

The main harvests are related to production of forest materials. At this point, Europe remains one of the largest producers of round wood in the world [Eurostat Pocketbooks 2009 p.48]. Also the demand for wood fuel is rapidly increasing in many European countries, which leads to increasing need for higher volumes of tree cuts – here the sustainable forest management is the tool that should be used to balance questions as: where can we expand our forest land, how can be growth supported, how can we increase the allowances of tree harvest by sustaining other forest values etc.

Apart from wood, non-wood products derived from forests are important sources of local income. Given by FOREST EUROPE homepage, section *Productive Functions of Forests*<sup>10</sup>, in 2010, Christmas trees, fruits and berries, and cork were the most important non-wood income sources. The market value of non-wood goods represented 15% of the value of marketed round wood in countries that reported both values. This is also important aspect from the perspective that in most countries non-wood values are not subject to tax, which means that direct income are generated for forest owners or producers of non-wood goods.

Criterion No.4: Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems

The fourth criterion describes the variety of existing life forms, the ecological roles they perform and the genetic diversity they contain in the European forests and the way they are managed. New pressures in the twenty-first century demand a more balanced approach in

<sup>10</sup> Available online: < [http://www.foresteuropa.org/sfm\\_criteria/criteria/functions-and-forests](http://www.foresteuropa.org/sfm_criteria/criteria/functions-and-forests)>, last time accessed on 11-12-2013 21:31

order to conserve biological diversity. Protected areas are one of the oldest instruments for protecting natural resources. They help to maintain and enhance biodiversity, as well as to conserve landscape and provide recreation opportunities. In Europe the area of protected areas is expanding. Approx. 10% of Europe's forests without the Russian Federation are preserved with the main objective of conserving biodiversity, and about 9% with the main objective of protecting landscape and specific natural elements. In North Europe and in some Eastern European countries restrictive protection with no or minimal intervention dominates, whereas in the Central and Southern European countries active management in protected areas is emphasized. As described in FOREST EUROPE homepage, section *Forest Biological Diversity*<sup>11</sup>, most of these forests landscapes, 70%, have been altered by humans and are classified as semi-natural, undisturbed forest amount to 26% and is located primarily in remote and inaccessible areas in eastern and northern Europe and in the Russian Federation. Plantations cover 4% of the forest area and are located mainly in Central-West Europe.

This criterion is characterized also by indicators as number of tree species, age structure, natureliness, introduced tree species, previously mentioned protected areas and also the volumes of the deadwood within forests (that helps at the beginning but after too high levels disturbs to have higher biodiversity in forests).

Criterion No.5: Maintenance, conservation and appropriate enhancement of protective functions in forest management (notably soil and water)

These functions include the prevention and mitigation of erosion and loss of soil, the preservation of drinking water resources, the stabilization of stream banks or sand dunes, and the reduction of noise pollution. Forests also play a role protecting human infrastructures from avalanches, landslides and rock fall; against hazards as storms, fires, floods, etc.

More than 20% of Europe's forests directly protect soil, water and other ecosystem services, 11% when including the Russian Federation<sup>12</sup>. Trends show a slight increase in protective forest area. The total area of forests with protective functions for infrastructure is 2%, 7% when including the Russian Federation. This role is increasing in the Central-West Europe Region while decreasing in Russian and Central-East Europe.

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<sup>11</sup> Available online: < [http://www.foresteurope.org/sfm\\_criteria/criteria/biological-diversity](http://www.foresteurope.org/sfm_criteria/criteria/biological-diversity)>, last time accessed on 11-12-2013 21:32

<sup>12</sup> Available online: < [http://www.foresteurope.org/sfm\\_criteria/criteria/protective-functions](http://www.foresteurope.org/sfm_criteria/criteria/protective-functions)>, last time accessed on 11-12-2013 21:33

## Criterion No.6: Maintenance of other socio-economic functions and conditions

Outside the Russian Federation, where forests are publicly owned, the European Forests are equally divided between private and public ownership. From an economical point of view, the forest sector, including the subsectors of forestry, wood industry, and pulp and paper industry, contributes on average to 1% of the GDP, a number that is decreasing over time. However, during the last few years, most regions have shown an increase in net added value and net entrepreneurial income from forestry enterprises. In terms of employment, around 4 million people work in the European forest sector, a number that is decreasing<sup>13</sup>.

In Europe 75.7% of available potential has been exploited for domestic use, meaning consumption (data from 2010). The main trading of wood products is between the European Union member states, however, even the volumes going externally are small, the EU external trade balance is positive. This shows the level of being self-contained within the EU, which is in a good benefit for member states – each of it can find the niche in the market, which is the most suitable for local industry.

In the first chapter reader has been introduced to the importance of the sustainable forest management as a tool for mitigating and adapting to climate change, insure nature values in national and international scale, and provide people with wood supply and non-wood goods from forests. The background of the SFM policy development in the EU and internationally was given to understand in the next chapter the global connection and requirements set by government to meet internationally binding goals. And finally the review on six pan-European criteria was given to define the range of different parameters that must be considered when creating the policy for sustainable forest management and promoting it in private sector.

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<sup>13</sup> Available online: < [http://www.foresteurope.org/sfm\\_criteria/criteria/socioeconomic-functions](http://www.foresteurope.org/sfm_criteria/criteria/socioeconomic-functions)>, last time accessed on 11-12-2013 21:34

## **2. Implementation of Sustainable Forest Management in Finland and Latvia**

In this research particularly Finland and Latvia have been chosen to analyse. Finland is chosen as one of the best examples in Europe and the European Union in sustainable forestry, while still having place for improvements, and Latvia as one of the countries with relatively large potential in forestry, while also having some particularly good practices to be emphasized. The description of SFM implementation will cover a broad and comprehensive data of forest management in Finland and Latvia. As one of main data information sources are country reports “Global Forest Resources Assessment 2010” for both Finland and Latvia, made by Forestry Department in Food and Agriculture Organization of the United Nations.

This chapter has the same structure as the first but with emphasis on data collection and analysis for Finland and Latvia particularly. The first sub-chapter is a brief introduction in each country’s political background through implemented policies, strategies, rules and other instruments. The second sub-chapter gives the data and analysis on each of the six pan-European SFM criteria for both countries. Very concrete data will be given in this paragraph that is the basic information for creating the SWOT analysis afterwards.

### **2.1. Forest Policies in Relation to Reach Sustainable Forest Management**

#### Latvia

In 1992 at that time called the Ministry of Forests developed the first Forest Management Development Plan, which evaluated and predicted the possible opportunities for forest management and the volumes of harvests from state forests. In 1995 State Forest Service in cooperation with Swedish consultancy company Swedforest International AB created the Program of development for Latvia’s forest and timber industries. However, there was no analysis of how the financing could be established for supporting the mentioned activities. So the work on forest politics was finally started in 1996 in cooperation with different forest governance and management institutions, social organizations and other stakeholders. The Forest Policy<sup>14</sup> was finally defined in 1998 to attain the compromise among all forestry stakeholders. The Latvian Forest Policy defines the long-term strategic and tactical goals and basic principles of forest sector development. The long-term forest function stabilisation and the promotion of private entrepreneurships have been supported by activities carried out by state institutions and with state funding. Such activities are professional and academic education; forest owner extension and consultancy systems; forest science; forest

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<sup>14</sup> Available online: <[http://www.zm.gov.lv/doc\\_upl/Latvian\\_forest\\_policy.pdf](http://www.zm.gov.lv/doc_upl/Latvian_forest_policy.pdf)>, last time accessed on 05-09-2013 12:30

inventory; statistical and information systems; pest and disease control; forest fire fighting; supervision of forest regeneration materials; forest monitoring etc.

In 2000 the Forest Law of the Republic of Latvia came into force<sup>15</sup>. The law says under article no.2: “[1] the objective of the given law shall be to provide for sustainable forest management in all the Latvia’s forests, while ensuring equal rights, inviolability of the property, independence in economic activities, and imposing equal obligations to all the forest owners / holders.” In 2002 for the planning period 2004 to 2013 the mid-term strategic development document Latvia’s Forest and Related Industries Program was created. According to Forest Policy, the aim of this program was to define the main strategic targets for forest and related industries and to develop detailed analysis for balanced and sustainable implementation of program. In 2006 the next Development Guidelines for Forest and Related Industries were defined. The main thesis of this guideline that I found interesting was that “sustainable forest management is mainly based on economic benefits”. The following development directions have been defined in this framework:

1. The forest management should be sustainable and internationally recognized;
2. The production of forestry should be competitive and with high added value, which also corresponds to customer needs. To achieve this political target it is necessary to improve technological modernization, science and innovations in sector, new product development etc, as well as create favourable business environment in forestry;
3. Appropriate level of education, science potential and knowledge of work force. The need for private investments in science is as important as the investments from state side in the professional education and possibilities of internships.

Different policies’ documents and researches mention the issue about un-sustainability in Latvia’s forest management. In National Plan of Biodiversity it is said that biodiversity in Latvia decreases, Latvian Rural Development National Strategy Plan supports the afforestation of land areas that are not used for agriculture, but it also mentions that the productivity must be improved. Also in Latvia’s National Lisbon Program 2005 – 2008 [p.26] it is said that the promotion of increasing productivity from forest stands are needed, which means, well timed and qualitative regeneration, selection of productive materials for regeneration and better care of young forest stands should be done. Latvian Sustainable Development Strategy (2010), which is one of the overall main policy instruments, however, emphasizes the economic perspectives from forest sector and says “for sustainable usage of nature values we should improve management of nature capital; create more market

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<sup>15</sup> The English version available online: <[http://www.lvm.lv/eng/lvm/legislative\\_acts/?doc=909](http://www.lvm.lv/eng/lvm/legislative_acts/?doc=909)>, last time accessed on 12-12-2013

instruments; to capitalize the actives from nature, but also to promote sustainable lifestyle”. From the other side it also says “the nature capital is insufficiently used and managed. Existing nature resources and natural environment diversity is the unique opportunity for Latvia not only for “green” economy and sustainable consumption development. This is also opportunity to create and maintain Latvia as a Green Country image”. In Latvia there are still disputes in policy documents visible, how to balance the economical gains and the maintenance of biological wealth. As the economical growth especially after global economical crisis is extremely important, many documents still has the main emphasis on economical values of forests. At the same time, due to large share of forest lands, Latvia is able to fulfil international commitments and perform in a high level, which I do not believe would be done if forests were less. Still improvements in the mindset are needed to really guide the management in the better way, also the people and private forest owners shall be encouraged to improve their knowledge and use it to raise the sustainability.

#### Finland<sup>16</sup>

The first actual forest programme was prepared in year 1961, latter came more known programmes as the Forest 2000 programme (created at 1985) and the New Environmental Programme for Forestry in Finland (1994). Subsequently, National Forest programmes have been drawn up. As discussed in the first chapter, exactly National Forest Programmes (NFP) can be the most effective policy instrument used for putting forward the internationally (not legally binding) targets to national levels and stimulate to take real actions. The most recent NFP in Finland is the National Forest Programme 2015, adopted by the Government in 2008 with revisions in 2010. The purpose of NFP 2015 is to support the development of the forest sector in approach that support bio-economy – it is to create an operating environment, where livelihoods and wood from forests is competitive and profitable for industry, while maintaining the biodiversity and other environmental benefits provided by forests.

Apart from the NFP 2015, the Forest Biodiversity Programme for Southern Finland 2008 – 2016 is also ongoing. As latter it will be described under biodiversity criteria, southern forests have been mainly used for commercial production but northern forests for conservation areas, this should be changed because the biodiversity in both parts are different but should be sustained equally important. To support forest biodiversity, new areas and networks of areas are being created, and existing conservation areas are being improved. The goal of the Forest Biodiversity Programme for Southern Finland 2008 – 2016 is to halt the

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<sup>16</sup> Information based mainly on MetlaINFO - Finnish Forest Research Institute homepage, section National Forest Programmes and other forest related programmes, available on: <<http://www.metla.fi/metinfo/sustainability/SF-2.htm>>, last time accessed on 12-11-2013 19:24

decline of forested habitat types and forest species and to establish the favourable development of natural biodiversity. It has also introduced the scheme for receiving compensation for activities that private forest owners are implementing for protecting their forests or enhancing natural values of the forests, through used management approach<sup>17</sup>.

Land use is designed and controlled in Finland through the local planning process governed by the Land Use and Building Act. The Forest Act (1997) contains provision on protection zones where forests must be specially managed and utilised with extra care, it also needs to prevent the timberline from receding further south. There is legislation also on protecting forest health and vitality - the Act on Protection of Plant Health (2003), it prevents the use and spreading of herbicides and controls for other health aspects. The Forest Insect and Fungi Damage Prevention Act (1991, revised on 2012) restricts the storage of coniferous timber in forests, it also stipulates that damaged coniferous trees must be removed from the forest whenever their amount exceeds a certain level. This is also in relation to internationally agreed normative of maximum damaged forest or deadwood volumes in forests, also the third parties as certification institutions controls for these effects.

The trading and the industry have been also regulated. There is an Act on Trade in Forest Reproductive Materials (2002), which sets different rules on production, sale, imports and exports of seedlings and seeds with the target to improve the forest health and to avoid low-productivity, damaged species to be planted. The EU Commission has also decided to prevent the spread of pine wood nematode (PWN) from Portugal and from outside the EU along with imports of coniferous wood products, sawn wood or coniferous packing materials. Finland has been granted derogation for inspecting the imported coniferous wood from Russia; samples are taken from at least 3% of the goods.

