



MANAGEMENT  
AND  
PROTECTION  
IN ESTONIA



## INTRODUCTION



Estonia has always had close relationship with forests. This also holds for the present time as almost one half of the Estonian territory is covered with forests, wood industry counts for 1/7 of our manufacturing industry, forest products give 13% of the total export value and we have 58 000 private forest owners in addition to the state as the biggest landowner.

The aforementioned proves that forest play a vital role both in the country's economy and in performing social functions. This means that we have to pay even more attention to the preservation of the ecological balance.

The rapid emergence of private forest ownership and private forest owners, abrupt development of the forest and wood industry and the increased possibilities of our society have all affected forestry in the last five years.

This report presents a review of what has happened in the Estonian forestry in the last years and which decisions the Estonian state has taken to direct forestry. The essence of the Estonian Forest Policy approved by the Parliament in 1997, the Forest Act adopted in 1998 and the Forestry Development Programme until 2010 (the latest major forestry-related public document, approved by the Parliament on November 13, 2002) will be presented. All these documents have one common goal – sustainable forestry, which means such forest management and forest utilisation that will enable our successors to feel themselves citizens of a country rich in forests.

A handwritten signature in black ink, consisting of a horizontal line followed by a stylized, cursive name.

Mr Olav Etverk  
Head of the Department of Forestry  
Estonian Ministry of the Environment

<b>INTRODUCTION</b>	<b>2</b>
<i>Olav Etverk</i>	
<b>CONTENTS</b>	<b>3</b>
<b>MAIN PRINCIPLES OF THE SUSTAINABLE FOREST MANAGEMENT</b>	<b>4</b>
<i>Kalle Karoles</i>	
<b>GENERAL MEASURES TO PROMOTE SUSTAINABLE FOREST MANAGEMENT</b>	<b>6</b>
<i>Kalle Karoles, Indrek Laas, Mati Valgepea</i>	
<b>Forest Policy and Institutional Framework</b>	<b>6</b>
<b>Legal/Regulatory Framework</b>	<b>7</b>
<b>Public forest administration</b>	<b>8</b>
<b>Forestry-related information</b>	<b>8</b>
<b>Development and Research Programmes and Projects</b>	<b>8</b>
<b>DATA ABOUT QUANTITATIVE INDICATORS ACCORDING TO THE PAN-EUROPEAN SYSTEM OF INDICATORS FOR SUSTAINABLE FOREST MANAGEMENT</b>	<b>11</b>
<b>CRITERION 1. MAINTENANCE AND APPROPRIATE ENHANCEMENT OF FOREST RESOURCES AND THEIR CONTRIBUTION TO GLOBAL CARBON CYCLES</b>	<b>12</b>
<i>Ülo Viilup and Endla Asi</i>	
<b>CRITERION 2. MAINTENANCE OF FOREST ECOSYSTEM HEALTH AND VITALITY</b>	<b>20</b>
<i>Kalle Karoles, Endla Asi and Heino Õunap</i>	
<b>CRITERION 3. MAINTENANCE AND ENCOURAGEMENT OF PRODUCTIVE FUNCTIONS OF FORESTS (WOOD AND NON-WOOD)</b>	<b>26</b>
<i>Ülo Viilup and Mati Valgepea</i>	
<b>CRITERION 4. MAINTENANCE, CONSERVATION AND APPROPRIATE ENHANCEMENT OF BIOLOGICAL DIVERSITY IN FOREST ECOSYSTEMS</b>	<b>35</b>
<i>Kaili Viilma, Tõnu Terasmaa and Vahur Siimon</i>	
<b>CRITERION 5. MAINTENANCE AND APPROPRIATE ENHANCEMENT OF PROTECTIVE FUNCTIONS IN FOREST MANAGEMENT (NOTABLY SOIL AND WATER)</b>	<b>44</b>
<i>Ülo Viilup</i>	
<b>CRITERION 6. MAINTENANCE OF OTHER SOCIO-ECONOMIC FUNCTIONS AND CONDITIONS</b>	<b>46</b>
<i>Mati Valgepea</i>	
<b>GLOSSARY OF THE DEFINITIONS USED</b>	<b>50</b>
<b>USEFUL CONTACTS</b>	<b>54</b>
<b>ANNEX</b>	
<b>IMPLEMENTATION OF THE COMMITMENTS OF RESOLUTIONS L1 AND L2</b>	<b>55</b>

## **MAIN PRINCIPLES OF THE SUSTAINABLE FOREST MANAGEMENT**

Forests play a significant role, providing different kinds of ecological, economic, social and cultural values. They are essential for the long-term well being of local populations, national economies, the maintenance of all forms of life and the earth's biosphere as a whole.

Forestry today is facing perhaps the biggest challenge in its history: there are more questions than answers, and they are coming more and more often from outside the forests and forestry (Rykowski, 2001). Forest policy is closely linked with environmental, agricultural and rural development policy, industry, energy and other sectors.

The leading principle of forest management is sustainability at ecological, economic, social and cultural level. In general, a political process to promote sustainable forest management has been adopted by all countries (Sector report on Forests ..., 1999)

Sustainable forest management means the stewardship and use of forests and forest lands in such 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, at local, national, and global levels, and that does not cause damage to other ecosystems (MCPFE, 1993).

“Forestry issues and opportunities should be examined in a holistic and balanced manner within the overall context of environment and development, taking into consideration the multiple functions and uses of forests, including traditional uses. National policies and strategies should provide a framework for increased efforts, including the development and strengthening of institutions and programs for the management, conservation and sustainable development of forests and forest land (Forest Principles, 1992).

The development and implementation of criteria and indicators for the conservation and sustainable management of forests is an important step in implementing sustainable forest management. An indicator is something that helps you understand where you are, which way you are going and how far you are from the target situation where you want to be. They also provide a common framework for describing, assessing and evaluating a country's progress towards sustainability at the national level.

In accordance with the MCPFE 'criteria characterise or define the essential elements or a set of conditions or processes by which sustainable forest management may be assessed' (MCPFE, 1998a). The 'indicators show changes over time for each criterion and demonstrate the progress made towards its specified objective' (MCPFE, 1998b).

Pan-European indicators are not meant for the direct assessment of sustainability at the forest management unit or operational levels. Individual criteria and indicators should be considered in the context of other criteria and indicators and will need to be assessed as trends or with a historical perspective to establish trends. Given the wide differences in natural, economic and social conditions among countries, the specific application and monitoring of the criteria and indicators, as well as the capacity to apply them, vary from country to country based on national circumstances.

The framework and structure of the following report is based on the MCPFE system of criteria and indicators approved by ministers in Lisbon 1998.

## List of publications

MCPFE (1993): **Second Ministerial Conference on the Protection of Forests in Europe, 16–17 June 1993 in Helsinki**, Documents. Resolution H1.

MCPFE (1998a): **Third Ministerial Conference on the Protection of Forests in Europe. General declaration and resolutions adopted. Resolution L 2**. Liaison Unit in Lisbon (Ed.), June 1998.

MCPFE (1998b): **Third Ministerial Conference on the Protection of Forests in Europe. Follow-up Reports on the Ministerial Conferences on the Protection of Forests in Europe**. Volume II. Liaison Unit in Lisbon (Ed.), June 1998.

Rykowski, K. 2001. **Future challenge to ensure sustainable forest management. Some remarks from European, Polish and Global perspective**. – In: Forests and Forestry in Central and Eastern European Countries. International Workshop, September 2001, p. 61–72.

**Sector report on Forests 2. Forest sector in the Baltic Sea region**. – In: Baltic 21 Series No 5/98. Stockholm, 1999, 84 p.

**Statement of the principles for a global consensus on the management, conservation and sustainable development of all types of forests** (Rio de Janeiro, 1992).

# GENERAL MEASURES TO PROMOTE SUSTAINABLE FOREST MANAGEMENT

## Forest Policy and Institutional Framework

The present report gives an overview of progress towards sustainable development in the Estonian forest sector.

In Estonia the **Ministry of the Environment** has the leading role in preparing the environmental and forest policy and the corresponding legislation. Since the beginning of the 1990s important steps on the way towards sustainable development were the elaboration of the **Sustainable Development Act** approved by the Parliament in 1995 and the **National Environmental Strategy** approved by the Parliament in 1997. To implement the Strategy the **Ministry of the Environment** has launched a detailed **National Environmental Action Plan**.

The positions fixed in the **Estonian Agriculture and Rural Investment Support Program for 2000–2006** (the **Rural Development Plan**), which provides the list of rural development measures are essential for developments in the forestry sector.

The **Ministry of the Environment** launched the **Estonian Forestry Development Programme** with the principal task of formulating the **National Forest Policy** in 1995 already. The **National Forest Policy** presents the principal ideas of forest policy development and implementation in Estonia, including following principal issues as strategic target setting, the functions of the state in the forest sector, reorganization of the public forest administration, establishment of an appropriate balance between forest production and conservation and provision of aid and assistance to private forest owners.

**The Estonian Forest Policy (EFP)** was approved by the Parliament in June 1997. The long-term objectives of forest management are fixed in the document.

According to the **EFP**, the following two principal and closely linked objectives for the Estonian forestry sector are:

- **sustainable forestry;**
- **efficiency in forest management.** (Estonian Forest Policy, 1997)

Pursuant to the **EFP**, the area of state-owned forests shall be at least 20 per cent of the area of the mainland of the Republic of Estonia in order to ensure the stable state of the environment, as well as the diversified use of forests.

In order to implement the **EFP**, the **Ministry of the Environment** decided in 1999 to launch the elaboration of the **Estonian Forestry Development Programme (EFDP)** for a ten-year period. All the major stakeholders within the forest sector – the public forest administration, research organisations, environmental NGO-s, the forest industry, the Private Forest Owners' Association, etc. participated in the drafting of the plan.

Six priority areas were determined, which have been thoroughly discussed in the workgroups during the preparation of the **EFDP**:

- purposeful use of forest lands that are temporarily in state ownership and not restituted or privatized to date;
- setting of objectives for the activities of the State Forest Management Center and the assessment of results;
- prevention of illegal forestry and the violation of forestry law provisions;
- determination of the share and location of strictly protected forests;
- calculation of optimum level of fellings;
- development of extension and support systems for private forest owners (Forestry and ..., 2001).

The first draft of the document was completed by June 2001, the second, revised version by April 2002 and in June, 2002 the Government approved the document. After the Parliament's approval in 2002 the document gained the status of the official sustainable development strategy for the Estonian forest sector.

The **EFDP** for a 10-year period is a concerted effort to define the development needs and priorities of the forest sector through a well-balanced and participatory process. The Programme presents a number of objectives, measures and an evaluation process that together have to ensure the sustainable management of Estonian forests in general. The document specifies the major programs requiring support from public funding.

## Legal/Regulatory Framework

The **Forest Act** (FA) was approved by the Parliament in December 1998. In the elaboration process of the FA the concept, positions and understanding, fixed in the Strasbourg, Helsinki and Lisbon resolutions of the Pan-European Ministerial Process of Forest Protection have been used.

The Forest Act came into force from the beginning of 1999. It aims at the promotion of economically, ecologically and socially sustainable forest management. According to the Act, different production and environmental functions and goals, as well as social aspects of sustainable forest management have equal priority. The Act applies to both private and state forests, providing the legal basis for the work of the public forest administration and the State Forest Management Center.

The FA obliges all the forest owners to manage their forests in a sustainable way, simultaneously considering the multiple functions of forests.

According to the FA, forest owners shall notify County Environmental Services about their planned silvicultural measures, fellings and forest damages. These notifications form a basis for the monitoring and supervision of planned and implemented forest management activities in private forests.

Some silvicultural principles, fixed in the Forest Act:

- the owner of a forest is required to reforest all the clear cut areas and perished parts of protection and commercial forests with an **area of more than 0,1 ha in three years** after the felling or perishing thereof;
- **twenty to seventy pines, birches, ashes or oaks** per one hectare shall be left on regeneration felling areas as the seed trees, also some deadwood, groups of natural regeneration and key habitats;
- upon natural regeneration or reforestation, the minimum closing time for pines and valuable broad-leaved trees shall be **four years**, for spruces **three years**;
- the regeneration felling of pine or broadleaved tree stands which are younger than a **hundred years**, spruce stands which are younger than **eighty years** and birch stands which are younger than **seventy years** is usually prohibited;
- the maximum area of regeneration felling in commercial coniferous forests is limited to **5 ha**.

**In 2002–2003 the Forest Act** is being revised as a follow-up to the new **Estonian Forestry Development Programme**. The revision is aimed at creating a more comprehensive legal framework taking into consideration various aspects of sustainable forest management and emphasizing the creation of new restrictive conditions for illegal forestry-related activities in the private sector.

The **Nature Conservation Act** provides the framework for nature conservation and management of protected areas in Estonia, including the protected forest area network. The **Planning Act** provides guidelines for regional planning, including the identification of areas reserved for potential afforestation, recreational areas and areas of high environmental value.

## Public forest administration

Following the approval of the Estonian Forest Policy, the public forest administration was reorganized in 1998–1999. Clear distinction was made between the administrative and commercial functions of the administration, and as a result two separate institutions were established:

- The Estonian Forestry Administration under the Ministry of the Environment consists of the Forest Department (established on 01.01.2000 as a result of the reorganization of the former Estonian Forestry Board), 15 County Environmental Services, the Environmental Inspectorate and the Center of Forest Protection and Silviculture. These institutions are responsible for policy implementation, supervision, forest inventory, forest monitoring and extension services.
- For the management of state forests, the State Forest Management Center, a profit-making state agency is responsible. Balanced development through the enhancement of the economic, social and environmental values of forests has been defined as the primary goal of the organization.

## Forestry-related information

The national forest inventories data collection and processing system will be based on the **State Register of Forest Resources**, which is in the stage of elaboration and implementation. The collection of information on several indicators of sustainable forest management will also be based on the Register.

In 1998 work for the establishment of the **sample-plot based National Forest Inventory** was commenced. The inventories have been organized by the **Ministry of the Environment** and carried out in 1999–2001. The methodology of statistical forest inventories is currently under development. The role of the National Forest Inventory is to provide unbiased, reliable information on forest resources and conditions in large areas. The inventory provides decision-makers with consistent, reliable and up-to-date information on forests. The information has been used to draft the Forestry Development Programme, to monitor and evaluate the National Forest Policy, to determine annual felling and regeneration volumes and in the strategic planning of the forest sector.

The State Forest Management Center elaborated its own **new information system for the management of state forests** based on its accounting system and a GIS-based database of forest resources.

In Estonia, **forest monitoring pursuant to the ICP-Forest Manual** was introduced in 1988 already at 91 permanent sample plots. The extension of the national network of level 2 permanent sample plots for the monitoring of forest ecosystems has continued. Currently there is a network of sample plots in consistence with the EU scheme.

Forestry-related statistical information has been systematically collected. The **“Yearbook of Forest”** has been prepared and published annually since 1995.

## Development and Research Programmes and Projects

### *Conservation of biodiversity in commercial forests*

The objective of the project was to prepare guidelines for sustainable forest management and the preservation of biological diversity, as well as to train forestry planners to ensure the compliance of all forest management plans with the nature and environmental protection considerations. The final version of “The Biodiversity Management Strategy for Commercial Forests” was drafted in 1999. The strategy gives a number of recommendations for improving biodiversity protection and sustainable management methods in the forests. The document emphasizes the revival of the ecological network concept as well as the introduction of the woodland key habitat concept as the basic tools for the preservation of biodiversity in commercial forests.

**Green Forest Management Planning** started in Estonia in the year 2001 in cooperation with the Swedish National Forestry Board. Now green forest management plans for 2 pilot areas have been completed.

In 1998 the preparatory work for **the inventory of woodland key habitats in commercial forests** was started. The term key habitat is formulated in the Forest Act. The project is coordinated by the Forest Department, Ministry of the Environment in collaboration with the experts from the Swedish National Forestry Board.

6009 key habitats with the total area of 15078 ha (8818 ha in state forests, 3304 ha in private forests and 2955 ha in forests subject to privatization) were recorded and mapped in 1999–2001. The estimated average area of a key habitat was 2,5 ha (Forestry and hunting .., 2001). During the inventory in 2002, the location of 998 additional key habitats was registered. The protection of woodland key habitats is based on the contract between the state and the forest owner. But some of the bigger selected key habitats will prospectively be protected by law.

### ***The inventory of forest protection areas and the development of the forest protection area network***

The target set in the **Forest Policy** was to increase the area of strictly protected forests to 4% of the total forest area. According to the **Estonian Forestry Development Programme** the new goal is fixed **at 10% level**.

Field works of the inventory of the existing and planned protected areas were carried out mostly in 1999–2001 in the cooperation of Estonian and Danish experts. More than 30 000 ha of new potential protected forests were proposed by the project. Criteria for inventories have been harmonized with Natura 2000 principles. In all the proposed public forest areas of high environmental value the managers have interrupted forest management activities; in the later stages the protection will mainly be based on the Nature Conservation Act.

More than 51 800 ha of forests are already included in the network of strictly protected areas, in addition to about 1000 ha of individual protected objects. 32 000 ha of forests belong to the zones of protected areas with no active intervention or minimum intervention. About 5000 ha of forests are located in forested wetlands. Altogether more than 7% of the forests are currently under protection.

### ***Drafting and implementation of the Estonian Sustainable Forest Management Standard***

The national workgroup on forest certification was established in November 1998. The workgroup started from the collection of relevant background information and organized a number of seminars on the existing forest certification schemes and international requirements set to forest certification. The main task was to draft the Estonian Sustainable Forest Management Standard, based on FSC 10 Principles and 56 Criteria (FSC P&C), which was completed and acclaimed as a national agreement in December 2000.

In 2001 certification on practical level was commenced and in 2002 the Estonian state forests (38% of all the forests) were granted a FSC and ISO 14001 Forest Management certification. From the private forestry side, the biggest certified property belongs to Lembit Laks (certified land area 517 ha). There are 9 FSC Chain of Custody certified wood processing companies in Estonia today. In 2001 the formulation of the Estonian PEFC Standard was commenced. The standard was completed in September and field-tested in the autumn of 2002.