The Government has set as a target that the total of area voluntarily offered for conservation by the landowners will be 96 000 hectares by 2016; moreover, the total area of sites safeguarding biodiversity in private forests will be increased by 82 000 to 173 000 ha<sup>18</sup>. This is one of several examples how the policy in Finland is involving forest owners directly in participation of SFM. This leads to increase of the meaning in owner perception for not only economical values, but also biological, natural, social, cultural and other values of forest lands. Also the Act on the Financing of Sustainable Forestry promotes sustainable forest management and maintenance of forest biodiversity and ecosystems by granting government support for private forestry measures. The total amount of environmental support for forest

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<sup>17</sup> Available online: <<http://www.metla.fi/metinfo/sustainability/SF-1-safeguarding-and-protecting.htm>>, last time accessed on 12-11-2013 19:31

<sup>18</sup> Available online: <<http://www.metla.fi/metinfo/sustainability/SF-1-safeguarding-and-protecting.htm>>, last time accessed on 12-11-2013 19:31

management granted under this act in 1997 – 2009 was EUR 31 million, and agreements valid at the end of 2009 covered a total of 39'643 ha. Financing is also used to support projects for the management of forest ecosystems, as ecosystem surveys, management and restoration of habitats extending over the area of several forest holdings, and landscape management projects.

## 2.2. Correspondence to Sustainable Forest Management Criteria

Criterion No.1: Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles

*Indicator: Forest area*

Both Latvia and Finland, together with other Northern and Central European and Baltic States countries as Sweden, Estonia, Austria and Poland, have relatively large forest areas [Winkel G. et al. 2009, p.23]. From the picture below, Finland and Sweden are countries with the highest percentage share of forests in EU, in between 76 and 100%; Latvia is in countries' group, where forest percentage share of land area is between 51 and 75 percent.

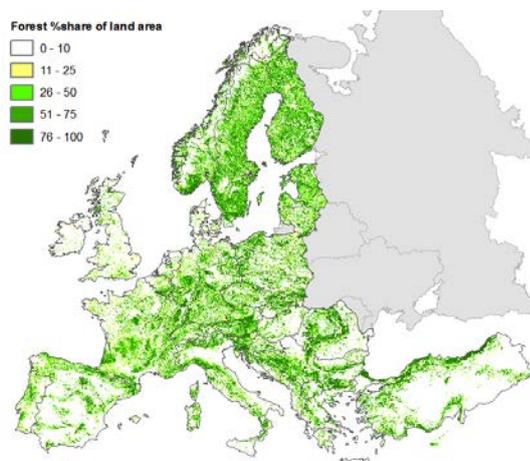


Figure 2.1. *Forest percentage share of land area*

*Source: European Forest Institute*

In the very beginning, some 1000 years ago, when population in the territory of Latvia was low, and forests covered around 80% of land. It was mixed forests with birch, pine and spruce species, still the same species are most common in nowadays forests. By rising of the population, more areas were used for agricultural production and the forest areas decreased dramatically, when in year 1920 it was only 23% of Latvia remained forestland. In Soviet times percentage increased again, as many forested areas were left unkempt and thrived, it grown to 47% in the beginning of Post Soviet times and increase continues [Hanley M. 2011].

In 2010 the forest share of total land in Finland was 65.5%, while forest and other wooded lands in total was 75 – 76%, which is also the level for year 2012.<sup>19</sup> Finland has the highest forest cover in Europe, and the Finland's' forests (23 million ha) only represents about 11% of the European (continental) forest area (210 million ha). Both Finland and Latvia, together with Sweden, Estonia and Spain also has the largest Forests and Other Wooded Lands (FOWL) ha per capita in Europe. [Eurostat Pocketbooks 2009, p.19] For every Finn, there are nearly 4.5 ha of forest.

Forests have several roles in economy; the main role is the availability of wood supplies. From the table presented in the appendix no.2 it is possible to say that countries with larger forest land areas can ensure more functions of forests, but where lower rate of Forest and Other Wooded Land is locally, the Forest Available for Wood Supply will be with higher share in usage of forests and wood availability. Both in Finland and Latvia forests available for wood supply are between 85 and 90% of total forests and other wooded lands in country. While taking as an example Sweden, where the forestland also exceeds 75% of total land area as in Finland, the forests available for wood supply is below 80% (66% in year 2009), at the same time in Germany forest land counts approximately 30% of total land area but forests available for wood supply are 95% from all forest lands. This shows the intensity in forest usage for wood supply when the accessible volumes of resource become limited or less.

*Indicators: Growing Stock and Age Structure*

There has been significant growth in the growing stock in Latvia. Between 1935 and 2005, the forest-covered area has increased 1.7 times and the growing stock – 3.3 times, reaching the level of 631 m<sup>3</sup> in year 2010, estimated by Forest Status Indicator database.

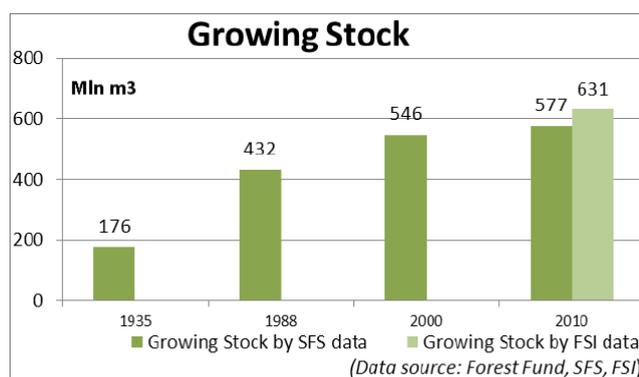


Figure 2.2. *Growing Sock in Latvia*<sup>20</sup>, Mln m<sup>3</sup>

Source: Forest Fund, SFS, FSI

<sup>19</sup> Available online: <<http://www.metla.fi/metinfo/sustainability/finnish.htm>>, last time accessed on 14-12-2013 12:20

<sup>20</sup> Available online: <[http://www.ahk-balt.org/fileadmin/ahk\\_baltikum/Projekte/Markterschliessungsprogramm/privateforestry09102012.pdf](http://www.ahk-balt.org/fileadmin/ahk_baltikum/Projekte/Markterschliessungsprogramm/privateforestry09102012.pdf)>, last time accessed on 11-12-2013 20:30

The forest area is increasing due to natural factors favouring forest growth (soils, climatic conditions, and human activities), less land used for farming, and more forests established on surplus farmlands. The higher growing stock is explained by an increase in the forest-covered area, positive net increment, and purpose oriented management activities like stand tending and the use of genetically improved planting stock for forest regeneration.<sup>21</sup> The growing stock has increased also in the state owned forests that represent almost 55% of total growing stock from 2004 to 2008.

Figures represented by Muiznieks A. (2012) in appendix no.3 show that the age structure has changed over time very differently for different species. There has been permanent decrease in young pine stands, thus has decreased from 50% young pine stands in 1961 to less than 25% of young pine stands in 2010. The middle age stands has been the most for pine over years. The spruce at the same time has had approximately 50% of young stands over the time without dramatic changes since 1978. Approximately 70% in 1988 and 50% in 2010 has been middle age stands for birches. The young birch stands has growth twice at this time, reaching 20% in 2010, however, in the long history, year 1961, young birch stands share was almost 50%. For all these species maturity stands were 10 to 20% in 2010, also aspen, which has the highest level of stands that has reached or exceeded the falling age – approximately 50% of all aspen stands, while for other previously mentioned species over maturity age stands were less than 15%. In this case, as for example, pattern of aspen shows, that the planting could be done in more even way. Looking to the age structure of aspen in 2010 seems that the planting has been started only when the majority of trees have reached the maturity level, but this is too late. Also this seems to be relevant for pine, where young stands are small now – if the planting will not be started now, there is possibility when the middle-age stands become mature and then the gap rises between mature and young plantations. This is important also in terms of the quality of the trees used for wood production, and extremely important for forest health and vitality, and the biodiversity opportunities.

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<sup>21</sup> Available online: <<http://www.latvianwood.lv/default.aspx?tabid=2&id=40&lang=2>>, last time accessed on 25-10-2013

In Finland there has been 60% increase in timber compared to the start of the 20th century, even though large areas were ceded to the Soviet Union after the World War II.

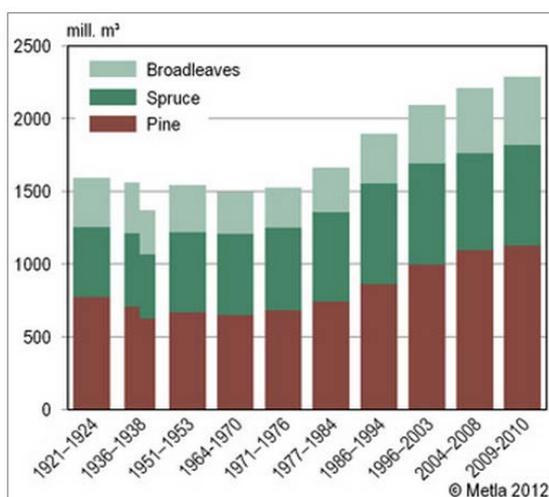


Figure 2.3. *Growing stock in Finland by tree main species, Miln m<sup>3</sup>*

Source: Finnish Forest Research Institute

The total volume of growing stock in Finnish forests has increased since the 1960s. This is due to new productive forest land by implementing the drainage systems and by afforestation of agricultural land, the growth increased, the number of low yield stands decreased, age structure of forests changed, and above all the fact that the increment has exceeded harvesting drain. The age structure of Finnish forests is nowadays fairly even. Looking at the situation by tree species, however, the age structure deviates from the recommended structure for wood production. It is opposite as in Latvia – spruce is usually older in Finland, while the stands of Scots pine of broadleaves are young. The Finland has act and increased the planting of spruce notably in relation to other tree species. This is in relation what I previously mentioned, to avoid gaps and provide industry with regularly mature forests for wood supplies. Since 1920s, the percentage of middle-aged forests has decreased especially in southern Finland but decrease in old forests has been in northern Finland (however, this is appropriate to the fact, that largest share of northern forests are conservation areas and there are a great many forests there that are over 140 years old)<sup>22</sup>.

#### *Indicator: Carbon Stock*

Most of the carbon in Latvia’s forests is stored in the soil – 948 million tonnes of carbon in year 2008. Living biomass contained 271.1 million tonnes of carbon in the same year, while the amount of carbon stored in litter and dead wood was heavily lower – 79.5 and 20 million tonnes of carbon respectively [BALTI Group 2011, p.16]. Carbon has increased for

<sup>22</sup> Available online: <<http://www.metla.fi/metinfo/sustainability/c1-age-structure.htm>>, last time accessed on 14-12-2013 12:52

years: in above-ground biomass it was 146.5 million metric tonnes of carbon in year 1990 and has increased up to 205.725 million metric tonnes of carbon in 2008, the levels in below ground-biomass at these years were 46.9 and 65.83 respectively (both estimates had increase by 40.4% in average). The most significant increase is however for the carbon stock stored in the dead wood, as dead wood has increased by 33 times from 1990 to 2008, it lead to increase of carbon stock stored in dead wood by 16 times. The increase of carbon in litter has been only by 5% from 1990 to 2008 [FRA 2010/113]. Because of the stable increase in the area of forests and the resulting growing stock, the forest sector currently absorbs two times more CO<sub>2</sub> than all other sectors in Latvia emit. This ensures a good national GHG balance, even more - Latvia is the only carbon-neutral country among the industrialized countries. Latvia is also direct participant in the European Emission Trading Scheme and it sells their emission quotas every year. The funds received are then given for projects that are related with further improvements in renewable energy production, emission reductions by shifting from coal to fossil fuel usage etc.

The amount of carbon stored in the soil in Finnish forests is currently estimated to be about 1300 million tonnes in the mineral soil forests and about 5500 million tonnes in the soil of peat-lands. The amount of carbon stored in woody biomass is about 700 million tonnes. The increase in carbon stock stored in above-ground biomass between 1990 and 2010 in Finland was by 16% and in below-ground biomass carbon storage increased by 13%. The absolute levels has been 3 to 4 times higher than in Latvia – in sub-total carbon stored in Finland, in living biomass was 720.8 million metric tonnes (in 1990) and it was 832.4 million metric tonnes (in 2010). Carbon stored in dead wood at the same period of time increased by 5% and carbon storage in litter increased by 17% [FRA 2010/069]. Finland is the only EU member state in which annual forest carbon sink credits are insufficient to cover the annual emissions caused by deforestation and afforestation. At the same time Finland supports the EU's decision on its readiness to scale up the emission reduction target to 30% for 2020, but still under condition that other industrialised countries undertake similar emission reduction actions and, within their capabilities, other important emitter economies make a contribution to emission reduction efforts too.

#### Criterion No.2: Maintenance of forest ecosystems health and vitality

##### *Indicators: Forest Damage and Defoliation*

The damage caused by diseases or other damaging agents to individual trees is normal in forests, it is not possible to avoid these cases, but if biotic agents succeed in spreading over

large areas, the forest damage is considered to have occurred. The causes of prevalence of damaging agents depend on pest population and weather conditions, as well as other factors that can change from year to year. Many damaging agents cannot be really controlled in advance, as for example, weather conditions as sudden snow in extremely large volumes that froze immediately etc. One of the effects of damaged trees is defoliation. As it was told before in chapter 1.1., exactly the defoliation that was observed in early 1980s was the first reason of new initiatives on international cooperative programmes for the forest health. Defoliation is the loss of needles or leaves, and it works as an indicator of forest health and vitality.

In Latvia there has been fluctuating but overall increasing levels of damages from storms and excessive snow over past two decades, however, the damages from fire have been decreasing. The forest fires have been the most common around the big cities in Latvia, in the territory of capital Riga the most [Donis J. 2010]. This means that the forest fires come mostly from wrong and incautious human actions, where there can be options to improve the situations and it has been done (as for example, through better fire security, but also by educating inhabitants. The other important effector has been pests. Interesting observation is that pests cause less damage in years when higher damages are faced by storms and excessive snow, and this is because they do not survive in harsh weather conditions, also in the case of fire the effect from pests will be lowered at the same year, as the population has been destroyed [BALTI Group 2011].

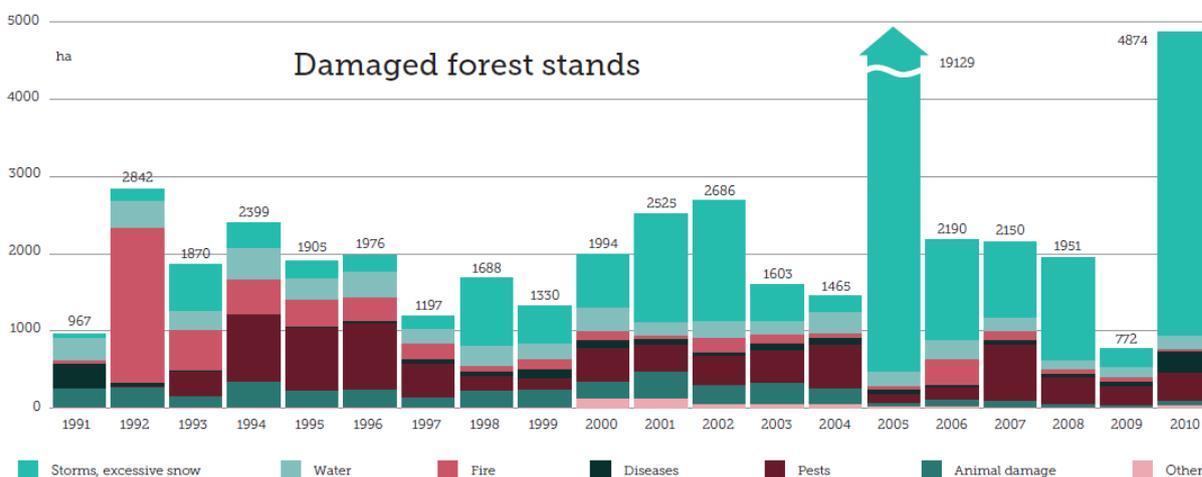


Figure 2.4. Reasons of Forest Damages in Latvia

Source: Ministry of Agriculture of Republic of Latvia

Unfortunately, the absolute levels of damaged forest stands are still high and the most effect comes from storms and excessive snow, which is partly un-controllable variable when it comes sudden and unexpected, however, more people could be employed in winters in forests to exempt trees from the high level of snow weight when it snows daily.

In 2010 one of the most effected tree species were spruce – the health and vitality decreased significant for this specie, and it was a lot because of weather conditions, but also because there was increase in different coniferous pests in spruce forests on peat soil<sup>23</sup>.

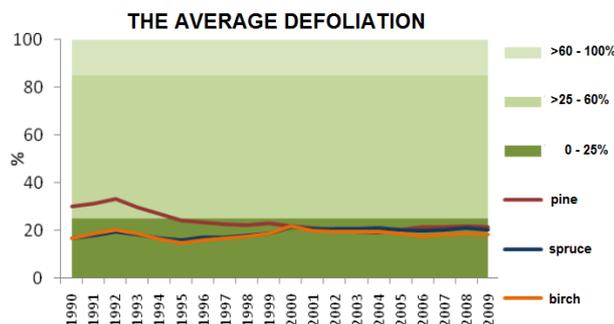


Figure 2.5. *The Average Defoliation in Latvia*

Source: Ozols A. 2011

In total, last time in 2012, defoliation of almost 4 000 trees were assessed, of which 75% were conifers and 25% broadleaves. Of all tree species, 11.8% were not defoliated, 79% were slightly defoliated and 9.2% moderately defoliated to dead [Latvian State Forest Research Institute "Silava" 2012]. The health and vitality of forests is lower in Latvia than in Finland, as it is described later, in Finland only 10% of forests have been affected by 25 to 60% defoliation rate, and most trees (more than 80%) have defoliation less than 25%.

In Finland, as shown in the figure 2.6., one third of damaging agents are unknown. Fortunately, no extensive forest damage has occurred in Finland in the last few decades. This is partly due to the strict legislation on insect and fungi damage prevention, restricting the storage of timber in the summer etc. Between 2004 and 2008, damages requiring immediate regeneration occurred over 38'000 hectares.

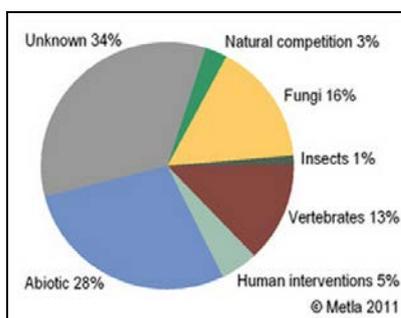


Figure 2.6. *Reasons of Forest Damages in Finland*

Source: Finnish Forest Research Institute

By the classification in Finland (that slightly differ from Latvia’s approach in terms of defining the same level of defoliation in other term), the degree of defoliation is called slight when 10 to 25% of needles or leaves have fallen down, moderate when 25 to 60%, severe

<sup>23</sup> Available online: <<http://www.vmd.gov.lv/?sadala=555>>, last time accessed on 15-11-2013 18:30

when 60 to 99%, and the tree are dead when 100% of needles of leaves have fallen down. A tree is classified as damaged when defoliation is greater than 25% - so this is most used way how to observe the health of the forests and trees, and when damage is identified, the causes can be analysed more specifically.

In Finland, defoliation is primarily caused by ageing, unfavourable weather and climate conditions, and damage due to fungi and insects. Defoliation is higher in places, where it is additionally caused by atmospheric pollutants - it is near to emission sources, in built-up areas and along roads. In the figure below the defoliation frequency distribution for pine, spruce and broadleaves in mineral-soil sites (1986 – 2008) are given.

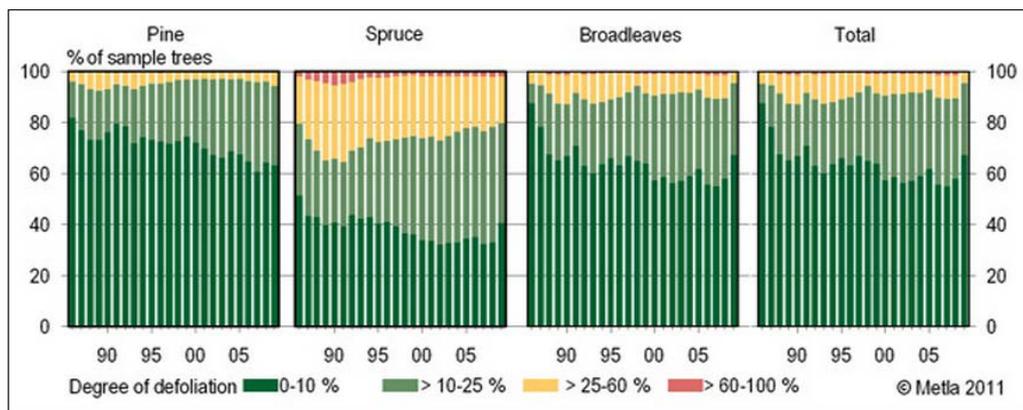


Figure 2.7. Forest defoliation in Finland by species

Source: Finnish Forest Research Institute

As shown in figure 2.7., the degree of no to slight defoliation has increased, which means that the health and vitality of forests have decreased over years. The highest moderate defoliation appears for spruce species, but is the lowest for pine. In total 60% of forests have been affected by up to 10% defoliation (which is low and not important, can be assumed as natural), and a little bit more than 20% of forests have slight level of defoliation.

Criterion No.3: Maintenance and encouragement of productive function of forests (wood, non-wood)

*Indicators: Increment and Fellings, Forests under Management Plans (Certification)*

The total increment is counted as the sum of forests planting, seeding and the promotion of natural recuperation in the lands not used for agriculture.

In Latvia the increment of forests has been increasing from approximately 2000 ha in 2004 – 2005 to more than 5000 ha in 2010. More than 70% from forests increment in 2010 were with main specie – spruce [Benta R. 2010]. In year 2010 more than 1500 ha were specially created plantation forests.

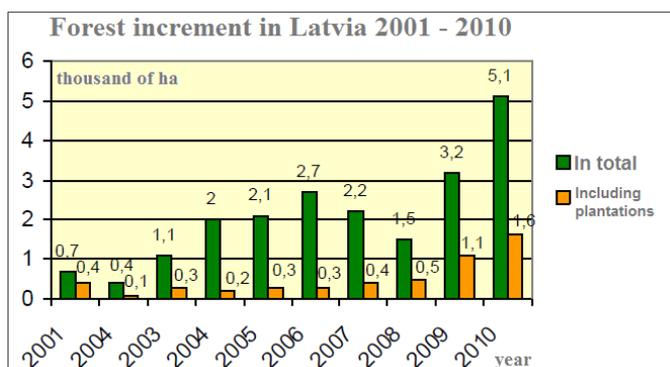


Figure 2.8. Forest increment in Latvia 2001 – 2010

Source: Ministry of Agriculture of Republic of Latvia

The level of fellings in state forests was around 4 million m<sup>3</sup> every year from 1991 to 2007, when after economic crisis it increased almost twice. At the same time, the increase from 1995 to 2000 in private forests was more than 4 times, leading to dramatically large overall increase in the first decade after independence restoration in 1990. From 2005 to 2010 the increase in felling volumes were by 15%, however, felling volumes were lower from 2006 to 2008, reaching the lowest bottom in 21<sup>st</sup> century in year 2008, when economic crisis started. As the increment has increased (shown in figure 2.8.), the levels of fellings increased, because by the low, in commercial forests it is allowed to harvest only 48% of annual growth to sustain long term perspective.

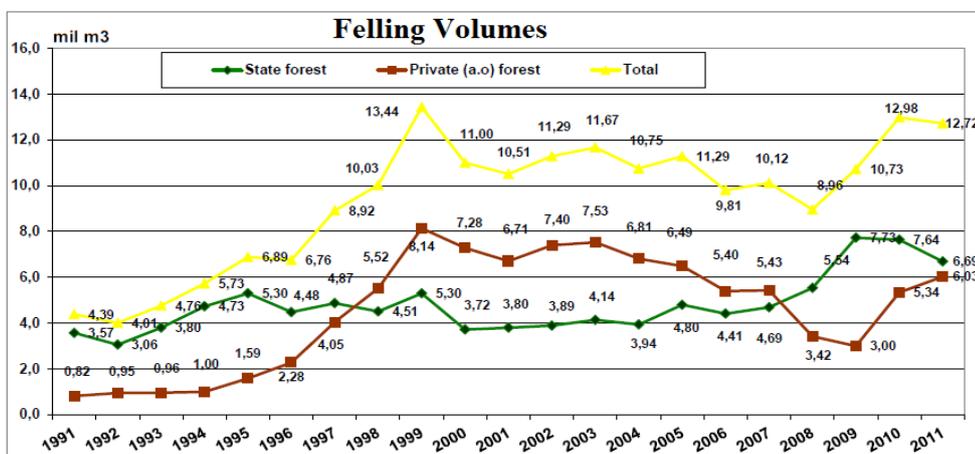


Figure 2.9. Felling Volumes in Latvia

Source: Ministry of Agriculture of Republic of Latvia

The fellings from total growing stock is only about 2% a year (shown in figure 2.10.). The extraction of timber from the increase in growing stock is slightly above 60% in nowadays.



Figure 2.10. *Felling intensity from total growing stock in Latvia*

*Source: Ministry of Agriculture of Republic of Latvia*

However, the problem is that the felling by itself has been done in not-sustainable way. Clean cut (complete deforestation in particular area) is in too high level in Latvia, as for example, in each of the years 2009 and 2010, 1.5% of state owned forest area was felled by clear cutting. Even this is the most common way of deforestation in Scandinavia and Finland including, in Latvia the levels are so high that it leads to the situation when by calculations after 8 years there would be 15% of state forests under age of 10 years and after 30 years almost half of state forests would be under 30 years<sup>24</sup>.

One of the most significant developments in the certification process in Latvia has been the certification of all state-owned forests. This process was completed in January 2003 by Latvia's new government institution for forest management – the State Joint Stock Company *Latvia's State Forests*. Also the capital Riga's municipal forests are certified, primarily under FSC, and a growing number of hectares of private forested land are coming under group certification through both FSC and PEFC [Actins A., Schwartz M. 2004]. In 2011 more than 50% of Latvian forests, including all state-owned forests, were certified in accordance also with the PEFC system, and 15 companies in Latvia had already received certification of their delivery chains (also under PEFC). In 2004 – 88, but in 2011 already over 280 forest-sector enterprises and forest owners had certified their timber chain-of-custody systems according to the FSC requirements [Investment and Development Agency of Latvia].

In Finland the balance between increment and drain varies between tree species and by region. Since the 1970s the growing stock has increased by more than 40%. More significant has become reforestation, while the natural expansion of forest has decreased by almost 3 times from year 1990 to 2005. From year 1990 to 2000 the increase in plantation volumes were by 1.21%, then from year 2000 to 2005 in increased by 3.56% reaching the level of

<sup>24</sup> Available on: <[http://www.pietiek.com/raksti/vai\\_meza\\_apsaimniekosana\\_latvija\\_ir\\_ilgtspejiga](http://www.pietiek.com/raksti/vai_meza_apsaimniekosana_latvija_ir_ilgtspejiga)>, last time accessed on 29-11-2013 14:30

5 904 000 ha, which has been remained up to year 2010 with no further increase in forest planting [FRA 2010/069].