### ***Some silvicultural measures and activities***

**To increase the relative share of hardwood forests the projects for the sustainable management of hardwood stands and the afforestation program** were launched in 1999 in collaboration with experts from the Swedish National Forestry Board.

The implemented hardwood project includes training and the establishment of the network of 15 sample and demonstration areas in private forests in each county.

### ***Extension services to private forest owners***

At the moment there are about 0,82 million ha of privately owned forests in Estonia. Another 0,56 million ha are subject to privatisation in the near future. The average size of a forest property is 10 ha. More than 70% of the forest owners are willing to manage their forests in a sustainable way, 20% would maintain them as is and less than 10% are planning to sell their properties.

In order to contribute to sustainable forest management, private forest owners are publicly supported by:

- forest management planning;
- extension services;
- co-financing of silvicultural investments.

The amount of support to private forestry has recently been 0,4–0,7 MEUR per year. The majority of this is allocated to forest inventories and forest management planning.

The preparation of forest management plans for private owners started in 1992 in connection with the start of the land reform. All the owners are entitled to receive forest management plans. The costs of forest survey and management planning are covered from the state budget. Among the measures financed from public funds, the preparation of forest management plans has the longest tradition and biggest share of financing, being 0,3–0,6 MEUR annually.

Extension services are mainly provided by the forestry specialists of County Environmental Services and private forestry consultants. Counselling in forest protection and plant production is the task of the staff of the Center of Forest Protection and Silviculture. The Ministry of the Environment and the Center of Forest Protection and Silviculture have also carried out various awareness raising campaigns (booklets, seminars etc.). The costs of the services have largely been covered by the state.

Due to limited financial resources, co-financing of silvicultural investments has only been available for some years. Currently soil scarification and pre-commercial thinning to improve the future quality of stands are supported.

The Estonian Rural Development Plan 2000–2004 (SAPARD Programme) makes available afforestation investment support aimed at better land use. Support will be provided mainly for purchasing forest reproductive material, planting and soil scarification. The contribution of the public sector for 2003–2006 will be 0,145 MEUR. The afforestation measure will continue after Estonia's EU accession, based on the Rural Development Plan 2004–2006.

The Single Programming Document 2003–2006 will also provide investment support for forestry-related investments to contribute to the maintenance and development of the economic, ecological and social functions of forests in rural areas.

## List of publications

**Estonian Forest Policy.** Estonian Forestry Development Programme. Tallinn, 1997, 12 p.

**Estonia (National report)** - In: Follow-up reports on the Ministerial Conferences on the Protection of Forests in Europe. Volume II: Lisbon, 1998, p. 116–124.

### **Estonian Rural Development Plan 2000–2004**

**Forestry and hunting.** – In: Ministry of the Environment of the Republic of Estonia, Tallinn, 2001, p. 17–18.

**DATA ABOUT QUANTITATIVE INDICATORS  
ACCORDING TO THE PAN-EUROPEAN SYSTEM OF  
INDICATORS FOR SUSTAINABLE FOREST MANAGEMENT**



## Criterion 1

### MAINTENANCE AND APPROPRIATE ENHANCEMENT OF FOREST RESOURCES AND THEIR CONTRIBUTION TO GLOBAL CARBON CYCLES

#### Indicator 1.1.

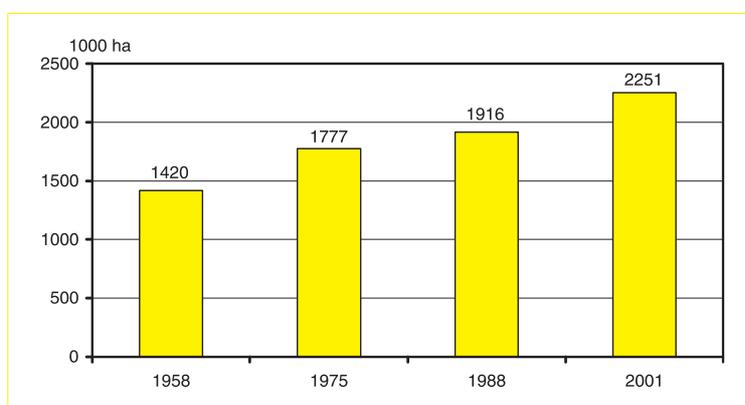
##### Area of forest and other wooded land and changes in area

According to the Forest Act (FA) (1998) forest is defined as a site of woody vegetation with an area of at least 0,5 ha which meets at least one of the following criteria:

- 1) the height of the trees is at least 1,3 m and the canopy density at least 30 per cent;
- 2) it is managed for obtaining timber or other forest produce, or woody vegetation is maintained there for the use in the ways specified in this Act.

The Estonian FA divides forest land by soil productivity into productive forest land (with annual increment of at least 1 m<sup>3</sup>/ha), and other wooded land (non-productive forest land, scrubland). The area of forests and the development of forest resources has been monitored for a long time mainly on the basis of stand-wise forest inventories, but since 1999 also National Forest Inventories (NFI) based on the sampling method have been carried out.

During the second half of the XX century the area of forest land has been constantly and quite rapidly increasing (from 1,42 mill. ha in 1958 to 2,25 mill. ha in 2001). The area of other wooded land based on the NFI data is 87 thousand ha and the total area of forest land and other wooded land is 2,34 mill. ha.



Source: Estonian Forest Survey Center

Figure 1.1.1. Changes in the area of forest land (1000 ha)

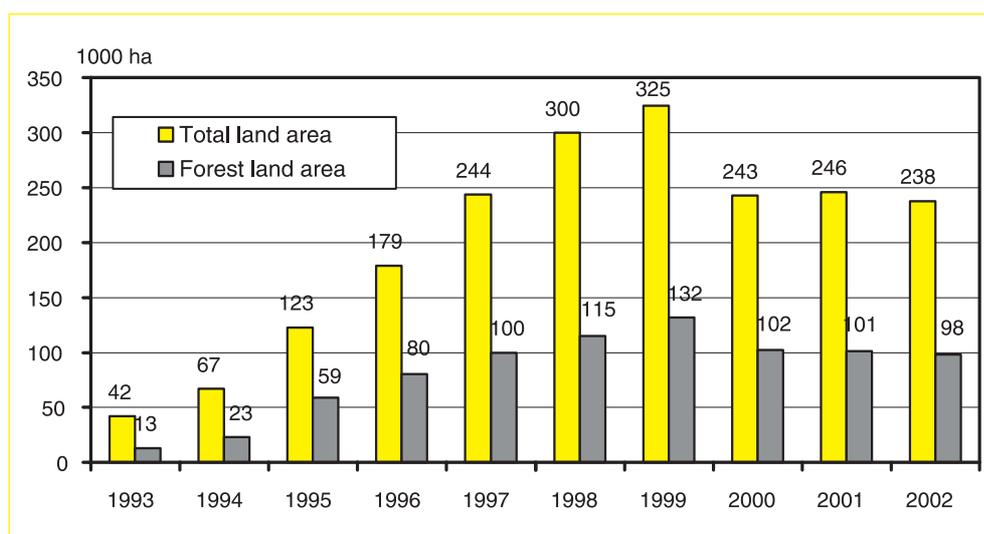
Forests cover more than a half (51,5%) of Estonia's mainland territory (without Lake Peipsi) and together with other wooded land – 53,5% of the mainland territory. The main reasons behind the increase in forest area have been the afforestation of non-used agricultural areas and the drainage of wetland areas between 1960–1980. The methodological differences of sample-plot based inventory (NFI) and stand-wise inventory could also affect the estimates. The annual average increase in forest area has been 19 300 ha between 1958 and 2001. There will probably be a continuous increase in forest area in the next decades due to low demand for agricultural land. Natural afforestation will mainly take place and forest area can expand to 2,5 mill. ha in 20–30 years.

As the density of population of Estonia is rather low (31,2 inhabitants per square kilometer), there is 1,65 hectares of forest land and 1,72 hectares wooded land per capita. These indicators surpass the World and European average and also the corresponding indicators of many European countries.

According to the NFI results, forest area available for wood supply has been estimated to be 2,11 mill. ha (about 93% of forest area and 90 % of the total area of forest and other wooded land). About 139 thous. ha of forest land have been classified as forest not available for wood supply due to conservation reasons and other wooded land (87 thousand ha) for economic reason.

## Ownership structure

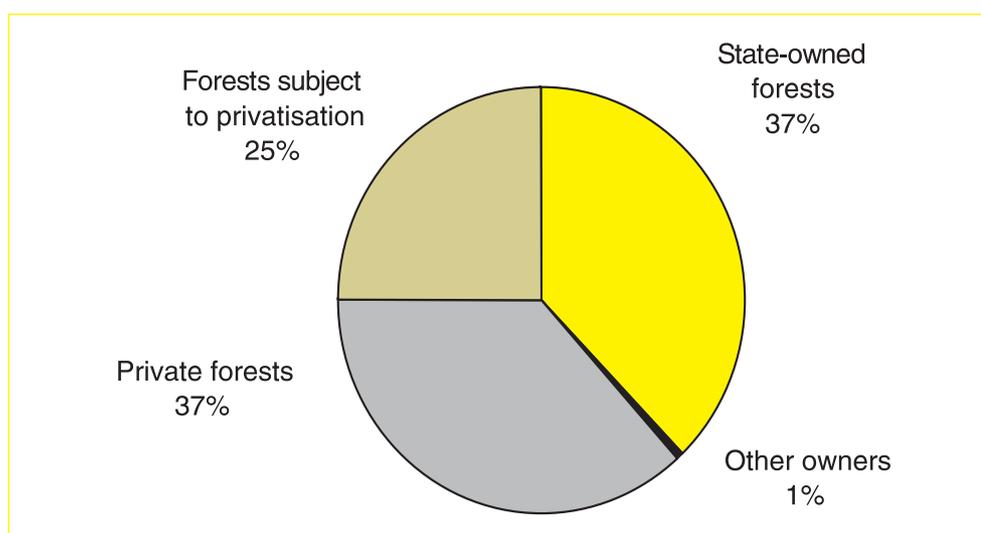
After the Second World War, during the period of Soviet occupation the state became the sole owner of forests. In that period about 60% of forests were managed by state forest enterprises, 37% by collective and state agricultural farms and 3% by the military forest enterprise. After the regaining of independence in 1991 the restitution and privatisation process started. The land and forest nationalized by the state in 1940 is now being returned to the owners or their inheritors or privatised by selling pursuant to law. The results of privatisation are shown in the following chart.



Source: Estonian Forest Survey Center

Figure 1.1.2. Registration of privately owned land in the Land Cadastre (1000 ha)

By the end of 2002, 3,1 mill. ha of land (of which 1,7 mill. ha of forest land) has been registered in the Land Cadastre and 1,2 mill. ha of land (0,6 mill. ha of forest land) will be registered in the next 3–4 years to complete the land reform. The ownership structure of forest land by the end of 2002 year is shown in the following chart



Source: Estonian Forest Survey Center

Figure 1.1.3. Forest land ownership structure

State-owned forests are predominantly managed by the State Forest Management Center (830 thousand ha) coordinating the forest management activities of 61 forest districts and by other state institutions (20 thousand ha), such as the Agricultural University, forestry or agricultural higher schools and the Ministry of Defence. The average area of a state forest district is 18 000 ha, 13 600 ha (75%) of which is forest land.

Private forests are mostly owned and managed by individuals (80%), but forest companies are increasing their forest property buying up forest land from individual owners or using the privatisation process. The average area of forest land in a private property is 10 ha, which is often divided into separate units.

### Tree species composition

The Scots pine (*Pinus sylvestris*), the Norway spruce (*Picea abies*), birch species (*Betula pendula*, *Betula pubescens*), grey alder (*Alnus incana*) and aspen (*Populus tremula*) are the most important tree species of the Estonian forests. The stands of other tree species (black alder, larch, oak, ash and some other) represent only an insignificant part of forests. The distribution of forest land by dominant tree species and changes in the share of dominant tree species are shown in the following table.

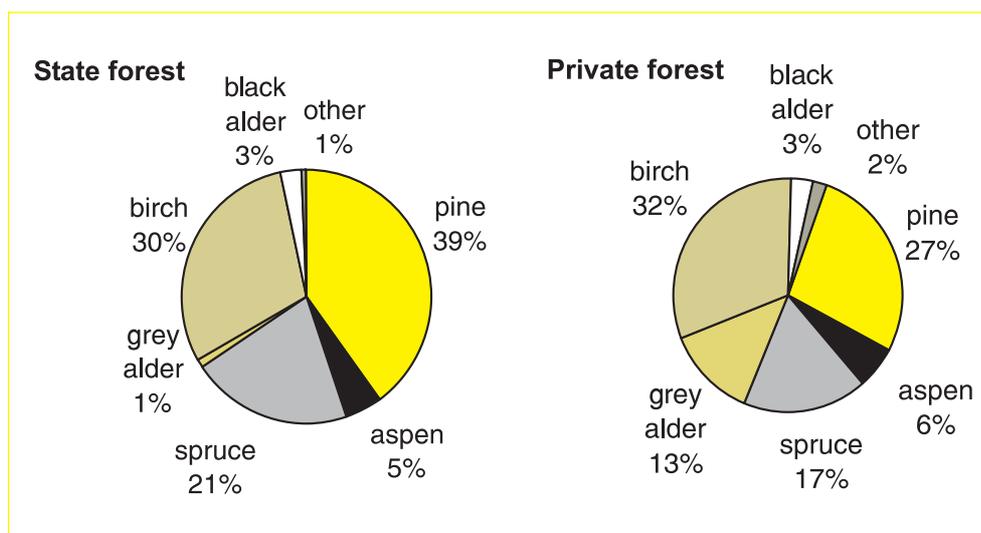
Table 1.1.1. Distribution of forest land by dominant tree species

Dominant tree species	1988		2001	
	area (1000 ha)	share (%)	area (1000 ha)	share (%)
pine	749,6	39,1	719,9	32,0
spruce	454,2	23,7	419,4	18,6
birch	540,4	28,2	699,1	31,1
aspen	30,1	1,6	122,0	5,4
black alder	28,9	1,5	67,7	3,0
grey alder	90,1	4,7	190,9	8,5
others	23,1	1,2	31,6	1,4
<b>Total</b>	<b>1 916,4</b>	<b>100,0</b>	<b>2 250,6</b>	<b>100,0</b>

Source: Estonian Forest Survey Center

There have been remarkable changes in the distribution of forest land by dominant tree species during the last period. On one hand, it could have been caused by different inventory methods (1988 – standwise forest inventory, 2001 – sample plot based National Forest Inventory), but also the natural afforestation of non-used agricultural areas mostly by deciduous tree species plays a significant role.

There are also remarkable differences in the dominant tree species distribution in the forests managed by the State Forest Management Center and in the forests of other owners (private forests and forests subject to privatisation). In state forests coniferous tree species have a majority (60%), but in the other owners' forests deciduous tree species are dominant (the share of coniferous tree species is only 46%). Grey alder forests are mostly growing on the private land. Those differences have a historical background. State forests are growing on the traditional forest land and have been managed according to good forest management practices and guidelines, while a great part of private forests originate from natural regeneration in non-used agricultural areas.



Source: Estonian Forest Survey Center

Figure 1.1.4. Distribution of forest land by dominant tree species

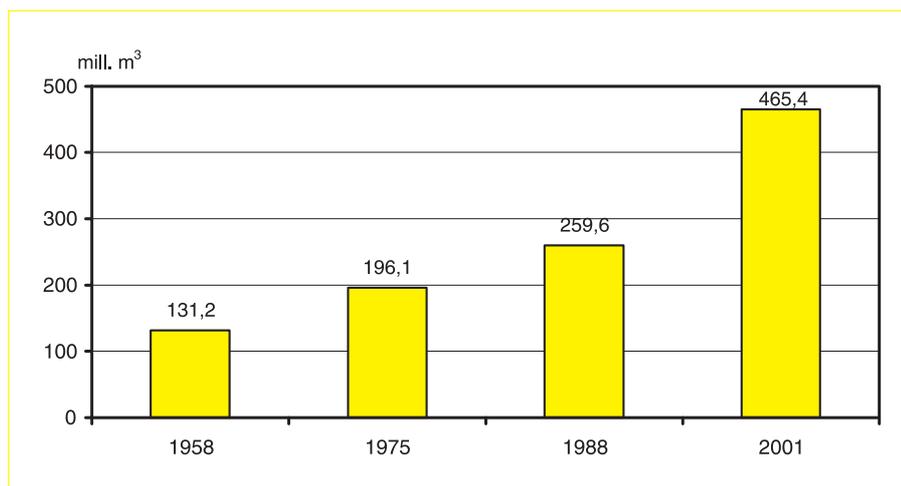
## Indicator 1.2.

### Changes in:

- total volume of the growing stock
- mean volume of the growing stock on forest land (classified, if appropriate, according to different vegetation zones or site classes)
- age structure or appropriate diameter distribution classes

## Total volume of the growing stock

Changes in growing stock have been similar to changes in the area of forest land. Throughout the second half of the XX century there has been constant and quite rapid increase in growing stock. It has increased from 131,2 mill. m<sup>3</sup> in 1958 to 465,4 mill. m<sup>3</sup> in 2001. Due to modest felling volumes in the period 1975–1995 both the total as well as the average growing stock per one hectare have increased from year to year. In the same period, total growing stock has increased much more compared to the area of forest land, which means that it is the result of the increase in both the forest area and the growing stock per hectare. The NFI estimates for the year 2001 also give more accurate results.



Source: Estonian Forest Survey Center

Figure 1.2.1. Changes in growing stock (mill. m<sup>3</sup>)

Growing stock per inhabitant is 342 m<sup>3</sup> and as the population of Estonia has been almost stable during the reference period, growing stock per inhabitant has increased by approximately 4 times.

Generally, the distribution of growing stock by dominant tree species is proportional to the area occupied by them. The growing stock of aspen stands, however, forms a proportionally much larger part of the total growing stock of stands compared to the share of aspen stands in the total area of forest land and birch stands show the opposite tendency. The reason for that distribution can be found comparing the average growing stock per hectare of aspen (325 m<sup>3</sup>/ha) and birch (172 m<sup>3</sup>/ha) stands to the total average (207 m<sup>3</sup>/ha).

Table 1.2.1. Distribution of growing stock by dominant tree species

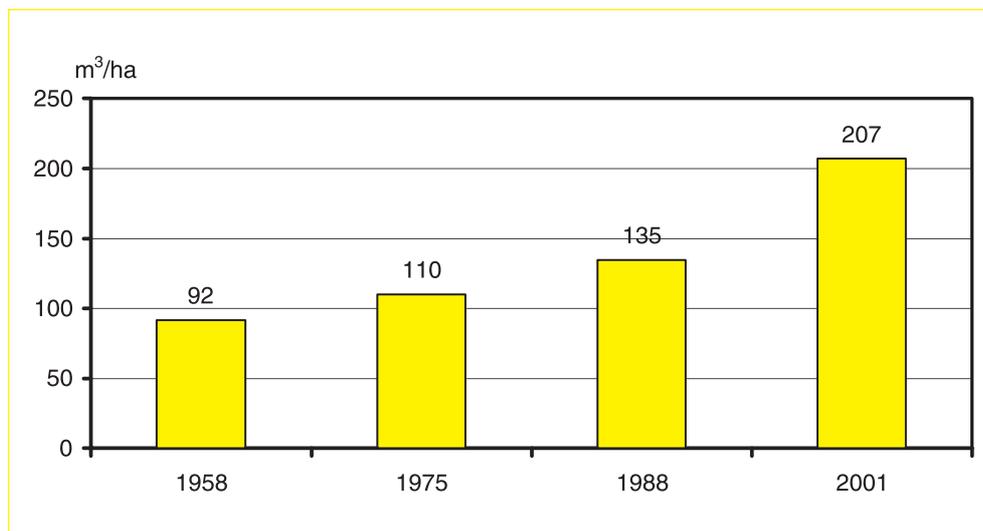
Dominant tree species	1988		2001	
	growing stock (mill. m <sup>3</sup> )	share (%)	growing stock (mill. m <sup>3</sup> )	share (%)
pine	106,0	40,8	151,9	32,6
spruce	69,1	26,6	93,5	20,1
birch	65,1	25,1	120,4	25,9
aspen	5,3	2,0	39,6	8,5
black alder	3,5	1,3	16,0	3,4
grey alder	8,2	3,2	36,8	7,9
others	2,4	0,9	7,2	1,5
<b>Total</b>	<b>259,6</b>	<b>100,0</b>	<b>465,4</b>	<b>100,0</b>

Source: Estonian Forest Survey Center

As the share of the area of coniferous tree species has decreased during the reference period, the share of their growing stock shows the same tendency. In spite of the absolute increase in the growing stock of coniferous stands from 175,1 mill. m<sup>3</sup> in 1988 to 245,4 mill. m<sup>3</sup> in 2001, their relative share has decreased from 67,4% to 52,7%.

## Changes in mean volume of growing stock

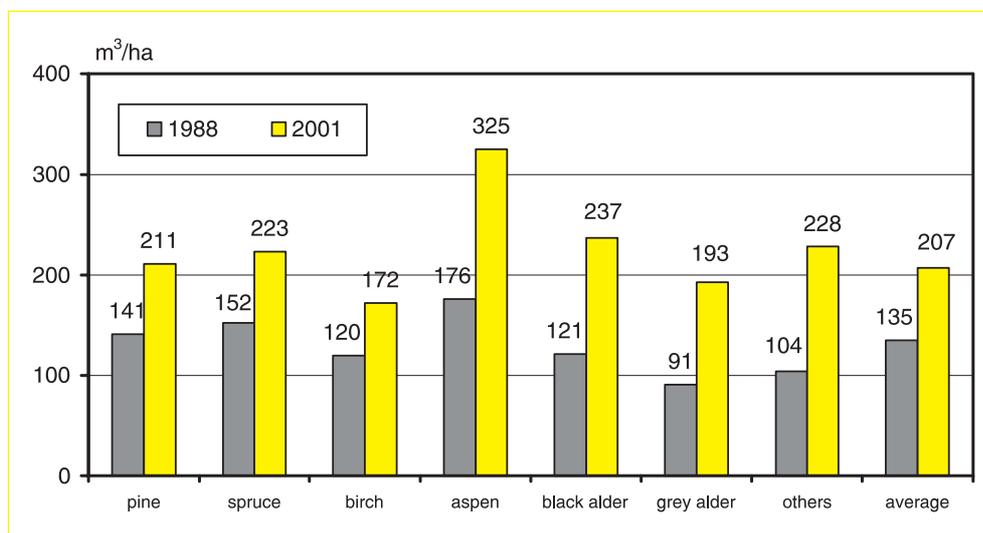
The average growing stock in Estonian forests has been increasing since the 1950s. This has been caused by the following factors: forest melioration creating new productive forest land after the 1970s; afforestation of non-used agricultural lands; changes in the age structure of stands (the average age of stands has increased); increased accuracy of the NFI estimates for the year 2001 data. Changes in the average growing stock in the last five decades are shown in the following chart.



Source: Estonian Forest Survey Center

Figure 1.2.2. Changes in the mean growing stock (m³/ha)

Changes in the average growing stock by dominant tree species for the last decade are shown in the following chart.



Source: Estonian Forest Survey Center

Figure 1.2.3. Changes in the mean volume of growing stock by dominant tree species (m³/ha)

The average growing stock volume has increased rapidly in the last decade, especially in deciduous stands. Comparing stand-wise inventory data with the NFI sampling method, the latter usually gives 15–20% higher results for growing stock. So the rather rapid increase in the total and average growing stock is caused by increased increment, but on the other hand the more accurate estimates for the year 2001 also play a vital role.

## Age structure

The age class distribution of more important tree species is uneven. Almost a half of coniferous stands are 41–80 years old (49,8% of pine stands and 47,2% of spruce stands). The share of young (aged under 20 years) coniferous stands is abnormally small, resulting from game damages of plantations and a low level of cleanings in the young stands in the 1990s. Birch and aspen stands have also very uneven age structure, the share of stands aged between 41–60 years is high (38,3% of birch stands and 44,8% of aspen stands).

The average rotation period is 110 years for pine stands, 90 years for spruce stands, 70 years for birch stands and 50 years for aspen stands. Taking into account the rotation period we could say that 2/3 of aspen stands are overmature, but the market value of aspen wood is rather low.

**Table 1.2.2. Age distribution of more important tree species**

Age class	Pine stands				Spruce stands			
	1988		2001		1988		2001	
	area (1000 ha)	share (%)						
under reg*	40,1	5,3	38,2	5,3	28,0	6,2	49,0	11,7
≤ 20	56,0	7,5	30,7	4,3	87,4	19,2	30,2	7,2
21 - 40	147,6	19,7	108,8	15,1	73,0	16,1	84,3	20,1
41 - 60	191,6	25,6	181,9	25,3	111,3	24,5	90,7	21,6
61 - 80	168,9	22,5	176,9	24,6	98,6	21,7	107,1	25,5
81 - 100	85,1	11,4	112,3	15,6	40,1	8,8	42,7	10,2
101 - 120	32,6	4,3	44,5	6,2	11,1	2,4	14,4	3,4
> 121	27,7	3,7	26,6	3,7	4,7	1,0	1,0	0,2
<b>Total</b>	<b>749,6</b>	<b>100,0</b>	<b>719,9</b>	<b>100,0</b>	<b>454,2</b>	<b>100,0</b>	<b>419,4</b>	<b>100,0</b>

Age class	Birch stands				Aspen stands			
	1988		2001		1988		2001	
	area (1000 ha)	share (%)						
under reg*	28,9	5,3	45,1	6,5	1,0	3,3	12,0	9,8
≤ 20	58,9	10,9	91,9	13,1	2,8	9,3	12,5	10,2
21 - 40	187,5	34,7	168,3	24,1	8,7	28,9	18,7	15,3
41 - 60	209,9	38,8	267,7	38,3	12,8	42,5	54,6	44,8
61 - 80	55,2	10,2	108,5	15,5	4,8	15,9	20,9	17,1
> 81			17,6	2,5			3,3	2,7
<b>Total</b>	<b>540,4</b>	<b>100,0</b>	<b>699,1</b>	<b>100,0</b>	<b>30,1</b>	<b>100,0</b>	<b>122,0</b>	<b>100,0</b>

\* areas under regeneration

Source: Estonian Forest Survey Center

Comparing the age structures in the reference years the following changes could be marked:

- the area and share of areas under regeneration is increasing, consequently the felling area has also increased;
- the share of young coniferous stands is decreasing and *vice versa*, the area of young deciduous stands and areas under regeneration with deciduous species have been increasing;
- in spite of the decrease in the area of coniferous stands the area and share of coniferous stands aged over 100 years has increased;
- the area and share of birch and aspen stands aged over 60 years has considerably increased.

## List of publications

**Yearbook Forest.** Centre of Forest Protection and Silviculture. Tartu, 2001.

**Eesti Metsad.** Metsavarude hinnang statistilisel valikmeetodil. Eesti Metsakorralduskeskus Tallinn, 2001.

### Indicator 1.3.

#### Total carbon storage and its changes in stands

The carbon storage in the soil on forest land has been estimated in soil cover.

**Table 1.3.1. Carbon storage in the soil cover of forest land by soil groups**

Soil groups	Soil cover thickness (average) cm	Carbon storage tons ha <sup>-1</sup>	Forest area %	Forest area 1000 ha	Carbon storage mill. tons
<i>Rendzic and Skeletic and Gleyic Leptosols</i>	24	91	0,8	16	1
<i>Calcaric and Endoskeletal Cambisols</i>	56	90	1,9	37	3
<i>Skeletigleyic Cambisols</i>	50	90	1,3	25	2
<i>Mollic and Endogleyic Cambisols</i>	47	78	3,3	64	5
<i>Cutanic and Endogleyic Luvisols</i>	70	96	2,4	47	4
<i>Glossic and Gleyiglossic Albeluvisols</i>	92	64	3,6	70	4
<i>Haplic Albeluvisols</i>	86	89	2,7	52	5
<i>Endogleyic Albeluvisols</i>	72	63	1,6	31	2
<i>Haplic Podzols</i>	67	41	3,8	74	3
<i>Endogleyic Podzols</i>	62	45	2,2	43	2
<i>Mollic and Calcic and Eutric Gleysols</i>	65	144	12,1	235	34
<i>Luvic and Epidystric Gleysols</i>	65	144	8,0	155	22
<i>Saprihistic and Fibrhistic Gleysols</i>	65	140	5,3	103	14
<i>Spodic and Umbric and Dystric Gleysols</i>	76	136	4,1	79	11
<i>Epigleyic and Fibrhistic Podzols</i>	75	116	8,2	159	18
<i>Eutric and Sapric Histosols</i>	50	450	16,1	312	140
<i>Dystric and Fibric Histosols</i>	50	187	20,6	399	75
<i>Eutric and Histic and Salic Fluvisols</i>	40	100	1,3	25	3
<i>Anthrosols, Rangelands, Pits</i>	30	40	0,7	14	1
<b>Total</b>			<b>100</b>	<b>1939</b>	<b>350</b>

Carbon storage in the soil cover of forest land is approximately 350 million tonnes. It is not possible to calculate the total carbon storage of forest land soil on the basis of the present data as peat land forests account for a large proportion (36%) of the forest land and peat layers have not been studied in their whole thickness.

**Table 1.3.2. Carbon storage in the woody biomass of forest land**

Year	Growing stock mill. m <sup>3</sup>					Carbon storage mill. tons					Area of forest land 1000 ha	Carbon storage tons ha <sup>-1</sup>
	Pine	Spruce	Birch	Other broad-leaved	Total	Pine	Spruce	Birch	Other broad-leaved	Total		
1988	106	69	68	17	260	47	28	44	11	130	1916	68
1994	111	72	80	22	284	49	29	52	14	145	1939	75
2000	146	81	114	71	411	65	33	74	46	218	2249	97

Carbon storage in the woody biomass of forest land is approximately 200 million tonnes. This estimate was obtained from a calculation based on growing stock, stem wood basic density, carbon content in wood and a biomass expansion factor. The latter is an estimate of the ratio of the total biomass above and below the ground to stem wood biomass.

Source: Center of Forest Protection and Silviculture, 2003

Department of Soil Science and Agrochemistry, Estonian Agricultural University, Kõlli, R., 2002



**Criterion 2**

**MAINTENANCE OF FOREST ECOSYSTEM HEALTH AND VITALITY**

**Indicator 2.1.**  
**Total amount of and, changes over the past 5 years in depositions of air pollutants (assessed in permanent plots).**

The following figures illustrate changes in the deposition of nitrogen, sulphur and base cations in intensive monitoring plots during a certain period. Four of the plots are located in Scots pine stands and one (Mäksa) in a Norway spruce stand.

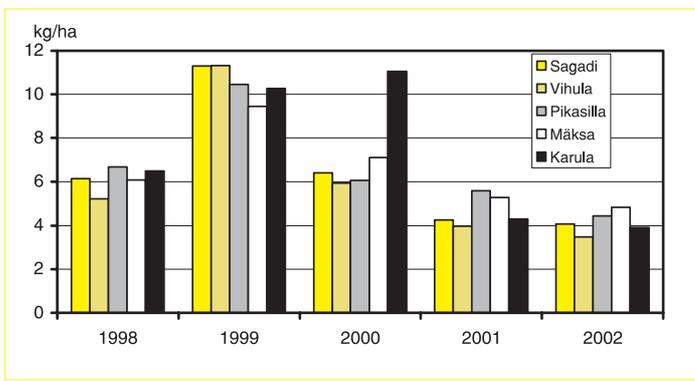


Figure 2.1.1. Deposition of total nitrogen (N) in 1998–2002

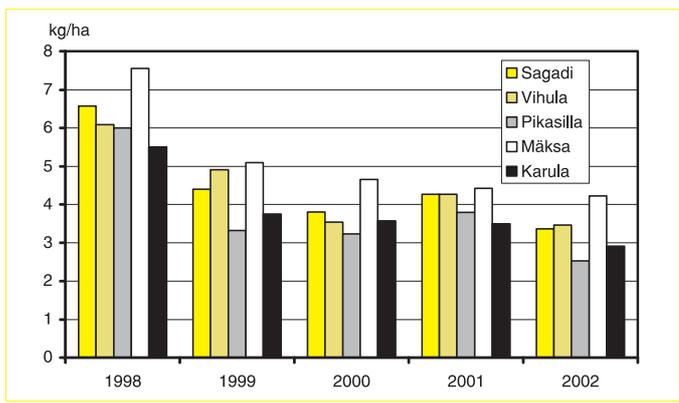


Figure 2.1.2. Deposition of sulphur (S-SO<sub>4</sub>) in 1998–2002

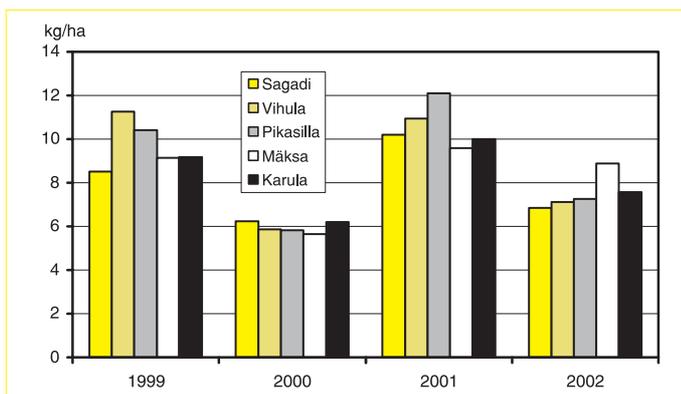


Figure 2.1.3. Deposition of calcium (Ca) in 1999–2002

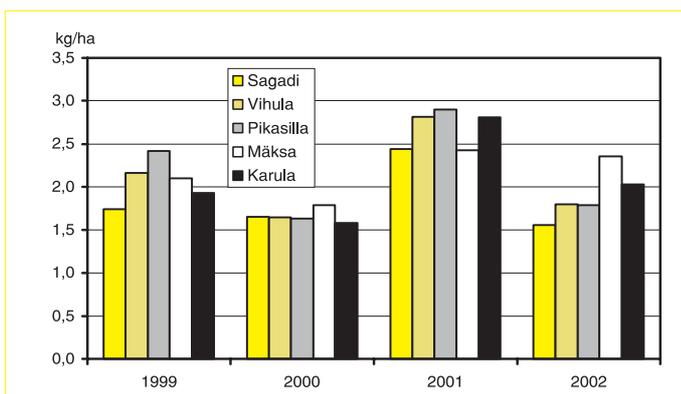


Figure 2.1.4. Deposition of magnesium (Mg) in 1999–2002

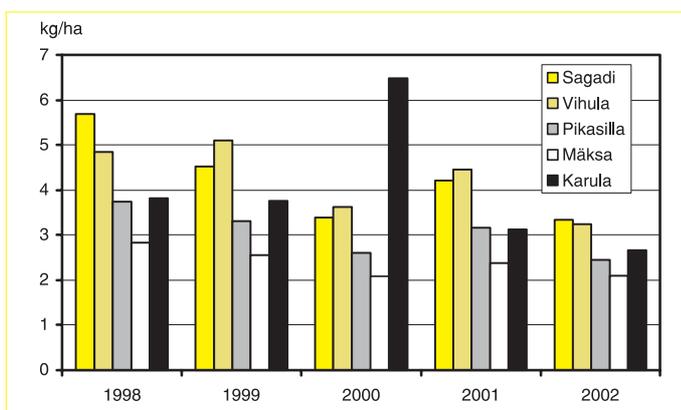
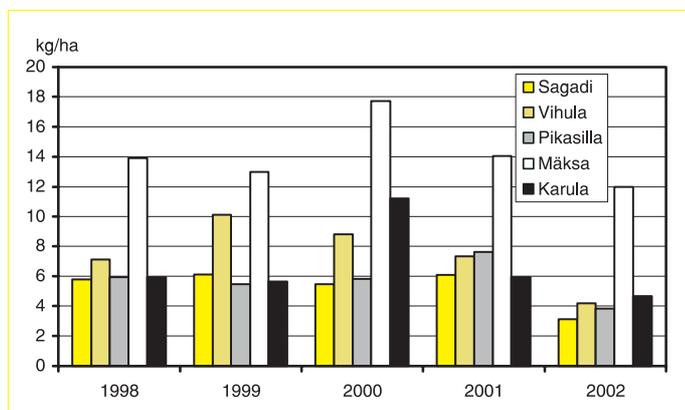


Figure 2.1.5. Deposition of sodium (Na) in 1998–2002



Source: Center of Forest Protection and Silviculture

Figure 2.1.6. Deposition of potassium (K) in 1998–2002

## Indicator 2.2.

### Changes in serious defoliation of forests using the UN/ECE and EU defoliation classification (classes 2, 3, and 4) over the past 5 years

Pursuant to the ICP-Forest (International Co-operative Program on the Assessment and Monitoring of Air Pollution Effects on Forests) Manual, the condition of the Estonian forests has been systematically assessed since 1988.