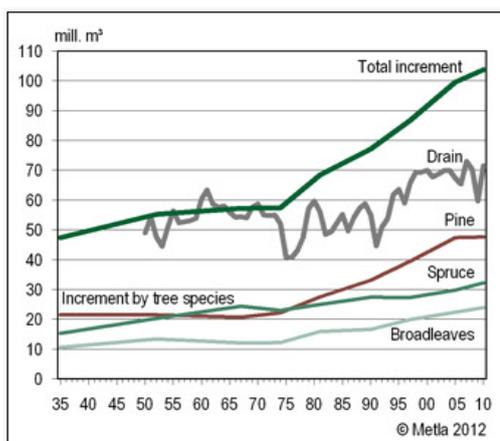


Figure 2.11. Total increment in Finland

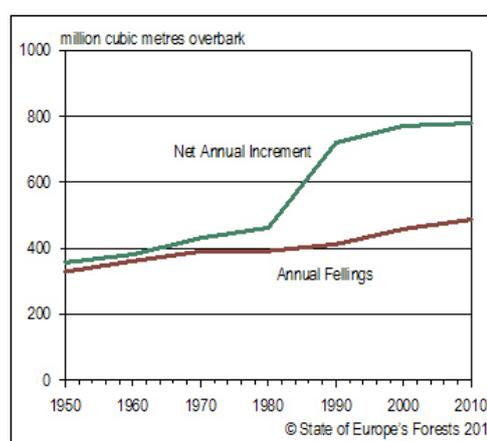


Figure 2.12. Net Annual Increment in Finland

Source: Finnish Forest Research Institute

Finland is one of few countries that have more than 75% certified forests. In 2000 the Finnish Forest Certification Scheme (FFCS) was endorsed by the PEFC, which means that the national certification scheme complies with jointly agreed international criteria. In 2012, 22 million hectares or 95% of all forests in Finland were certified under PEFC<sup>25</sup>.

Criterion No.4: Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems

*Indicators: Tree Species Composition, Regeneration, Naturalness, Introduced Tree Species, Protected Forests*

By the Central Europe vegetation classification system the forests of Latvia belong to five classes: Boreal coniferous forests; Dry sub continental pine forests; Pine and birch bog forests; Wetland alder woods; Broadleaved forests. The forests of Latvia are dominated by three tree species – Scots pine, Norway spruce and birch species (silver and downy birch); together they constitute 73.8 % of the total forest area (according to the data of NFI).

The share from total forest trees of pine stands is 28.9 %, but the proportion of spruce and birch stands – 17.0 % and 27.9 % respectively. The remaining forest areas are occupied by stands of black alder (5.1%), grey alder (9.8%), aspen (7.7%), ash and oak (1.5%), and other tree species (2%). The coniferous stands in general occupy 46% of the total forest area, but stands of deciduous trees – 54%.<sup>26</sup> Unfortunately, species distributions according to forest

<sup>25</sup> Available online: <<http://www.metla.fi/metinfo/sustainability/SF-2-informational-means.htm>>, last time accessed on 14-12-2013 15:27

<sup>26</sup> Information from the International Contest: *Young People in European Forests*. Available on: <<http://ypef.eu/files/booklet/ang/latvia.pdf>>, last time accessed on 07-11-2013 07:45

site types do not in all cases correspond to the conditions of optimum growing for particular tree species [Ozols A. 1992].

There are regulations on forest regeneration and the preferences to ensure by forest owners and managers that forests are regenerated by Latvia's four major commercially valuable tree species – birch, spruce, pine and aspen. However, there are and always will be differences between privately regenerated or regenerated by state forests. In state forests the conifers make 73% of the total area regenerated (spruce 35% and pine 38%), however, in other ownership forests conifers are only 24% (spruce 16% and pine 9%), at the year 2009 [State Forest Service]. From introduced species, the European larch, poplars, Jack pine, and Weymouth pine, silver firs, cedar pine, Douglas fir, common beech occur more frequently. The total area of these species stands is very small.

When analysing the period of global economical crisis, it is shown by next table, that there has been significantly high levels of forest regeneration in years 2008 to by state, which increased year by year comparing the economical peak in 2007. At the same time the private sector had the highest forest regeneration levels on the peak in 2007 and 2008 and then significant drop since 2009. This leads to think about the incentive policy state has introduced to sustain the forest industry and give stimulus while the private sector is not able to invest. However, in absolute volumes the regeneration by non-state forests has overhead the state managed forest regeneration, which is a good sign for the high investment levels in private sector and gives the knowledge about market values.

FOREST REGENERATION	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
TOTAL													
Forest regeneration	25,293	15,164	17,973	29,411	37,571	34,795	29,488	36,233	40,621	34,443	32,205	35,230	35,230
..Of which seeding and planting	8,613	8,005	8,774	10,408	11,972	11,676	10,999	11,451	11,211	10,565	10,811	12,908	13,290
State forests													
Forest regeneration	14,381	8,606	9,347	10,688	11,498	10,883	9,947	9,755	11,300	11,588	13,409	17,576	16,797
..Of which seeding and planting	5,870	5,448	6,353	7,046	7,256	7,483	7,257	6,885	7,663	7,990	9,164	11,242	11,242
Other forests													
Forest regeneration	10,912	6,558	8,626	18,723	26,073	23,912	19,541	26,477	29,321	22,855	18,796	17,654	18,432
..Of which seeding and planting	2,743	2,557	2,421	3,362	4,716	4,192	3,742	4,566	3,548	2,574	1,647	1,666	2,048

Table 2.1. *Forest Regeneration in Latvia, 2000 – 2012*

*Source: Eurostat*

In Latvia, forests are comparatively natural systems. As it also is shown by previous table, the planting and seeding is only about 10% in private forests, but exceeds 70% in state forests (in 2012), in average leading to less than 40% of seeded and planted forests from total forest regeneration. Before the economic crisis this level was slightly above 30%, and it has increased due to previously mentioned incentive policy (Country report of Latvia to FAO, 2010). However, the proportion of primary forests (forests of native tree species, in which

there are no clearly visible indications of human activity and ecological processes are not significantly disturbed) is very small and they are mainly located in the strict and regulatory regime zones of Nature reserves and National parks. In Latvia, almost 20% from all forest lands are with the objective of management to sustain and expand the biodiversity. A list of specially protected environmental territories was established in 1993 and it has constantly been improved over the years. Today nearly one half of the 674 protected environmental territories in Latvia are also Natura-2000 territories, the program Latvia joined since becoming European Union member state. At the end of 2008, there were 39 285 natural forest biotopes in Latvia covering 66 337 hectares of land.

The majority of Finland is situated in the boreal coniferous zone. Almost 90% of forests in Finland are predominantly coniferous forest land and 10% predominantly broadleaved forest land (this was different in Latvia, where coniferous and broadleaved forest lands were almost even). In the boreal coniferous zone the soil is poor and acid and there are few tree species to form forests. Almost half of the volume of the timber stock consists of pine. The other most common species are spruce, downy and silver birch. These species make for 97% of total timber volume in Finland. The majority of Finnish forests are mixed means that they are made of more than one species. But still, many sites are dominated naturally by just one species, such as pine in upland forests. Pure stands account for 55% of all forest land, stands with some mixing account for 31%, and actual mixed stands account for 13%. The most common species growing in mixed stands is downy birch. Pine predominates on 67% of forest land, spruce on 22% and broadleaves on 11%. Broadleaves, which are important to forest biodiversity and the soil and grow mostly in mixed stands, account for 20% of the total volume of growing stock, which is clearly more than the total area of predominantly deciduous stands<sup>27</sup>.

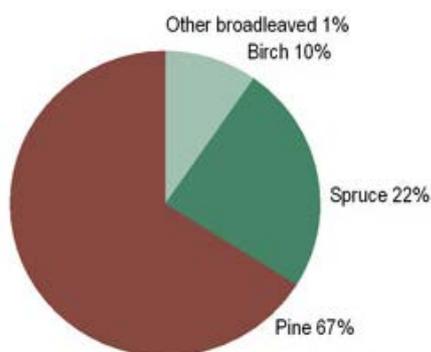


Figure 2.15. *Tree species in Finland*

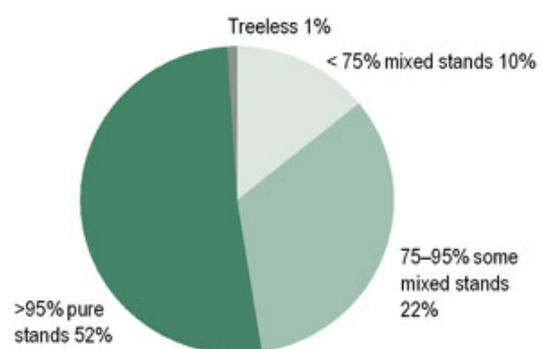


Figure 2.16. *Forest types in Finland*

Source: Finnish Forest Research Institute

<sup>27</sup> Available online: <<http://www.metla.fi/metinfo/sustainability/c4-tree-species.htm>>, last time accessed on 14-12-2013 16:05

In all, Finland has about thirty indigenous tree species: four conifers (Scots pine; Norway spruce; Common juniper; and European yew) and 27 broadleaved species of trees, bushes or small trees. This is much higher number than in Latvia, however introduced species have been planted in Finland only for research and experimental purposes, or as decorative trees and stands in arboretums, for example. There are about 9 500 hectares (ha) of forests in Finland composed of introduced species, of these, 9 000 ha are stands of lodge pole pine<sup>28</sup>.

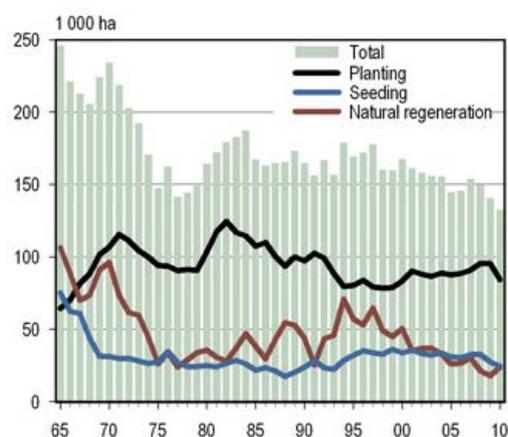


Figure 2.17. Annual forest regeneration in Finland

Source: Finnish Forest Research Institute

The annual forest regeneration area in Finland is about 150 000 ha, and it has decreased over time, especially after global economic crisis, which is opposite trend as in Latvia. Of this area, planting Norway spruce and Scots pine cover about half, direct seeding (mainly Scots pine) about fifth and the rest is naturally regenerated (mainly Scots pine) [Saksa T. 2006].

According to the 9<sup>th</sup> National Forest Inventory, there were a total of 170 000 hectares of old forests resembling natural forests (forests over 140 years old with observed indicators suggesting naturalness) in the hemi-boreal, southern and middle boreal zones. Of these, 40% were in conservation areas. In the northern boreal zone there were 716 000 hectares of such forests, 56% of them in conservation areas. This has shown the pattern in Finland that the northern forests are more for biodiversity and functions as protected forests, while in the middle and south part forests are more utilized for wood supplies.

In Finland protected areas (3.0 million hectares) accounts for almost 13%<sup>29</sup>, including 4% of all forests that are undisturbed forests<sup>30</sup>. The area of protected forests (forest and low productive forest) in Finland is currently 2.2 million hectares (9.6% of the total area of forests). In addition, there are 0.8 million hectares of forests under restricted forestry use. The

<sup>28</sup> Available online: <<http://www.forest.fi/smyforest/foresteng.nsf/0/BE3C5576C911F822C2256F3100418AFD>>, latest time accessed on 04-09-2013 20:33

<sup>29</sup> Available online: <<http://www.nordicforestry.org/facts/finland.asp>>, last time accessed on 14-12-2013 16:19

<sup>30</sup> Available online: <<http://www.metla.fi/metinfo/sustainability/finnish.htm>>, last time accessed on 14-12-2013 16:20

majority of protected forests are in northern Finland<sup>31</sup>. In the protective forest zone, the special aim to retreat timberline and to maintain the forests vitality is defined for management. To support the development of forest protection especially in southern forests, where it is not so common, the Forest Biodiversity Programme for Southern Finland (208-2016) offers by giving compensation and helping with the management for forest owners voluntary protect their forests or to enhance natural values of the forests<sup>32</sup>. The Government has set as a target that the total of area voluntarily offered for conservation by the landowners will be 96 000 hectares by 2016; moreover, the total area of sites safeguarding biodiversity in private forests will be increased by 82 000 to 173 000 ha<sup>33</sup>.

*Indicator: Deadwood*

Comparing the cubic metres per hectare of deadwood by countries [see figure 2.18 in next page], Finland relatively to its large areas of forests has really low level of both standing and lying deadwood, while Latvia has levels between two to three times higher. The forests in Finland are better managed and controlled, in Latvia the forest owners have still place where to improve significantly, to improve. This also says in relation to earlier discussed health and vitality of forests and defoliation as its indicator, that these parameters are lower in Latvia than in Finland.