Objectives of the program:

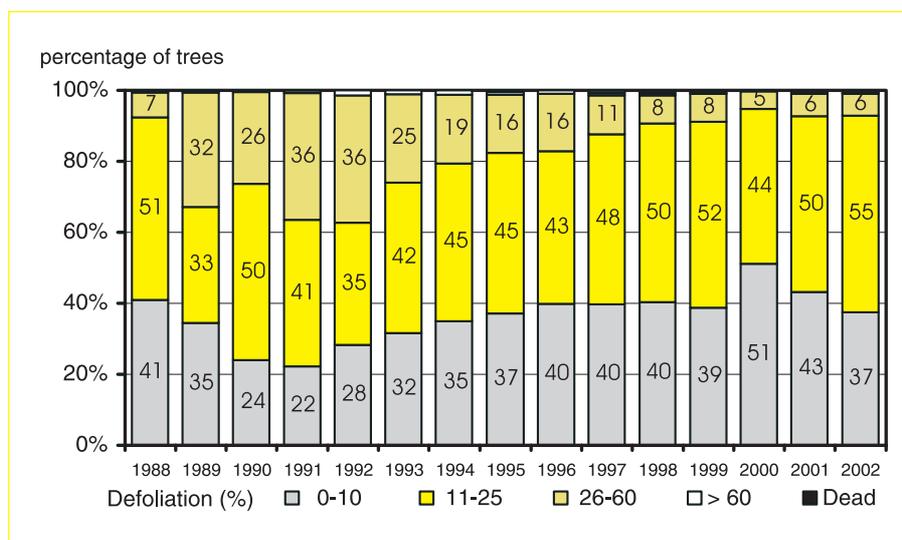
- to provide a periodic overview of the spatial and temporal variations in forest conditions in relation to anthropogenic (in particular air pollution), as well as natural stress factors (Level I);
- to contribute to a better understanding of the relationships between the condition of forest ecosystems and anthropogenic (in particular air pollution), as well as natural stress factors through intensive monitoring on a number of selected permanent sample plots (Level II) and to study the development of important forest ecosystems;
- to provide a deeper insight into the interactions between the various components of forest ecosystems by compiling available information from related studies.

The Level I network consists of 91 permanent plots throughout Estonia, systematically arranged in a 16x16 km grid. The network provides a variety of ecologically relevant data (including information on forest type, soil type and chemistry, vegetation, lichens etc.).

In 2001 and 2002 trees were assessed in 89 level I permanent sample plots. The survey was carried out by the specialists of the Estonian Center of Forest Protection and Silviculture in the period since August to October. 2136 trees were assessed: 1444 Scots pines (*Pinus sylvestris*), 597 Norway spruces (*Picea abies*), 53 birches (*Betula pendula* and *B. pubescens*), also some aspens (*Populus tremula.*), alders (*Alnus glutinosa* and *Alnus incana*), elms (*Ulmus glabra*), ashes (*Fraxinus excelsior*) and maples (*Acer platanoides*).

Crown condition reacts to a number of different stress factors. Recent monitoring results clearly indicate that the condition of Estonian forests is influenced by a complex of extreme weather conditions and air pollutants, also by insect attacks, game injuries and fungal infections. The development of defoliation over time may, however, give evidence of some continuously acting group of stressors.

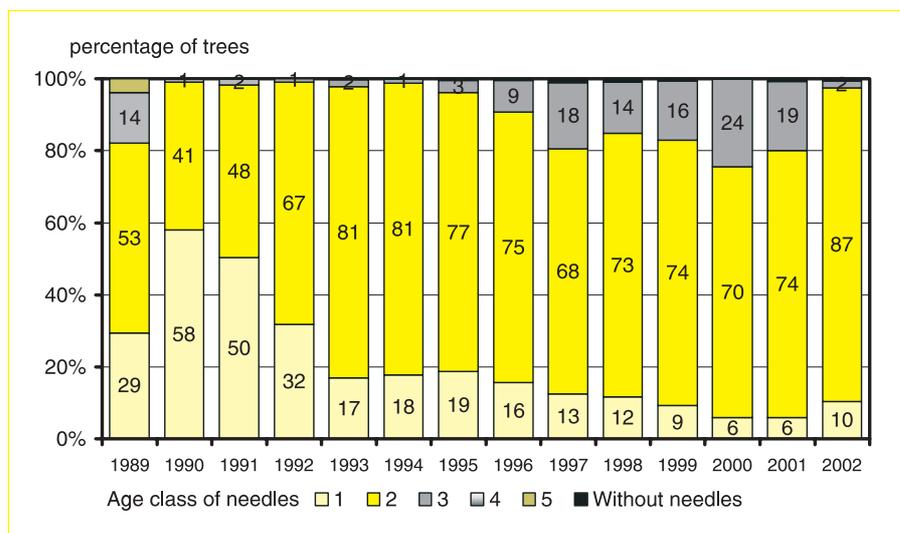
The development of defoliation varies by different species and regions. The most heavily defoliated tree species has been the Scots pine. Essential improvement of the crown condition of the Scots pine was observed in 1991–2000. In 2001 the share of healthy Scots pines was 8% and in 2002 – 12% lower than in 2000, but it was still higher than in the years 1989–1995. The percentage of healthy Scots pines was 41% in 1988, but only 22% in 1991, however, it was 51% in 2000 and 37% in 2002. On the other hand, only 5,2 percentage points of Scots pines were included in the defoliation classes 2–4 in 2000 and 7,2 percentage points – in 2002.



Source: Center of Forest Protection and Silviculture

Figure 2.2.1. Distribution of the Scots pines by defoliation classes in monitoring sample plots in 1988–2002

The age of the remaining needles in pine crowns has been regularly checked during the assessments periods. In 2002, 10% of the pines had only one year old needles, 87% – needles of the age of two and 3% – of three or more years. The years 1990–1991 were the most critical in the whole survey period. In 1990, 58% of the observed pines carried only the needles of the current year and 41% – the needles of the current and the previous years listed.

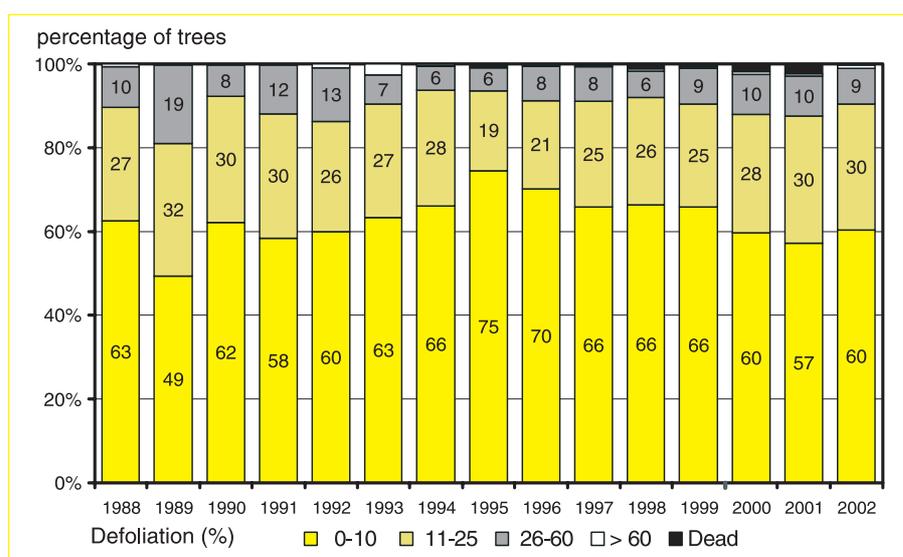


Source: Center of Forest Protection and Silviculture

Figure 2.2.2. Distribution of the Scots pines according to the age of remaining needles in monitoring sample plots in 1988–2002

Diseases, especially the outbreak of shoot blight caused by *Ascochyx abietina* recorded in 2002 on 51% of pines and needle cast caused by *Lophodermium seditiosum* on 28% of pines had an important role in the formation of defoliation. The share of pines attacked by shoot blight has increased from 14% in 2000 to 28% in 2001 and 51% in 2002.

The permanent increase in the defoliation of the Norway spruce registered in 1995–2001 came to an end by 2002. Warm and dry weather in the summer of 1999, in the second half of the summer of 2001 and the extremely dry summer of 2002 could nevertheless be the reason for drought stress and the colonisation of Norway spruce by bark beetles. Heavy wind could be another reason of Norway spruce damages.



Source: Center of Forest Protection and Silviculture

Figure 2.2.3. Distribution of the Norway spruces by defoliation classes in monitoring sample plots in 1988–2002

In 2002 the share of healthy Norway spruces was 3% higher than in 2001 but 14% lower than in 1995. The percentage of healthy Norway spruces in level I sample plots was 63% in 1988, 58% in 1991, 75% in 1995 and 60% in 2002. Only 9,6 % of the Norway spruces belonged to the defoliation classes 2–4 in 2002. Mechanical and wind damages, stem injuries (moose peeling), root rot and the colonisation of trees by bark beetles (*Ips typographus* a.o.) were the main causes of damages and perishing of the Norway spruce.

Altogether, the crown condition of deciduous tree species was markedly better than that of conifers, but compared to 1999, the share of damaged deciduous trees had seriously increased in 2001–2002. For example, the share of healthy birches was 75% in 2001, but as high as 96% in 1999.

There were considerable regional differences in the defoliation rate. The same regions as in the previous years had higher defoliation rates. Some sample plots with a high level of defoliation of the Norway spruce were situated in the vicinity of local sources of air pollution in the north-eastern part of Estonia. On the regional level, the most severe defoliation of the Norway spruce occurred in the western and north-western part of Estonia. The most severe defoliation of the Scots pine also occurred in the north-western part of Estonia.

### Indicator 2.3.

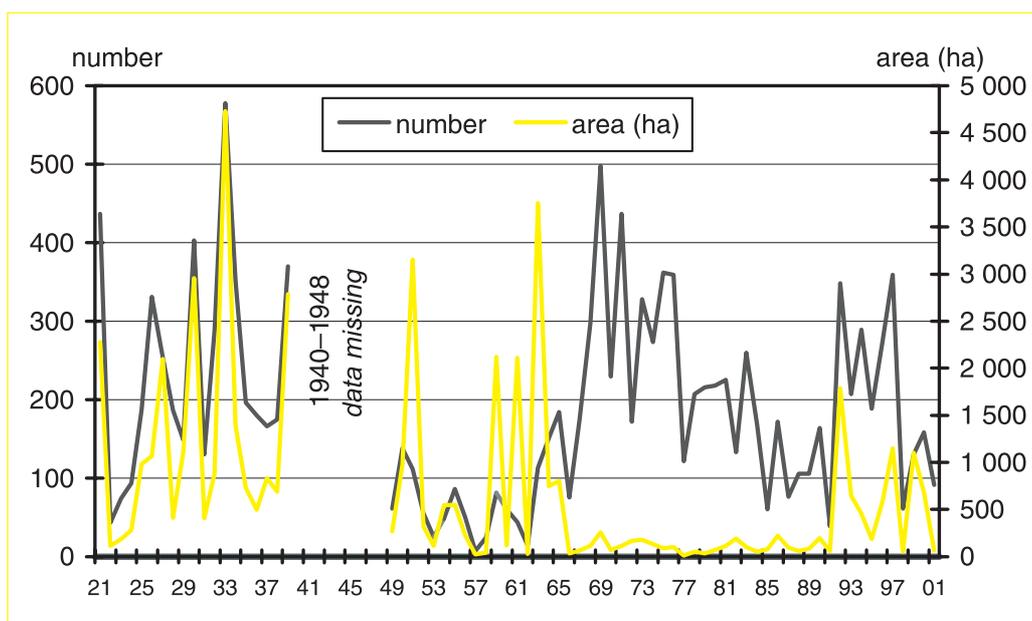
#### Serious damages caused by biotic or abiotic agents

##### 2.3.1. Severe damages caused by insects and diseases

In 2001 the registered area of insect damages was 1700 ha and registered area of forest damaged by diseases was 6500 ha – 0,1 and 0,3% of forest land area respectively. The most significant insect pest was eight-toothed spruce bark beetle (*Ips typographus*) and the most harmful disease was *Heterobasidion* root rot (caused by *Heterobasidion parviporum*) – both in Norway spruce stands.

##### 2.3.2. Annual area of burnt forest and other wooded land

The annual area of burnt forests varies substantially from year to year, and to a large extent it mostly depends on weather conditions. The annual number of registered forest fires varied from 7 to 578, average area of burnt forest varied from 0,1 to 33,2 ha and the total area of burnt forests varied from 11 to 4733 ha in 1921–2001 (Figure 2.3.2.1). In 2000 and 2001 vacationers, campers and other visitors caused most of forest fires or the causes of forest fires were unknown (Table 2.3.2.1). Natural factors (lightning) caused only 1–2% of forest fires.



Source: Ministry of the Environment

Figure 2.3.2.1. Number and total area of forest fires in Estonia in 1921–2001

**Table 2.3.2.1. Causes of forest fires in Estonia in 2000 and 2001.**

Forest fire causes	2000		2001	
	Number	Share (%)	Number	Share (%)
Arson	14	9	7	8
Agricultural operations	4	2	5	6
Logging and forest operations	2	1	0	0
Other industrial activities	1	1	0	0
Communications (railways, electricity lines etc.)	16	10	3	3
General public (campers, other visitors, children)	63	40	22	24
Other	2	1	2	2
Natural causes (lighting)	3	2	1	1
Unknown causes	53	34	51	56
<b>Total</b>	<b>158</b>	<b>100</b>	<b>91</b>	<b>100</b>

*Source: Estonian Rescue Board, State Forest Management Center, County Environmental Services*

### 2.3.3. Annual area affected by storm damage and volume harvested from these areas

Annual variations in the areas affected by storm damages are also remarkable. In 2001 this area was comparatively big – 14700 ha (0,7% of forest land area). Volumes harvested from these areas extended to 1180000 m<sup>3</sup>.

### Indicator 2.4.

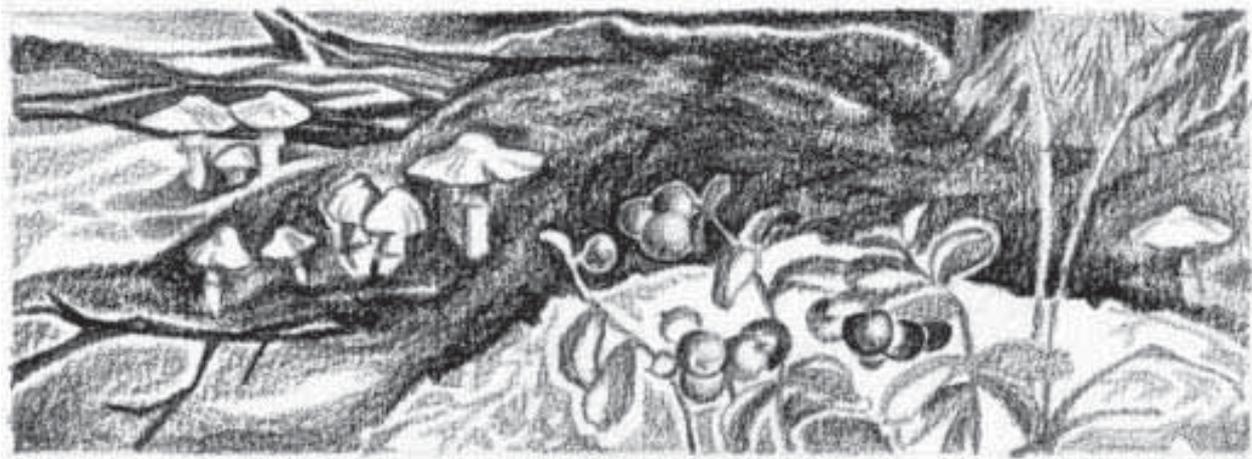
#### **Changes in nutrient balance and acidity over the past 10 years (pH and CEC); level of saturation of CEC on the plots of the European network or an equivalent national network**

The available data do not enable to detect any changes in the nutrient balance of forest soils as the monitoring of forest soil characteristics describing these qualities was initiated only in 1989.

More than 50 % of the Estonian forest soils are relatively acidic and the acidity varies considerably in different soil layers and in different regions. The acidity of forest soils is the lowest in the northern and western part of Estonia and the highest in the southern part of the country.