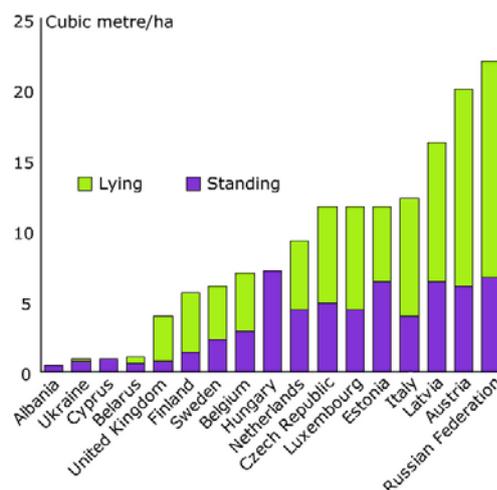


Figure 2.18. *Deadwood in Europe, 2005*

Source: MCPFE, 2007

<sup>31</sup> Available online: <<http://www.metla.fi/metinfo/sustainability/c4-protected-forests.htm>>, last time accessed on 14-12-2013 16:21

<sup>32</sup> Available online: <<http://www.metla.fi/metinfo/sustainability/c4.htm>>, last time accessed on 14-12-2013 16:25

<sup>33</sup> Available online: <<http://www.metla.fi/metinfo/sustainability/c6-public-commodities.htm>>, last time accessed on 14-12-2013 16:26

Criterion No.5: Maintenance, conservation and appropriate enhancement of protective functions in forest management (notably soil and water)

*Indicator: Protective Forests*

The figure 2.19 has shown that in relative values – hectares per capita, forests for soil and water protection are not many in Finland and Latvia. It is because the lands are relatively flat in Finland and Latvia, versus Sweden, which has a lot of mountains in the north of country that leads to necessarily large protective areas for both soil and water. The level in Finland is still higher, because of more water protection and also a slightly more uplands in northern territories and Lapland.

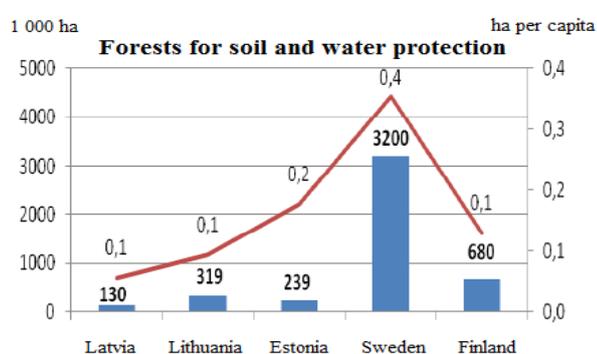


Figure 2.19. *Forests for soil and water protection*

*Source: Ozols A. 2011*

In Latvia the Cabinet of Ministers has created the Rules for Protection of Environment in Forest Management in 2001, which describes how the protective zones must be created and managed at the beginning and additional actions when harvesting is in process. Also drainage systems are implemented; however, there is still place for improvements in Latvia for implementing more and better protective forest lines.

The land is fairly flat in Finland, and there are hardly any problems caused by soil erosion, avalanches or shifting of the ground. Protective functions therefore mostly focus on protective forests in the timberline area in Lapland. The special attention in forest management is for waterways, because there is a great number of peatland forests and waterways as lakes, rivers, small water systems etc. Forest management measures that may burden waterways include final fellings, soil preparation, drainage and fertilisation. The level of water protection has improved continuously at felling sites, which has been proved by monitoring of the effects of civil culture on water systems over a period of 15 years. It is estimated also that the level of water protection regarding harvesting and soil preparation is excellent or good in over 90% of the sites. Protective zones with trees are established alongside waterways in harvesting, sludge sumps are dug during drainage reconditioning, and

waters from the area are passed to open water through an infiltration area to prevent leaching of nutrients and sludge [Finnish Forest Research Institute 2011].

Criterion No.6: Maintenance of other socio-economic functions and conditions

*Indicator: Forest holdings*

In Eastern Europe in average more than 70% of forests are state or communal property, while in Western, Northern and Southern Europe in average more than 70% of forests are privately owned forests [Winkel G., p.21]. The share of forests owned by state decreased between years 2000 and 2010 in ten EU Member States, most notably in Romania, Slovenia and Lithuania and to a lesser extent in Austria, Finland, Latvia, Estonia, the United Kingdom.

About 50% of forests in Latvia are owned by state and managed by state stock company Latvian State Forests. In the private sector, the market for forest property in Latvia primarily consists of many small areas of forest lands, in size between 5 and 40 ha<sup>34</sup>. As in the figure below, the average size of forest in Latvia is 7.5 hectares.

In Finland, the state owns 26% of the Finnish forestry land. The state forests are mainly situated in the north of Finland, and 45% of them are under strict protection. Private individuals and families own 60% of the productive forestry land in Finland. Typically, Finnish forest holdings are as in Latvia also small. The number of holdings above 2 ha is close to 350 000, size of these holdings is in average 30.1 ha. Overall the average size of owned forest areas is 35.5 ha. The share of holdings over 100 hectares is only 5%<sup>35</sup>.

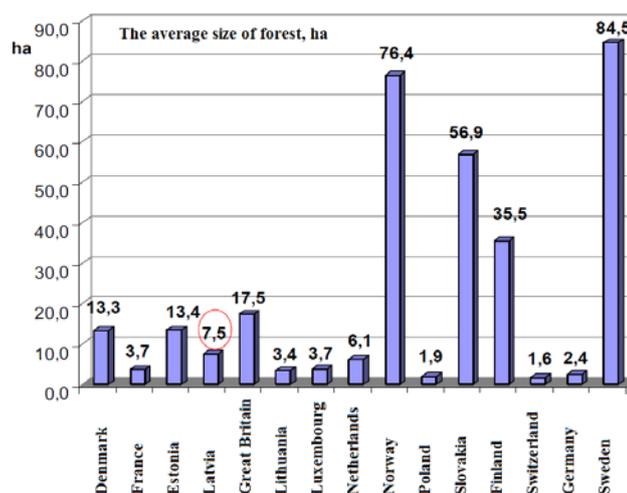


Figure 2.20. *The average size of forests in Europe*

Source: Muiznieks A. 2010

<sup>34</sup> Available on: < <http://www.latvianforest.lv/en/market-0>>, last time accessed on 18-12-2013 18:57

<sup>35</sup> Available on: <<http://www.forest.fi/smyforest/foresteng.nsf/0/2060D041E6A0B051C2256F25003E4B8D?Opendocument>>, last time accessed on 10-09-2013 22:30

*Indicator: Contribution of Forest Sector to GDP*

By now Latvia has the contribution of forest sector to GDP (indicated as gross value added of forestry in percentage of total gross value added) somewhere close to level in Finland and even exceeds the level in Sweden. When divided by forest product groups, in Latvia the level of manufacture of wood and articles in wood exceeds the level in Finland, but Latvia has significantly less contribution to GDP in manufacture of paper and paper products, which are main industry in Finland [UNECE Statistical Database].

Contribution of forest sector to GDP (Indicator 6.2) by Gross Value Added, Sector, Country and Year			
	2000	2005	2008
<b>Gross Value Added: % of total GVA</b>			
Forestry (ISIC/NACE 02)			
Denmark	0.10	0.10	0.10
Finland	2.10	1.80	2.20
Latvia	1.60	1.40	1.30
Lithuania	0.60	0.50	0.50
Sweden	1.20	0.60	0.90
United Kingdom	0.00	0.00	0.00
Manufacture of wood and articles in wood (ISIC/NACE 20)			
Denmark	0.50	0.40	0.40
Finland	1.20	1.00	0.80
Latvia	2.60	2.50	1.80
Lithuania	1.30	1.70	1.20
Sweden	0.80	0.90	1.00
United Kingdom	0.30	0.30	0.20
Manufacture of paper and paper products (ISIC/NACE 21)			
Denmark	0.30	0.20	0.30
Finland	4.80	2.60	2.10
Latvia	0.20	0.20	0.10
Lithuania	0.30	0.30	0.30
Sweden	2.20	1.30	1.20
United Kingdom	0.40	0.30	0.20

Table 2.2. Contribution of forest sector to GDP for Denmark, Finland, Latvia, Lithuania, Sweden and United Kingdom

Source: FOREST EUROPE

In Latvia, the only period when forest industry in % of GDP counted less than 4% were 2008, all other years the level has been between 4 and 6% [shown in figure 2.21].



Figure 2.21. Forests added value and share of GDP in Latvia

Source: Ministry of Agriculture of Republic of Latvia

The recovery of the sector after financial crisis is also shown in the next figure, where the value added by forest industry in 2010 has been even higher than in year 2007 and almost the same share of GDP has been reached in 2010 as in 2007 [Latvia's State Forests 2011]. It was forecasted in 2006 - 2007 that growth of agricultural and forestry sectors in forthcoming years may accelerate 1.4 times, thus would lead to doubling the value added [Ministry of Agriculture 2007], however, the pattern was destroyed by global economic crisis. But at the same time the increase in 2010 has been important and the improvements in forest industry keeps raising the added value and the contribution to GDP.

In Finland, today forestry and the forest industry make up about 5.1% of Finland's gross domestic product, and approx. 18% of Finnish exports. In 2010 Finland's national economy continued to rise from the 2008 and 2009 recession. The gross value added at current prices was EUR 157 billion in 2010, of which forestry accounted for 1.9%, the wood-products industry for 0.8%, and the pulp and paper industry for 2%.

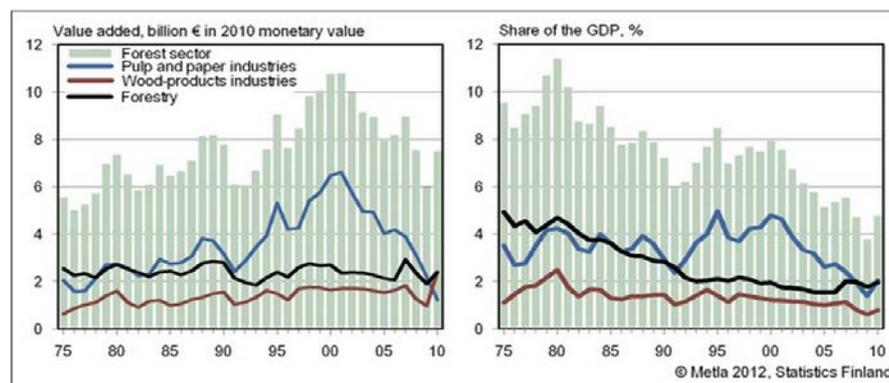


Figure 2.22. Forests value added and share of the GDP in Finland

Source: Finnish Forest Research Institute

#### Indicator: Trade in Wood

The forest industry has always been the export leader in Latvia. In the percentage of total exports the highest importance of forest industry was from 1999 to 2003 – above 40% of total exports were forest industry's products; since then it has decreased, however, the exports absolute value in million Latvian lats (LVL) has increased significantly [Latvia's State Forests 2011]. This is because the overall volumes in exports are increasing in Latvia (so the share of forest industry is lower), as well as the value of products is increasing (higher income from exports). And still, export of wood and its products was the most significant sector of Latvian export in year 2011, however, comprising now just 17% of the overall export value in Latvia. This industry has had the quickest recovery from the global economic crisis. The fast recovery is seen from the fact that in 2010 the absolute value of exports in Latvian lats was

almost on the level of year 2007 or before economic crisis. Also the foreign trade balance of the Latvian wood industry is positive, it has reached the value of 1.2 billion EUR in year 2011. This year the value of wood product exports was 1.7 billion EUR, which was by 15% more than in 2010, while imports in 2011 was only 447 million EUR. Currently about 75% of forest sector output is exported<sup>36</sup>.

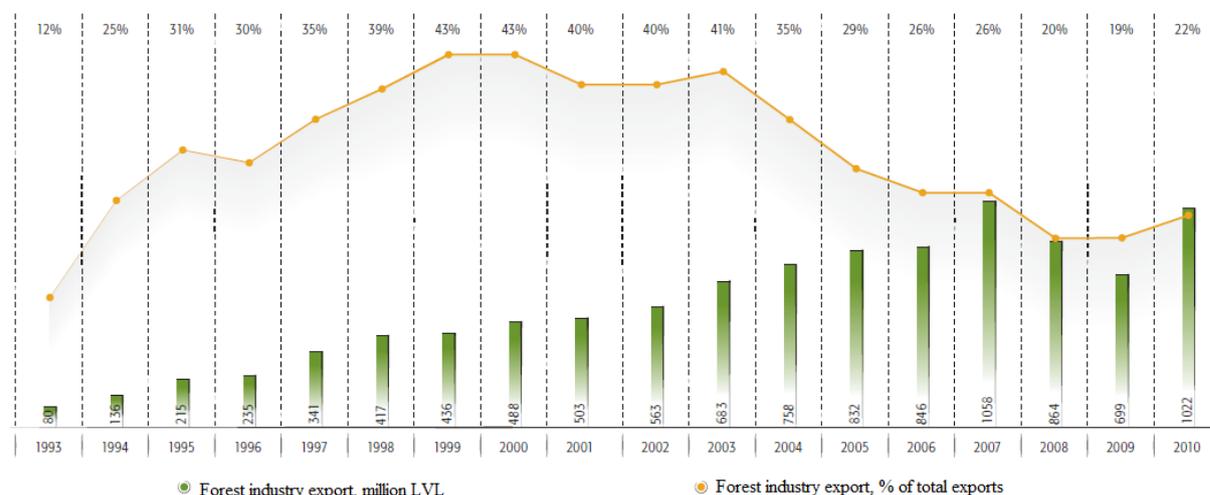


Figure 2.23. *Forest industry exports in Miln. LVL and as share of total exports in Latvia*

*Source: Ministry of Agriculture of Republic of Latvia*

In period of January to April 2012 foreign trade turnover value reached 4.7 billion LVL – an increase of 15.1% as compared to the corresponding period of the previous year. The proportions of increasing trade turnover is as follows: the value of exports increased by 11.4% and value of imports of 18.2% at the first half of year 2012, comparing to the first half of year 2011 [Laganovska L. 2012].