There are no indications for any significant acidification of forest soils in Estonia during the last decades. Flue gases, emitted from two gigantic thermal power plants in the north-eastern part of Estonia and consisting of approximately 75% CaCO<sub>3</sub> are the cause of alkanisation of forest soils in about 7% of the Estonian territory. Particularly sensitive to alkanisation are podzolised soils formed on sandy deposits that have a low buffering capacity. Alkanisation, recognised by an organic layer pH value which is higher than or equal to the pH value of the underlying mineral layer, is found in five soil survey plots of the level I monitoring network. It causes a significant decrease in the content of exchangeable aluminium in the organic top layer and an increase in the content of plant nutrients. A decrease in acidity in subsurface horizons of some soils in comparison to reference soils is also observed.

*Source: Center of Forest Protection and Silviculture, 1997*



## Criterion 3

### **MAINTENANCE AND ENCOURAGEMENT OF PRODUCTIVE FUNCTIONS OF FORESTS (WOOD AND NON-WOOD)**

#### **Indicator 3.1.**

#### **Balance between growth and removals of wood over the past 10 years**

One of the core elements of sustainable forest management is the balance between felling and the increment from one hand and between the felling and growing stock of mature stands in commercial forests from another hand. The monitoring of this objective is complicated and difficult, because many factors, such as natural losses, age distribution, harvesting losses, must be taken into account. The following explanatory definitions are used in this chapter:

- gross annual increment (GAI) – average annual volume of increment over the reference period of all trees, including the increment of trees which have been felled or died during the reference period;
- net annual increment (NAI) – average annual volume over the given reference period of gross annual increment less that natural losses of all trees;
- natural losses – average annual losses of the growing stock during the given reference period due to mortality from causes other than felling by man;
- annual felling – average annual standing volume of all trees, living or dead, measured overbark, that are felled during the given reference period, including the volume of trees or part of trees that are not removed from the forest;
- annual removals – average annual volumes of timber that are removed from the forest.

In Estonia the annual removals are not measured outside state forests. Therefore the following analysis is focused on the balance between growth and fellings.

For a long period before the 1990s the average annual felling volume remained between 3,0 and 3,3 million cubic metres. The average intensity of fellings per hectare, considering whole forest area, was 1,6 cubic metres and it was considerably smaller than the volume increment. The unfavourable age structure of stands has been one reason for the low felling volume: the share of mature stands was smaller than it would have been for the normal age structure of forests. The other reason was cutting restrictions in about 1/3 of the forests where environmental protection, recreational and other considerations were more important than timber production. Sometimes maturity age was also artificially increased to reduce the cutting volumes.

When Estonia had regained independence, at the time of general economic recession, the felling volumes decreased even more. According to the data of the Statistical Office, the total felling volume was only 2,2 million cubic metres in 1992. The main reasons for low cutting intensity were: low demand for timber in the domestic market, restructuring and privatisation of the forest industry, reorientation of foreign trade and forest land ownership structure.

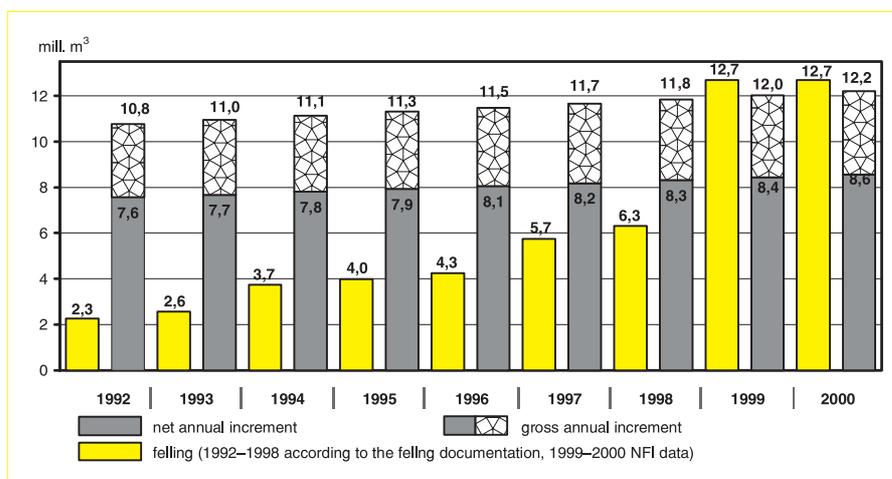
The following table and figure present the balance between felling and increment over the period 1992–2000. From 1992 to 1998 data on fellings are based on the felling documentation of forest owners gathered from forest notifications – the latter are collected by County Environmental Services. Every owner is obliged to notify county level authorities 2 weeks in advance before the commencement of forestry operations. So those volumes in the table represent forest owners' plans and not the real felling volumes. There is a tendency to report smaller volumes than later felled in the reality.

Felling data on the years 1999 and 2000 are based on the National Forest Inventory estimates. One of the aims of this inventory was to get comprehensive data on felling volumes. For this estimate each stump that happens to be on the sample plot is measured and based on models, the volume of felled trees is calculated. The sample plot based NFI gives felling volumes nearly two times higher compared to ESO-based cutting data. Of course, one has to remember that due to the minimisation of NFI costs the number of measured plots and stumps gives an approximately 20% error for felling volume estimates, but the difference between these two estimates is much higher.

**Table 3.1.1. Balance between felling and increment in 1992–2000**

Year	Felling (mill. m <sup>3</sup> )			Annual increment		Balance felling/GAI (%)	Balance felling/NAI (%)
	State forest	Other forest	Total	gross (mill. m <sup>3</sup> )	net (mill. m <sup>3</sup> )		
1992	1,85	0,40	2,25	10,77	7,56	21	30
1993	2,10	0,45	2,55	10,95	7,68	23	33
1994	2,92	0,82	3,74	11,13	7,81	34	48
1995	2,99	1,00	3,99	11,31	7,93	35	50
1996	2,89	1,36	4,25	11,48	8,06	37	53
1997	3,06	2,68	5,74	11,66	8,18	49	70
1998	2,93	3,39	6,32	11,84	8,31	53	76
1999	3,26	9,43	12,69	12,02	8,44	106	150
2000	3,52	9,23	12,75	12,20	8,56	104	148
<b>Total</b>	<b>25,52</b>	<b>28,76</b>	<b>54,28</b>	<b>103,36</b>	<b>72,53</b>		
<b>Average</b>	<b>2,84</b>	<b>3,20</b>	<b>6,03</b>	<b>11,48</b>	<b>8,06</b>	<b>53</b>	<b>75</b>

Source: felling - Statistical Office of Estonia, Estonian Forest Survey Center  
increment - Estonian Forest Survey Center



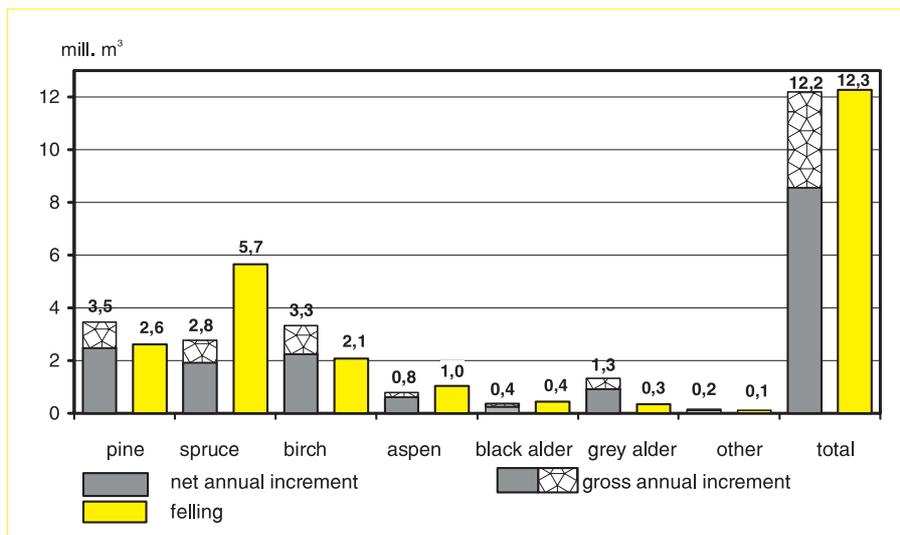
Source: Felling - Statistical Office of Estonia, NFI; Increment - Estonian Forest Survey Center

Figure 3.1.1. Balance between increment and felling in 1992–2000

Felling volumes in state forests have remained stable from 1994 to 2000, but in private forests (other forests) felling volumes have increased rapidly over the reference period. Resulting from the land reform, the area of private forests has increased and more private forest owners have a legal right to forests.

The gross annual increment is calculated using NFI sample plot data for the last reference year and the average increment per hectare for the previous years is calculated on the basis of the average changes in the forest area over the reference period. Natural losses are calculated using tree species, age and site quality distributions of stands based on the growth tables. Natural losses form approximately 30% and net annual increment forms about 70% of gross annual increment.

As felling volumes were rather low in the first years of the reference period, fellings form 75% of net annual increment in the average for the whole reference period. The NFI sample plot method also provides data for calculating felling volumes by tree species and enables comparisons between increment and felling volume by tree species. The following chart presents the balance between net annual increment and felling volume of growing trees by tree species for the 2000–2001 felling season.



Source: Estonian Forest Survey Center (National Forest Inventory)

Figure 3.1.2. Balance between NAI, GAI and felling of growing trees by tree species (mill. m³) in the felling season 2000–2001

The felling of growing pine, spruce and birch trees forms 84 % of the total felling volume. The balance between net annual increment and felling volume is equal for pine and birch, but the felling volume of spruce almost threefold exceeds the net annual increment. The main reasons are the following: uneven age distribution of spruce stands and a high proportion of mature spruce stands, especially in private forests; the risk of damages in spruce stands; also the high market demand for and price level of spruce saw logs and pulpwood. Uneven age distribution and a high proportion of mature spruce, aspen and grey alder stands is partly caused by low felling volumes in the beginning of the 1990s and is also resulting from a total increase in timber resources (see indicator 1.2).

The calculated optimum annual felling volume for the Estonian forests (taking into account tree species composition, age structure, site quality and environmental restrictions) for the years 2001–2010 is 12,6 mill. m³ over bark (Estonian Forestry Development Programme until 2010).

## List of publications

Center of Forest Protection and Silviculture. **Yearbook Forest 2001**.

Eesti Metsakorralduskeskus. **Eesti Metsad 2001. Metsavarude hinnang statistilisel valikmeetodil.**

**Estonian Forests and Forestry.** Tallinn 1995.

Statistical Office of Estonia. **Forestry.** 1999–2001

Economics and Information Center of Forestry. **Yearbook Forest 1994, 1995, 1998**

Estonian Forestry Development Programme until 2010

### Indicator 3.2.

#### Percentage of forest area managed according to a management plan or management guidelines

According to the Forest Act all forests must be inventoried and the inventory data stored in the State Register of Forest Resources. Forest inventories shall be financed from the state budget. All state forests are managed according to management plans. Private forest management according to management guidelines is recommended.

Forest inventories and forest management planning still have a fixed 10 years interval in state forests. Forest management plans are compiled by the management units – forests districts. Since 1992, forest inventories have been carried out in private forests and forest management guidelines prepared for private forest owners. After the restitution or privatisation and registration of a land property in the Land Register forest inventories and management plans become important tools supplying owners with information on their forests and guidelines for management activities. The overview of forest areas managed according to management plans or management guidelines by owner categories is given in the following table.

**Table 3.2.1. Area of forest managed according to management plans or management guidelines (as of January 2003)**

Owners	Forest land area (1000 ha)	Managed by plan or guidelines area (1000 ha)	%
State owned forest	850	850	100
Private forest	823	500	61
Other owners	15	3	20
Forest subject to privatisation	563		
Total	2251	1353	60

Source: Estonian Forest Survey Center

### Indicator 3.3.

#### Total amount and changes in the value and/or quantity of non-wood forest products (e.g., hunting and game, cork, berries, mushrooms)

### Hunting and game

The Estonian Ministry of the Environment is responsible for the organisation of hunting matters and the accounting of resources at the state level. The management of hunting areas (4,07 mill. ha) is carried out in 299 hunting districts (of which 11 are state hunting district). The economic indicators of hunting activities for the years 1992–2001 have been reported by the hunting societies (see Table 3.3.1).

**Table 3.3.1. Economic indicators of hunting in 1992–2001**

Indicator	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Hunting area (mill. hectares)	4,03	4,01	4,11	4,08	4,07	4,11	4,07	3,98	4,00	4,07
Number of employees engaged in hunting	135	128	139	138	113	108	103	104	102	90
Number of registered hunters (1000 hunters)	16,4	16,6	20,0	19,5	20,2	20,0	18,8	15,6	13,6	14,0
Number of hunting licences for the citizens of foreign countries	..	..	..	..	1660	1852	1871	2040	1830	1826
Sale of venison (mill. EEK)	2,00	2,95	1,30	0,98	1,29	1,85	1,42	2,20	2,69	3,83
Sale of furs (mill. EEK)	0,05	0,17	0,10	0,08	0,09	0,09	0,15	0,06	0,07	0,11
Total income from hunting (mill. EEK)	4,06	8,13	8,05	8,85	9,40	10,96	14,88	17,78	16,98	17,98
income from hunting tourism (mill. EEK)	..	..	..	..	4,22	4,87	7,86	8,04	7,83	6,62
Total expenditure on hunting (mill. EEK)	3,06	6,63	8,00	8,81	10,44	10,78	13,99	17,65	17,23	17,31
expenditure on hunting tourism (mill. EEK)	..	..	..	..	2,35	3,05	4,51	5,89	7,29	5,26
expenditure on game management (mill. EEK)	0,66	1,26	1,74	1,89	1,98	1,88	2,27	2,67	2,59	2,47
expenditure on game protection (mill. EEK)	0,18	0,39	0,78	0,73	0,65	0,61	0,63	0,69	0,55	0,53

Source: Ministry of Environment

The number of registered hunters has decreased in the recent years because the cost of hunting as a hobby has increased significantly. Many “inactive” hunters were excluded from the register during the re-registration of hunters at the end of the 1990s. Hunting tourism of foreign citizens has gained popularity; incomes and expenditures in this field give a substantial part of the total economic data for hunting. The sale of venison has increased and totalled 3,8 mill. EEK in 2001, the sale of furs amounted to 0,1 mill. EEK for the same period.

Hunters count every year in nature the number of many game species; total figures form “the official game census” data. Special inventories are carried out for some species (e.g. bear, beaver). Number of harvested game (and most of hunting statistics) is registered in hunting societies that manage the hunting districts.

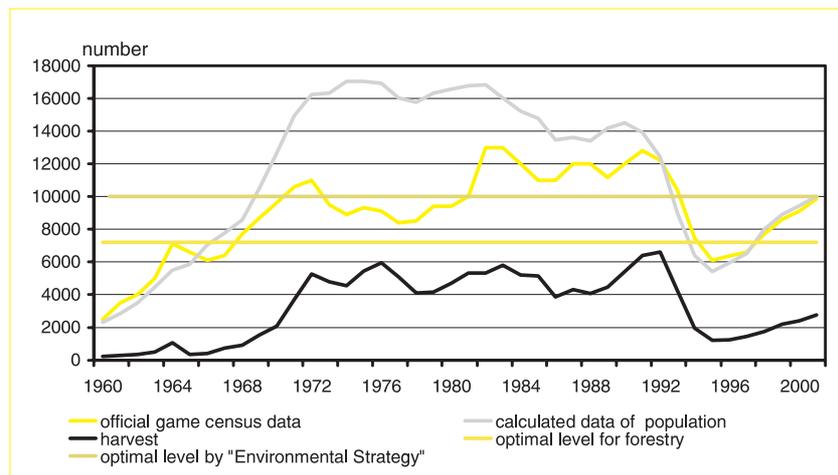
**Table 3.3.2. Population and harvest of game animals in 1992–2001 (1000 animals, game census data)**

Species	Number (1000 animals)	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Elk	Counted	15,0	12,0	7,5	6,2	6,3	6,6	7,7	8,7	9,2	10,0
	Hunted	6,6	4,3	2,0	1,2	1,2	1,5	1,8	2,2	2,4	2,7
Red Deer	Counted	1,3	1,2	1,3	1,2	1,2	1,1	1,4	1,5	1,5	1,3
	Hunted	0,2	0,2	0,1	0,1	0,1	0,1	0,2	0,2	0,2	0,1
Roe Deer	Counted	60,0	58,0	43,0	37,0	35,0	29,0	29,0	29,0	30,0	33,0
	Hunted	9,8	10,2	7,5	6,4	4,6	3,8	3,8	3,3	3,6	4,0
Wild Boar	Counted	16,0	16,0	13,0	11,0	10,0	8,5	10,0	11,0	11,0	12,0
	Hunted	9,2	8,2	4,9	3,9	2,3	2,4	3,3	3,5	4,0	4,9
Brown Bear	Counted	0,80	0,80	0,67	0,66	0,60	0,60	0,60	0,60	0,60	0,55
	Hunted	0,03	0,04	0,04	0,03	0,04	0,03	0,04	0,03	0,02	0,03
Wolf	Counted	0,40	0,46	0,52	0,70	0,50	0,30	0,30	0,20	0,15	0,19
	Hunted	0,12	0,15	0,21	0,30	0,20	0,14	0,12	0,10	0,06	0,05
Lynx	Counted	1,00	1,10	1,15	1,10	1,20	1,20	1,20	1,10	1,00	0,90
	Hunted	0,06	0,06	0,06	0,11	0,15	0,18	0,22	0,18	0,12	0,18
European Beaver	Counted	4,0	4,6	5,4	6,7	7,4	9,0	9,0	10,0	11,0	14,0
	Hunted	0,2	0,5	0,8	0,8	0,9	1,2	1,4	1,9	2,2	3,2

Source: Ministry of Environment

The number of elks, roe deer, wild boars and beavers has increased in the recent years, the number of wolves and bears has been stable and the number of red deer and lynxes has decreased. The number of beavers has experienced the most dramatic increase, with the species reintroduced into Estonian nature in the 1960s. Wolf, bear and lynx are considered and managed (including hunting) as managed species in Estonia. The numbers of harvested game of most of the above-mentioned species have increased except for wolf and red deer.