The biggest share of export value has sawn wood, round wood and fuel wood, with share of 26.8%, 13.7% and 12.7%, respectively. In 2011 compared to year 2010, the most significant increases in exports were for paper and paperboard products, wood packaging, and wood construction components.

Primary the export countries are Sweden (16% of total wood-working product exports), UK (12%) and Germany (12%), the export also goes to Estonia, Lithuania, Finland, Denmark, Netherlands etc. While imports mainly come from Lithuania (17% of total wood-working product imports), Poland (15%) and Estonia (10%), but in less extent also from Finland, Germany, Russia, Sweden etc. Latvia has one of the highest investment rates in Europe in wood and wood products and the most competitive labour force. The most investments in forest industry in 2011 came from countries as Cyprus (30%), Estonia (17%), USA (14%) and Iceland (14%). The level Foreign Direct Investment (FDI) in forestry has increased

<sup>36</sup> Available online: < <http://www.liaa.gov.lv/trade-latvia/industry-profiles/forestry-and-woodworking>>, last time accessed on 14-12-2013 17:36

significantly since world global economic crisis and the level now is almost as twice as high as in year 2005<sup>37</sup>.

Also in Finland, most of the production of forest industry products is exported. Finland is among the major suppliers of forest related products to the world markets, particularly in printing and writing paper. High-quality printing and writing paper share exceeds over 40% of the total export value of forest industry products, while sawn goods and wood-based panels account for approximately 20% of export value. Some 60% of Finnish exports go to the EU countries, mainly to Germany, Great Britain, France and Spain. Other European countries account for 10% of forest industry exports, and the rest of the world 30%<sup>38</sup>. At the same time, Finland is one of the biggest importers of round wood.

In 2010 the total value of the incomes from exports of the forest industry's products was EUR 10.8 billion, of which 80% was from products of the pulp and paper industries, 19% from the industries of wood-products and 1% from the exported round-wood. The total value of the imported wood and others forest industry's products in 2010 was EUR 2 billion (that was five times less than value of exports), of which 42% was from products of the pulp and paper industry, 32% from the wood products industries and 26% from the import of round-wood<sup>39</sup>.

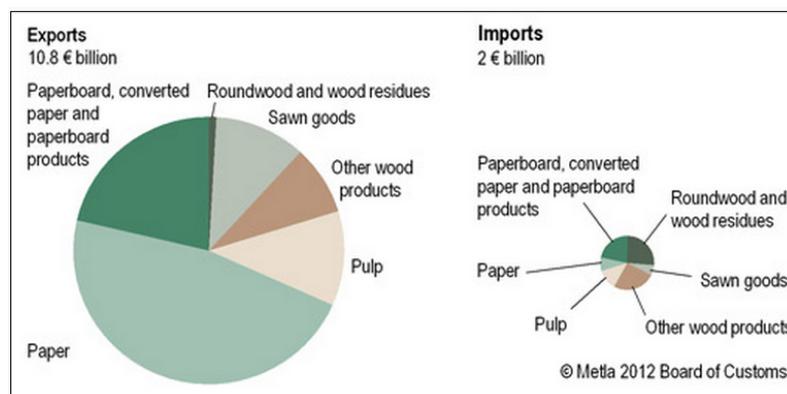


Figure 2.25. *Export and Imports of forest products in Finland*

*Source: Finnish Forest Research Institute*

The demands for pulp on the global market as well as the growth in demand for packaging materials are increasing the production and exports of paperboard and pulp. The exported amounts and export unit prices of both sawn wood and plywood are increasing in 2013 [Finnish Forest Research Institute 2013]. There was a 10.9% annual increase in the

<sup>37</sup> Available online: <<http://www.liaa.gov.lv/trade-latvia/industry-profiles/forestry-and-woodworking>>, last time accessed on 14-12-2013 17:36

<sup>38</sup> Available online: <<http://www.metla.fi/metla/finland/finland-forest-industries.htm>>, last time accessed on 14-12-2013 17:48

<sup>39</sup> Available online: <<http://www.metla.fi/metinfo/sustainability/c6-foreign-trade.htm>>, last time accessed on 13-11-2013 15:04

amount of paperboard produced, following significant investments to boost capacity in this area. Production of pulp in first six month of year 2013 was increasing by 4.4% in comparison to year 2012. In contrast, the demand for paper in the main market area, the euro area, continues to fall, causing a decline in Finnish paper production. However, it has been possible to compensate for the weak demand in Europe by increasing exports to third countries - to the markets in Asia and the Middle East [Finnish Forest Research Institute 2013]. Manufacture of graphic paper declined by 3.8% in first six month of year 2013 compared to first six month of year 2012. This product accounts for approximately 60% of overall paper production, but demand from Europe was 6% lower year-on-year<sup>40</sup>.

While the exports are highly important for both countries, the pattern of exported products, partner countries and volumes in Latvia and Finland are different. Latvia has more exports of round wood and less exports of different secondary goods, while it is opposite in Finland. This shows the need for improvements in Latvia to increase the higher added value production sectors and develop the industry. At the same time also Finland has its challenges, as the demand for paper products (which is main sector of industry in Finland) changes, the orientation must be shifted from European area to Asia and Middle East.

#### *Indicator: Energy from Wood Resources*

Latvia has the highest energy production from wood relatively to total national primary energy consumption in EU, which was slightly over 30% in year 2011. It is followed by Finland with the second highest percentage of approx. 20% and then Sweden with about 16%<sup>41</sup>. Most part of renewable energy in Latvia comes exactly from forests. Renewable energy sources in 2012 accounted for 36.3% of total primary energy balance and the two most commonly used forms of renewable energy were fuel wood (27.6%) and hydro resources (7.0%) [Ministry of Economics of Republic of Latvia]. Based on different calculations and expertise, the wood used for energy production was about 7.2 million cubic meters, but the additional potential was counted extra 5.7 to 7.1 million cubic meters, which potentially could come from available wood resources from forests (approx. 1.9 to 3.3 million cubic meters), also if the exported wood for energy supply would be utilized locally in Latvia (1.8 million

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<sup>40</sup> Available online: <<http://www.hdfestforest.com/News-archive.10028.aspx?recordid10028=801633742>>, last time accessed on 30-10-2013 09:43

<sup>41</sup> Available online: <<http://www.metla.fi/metinfo/sustainability/finnish-wood-based.htm>>, last time accessed on 14-10-2013 20:09

cubic meters) and if the efficiency of wood harvesting, usage, management and utilization would be improved (1.8million cubic meters)<sup>42</sup>.

As previously discussed, in Finland the CO<sub>2</sub> emissions from deforestation and afforestation are higher than total carbon storage, so the topic on different other possible improvements in connection to climate change are important in Finland. As one of the targets is the renewable energy increase, Finland finds this also possible to develop. It was mentioned in previous paragraph that Finland has the second highest level in EU for energy production from wood. Exactly forest-based bio-energy represents the most significant and cost efficient way of increasing the share of renewable energy in Finland even more. Over 90% of the biomass consists of small-sized trees and logging residues, which is sub-product in forest industry and can be utilized efficiently. In 2010, wood-based fuels accounted for 22% of total energy consumption; it was about 7 million cubic meters of wooden biomass used, while the estimated sustainable potential is estimated to be twice as big – about 15 million cubic meters of wooden biomass per year<sup>43</sup>.

#### *Indicator: Forest Sector Workforce*

The employment rate in forestry in Latvia has decreased over time. Starting with slight increase from 2000 (around 60 000 employed persons) to 2004 (almost 80 000 employed persons) and followed by decrease at higher rate to reaching about 40 000 employees in 2010, what of course was partly caused by global economic crisis in 2008 and 2009 [Ozols A. 2011]. At the same time, in Finland in 2010, the forest sector provided employment to about 69 000 people. Also in Finland the effect of global economic crisis caused decrease in employment and particularly the most in the pulp and paper industries (the production and export volumes decreased), however, now it can be said that overall the employment in forest sector is stabilized. The average unemployment rate in the forest sector in 2010 was 9%<sup>44</sup>.

In this chapter Finland's and Latvia's forests and their sustainable management were characterized by collecting and analyzing the six pan-European criteria and their indicators, as well as, looking into the policy documents, regulations and instruments used in each country. All these data give a quantitative (not only qualitative, which was often used some decades

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<sup>42</sup> Available online:

<[http://www.varam.gov.lv/in\\_site/tools/download.php?file=files/text/ESinfo/padomes//080411\\_zinoj.pdf](http://www.varam.gov.lv/in_site/tools/download.php?file=files/text/ESinfo/padomes//080411_zinoj.pdf)>, last time accessed on 14-12-2013 18:05

<sup>43</sup> Available online: <<http://www.metla.fi/metinfo/sustainability/finnish-wood-based.htm>>, last time accessed on 03-10-2013 16:33

<sup>44</sup> Available online: <<http://www.metla.fi/metinfo/sustainability/finnish-forest-sector.htm>>, last time accessed on 29-11-2013 13:59

ago) information through measurements and estimates, to understand what is the situation, position and condition for forests in each country. It gives the understanding of the strong and weak factors, as well as, opportunities and threats for each country – to gather this information in more concrete analysis, the next chapter of SWOT analysis is developed.

When some of criterion is not fulfilled, the governmental institutions need to implement new or more effective actions through policies, to ensure that necessary levels will be reached. As for example, the policy can help in Latvia to increase the number of private forests being certified under internationally recognized certification schemes – if the stronger requirements in forest management for the private forest owners are defined by policy, it leads to closer linkage to reach requirements by certification schemes. Also as example can be given, that the Finland has need to improve their GHG balance, where only through stronger policy instruments some achievements can be attained.

At the same time by the data analyzed, it is possible to find that countries have similar starting conditions, as weather, species planted; both have export based forest industries, but they have different products produced and exported etc. Overall, the previous chapter gives the possibility in further analysis to compare both countries – what the common and different factors are, when more or less both countries have all the same conditions in developing sustainable forest management. The comparison will be given after the SWOT analysis. The comparison of two countries gives an important tool to assert whether some of the weak factors can be improved in one country, if the other has proved it already. At the same time the specification is that the forest sector is still related to all other economic sectors, which must be taken in consideration if there is a will to create more specific activities for achieving any particular goal.

The target of the paper was to define the SWOT analysis for each country and to compare both of them. The previous chapter was important in terms to, firstly, find each of the SWOT factors and define the policies in Finland and Latvia, as well, as to give the understanding generally what is the sustainable forest management in each country. Based on data collected and analyzed the main research question can be answered and the focuses for each country can be defined - where improvements are the most important and needed.

### **3. The Comprehensive Analysis of Sustainable Forest Management and its Policies in Finland and Latvia**

The research question of this paper has been to define the strength and weak factors and opportunities and threats for sustainable forest management (SFM) in Finland and Latvia. In previous chapter the all necessary data were collected and analyzed to characterize the SFM in each country. The upcoming SWOT analysis will summary the main aspects of previous research and will give more discussion– what has been done well but where the development is still needed. This will finally highlight what the focus of the future should be and what activities must be implemented for further improvements to reach better SFM.

The SWOT analysis is a tool to define four aspects of the subject being analyzed, in this case country wide. The Strength and Weak factors are more constrained to internal effects, while the Opportunities and Threats are related to external effects and positioning within market or different international treaties at this case. The analysis is arranged by countries and then each of SWOT factors are defined, by saying the concrete finding and then discussing it briefly. Up to five points for each of SWOT factors are given for each country, to make final analysis concrete, specific and with the most important focuses mentioned.

#### **3.1. The SWOT Analysis for SFM and its Policies in Finland and Latvia**

##### Latvia

###### *Strengths*

1. The forest land in Latvia has been growing for few last decades and growth is maintained also after recovery of Independency in 1990.

This is important strength for Latvia that gives the possibility to improve the SFM in terms of biodiversity (as more land is available) and continues supplies for wood production (as growing stock is increasing and more harvesting can be ensured). At the same time government has also showed the strength in forest regeneration by planting and seeding more after global economic crisis, when in the private sector regeneration volumes decreased badly. It is often observed, when system changes from central to market based, resources are utilized in too high manner, but this is not the case for Latvia. It has still the highest forest land growth rate in the EU.

2. Regeneration in non-state forests in total is higher than in the state managed forests since year 2003.

The total regeneration by private sector has overtook the state forest regeneration; however, it has happened because of natural regeneration mainly, not by direct heavily planting or seeding in private forests. This is positive in a way, that providing the conditions for natural regeneration, it is cheaper than proceed with direct seeding or planting. At the same time it has a struggle in a fact, that the control over species is lower, because many of forests are mixed, as well as the final quality of the wood cannot be controlled as it is under planting process and growth monitoring.

3. The level of protected forests is high.

The forests with specific nature environment are saved under restricted forest management. This gives the possibilities to develop the biodiversity and increase the quality of other non-wood goods. Unfortunately, the general policy does not require strictly the private sector to participate in these activities. By simply increasing protected areas, it is possible to insure that SFM in terms of biodiversity will be reached. In Latvia there is one of the highest shares of protected areas in European Union, giving the strength for improving non-wood related criteria of SFM at national level.

4. 50% of all forests in Latvia are owned by state, which gives different strengths to have direct effects from state activities and new policy's instruments.

This also goes hand in hand with the previous point of protected areas. When state owns more forest lands, it has more options to really affect the forest sector. As previously mentioned, state took direct participation in forest sector recovery after global economic crisis by increasing the regeneration in state owned forests. However, even this is strength for the governmental institutions to make better forest industry by active membership; it must be used with cautions and with the closest linkage to market needs as possible.

5. Almost the same volumes of wood that are used for primary energy production now are still available to increase further the renewable energy usage within Latvia.

Latvia has the highest share of forest based renewable energy used for primary energy production in the EU. In total almost 50% of primary energy consumption is based on renewable energy in Latvia, which already reaches the 20-20-20 target by now. Forests count almost 30% on primary renewable energy production and hydro power a little less than 10%. But still there is potential of the same volumes of wood available in nature that can be used.

This can be a good option to develop and maybe export further to other countries where renewable energy is more challenging or not so easily available.

### *Weaknesses*

1. Short history of country leads to lower experience in creating political instruments.

Latvia has restored its independency only a little more than 20 years ago. The policies and their instruments are new, especially the involvement in international treaties. There are some gaps in policies that do not cover some of sustainable forest management criteria in the most appropriate way, which leads to the next weakness defined.

2. The biodiversity target is defined unclearly, and the policy documents still have the highest focus on economic values of forests.

The definition of sustainable forest management in Latvia is different from Finland's. The policy documents are still mainly focused on economic perspectives, while the other sustainability factors are mentioned as recommended but not always required. This reduces the actions especially in the private sector for improvements in the level of biodiversity, health and vitality, as well as to increase the cultural and spiritual meaning of forests. As follows, it leads to the next weakness.

3. High defoliation rate and deadwood volumes imply low health and vitality of Latvia's forests.

There are requirements on the deadwood allowed in forests and the rules on using different chemistry or fertilizers. Still, not enough regulations are set and this has led to low health and vitality of forests. It is observed by high defoliation rate and the share in cubic meters of dead wood in forests (see figures 2.5. and 2.18. in previous section). Exactly governmental institutions have the power to change it by requiring higher standards. If it is done, it also leads to approaching the requirements set by international certification schemes. This would help to certify more private forests under these schemes with no additional requirements than already nationally reached. This is also the principle applied by PEFC, whose requirements by the national certification scheme must reach or exceed PEFC requirements.

4. Most part of renewable energy in Latvia comes exactly from forests showing that the diversification of renewable energy is low and forest materials are used in high levels.

Previously under strength section it was mentioned that there is the same level of available renewable energy from forests that is used already. However, the weakness is that Latvia relies on the forests in renewable energy sector so heavily. If Latvia had lower share of forest area, as some time ago, or less state owned forests, it could lead to situation when the level of renewable energy is below 20-20-20 target. The differentiation would be necessary to have more flexible economy, also several more developed industry sectors etc. At the same time, it is not bad to stay relayed on forests, but then the state must be ready enough to implement necessary regulations in the industry to produce renewable energy by considering the most sustainable management possible.

### *Opportunities*

1. Latvia is the only industrialized country with carbon storage covering more than emitted GHG by other sectors.

Carbon stock in Latvia already covers twice as much as all other industries in country emit. Unused emissions trading quotas (under Kyoto protocol) are sold each year raising an availability of extra funds. These funds are allocated to projects that move forward the “green economy” and renewable energy in Latvia. There is a policy instrument created, called Climate Change Financial Instrument, and it co-finances activities that have the target of fuel or coal technology change to renewable energy, as well as, to renovate different manufacturing or other building, so to reach the energy efficiency targets etc. This leads from good situation to even better, but improvements are still needed in energy efficiency and renewable energy diversification.

2. Latvia is the country in the EU with the highest increase of wooded area in recent years.

This factor gives several gains for Latvia. First it is the competitive advantage, as there is increasing availability of the wood to be used for economic and social benefits - it can be used for developing the forest industry and improving the competitiveness in the EU timber markets (the main focus already now is to increase the higher added value production). Secondly, Latvia can gain the favourable attitude from other countries in further benefit for positioning itself in international treaties. Third, more areas can be with restricted

management to improve the biodiversity and other non-economic values of forests. Even more, if these previously mentioned opportunities are reached, the forests can be also certified under internationally recognized certification schemes. This would lead to further increase in different benefits received. So the next opportunity is defined in relation to certification.

3. The understanding of market based mechanisms that are globally supported has improved. It is shown by the increase in the number of enterprises and forest owners, who had certified their timber chain-of-custody systems. Also all state owned forests are certified under PEFC scheme.

Very important aspect is that all state owned forest lands are certified under international scheme PEFC. This means that at least in half of the total forest land areas there is sustainable forest management implemented. While, the levels of privately owned forests are still low, the positive side is that the number of private forests certified is increasing. The market-based mechanisms are better understood and more often used. It could be argued that it has been low, because in Latvia the market-based economy is still young (the first weakness mentioned). The increase of certified forests improves the situation both in terms of ability to compete in international markets, and also in terms of sustainability in the forests, as is shown that the management is improved in more privately owned forest areas.

4. Currently two to three quarters of all forest sector output is exported, there is a positive trading balance in forestry in Latvia.

Forestry is one of the main industrial sectors in Latvia – it is shown by the high export volumes. As there is no need for so high production domestically, the ability to export gives the income generation based on demand abroad. Still problems arise because of the low value of exported goods. The secondary production must be developed nationally so to export higher added value production. But still high export volumes generate additional income and increase in GDP. There are high opportunities to develop the forest industry within a country, so the primary products can be processed in manufactures and exported afterwards. For improving the situation the chapter two gave information of policy instruments developed that are created to support the education, research and science, investments, entrepreneurship etc.

## *Threats*

1. There are high fluctuations of harvesting in private sector, which means that the sector is highly dependent on export markets and demand.

As the export is unfortunately still based on primary products that come directly after prior processing harvested wood, it is highly dependent on demand abroad. If there is any decrease in secondary production in main export countries, it leads to decrease in export volumes and generated income. If the secondary production would be done domestically, there would be possibilities to either shift to similar or complementary products that have higher demand, or shift the markets, as it was done by Finland – to change the focus to Asia or Middle East. Now the forestry sector in Latvia works more as a supplier for other countries' industries, which makes the sector highly dependent on others and not so consistent and neither flexible.

2. The overall certification level is low, which also shows the need of new policy's requirements and rules, so to improve management in private sector. More strict standards of SFM are needed that would respond to all internationally defined sustainability principles.

Around 50% of total forest areas in Latvia are owned by state, these areas all have been certified under PEFC. At the same time the total certification level was slightly above 50% in 2011. This means that the certification in private sector is extremely low. Only 280 companies had certified their timber-to-custody chains by year 2011. So low certification level in private sector leads to thinking of several problems – firstly, there are not enough regulations in force that would stimulate private sector act in a more sustainable way; secondly, without regulations private owners are not interested voluntarily base their management on sustainability principles, thirdly, the knowledge of certification process is low and not all owners know how to move towards certified lands. This is important threat for the producers to be not accepted in the international markets, and to not be able to increase the value of supplied wood, which is also observed currently.

3. The exported products are often raw materials (as round wood and sawn wood mainly) and other primary sector products, instead of secondary products with higher added value. This shows the problems in development of forest industry.

It is big threat for mismanaging the forests in economic terms. When primary products are sold, they are usually cheap, both because they have no added value and the prices are

forced down of many potential suppliers in the market and high competition. This is not the case for secondary products – they have higher added value, they can be differentiated, they can be moved towards niche markets, also the transportation to further places is worth it, which is opposite to primary products (the transportation increase the cost dramatically, so it cannot be supplied in many markets but only the closest ones). The main threats are dependency on secondary product producers and inflexibility of changing the primary production. Also the low added value generates low income. This is one of the most important challenges now in Latvia, which is already in the top of the list when it comes to new support or policy instruments for industrial development in forestry.

## Finland

### *Strengths*

1. Long history of sustainable forest management, all goals and targets are well defined, measured and monitored.

The first actual forest program has been drawn up already in 1960s and the development towards sustainable forest management has started since then. This has given an experience to test different policy instruments, to better and more precisely define the targets that should be reached, to find ways how the private sector can be involved, to develop funding schemes etc. As well as, the science is well developed and directly involved in improving sustainable forest management in Finland. The overall knowledge gained in national and international levels gives better understanding and tools for further improvements. The targets of policies have been crystallized through time leading to very concrete, precise and well defined goals and instruments to be used in reaching them.

2. High level of forest ha per capita, also high rate of inhabitants owning a forest lands leads to direct involvement of people and society.

As described in previous chapter, more than 60% of commercial forests are privately owned. Because the forests are so common among inhabitants, population creates an important community in terms on forest management. If more people understand the importance of “green” economy and e.g. support reaching the higher share of renewable energy, they have more strength to implement good practice, as they are direct owners of forests. Private individuals and companies have become direct members in decision making by promoting their ideas, targets and visions. The funding scheme for increasing the number of conservation areas also promotes owners to think in more nature friendly way. At the same

time private owners well understand the importance of market-based mechanisms (almost all forests are internationally certified) and it is possible to affirm that they are well educated in sustainable forest management and gives a contribution for reaching national goals.

3. Species planting is done according to distribution in trees age structure. As the stand of spruce are older than young dominant Scots pine and broadleaves stands, the planting in recent years has been increased for spruce to improve the age structure.

It is very important to ensure continues supply of species that are commercially used and utilized. Here in Finland the plantation according to the age structure is introduced. Even if it is usually important in the most countries, not always the plantation plans follow the optimality rules. In Finland the right regulations are in place to approach not only sustainability but also optimality for the economical purpose and needs.

4. The health and vitality of forests is high, which is indicated with low defoliation levels. The specific and important nature especially in northern Finland is saved under conservation areas to expand other non-wood values by forests.

The overall health and vitality of forests is high, even the soil is usually dry and not the most fertile (that is also the reason why pine is the most common specie in Finland). The defoliation rates are low overall (while worse situation than for other trees is for spruce, but this is now ameliorated by new plantations and improving age structure, which will improve the average health). And the most important forests for biodiversity or with specific meaning in terms of landscape, cultural, spiritual and other values are saved under conservation areas, which is extremely widespread in northern Finland (including Lapland). But special programs for southern Finland forests are also created to expand protected areas within commercial forests. In general by several previously described strengths, it is shown that the policy works in linked chain and different actions or instruments supplement each other – to improve age structure for spruce means also to reduce defoliation and improve health of the forests (as it is obvious that older trees have lower health and so the defoliation will be higher). It has been estimated that water and soil protection is good or excellent in 90% of forests with protection purpose. This leads to the next (more or less summarizing) strength.

5. State provides the main functions of forests as health; biodiversity and cultural values etc., while leaving the market with its own mechanisms in place for productive forests, especially through certification system.

It was previously mentioned that the biggest share of commercial forests are owned by private individuals or companies, and at the same time large areas of state forests are under restricted or limited use. The government also gives subsidies to those private forest owners who take actions on increasing the protected forest areas. This shows a good example how governmental institutions can help the private sector to improve their way of managing forests toward implementing more sustainability's principles. Furthermore, approximately 95% of forest lands are certified under PEFC, which says that most of the privately owned forests are also certified. The meaning behind is that, firstly, the most forests are sustainably managed, secondly, private forest owners understands the value of sustainability as good as state, thirdly, market-based mechanisms are common in Finland, fourthly, there are additional competitive advantages for production in Finland, as it comes from internationally certified forests– customers see the quality of the product and the value of growth of the materials.

#### *Weaknesses*

1. Majority of protected forests are in northern Finland, this leads to potential biodiversity loss in the southern part.

Still the southern forests are mostly used for commercial needs and the northern forests for biodiversity needs, which lead to improving non-wood values in north but not so much in south, where different biodiversity can be lost. At the same time government has realized this weakness and implemented a funding project that supports private forest owners to increase the conservation areas in the southern forests.

2. The percentage of middle-aged forests has decreased especially in the southern Finland, affecting the volumes of harvests. Also the overall fall in wood land is observed and improvements in reforestation are needed.

Even the governmental institutions work on supporting plantation to improve age structure, there have some gaps appeared. The planting decreased significantly between years 1985 and 1995, which has led to decrease in middle-aged forests at today. Even more, since 1995 the natural regeneration has decreased twice and no additional planting has been implemented to compensate for it. This leads as in second chapter described to overall loss of forest areas in Finland. This will lead to lack of available mature forests for wood supply and

too young forests could be harvested. The optimality of growth will not be fulfilled in this case, which says that, firstly, the potential carbon stock will not be stored within these forests, the maximum timber yield will not be reached etc.

3. Defoliation is the highest for spruce and it is the only specie (from 4 main analysed on page 34) where slight defoliation (of 0 to 25%) has affected more than one fifth of spruces trees.

This fact comes from the point that the spruces are the oldest in terms of age structure. The older a tree is, the more health decreases and then also the defoliation will be higher. Here the third strength previously mentioned - the planting of spruce in recent years - is the governmental activity to change situation, however, it would be better if it is done in timely manner, then no ageing would appear if planting was started earlier. This timely planting or seeding is also needed in terms of forest health and balance. It is always a risk that new trees will be affected by unpredicted snow weights or storms, which mean that planting today does not always guarantee a raise of trees for the future, and then only regular and timely managed planting can help in creating even age structure and better health of the forests.

4. Diversification of tree species is low, which defines the possible industries that utilize forest resources. This is defined by natural conditions and so the country must more adapt than search for new options.

This is a weakness that Finland is facing without really necessarily political influence on it. The trees differ in the southern Europe and the northern Europe because of the weather conditions. However, the diversification is really low (90% of all trees are pine) and could be improved slightly (which is happening, by increasing plantations of spruce). However, at the end this is only a peculiarity that must be accepted and used in the most appropriate way by the industry.