The number of elk has decreased considerably in 1990s and is close to the optimum level at the moment. Therefore the elk damages (browsing of pine shoots and peeling of spruce bark) have decreased.



Source: Ministry of Environment

Figure 3.3.1. Population and harvest of elk in 1960–2001

Table 3.3.3. Harvest of other game animals in 1992–2001

Species	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Raccoon Dog	2796	3278	2245	1723	1393	1516	1497	1925	2222	3753
Pine Marten	1115	1216	1031	817	643	608	633	811	912	1150
American Mink	368	249	324	157	151	184	328	313	343	342
Eurasian Badger	52	22	25	46	23	22	18	15	46	56
Muskrat	152	31	135	47	22	64	25	27	6	1
Red Fox	2369	3470	2524	3326	3955	3156	4179	4508	5022	5797
Western Polecat	322	310	252	139	103	150	150	163	158	250
European Hare	1596	1757	1667	2116	1879	1753	1489	1762	1621	1463
Mountain Hare	1568	1267	1106	1045	956	817	594	646	663	474
Fieldfare	0	0	0	0	0	0	0	104	42	75
Goose	1079	1118	919	1500	2207	1822	2007	3283	2901	3414
Pheasant	0	0	0	0	0	0	112	467	799	716
Woodpigeon	155	167	166	107	113	240	208	405	328	405
Hazel Grouse	340	203	151	132	122	212	100	119	245	123
Coot	194	87	51	309	18	151	221	112	72	121
Woodcock	2603	2457	1587	1510	61	164	267	352	588	760
Partridge	103	45	12	61	47	17	8	31	83	70
Duck	8985	8069	7035	..	9277	11159	12097	14135	11551	14403
Carrion Crow	4076	3227	3390	1111	865	2057	3137	2542	3390	3008

Source: Statistical Office of Estonia

The numbers of harvested pine martens, foxes and raccoon dogs are higher than the figure for hares – an indication of the high number of small predators. This fact explains the low figures for the population and harvest of hazel grouse, partridge and hares.

There is no systematic registration of the value and amount of venison. Expert estimates for the total amount of elk meat harvested in 2001 is 350 000 kg and for its value – 10,5 million EEK (the estimates are based on the calculation of the total amount of harvested venison and market prices, in reality most of the meat is not marketed). A similar estimate is 1500 kg and 0,2 mill. EEK for brown bear meat, 150 000 kg and 7,5 mill. EEK – for wild boar and 60 000 kg and 2,4 mill. EEK – for roe deer.

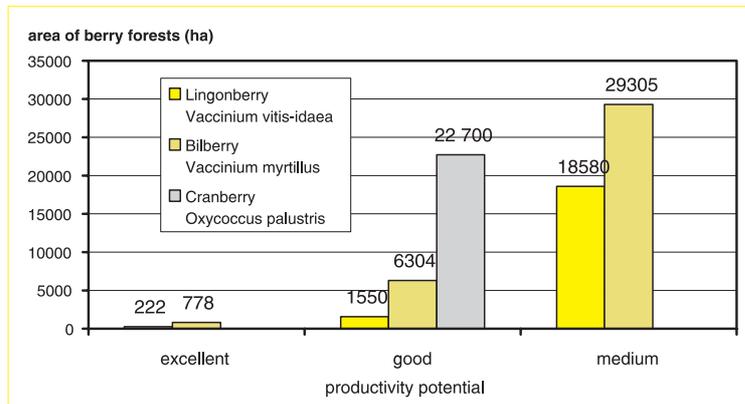
## Berries and mushrooms

Picking of wild berries and mushrooms is a right granted to everyone by the right to public access pursuant to Chapter 4 “Use of Forest” of the Forest Act.

The Act states in **§ 32. Restrictions on the right to use forest:**

- (1) 1) it is permitted to stay in the forest, and to gather berries, mushrooms, nuts, ornamental branches, herbs and ornamental plants or their parts, without prejudicing the interests of the owner of the forest; without disturbing the ecosystem, game and protected animals during their breeding season, and without disturbing other persons staying in the forest; without leaving permanent traces; and filling fire safety requirements and the requirements of the owner of the forest or the manager of state forest;
- (2) If a forest owner has made expenditures to increase the productivity of forest berries, mushrooms, nuts, ornamental branches, herbs and ornamental plants or their parts, or if the revenues from other uses of forest have decreased due to the measures to increase productivity of the above-listed by-products, he or she has the right to charge for the gathering of forest berries, mushrooms, nuts, ornamental branches, herbs and ornamental plants or their parts.

Picking of wild berries and mushrooms is one of the traditional uses of forests, which has not lost its economic importance. Although it is often just a good reason to go to the forest and enrich one’s diet, many people still earn a great part of their summer-time income from selling berries and mushrooms. It is an important activity in the southern and eastern parts of Estonia with their good berry forests, high unemployment rates and a low general income level.

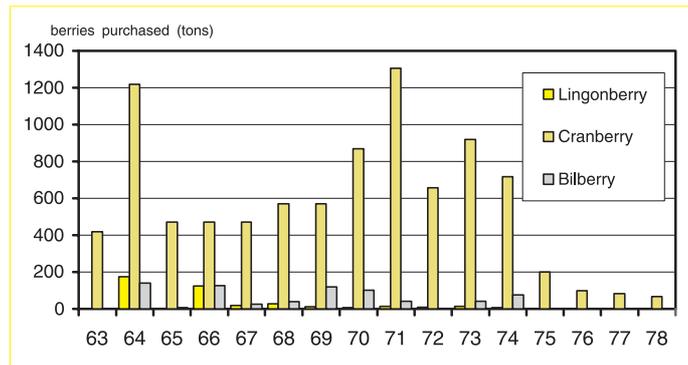


Source: Forestry Research Institute

Figure 3.3.2. Area of most important wild berry habitats

The total area of productive cranberry sites (average crop per ha at least 250 kg) was estimated to be 22 705 ha (1% of the total forest area estimate in 2001) according to the inventory of cranberry bogs carried out in 1966–71. Good bilberry forests form about 1,6% of the total forest area and lingonberry forests 0,9%. According to the research from 1986 there were 222 ha of high productivity lingonberry forests, 1550 ha with average productivity and 18 580 ha of young prospective lingonberry forests; there were 778 ha of very good bilberry forests, 6304 ha of average and 29 305 ha of young potential bilberry forests.

Cranberry was the most actively purchased wild berry for many decades with its biological crop 5700 tons per year. In the 1990s situation changed and bilberry became the best-purchased berry. In a mediocre crop year it is possible to gather 2150 tons of bilberries and 120 tons of lingonberries; in a good crop year the figures are 3500 tons for bilberries and 250 tons for lingonberries. This is based on the assumption that about 15-25% of cranberry stock, 30–50% of bilberry and 40% of lingonberry biological yield is picked annually and remote areas with difficult access were excluded. Of mushrooms, with the exception of chanterelles, only a little part of the total stock is used



Source: Forestry Research Institute

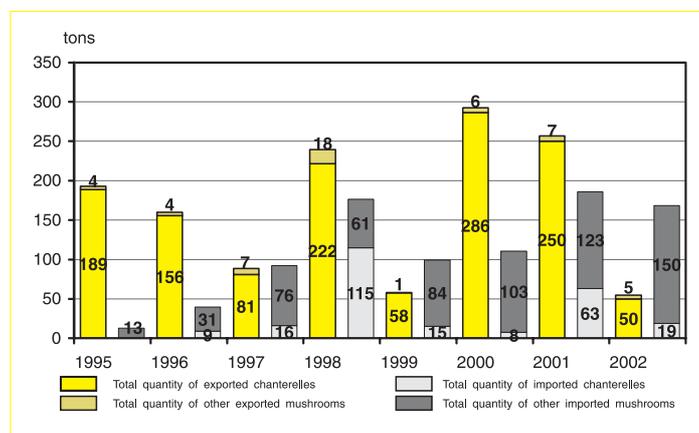
Figure 3.3.3. State purchases of wild berries in 1963–1978

There is no statistics available on the amounts and values of berries marketed in the recent years. Data of purchased berries in Figure 3.3.3. date back to the period when a centralised purchasing system existed. At the beginning of the 1990s the amount of purchased berries decreased rapidly and later only the data on bilberry purchases have exceeded the relevant figures for the 1960–1970s. Prices of 1 kg of wild berries have been 8–12 EEK in the recent years.

In 1995, an analysis of household budgets indicated that in the period 1992–1995 2 kg of wild berries and 2,4 kg of mushrooms per capita were gathered or purchased at the market.

### Foreign trade of berries and mushrooms

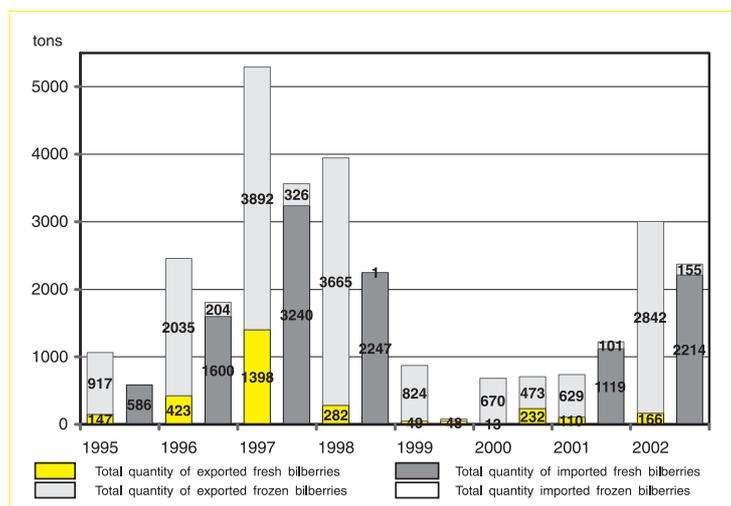
Of numerous edible mushrooms only chanterelles have been picked and traded in bigger quantities. Chanterelles (*Cantharellus cibarius*) formed the majority of exported mushrooms (92–99%) and the annual value of their exports was 3,5–10,4 mill. EEK in 1995–2002.



Source: Statistical Office of Estonia

Figure 3.3.4. Foreign trade of mushrooms in 1995–2002

Bilberry has the highest commercial value among the wild berries. Fresh bilberries were imported from neighbouring countries (Latvia, Lithuania, Russia), frozen and then exported to Scandinavia or Central Europe in many cases. The total annual value of bilberry exports was 11,6–68,6 mill. EEK and the value of their imports 1,4–29,2 mill. EEK in 1995–2002.



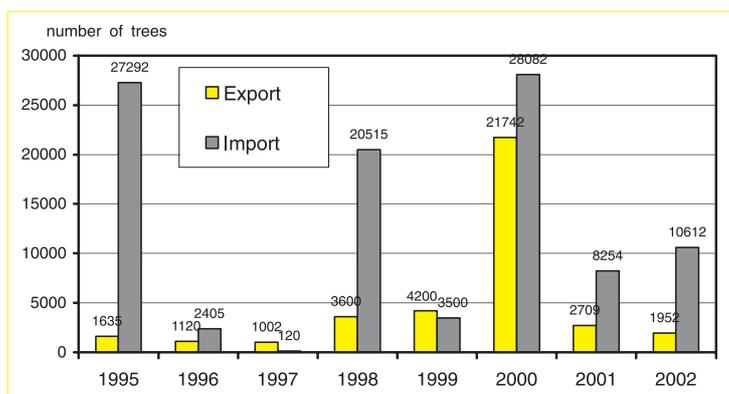
Source: Statistical Office of Estonia

Figure 3.3.5. Foreign trade of bilberries in 1995–2002

The total export value of non-wood forest products was 2% of the relevant value of wood and wood products in 2000.

### Christmas trees

About 200 000 Christmas trees have been used for decoration in the recent years. Most of them are Norway spruces cut from the home forest or bought at the market but a number of imported trees have entered the market in the 1990s. The expert estimate for the total annual value of all the used Christmas trees is 30 mill. EEK. There are ca 45 ha Christmas tree plantations in Estonia.



Source: Statistical Office of Estonia

Figure 3.3.6. Foreign trade of Christmas trees in 1995–2002



## Criterion 4

### MAINTENANCE, CONSERVATION AND APPROPRIATE ENHANCEMENT OF BIOLOGICAL DIVERSITY IN FOREST ECOSYSTEMS

#### Indicator 4.1.

#### Changes in the area of

##### a. natural and ancient seminatural forest types

Fast changes in Estonia's forest area during the 19<sup>th</sup> and the 20<sup>th</sup> centuries have also involved changes in the areas of natural and seminatural forest types. Although the majority of the Estonian forests are natural in their origin, later forest management activities have influenced them in such a way that they do not resemble **natural forest types**. Naturally developed forests can be found in single small patches scattered all over Estonia and the area of so-called **old-growth forests** is estimated not to exceed 500 ha (0,02%). Together with **natural** and **recovering forests** the rate of forests relatively little disturbed by human activities is estimated to be 2-2,5% of the total forest area, ca 45 000–55 000 ha. The majority of natural forests is assembled in the existing and designed conservation areas, where their rate extends to 5,3% on the average, in exceptional cases in small conservation areas – up to 95% (Completion Report, 2001). In commercial forests the rate of woodland key habitats is 1,2% as an average (Martverk, 2001).

Most of the Estonian forests are secondary forest communities that have been formed after comprehensive disturbances of human origin. From these, only mesotrophic pine forests (*Vaccinum vitis-idea* and *Oxalis–Vaccinum vitis-idea* site types of the mesotrophic forest group) formed after the clearing of land for tillage on poor soils are regarded as **ancient seminatural forest types**, which do not occur in forest natural succession. According to the data of statistical forest inventory from 1999 (Eesti Metsad 1999, 2000), their area is approximately 100 000 ha (ca 4,5% of the total forest area). During natural succession mesotrophic pine forests turn into spruce-stands and further – mixed spruce stands. The need to preserve mesotrophic pine forests as seminatural heritage communities having original cultural value and enriching biological diversity has become actual since mid 90s and present trends of forest management, including forest certification requirements, stress the need to use special forest management measures to assure their preservation as pine stands.

The most typical heritage communities associated with forest – **wooded meadows and wooded pastures** – are not forests by definition and they are not classified as forest types, because they do not comply with the definition of forests in the Forest Act (canopy density below 0,3). Still, they are registered as woodland key habitats what should be paid special attention. It is the most ancient and species-rich ecosystem in the forest belt that has been formed as a result of human activities ([www.pk.ee](http://www.pk.ee)). Communities resembling wooded meadows started to emerge around ancient settlements 7000–8000 years ago and their highlight was at the end of the 19<sup>th</sup> century, when the area of wooded meadows being mowed and pastured was approximately 850 000 ha or 18% of the

Estonian mainland. Until World War II the area of wooded meadows decreased slowly. Without mowing wooded meadows overgrow with bushes in 5–10 years and a great part of our wooded meadows perished during 20–30 years after the cessation of management activities. Nowadays the area of species-rich wooded meadows in Western Estonia is approximately 500 ha and species-poor alluvial wooded meadows in other parts of Estonia cover up to 300 ha.

## b. strictly protected forest reserves

The existing protected areas of Estonia have been established in view of different considerations. However, these areas mainly focus on the protection of rare or otherwise valuable objects of biotic and abiotic nature, while the aspects of representativeness of biological diversity of forests have been largely overlooked. Therefore the existing protected areas do not form a coherent network in which the diversity of Estonian landscapes, habitats of different organisms, communities (including forest ones) and species would be represented to a maximum possible extent.

The Protected Natural Objects Act adopted in 1994 determined the need to draw up new protection rules for protected areas and to adjust the existing zoning and external boundaries. Approximate estimates of the overall area of strictly protected forests for this report have been calculated on the basis of CORINE Land Cover map and the data of state forests can be extrapolated to all the protected forests to get an estimate of the distribution of forest site-types.

There were approximately 52 000 ha of strictly protected forests, i.e.

- forests in strict nature reserves
- forests in special management zones

of the existing protected areas left to natural development on the basis of data from December 2000 (Viilma, et. al., 2001). In addition, there were 32 000 ha of tended forests in the special management zones of protected areas that have also been strictly protected forests according to the interpretation agreed upon within the framework of preparing the Estonian Forestry Development Programme. All together there were **84 000 ha (3,7% of the total forest area) of strictly protected** forests where the main goal was to protect the natural development of forest communities, as well as species protection.

As a result of the ongoing establishment of forest reserves within the framework of different projects (e.g. the Estonian Forest Conservation Area Network and Estonian Natura 2000) and the preparation of new protection rules for the existing protection areas and habitats of protected species, the total area of strictly protected forests including forests in

- strict nature reserves
- special management zones (either tended or left to natural development)
- woodland key habitats of more than 4 ha in state forests left to natural development
- strictly protected zones of prospective forest reserves
- display grounds of *Capercaillie*
- surroundings of habitats of the category I protected species

has increased to more than **163 600 ha or 7,3%** of the total forest area of Estonia (data from 18 December 2002, table 4.1.1.).

In 2002 the Estonian Forestry Development Programme stated the objective to achieve the area of protected forests to be 10% of the total forest area of Estonia by 2012. To achieve this goal, an inventory of areas subject to the land reform was foreseen. The area of strictly protected forests also increases resulting from the compilation of new protection regulations for the existing conservation areas as their zonation will determine new areas for strict protection. The development of Natura 2000 network will also add some strictly protected areas. The Nature Protection Department of the Estonian Ministry of the Environment as the body responsible for Estonian Natura 2000 project, considers the establishment of new nature conservation areas for most of the forest habitats under the EU Habitat Directive to preserve their favourable conservation status. In 2003 protection rules and management plans will be prepared for all the potential Natura 2000 areas and strictly protected forest areas will be determined in course of this process.

### c. forests protected by special management regime

Forests protected by special management regimes are the stands in special management zones of conservation areas and in areas equivalent to them – within a 50 m radius around single protected nature objects. The current overview does not involve forests with restricted use, the management restrictions of which arise from other legal acts besides the Nature Conservation Act (the Water Act, the Shores and Banks Protection Act etc), because the area of these forests is unknown and their management regime is subordinated to requirements similar to those limiting mainly the area of final fellings.

In the future forests protected by special management regimes should also include forests where nature restoration measures are applied. Relevant guidelines were compiled by the end of 2002 and presented for public discussion. The first experiments on the restoration of biological diversity and the natural state of cultivated stands in Estonia were carried out in 2001 in Karula National Park. Similar activities are to be continued within the framework of LIFE-Nature project.

#### Naturalness

There are no comparable data on the previous decades to calculate changes in the **area of forests undisturbed by man**. Presumably the forests of strictly protected zones of conservation areas and similar areas remain undisturbed and the enclosed area of forests partially disturbed by human activities increases slowly. In commercial forests changes in the area of natural forests can be estimated only by the results of old-growth forests inventory carried out in the middle of the 1990s: within three years after the inventory about 60% of the registered old-growth forests lacking any protection regime had been cut.

In state forests woodland key habitats that often represent undisturbed forest patches surrounded by commercial forest, have been registered and protected since 2000. Thus the actual decrease of the area of forests undisturbed by man should be significantly slower.

Most of the Estonian forests (over 96% of them) are to be classified as **semi-natural** forests at the current stage, i.e. they are either naturally regenerated or cultivated, but moderately managed and therefore cannot be defined as plantations.

In Estonia, conclusions on the area of cultivated stands cannot be made on the basis of annual regeneration volumes: in some cases the same sites are repeatedly cultivated, data on older planted stands and annual felling volumes of cultivated stands are not registered and the state forest survey databases do not contain systematic information on older cultivated stands. In the 1990s less than ¼ of regeneration felling areas were reforested, the rest of the felling areas were left to natural regeneration. Cultivated stands become mostly mixed stands due to the invasion of natural tree species and in terms of the present instruction they should be handled as seminatural stands.

The area of intensively managed monoculture plantations is represented to a very limited extent – up to 800 ha altogether:

- plantations of Christmas trees – estimated area 40–45 ha ;
- plantations of hybrid aspen (*Populus wettstein*) – estimated area 480–500 ha;
- generative seed orchards – 248 ha.

#### Protected forest

The Protected Natural Objects Act (passed in 1994) stipulates rules for the establishment of protected areas. Their territories are divided into zones according to the protection regime. The territory of a national park and a nature reserve is divided into strict nature reserves, special management zones and restricted management zones, the territories of protected landscapes are divided into special management zones and restricted management zones. In addition, surroundings of the habitats of protected species are managed as special management zones or restricted management zones of protected areas.

Silvicultural activities allowed in a protected area are specified by the protection rules. Forests of **strict nature reserves** and special management zones belong to the category of protected forests and are strictly protected pursuant to the **Forest Act** (passed by the Parliament in December 1998). Forests of a **restricted management**

**zone** where certain silvicultural activities are allowed by protection rules belong to the category of protection forests. In a **special management zone**, thinning of the tree and shrub layer can be allowed in conformity with the protection objective.

The Forest Act also defines **woodland key habitats** as a part of forest that requires protection and where there is a high probability of the occurrence of endangered, vulnerable or rare species. Key habitats include biotopes such as small patches of old-growth and natural forests, small mires, burnt woodlands, bog islands, ravines, overgrown former gardens and wooded meadows.

Forests of various protection regimes have been divided into MCPFE categories according to the protection regime as shown in table 4.1.1. The analysis is based on the data of the Estonian Nature Database EELIS, GIS of the Estonian Forest Conservation Area Network Project, the Register of Woodland Key Habitats and the CORINE Land Cover Map from December 2002. Broad-leaved forests, coniferous forests and mixed forests on the CORINE Land Cover Map have been calculated as 'forests', transitional woodlands on mineral soils and mires have been calculated as 'other wooded land'. Forests fulfilling the criteria of different protection regimes can overlap, but overlaps are eliminated under the summaries of different MCPFE categories (1.1.; 1.2. etc.) and the relevant forest area is presented here under the strictest of the alternative protection regimes.

**Table 4.1.1. Forests of different protection regimes according to MCPFE categories.**

MCPFE category (CORINE Land Cover Map data)	Forest		Other wooded land		Total	
	ha	%	ha	%	ha	%
<b>1.1. No active intervention</b>	<b>3372</b>	<b>0,15</b>	<b>924</b>	<b>1,06</b>	<b>4296</b>	<b>0,18</b>
* strict nature reserves	3372	0,15	924	1,06	4296	0,18
<b>1.2. Minimum intervention</b>	<b>124369</b>	<b>5,53</b>	<b>48187</b>	<b>55,39</b>	<b>172557</b>	<b>7,38</b>
* special management zone left to natural development	51980	2,31	37497	43,10	89477	3,83
* woodland key habitats left to natural development	12464	0,55	874	1,00	13338	0,57
* strictly protected zone of proposed new forest reserves	24353	1,08	3117	3,58	27470	1,18
* display grounds of <i>Capercaillie</i>	37733	1,68	8895	10,22	46628	2,00
* surroundings of habitats of the protected species of I category	8288	0,37	1154	1,33	9442	0,40
<b>1.3. Conservation through active management</b>	<b>103809</b>	<b>4,61</b>	<b>22137</b>	<b>25,44</b>	<b>125946</b>	<b>5,39</b>
* special management zone maintained	35884	1,59	8931	10,27	44815	1,92
* woodland key habitats to be maintained	500	0,02	44	0,05	544	0,02
* buffer zone of display grounds of <i>Capercaillie</i>	71944	3,20	14357	16,50	86301	3,69
<b>2. Protection of Landscapes and Specific natural elements</b>	<b>95051</b>	<b>4,22</b>	<b>16423</b>	<b>18,88</b>	<b>111474</b>	<b>4,77</b>
* limited management zone	94799	4,21	16391	18,84	111190	4,76
* surroundings of single protected nature objects	252	0,01	32	0,04	285	0,01
<b>Total area of protected forest</b>	<b>300924</b>	<b>13,37</b>	<b>81811</b>	<b>94,04</b>	<b>382734</b>	<b>16,38</b>
<b>Total area</b>	<b>2250000</b>	<b>100,00</b>	<b>87000</b>	<b>100,00</b>	<b>2337000</b>	<b>100,00</b>

## List of publications

**Completion Report**, January 2001. Estonian Forest Conservation Area Network. Manuscript, Tartu. 35 p.

**Eesti Metsad 1999, 2000**. Metsavarude hinnang statistilisel valikmeetodil. OÜ Eesti Metsakorralduskeskus. Tallinn. 44 p.

Martverk, R. 2001. **Vääriselupaigad – metsade rikkus**. Eesti Loodus, 11: p. 414–417.

Paal, J. 2000. **“Loodusdirektiivi” elupaigatüüpide käsiraamat. Eesti Natura 2000**. Tartu. 202 p. – <http://www.botany.ut.ee/jaanus.paal/n2000.pdf>

Vilma, K., et al. 2001. Estonian Forest Conservation Area Network. **Final Report of the Estonian Forest Conservation Area Network Project**. Triip Grupp, Tartu. 95 p+306 p.

## Indicator 4.2.

### Changes in the number and percentage of threatened species in relation to total number of forest species (using reference lists e.g., IUCN, Council of Europe or the EU Habitat Directive)

#### Threatened forest species

Altogether 16 042 species of birds, mammals, invertebrates, vascular plants, cryptogams and fungi have been registered in Estonia; a half of them are connected with forests. 504 forest species are estimated to be endangered (6% of all the forest species). The biggest number of endangered and protected species can be found in secondary forest communities (mesotrophic pine forests), but many species are also connected with undisturbed forests – especially insects, mushrooms, lichens and mosses.

Legislation stipulates the compilation of species management plans, which form a basis for the management of species habitats, species management activities and monitoring. Until now species management plans are compiled only for some species as *Tetrao urogallus*, *Cypripedium calceolus*, *Aquila clanga*, protected ferns of I category and big predators.

**Table 4.2.1. Species that are threatened and need protection in the Estonian forests (Viilma, et. al., 2001)**

Species groups	Total number registered taxa in Estonia	IUCN Red List categories				Total number of threatened taxa in forest
		Vulnerable	Endangered	Critically endangered	Extinct in the wild	
		no of taxa/% from total number of species				
Birds	329	14 4,2%	92 28,0%	6 1,8%	3 0,9%	115 34,9%
Mammals	65	7 10,8%	20 30,8%	6 9,2%		33 50,8%
Other vertebrates	11 amphibians		8 amphibians 72,7%			8 amphibians 72,7%
	5 reptiles		5 reptiles 100,0%			5 reptiles 100,0%
Invertebrates	9499	13 0,1%	24 0,3%	39 0,4%	1 0,0%	77 0,8%
Vascular plants	1182	6 0,5%	49 4,1%	28 2,4%	2 0,2%	85 7,2%
Cryptogams and fungi	3626 fungi	6 0,2%	21 0,6%	73 2,0%	1 0,0%	101 fungi 2,8%
	525 mosses		4 0,8%	21 4,0%		25 mosses 4,8%
	800 lichens	9 1,1%	13 1,6%	18 2,3%	15 1,8%	55 lichens 6,8%
<b>Total</b>	<b>16 042</b>	<b>55 0,3%</b>	<b>236 1,5%</b>	<b>191 1,2%</b>	<b>22 0,1%</b>	<b>504 3,1%</b>

According to the best knowledge, the forest environment of Estonia hosts at least **504** species that are threatened and require protection on the state level. Of these, more than **200** species are rare or threatened in Europe and are listed in different “red lists”. Of these, **125** species are listed as species requiring protection in annexes II, IV or V of the Habitats Directive or Birds Directive, **121** species in the Bern Convention, **20** species in the Bonn Convention and in other international agreements. In addition to the above-mentioned species, Estonia hosts also **8** species that are listed in the annexes of the Habitats Directive but are not deemed as threatened or requiring protection in Estonia. For instance, the largest carnivores of Estonia are not threatened here and have been recently managed as game. The designation of the lynx, brown bear and wolf as strictly protected species causes problems in Estonia and will affect the balance of forest ecosystems.

The occurrence of a considerably large number of species (in comparison to the area) that are rare in Europe is mainly due to the fact that until the middle of 1990s the management intensity of forests has been relatively low. A large number of species considered to be threatened in Estonia but not in Europe results from the fact that Estonia remains in the marginal area of the zone of occurrence of many species, they are not numerous here and need special attention for preservation.

Most of the threatened and/or rare species do not tolerate active human activities in their habitat or in its immediate vicinity and prefer old untouched forest communities. The largest number of species that are rare and require protection occurs in moderately moist forests. Biological diversity is low in pure stands and young and middle-aged stands.

The lists of threatened species are likely to be substantially supplemented in the future. Incompleteness of the lists is caused by the fact that many species have not been adequately studied and, therefore, it is difficult to assess their threatenedness, rarity and protection requirements.

## List of publications

Viilma, K., et al. 2001. Estonian Forest Conservation Area Network. **Final Report of the Estonian Forest Conservation Area Network Project.** Triip Grupp, Tartu. 95 p+306 p.

<http://sunsite.ee/loomad/>

<http://www.zbi.ee/punane/>

<http://www.redlist.org/>

### Indicator 4.3.

**Changes in the proportions of stands managed for the conservation and utilization of forest genetic resources (gene reserve forests, seed collection stands, etc.); differentiation between indigenous and introduced species.**

The network of *in situ* gene conservation units includes the gene reserve forests of the two major softwood species in Estonia – the Norway spruce (*Picea abies* (L.) Karst.) and the Scots pine (*Pinus sylvestris* L.). The inventory, management and protection of the gene reserve forests has started in 1985. The objective of the work was to conserve the gene composition of the best natural or seminatural softwood populations. The forests of these selected populations are regenerated either naturally or artificially using the seeds or nursery plants originating from the same area as the gene conservation unit. Gene transfer is not allowed in gene reserve forests. Today, the total area of gene reserve forests is 2648 ha (Table 4.3.1.). During the last 10 years the total area of gene reserve forests has decreased by approximately 25%. Changes in the management of these forests due to the privatization of former state forests have been among the reasons behind the reduction in this area.

Table 4.3.1. Gene reserve forests in 2002

Species	Number	Area, ha
Scots pine	4	1477
Norway spruce	5	1171
<b>Total</b>	<b>9</b>	<b>2648</b>

Source: Estonian Center of Forest Protection and Silviculture

To manage genetic resources for *ex situ* gene conservation the collection of the best clones (the clone archives) has been introduced since 1965. In 2002 the total area of clone archives was 248 ha. 83% of the area is dedicated to the maintenance of the best genotypes of the Scots pine and 14% – of the Norway spruce. About 3% of the area is covered by larch species introduced into Estonia. At present 82% of the total area (204 ha) of clone collection areas is also managed as seed orchards.

To avoid poor genetic adaptation the seed and plant material of the Norway spruce and the Scots pine must comply with the requirements for regions of origin. The regions of origin are determined by areas of the similar ecological conditions and phenotypic characteristics. There are 2 regions of origin for spruce and 4 for pine.

In 2002 the national project for selection, registration and special management of the seed collection stands of the Scots pine and the Norway spruce was started. One of the purposes of the project is also the maintenance of genetic resources.

## Indicator 4.4.

### Changes in the proportions of mixed stands of 2–3 tree species

The National Forest Inventory (NFI) based on the sampling method was implemented in Estonia in 1999–2001. For the first time, data on pure and mixed stands were calculated separately, using the NFI data.

Table 4.4.1. The share of pure and mixed stands in 2001

Dominant tree species	Distribution of stands by dominant tree species		PURE* STANDS		
	Area (1000 ha)	Share from total area of stands (%)	Area (1000 ha)	Share of pure stands (%)	Share of pure stands from total area of stands (%)
<b>CONIFEROUS STANDS</b>	<b>1052,3</b>	<b>50,3</b>	<b>691</b>	<b>65,7</b>	<b>33,0</b>
Pine	681,9	32,6	514,1	75,4	24,6
Spruce	370,4	17,7	176,9	47,8	8,5
<b>Deciduous stands</b>	<b>1038,6</b>	<b>49,7</b>	<b>561,9</b>	<b>54,1</b>	<b>26,9</b>
Birch	654,0	31,3	369,9	56,6	17,7
Aspen	109,9	5,3	45,3	41,2	2,2
Black alder	65,0	3,1	22,7	34,9	1,1
Grey alder	178,6	8,5	124,0	69,4	5,9
Others	31,1	1,5			
<b>TOTAL</b>	<b>2091,1</b>	<b>100,0</b>	<b>1252,9</b>	<b>59,9</b>	<b>59,9</b>
			MIXED STANDS		
			Area of mixed stands (1000 ha)	Share of mixed stands from total area of stands (%)	
<b>CONIFEROUS MIXED STANDS**</b>			182,2	8,7	
<b>DECIDUOUS MIXED STANDS***</b>			398,5	19,1	
<b>CONIFEROUS/DECIDUOUS MIXED STANDS****</b>			257,5	12,3	
<b>TOTAL MIXED STANDS</b>			<b>838,2</b>	<b>40,1</b>	
		<b>TOTAL</b>	<b>2091,1</b>	<b>100,0</b>	

\* pure stands contain at least 70 % of the dominant tree species, therefore 3/4 (75,4 %) of stands with pine as the dominant tree species are pure stands, etc.

\*\* the share of pine and spruce together is at least 70 % in coniferous mixed stands

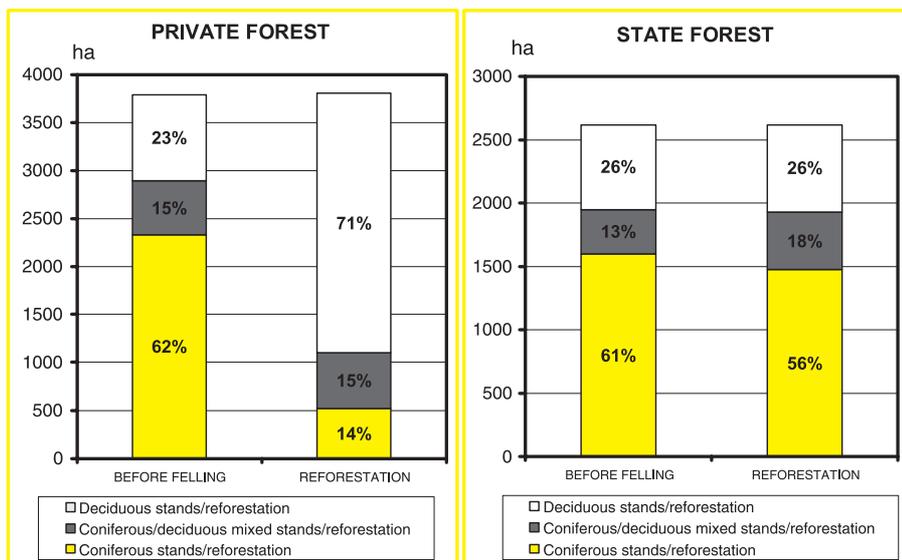
\*\*\* deciduous mixed stands contain at least 70 % of deciduous trees

\*\*\*\* all the other cases

Source: Estonian Forest Survey Center

In 2001, a review of clearings from the years 1996 and 1997 was conducted covering 67% of these areas in private and 52% in state forests. It was aimed at getting an overview of the regeneration of 4–5 years old clearings **in state and private forests** by tree species and site conditions. Pre-felling and regeneration information was matched, thus receiving an overview of the general tendencies in the species composition of forests. The review of clearings and the inventory of forest resources based on the sampling method both used the same methodologies for the classification of cut stands and the consequent regeneration of clearings.