### *Opportunities*

1. Finland forests cover 11% of total the European forests, which gives opportunity, if correctly utilized, to have a great share in forestry products market.

Owning more than one tenth of all European forests is an opportunity to reach almost the same level of share of industry's markets. Finland is already the main paper and pulp producer in the EU and now it is expanding to supply Asia and Middle-East markets. When

under threats section the low diversification of products was mentioned, Finland has opportunities to use its strong sides and work on expanding its market share internationally.

2. Finland has been granted as a delegator, concerning the inspection from the European part of Russia, which gives competitive advantages not within forest product markets only, but also among the political rating as for trusted the EU delegator and partner.

The science and research, as well as innovations and other supplementary fields for sustainable forest management are in good level in Finland. This background has given Finland an important role within EU and new responsibilities to represent the EU internationally. This gives more opportunities to become trusted partner in international treaties, to increase the number of international projects where Finland participates etc.

3. 95% of all forests in Finland are certified under PEFC system, which leads to competitive advantages in exports and overall sales of forestry products.

The highest share of certified forests in the EU definitely leads to competitive advantages internationally, firstly, for the exported materials and products, where client can be sure about the quality received and the value of the forest from the start; secondly, more connections in scientific sphere can be established – investors can be more attracted and that would give more co-finance to projects in international initiatives.

### *Threats*

1. Not all emissions are absorbed, neither the targets of 20-20-20 is possible to reach. Finland is the only the EU member state in which annual forest carbon sink credits are insufficient to offset the annual emissions from deforestation and afforestation.

The bad GHG balance for Finland is an international threat as it is the only country, which cannot cover at least the emissions from deforestation and afforestation. By the nature the species that growth in Finland (and also in Latvia) are not that store the highest possible volumes of carbon, however, the most important storage source is still the soil and litter. As the natural regeneration has decreased over time, it shows the reducing productivity of soil in Finland's forests, which also limits the possible carbon storage. This fact also says that harvesting volumes are too high, firstly, because the total forest land area is decreasing leading to decrease in carbon sinks, and, secondly, the often used clear cuts damage the soil significantly. In my opinion there should be more effort done on improving the soil condition

so the carbon storage can increase, as well as the natural regeneration recovers and rise, and promotes all other benefits that comes from it.

2. Too high share of paper and printing material production gives fewer opportunities to balance the industry in times of economic recession.

The threat for Finland now is the high dependency on paper and pulp product exports and demand for these products from EU mostly. Already now Finland has seen the need for growing internationally and has moved towards Asian and Middle-East markets. The EU member states are too connected in their production chains, so it always threatens any member to be out forced from market whenever production is going to be changed or any other company goes bankruptcy. Diversification within production or markets must be improved.

### **3.2. The Comparison of Sustainable Forest Management between Finland and Latvia**

There are both common and different properties found when previously sustainable forest management (SFM) in Finland and Latvia have been analyzed. When both countries are covered by the same mean tree species as spruce, pine, birch, which is because of similarities in weather and soil conditions, in Latvia the distribution between coniferous and deciduous forests is more even, but in Finland 90% of forests are with coniferous. And this is only one of the all differences that actually both countries have.

In the differences between both countries, firstly the history has played an important role. Finland has stronger understanding of sustainability within forest area and the meaning of other non-economic and social values, as health, biodiversity and protective functions. When setting and defining the political goals by introducing them in legacy documents – there are still lessons to be learned and approaches to be developed, as previously discussed – not only the target is important, but also the way it has been reached.

The export is important both in Finland and Latvia; the forest sector contributes to around one fifth of the total export volumes in both countries. So it is meaningful income generator and GDP creator. At the same time the differences is that Latvia exports mainly round-wood and sawn-wood, and other primary wood goods, while Finland has big exports in paper and pulp production and some in other secondary products. This shows the weakness in Latvia to generate high added value (secondary) products. Instead low added value products are exported, so the income is lower than it potentially could be. This means also that the industry has low development level, as volumes of secondary products produced are not high. At the same time Finland still has opportunities to improve their trading strategy, by increasing the differentiation both in terms of markets but also in terms of products.

The health and vitality of forests is lower in Latvia than in Finland. In Finland only 10% of forests have been affected by 25 to 60% defoliation rate, versus in Latvia around 60% of all trees have been affected by this high defoliation rate – this difference is dramatic. Also the deadwood in m<sup>3</sup> to each hectare of forests is three times higher in Latvia than in Finland.

Latvia has a good GHG balance as a country and the carbon storage covers all other sector's emissions versus Finland has negative carbon storage balance and it cannot even cover the CO<sub>2</sub> volumes emitted by deforestation and afforestation nationally. Finland needs to work on reaching 20-20-20 goal very hard; there is no way to achieve it if no new drastic changes are implemented. At the same time, both countries are really good at renewable energy targets – Latvia on the first place and Finland on the second place in the EU in terms of renewable forest sector materials for primary energy production.

Latvia has also showed a good example how the government can step in when help for the industry is needed. The total regeneration after crisis was low by private sector, so the state improved the sustainability in terms on continues forest growth by increasing planting and seeding in state forests – this was incentive policy implemented. While in Finland the regeneration decreased since 1980s with even more decrease after global economic crisis.

The one of the biggest difference is also in certification levels – while in Latvia all state forests (approximately 50% of total forest lands) but only small share of private forests are certified under PEFC, in Finland 95% of all forest lands have been certified by this certification scheme. This gives a competitive advantage in international markets for Finland. And it also says that private forests in Latvia are actually not enough sustainably managed.

Overall both countries have showed their SWOT factors. There are good lessons to be learned from each of country. If really the good practice from Latvia and Finland is implemented in any other country, this would lead to better SFM in EU overall.

In the third chapter the final comprehensive analysis for sustainable forest management in Finland and Latvia were given by using as a tool - the SWOT analysis. The information was fully based on findings from second chapter and additionally my own view and discussion on each of the factors were given. Here the very main outstanding matters have been mentioned and described, and compared between both countries. The research question has been answered: the main SWOT factors have been defined and compared. These findings give a broad understanding of sustainable forest management in each country; the focuses for future have been mentioned. I have also suggested the actions to be implemented and how the policies should be improved. I hope this has been an analysis that governmental institutions could use when thinking about new needs for the forestry management and industry.

## **Concluding remarks**

Both Finland and Latvia have created policy instruments to implement sustainable forest management. Each has protected and protective areas, actions for health and vitality, while also focusing strongly on economic perspectives. As forests cover large areas of land, it has become an important economic growth generator and is one of the main trading sectors in both countries. However, while in Finland the paper production is highly developed and other secondary wood products are produced, Latvia has mainly primary products exported, which leads potentially to lower added value and income generated.

In Latvia the forest health and vitality should be improved, as now the defoliation rate is high and damages happen intensively from time to time. However, in Latvia there is the largest share of protected areas in the European Union, which is 20 – 25% (depends on buffer zones included), and it is followed by Sweden and Estonia and then Finland (9 – 11%). All state owned forests have been certified, while it is not the case with privately owned forests. This means that, sustainable forest management should be improved in private sector to be able to reach international certification requirements. The set targets of increments of annual growth are almost fulfilled every year, which shows the importance of correct target setting and importance of policy (and calculations behind). Latvia is the only country which has a positive GHG balance. Also the level of renewable energy is high, already above 20-20-20 target, and forests have the biggest share in primary energy production from renewable materials. Still, Latvia needs stronger focus on higher added value production and exports.

Finland has very strong political believes and it feels really engaged in international treaties. The political strength does not come from governmental institutions or leaders only, but also from private forest owners, who own the biggest share of commercial forests. They are stimulated through different policy instruments, such as subsidies to supply non-wood products and be involved in expanding protected and conservation areas. The forest economics is built on mainly one tree species that is defined by nature conditions. Main products produced are paper and printing materials, where demand in Europe decreased slightly so the expanding is now focused on third countries (Asian and Middle-East markets). As diversification of exported forest products is low, the global economic crisis had its effects on production volumes and employment. Almost all forest land areas are certified giving a strong competitive advantage in the international markets, providing client with high quality products; it also states that almost management over private forests also fulfils the internationally set requirements for sustainable forest management.

## **Discussion and suggestions**

This paper shows that sustainable forest management (SFM) is complex many criteria goal that can be reached by using different tools and approaches. The most important to be mentioned is that SFM can be measured by criteria and indicators and so for analysed and compared. Then more concrete needs can be found and also supported by government to solve the issues or give support for private sector to proceed towards sustainability goals. The paper gives inside on weak sides and threats that each country could solve. However; the target can be reached in different ways, SFM is the process not the result. The paper also proves that under similar climate and weather conditions, as well as having the same most common tree species, it does not necessarily lead to similarities in industrial sector.

The research question of the paper has been answered – the final theses for each of the SWOT factors are given for Finland and Latvia, as well as both countries have been compared. Main SWOT points that are given are immediately usable information for new tools to be implemented in country's policies. It is well defined how country has developed their forest sector and what would be next steps to take for further development. It has also shown how important well-defined policy targets are and what effects directly they have on management and actions in private sector. It can stimulate not only to increase harvesting levels as in Latvia, but also to expand protected forests in private forest land areas as in Finland. Also the case when state can replace the functions of private sector to evolve SFM and to recover the industry at the same time was presented.

For improving findings of the paper, the taxation system and subsidiaries mechanisms by country could be analysed. These financial instruments directly change the equilibrium of the market and it can promote or restrict sustainable forest management, as well as to develop the production in forestry sector and its exports.

Main suggestions – for Finland the focus should be moved forward to GHG balance and how to improve it by not so much reducing deforestation but more increasing the regeneration of forests. In Latvia's case, firstly, more specific target of biodiversity, forest health and vitality, and non-wood goods should be defined. Then the certification could be developed, and that would lead to higher competitiveness.

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## **Appendixes**

### Appendix No.1

*The six pan-European sustainable forest management criteria and their indicators introduced by FOREST EUROPE.*

Criterion1: Maintenance and Appropriate Enhancement of Forest Resources and their Contribution to Global Carbon Cycles.

Indicators:

- 1.1. Forest area;
- 1.2. Growing Stock;
- 1.3. Age structure and/or diameter distribution;
- 1.4. Carbon Stock.

Criterion2: Forests Ecosystems Health and Vitality.

Indicators:

- 2.1. Deposition of air pollutants;
- 2.2. Soil condition;
- 2.3. Defoliation;
- 2.4. Forest damage.

Criterion3: Maintenance and Encouragement of Productive Functions of Forests (Wood and Non-Wood).

Indicators:

- 2.1. Increment and fellings;
- 2.2. Round wood;
- 2.3. Non-wood goods;
- 2.4. Services;
- 2.5. Forests under management plans.

Criterion4: Maintenance, Conservation and Appropriate Enhancement of Biological Diversity in Forest Ecosystems.

Indicators:

- 3.1. Tree species composition;
- 3.2. Regeneration;

- 3.3. Naturalness;
- 3.4. Introduced tree species;
- 3.5. Deadwood;
- 3.6. Genetic resources;
- 3.7. Landscape pattern;
- 3.8. Threatened forest species;
- 3.9. Protected forests.

Criterion5: Maintenance and Encouragement of Protective Functions of Forests (Wood and Non-Wood).

Indicators:

- 4.1. Protective forests – soil, water and other ecosystem functions;
- 4.2. Protective forests – infrastructure and managed natural resources.

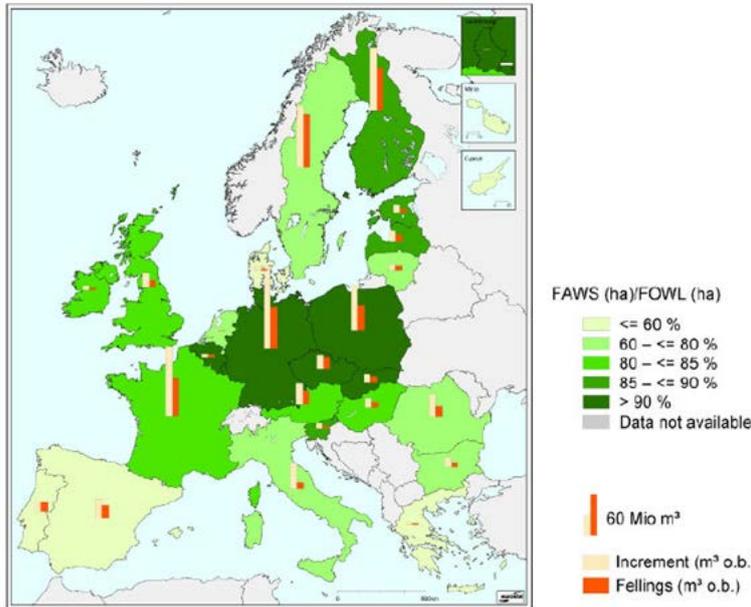
Criterion6: Maintenance and Encouragement of Productive Functions of Forests (Wood and Non-Wood).

Indicators:

- 6.1. Forest holdings;
- 6.2. Contribution of forest sector to GDP;
- 6.3. Net revenue;
- 6.4. Expenditures for services;
- 6.5. Forest sector workforce;
- 6.6. Occupational safety and health;
- 6.7. Wood consumption;
- 6.8. Trade in wood;
- 6.9. Energy from wood resources;
- 6.10. Accessibility for recreation;
- 6.11. Cultural and spiritual values.

Appendix No.2

*Forests Available for Wood Supply from total Forests and Other Wooded Lands in Europe*  
 [Eurostat Pocketbooks (2009), p.23]



Appendix No.3

*Forest Age structure in Latvia for main tree species* [Muiznieks A. 2012]