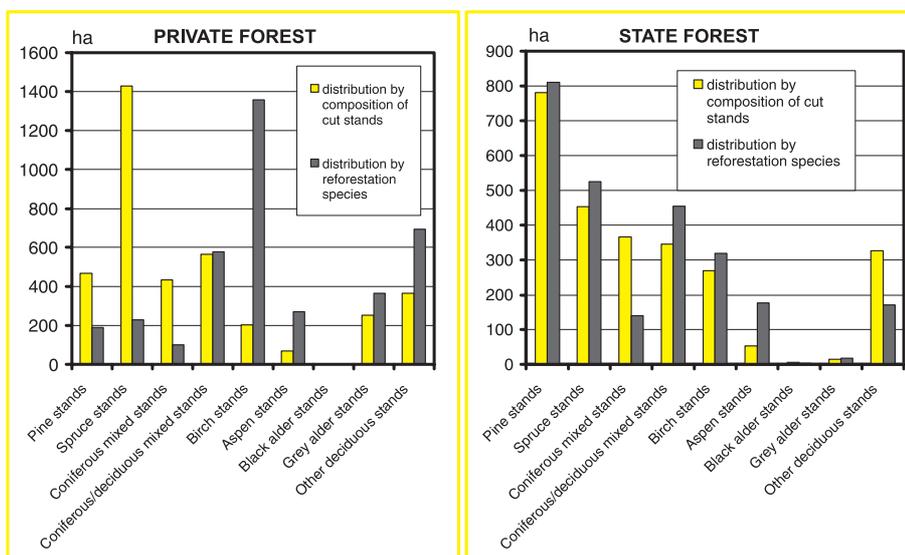
In state-owned forests both the changes in the species composition of the regeneration in comparison with composition of cut stands and the share of clearings with low regeneration potential (2%) are insignificant.



Source: Center of Forest Protection and Silviculture

Figure 4.4.1. The share of coniferous, deciduous and deciduous-coniferous mixed stands before felling and reforestation 4 years after felling

16% of the clearings inventoried in private forests have no regeneration potential. Of these, 70% were previously covered with coniferous stands and 15% – with coniferous-deciduous mixed stands. The share of coniferous stands is decreasing by almost 48% in the inventoried areas with regeneration potential. Prior to the fellings, 62% of the corresponding areas were covered by coniferous stands, but data on the species composition of forest regeneration demonstrate that coniferous regeneration covers only 14% of the area (Figure 4.4.1.).



Source: Center of Forest Protection and Silviculture

Figure 4.4.2. The distribution of regeneration areas by dominant tree species before felling and reforestation 4 years after felling

Inadequate tending of coniferous regeneration can reduce the share of coniferous stands in the inventoried areas by another 7%. The area of spruce stands in the inventoried areas with regeneration potential is decreasing by 84%, that of pine stands – by 60% and the area of mixed coniferous-deciduous stands – by 77% (Figure 4.4.2.).

## Indicator 4.5.

### In relation to total area regenerated, proportions of annual area of natural regeneration

Clearfellings and forest regeneration volumes have remained stable in state forests and the share of areas left to natural regeneration has varied between 26–37% of the clearfelling area for the previous year (Table 4.5.1.).

As clear felling volumes have increased rapidly in private forests, a certain increase in the private forest owners' interest in artificial regeneration can be noticed. But most of the clearings (88–94%) are still left to natural regeneration.

Continuous increase in the clear felling volumes in private forests together with low artificial regeneration volumes has increased the share of areas left to natural regeneration from 41% to 72% in all the Estonian forests taken together.

**Table 4.5.1. The share of areas left to natural regeneration compared to the regeneration felling area for the previous year in 1995–2001**

Year	1994	1995	1996	1997	1998	1999	2000	2001
STATE FOREST								
Regeneration felling (ha)	6609	5794	6730	7107	6982	7506	7907	7719
Cultivated areas (ha)		4186	4297	4686	4739	5075	5156	5102
Share of natural regeneration*, %		37	26	30	33	27	30	35
PRIVATE AND OTHER FOREST								
Regeneration felling (ha)	841	1713	3106	7782	10152	15095	17675	21897
Cultivated areas (ha)		98	99	250	757	1061	1503	1983
Share of natural regeneration*, %		88	94	92	90	90	90	89
TOTAL								
Regeneration felling (ha)	7450	7507	9836	14889	17134	22601	25580	29616
Cultivated areas (ha)		4284	4396	4936	5496	6136	6659	7085
Share of natural regeneration*, %		42	41	50	63	64	71	72

\* share of natural regeneration is the ratio of areas left to natural regeneration into the regeneration felling area of the previous year

\*\* figures of regeneration felling areas for 1994–1998 include shelterwood fellings, figures for 1999–2001 indicate area of clearfellings

Source: Statistical Office of Estonia



## **Criterion 5**

### **MAINTENANCE AND APPROPRIATE ENHANCEMENT OF PROTECTIVE FUNCTIONS IN FOREST MANAGEMENT (NOTABLY SOIL AND WATER)**

#### **Indicator 5.1.**

##### **Proportion of forest area managed primarily for soil protection**

Forests designated primarily for soil protection, are situated:

- in areas sensitive to erosion and wind damage;
- on alvars.

The area and proportion of forests managed primarily for soil protection are calculated using NFI sample plot information. Each sample plot from the inventories of 1999–2001 situated on an alvar or in an area sensitive to erosion was classified as a soil protection plot. The area of forest managed primarily for soil protection calculated according to that method is 63,2 thous. ha, soil protection forests form 2,8% of the total forest area.

Management requirements for soil protection forests:

- the width of a clearfelling area shall not exceed 30 m and its area shall not exceed 2 ha;
- the area of a shelterwood felling area shall not exceed 10 ha.

## Indicator 5.2.

### Proportion of forest area managed primarily for water protection

Forests, which are designated primarily for the water protection, are situated:

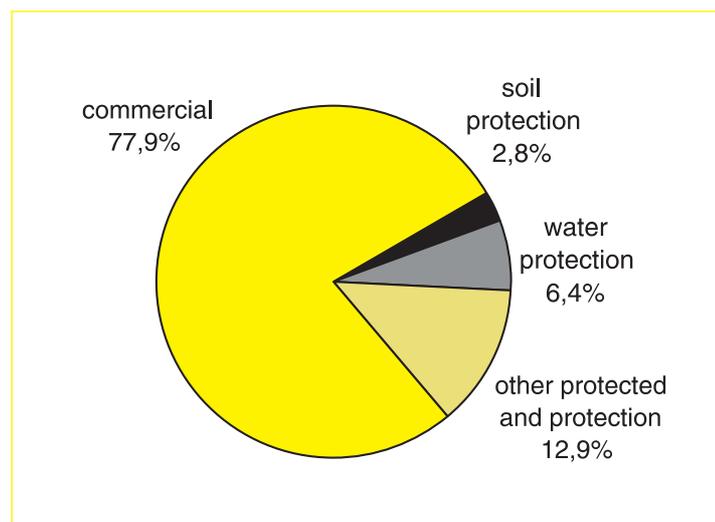
- on shores and banks;
- near springs and in areas with pressured groundwater;
- in infiltration areas;
- at drinking water intakes.

The width of water protection belts on shores and banks is determined by the Water Protection Belts Act depending on the size of a catchment area.

The area and share of forests managed primarily for water protection are calculated using NFI sample plot information. Each sample plot from the inventories of 1999–2001 situated on shores and banks, near springs and areas with pressured groundwater, in infiltration areas or at drinking water intakes was classified as a water protection plot. The area of forests managed primarily for water protection calculated according to that method is 144,2 thous. ha, water protection forests form 6,4% of the total forest area.

Management requirements for water protection forests:

- clearfelling is not allowed in special protection belts up to 20 m wide;
- in the vicinity of a special protection belt the width of a clearfelling area shall not exceed 30 m and its area shall not exceed 2 ha;
- the area of a shelterwood felling area shall not exceed 10 ha.



Source: Estonian Forest Survey Center

Figure 5.2.1. Distribution of forest land area by protection category

## List of publications

Eesti Metsakorralduskeskus. **Eesti Metsad 2001. Metsavarude hinnang statistilisel valikmeetodil.**



## Criterion 6

### MAINTENANCE OF OTHER SOCIO-ECONOMIC FUNCTIONS AND CONDITIONS

#### Indicator 6.1.

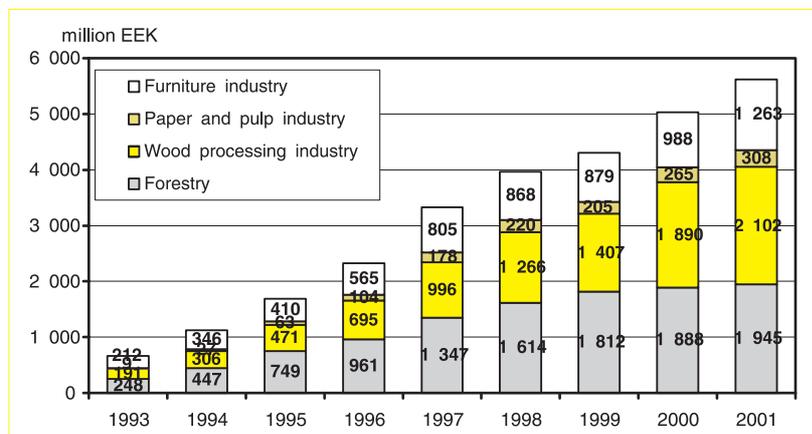
#### Share of the forest sector from the gross national product

Forestry and forest industry are closely interlinked with many other sectors e.g. transport, energy, tourism etc. The forest sector in this report means:

- forestry – forestry, logging and related services, ISIC/NACE 02.2;
- wood processing industry – manufacture of wood and articles of wood, ISIC/NACE 20;
- pulp and paper industry – manufacture of paper and paper products, ISIC/NACE 21;
- furniture industry – manufacture of furniture, ISIC/NACE 36.1.

Usually the furniture industry is not included in the sector. In this report it is included due to the big share of wooden furniture in the total furniture production. Nevertheless figures for the furniture industry must be considered carefully because they contain figures of other furniture makers.

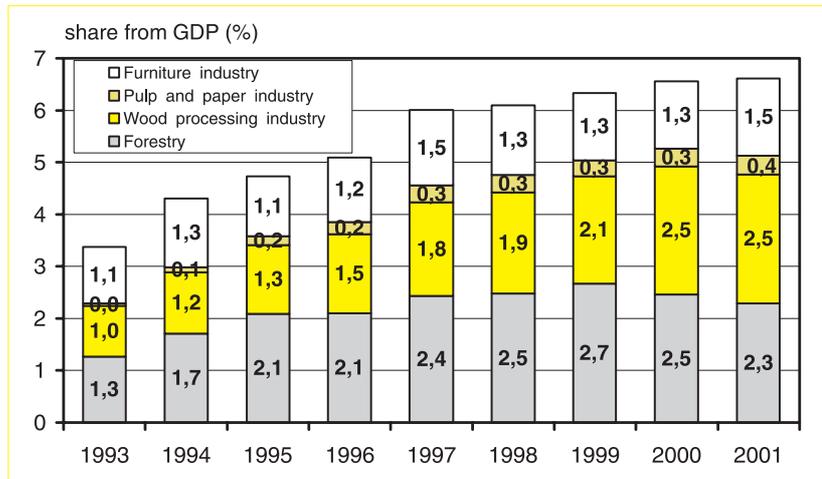
After a deep recession at the beginning of the transition to the market economy the forest sector companies have experienced a rapid and steady increase. Especially quick developments took place in the wood processing industry and forestry. Pulp and paper industry has not regained the position it had in the 1980s. The development of forestry has stabilised in the recent years.



Source: Statistical Office of Estonia

Figure 6.1.1. Added value of forest sector companies by current prices in 1993–2001

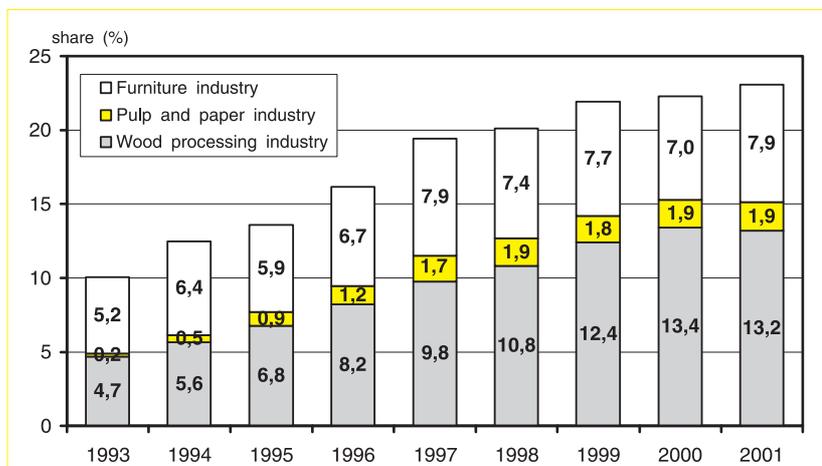
The share of the forest sector companies in the GDP is relatively high compared to other European economies. Wood processing industry had the biggest share in 2001 reflecting investments into sawmilling and further processing in the last 5–7 years. The total share of the forest sector in the GDP remained stable in the last 3 years, the growth in volumes is not visible because of the rapid development of other sectors (especially subcontracting in the manufacturing of electronic devices).



Source: Statistical Office of Estonia

Figure 6.1.2. Share of forest industry in the gross domestic product (by current prices) in 1993–2001

The share of forest industry in the added value of the manufacturing industry has been growing since 1993 and reached the high level of 23%. The forest sector is among the 3 major exporting sectors and is the biggest trade balancer of Estonia's overall negative trade balance.



Source: Statistical Office of Estonia

Figure 6.1. 3. Share of forest industry in the added value of the manufacturing industry (by current prices) in 1993–2001

## Indicator 6.2.

### Provision of recreation: area of forest with access per inhabitant, % of total forest area

Access to the forest is granted to everyone by the right to public access pursuant to Chapter 4 "Use of Forest" of the Forest Act.

The act states in **§ 32. Restrictions on the right to use forest:**

- (1) In forests owned by persons in public law and in private forests that are not fenced or marked, the following restrictions shall apply to the user of a forest that belongs to another person:
  - 1) it is permitted to stay in the forest, and to gather berries, mushrooms, nuts, ornamental branches, herbs and ornamental plants or their parts, without prejudicing the interests of the owner of the forest; without disturbing the ecosystem, game and protected animals during their breeding season, and without disturbing other persons staying in the forest; without leaving permanent traces; and filling fire safety requirements and the requirements of the owner of the forest or the manager of state forest;
- (3) In order to prevent a natural disaster in the case of an extraordinarily high fire hazard, the executive body of a local government has the right to prohibit:
  - 1) the use of forest for obtaining timber, the use of by-products, hunting, research and education, and recreation;
  - 2) staying in the forest belonging to another person.

Public access is prohibited in the strict nature reserves i.e. in 3372 ha of forest land and 924 ha of other wooded land. Thereby the public has access to 99,82% of the total forest and other wooded land area. The population of Estonia was 1 361 242 in 2002, the area of forest and other wooded land accessible to the public was 2 332 704 ha and the area of accessible forest and other wooded land per inhabitant was 1,71 ha.

Temporary restrictions are applied in the special management zones of protected areas; these are announced in the protection regulations of the area and are usually protected species specific. Local governments also have the right to prohibit the access to forest.

There are no data available on recreational facilities, the number of visits or time spent in the forests at the national level. The State Forest Management Center – the manager of one third of the forests of Estonia has classified 40 000 ha of state forests as recreational forests in 10 recreational areas. 8 forest houses, 9 forest huts, 26 camping sites, 330 km of hiking tracks, 22 watchtowers and 6 nature centres provide possibilities for recreation in state forests.

### Indicator 6.3.

#### Changes in the rate of employment in forestry, notably in rural areas (persons employed in forestry, logging, forest industry)

Forestry and forest industry have provided jobs for many persons. The following figures have been gathered by the Estonian Statistical Office during the Estonian Labour Force Surveys. Economic activities are grouped using the NACE categories.

The share of persons employed in forestry and pulp and paper industry have remained relatively stable throughout the period. The biggest increase in the number of employed persons took place in the wood processing industry; there were 19 100 persons employed i.e. 3,3 % of the total number of employed persons. The total forest sector employment figure for 2001 is 29 500 persons that makes 5,1% of the total number of employed persons.

Table 6.3.1. Number and changes in employment in the forest sector in 1989–2001

Economic activity		1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Forestry (NACE 02.2)	1000 persons	12,0	11,0	10,9	9,5	9,1	10,9	6,9	6,8	8,1	8,5	8,6	9,4	8,4
	share of the total (%)	1,4	1,3	1,3	1,3	1,3	1,6	1,1	1,1	1,3	1,4	1,5	1,6	1,4
Wood processing industry (NACE 21)	1000 persons	5,8	5,6	5,4	6,5	7,7	10,5	18,3	17,3	19,8	20,3	18,4	19,9	19,1
	share of the total (%)	0,7	0,7	0,7	0,9	1,1	1,6	2,9	2,8	3,2	3,4	3,2	3,5	3,3
Pulp and paper industry (NACE 22)	1000 persons	3,2	3,1	2,8	2,7	2,0	1,4	2,0	2,0	1,5	1,5	1,6	2,1	2,0
	share of the total (%)	0,4	0,4	0,4	0,4	0,3	0,2	0,3	0,3	0,2	0,2	0,3	0,4	0,3
Furniture industry (NACE 36.1)	1000 persons	n.a	5,5	10,4	10,7	9,8								
	share of the total (%)	n.a	0,9	1,8	1,9	1,7								
Total forest sector*	1000 persons	21,0	19,7	19,1	18,7	18,7	22,8	27,1	26,1	29,4	30,3	28,6	31,4	29,5
	share of the total (%)	2,5	2,4	2,4	2,5	2,7	3,4	4,3	4,2	4,7	5,0	5,0	5,5	5,1
Total number of employed persons	1000 persons	838	826	807	761	699	675	633	619	620	600	576	572	583

\* without furniture industry

Source: Statistical Office of Estonia

## GLOSSARY OF THE DEFINITIONS USED

### FOREST AND FOREST MANAGEMENT

According to the Forest Act (FA) (1998) forest is defined as a site of woody vegetation with an area of at least 0,5 ha which meets at least one of the following criteria:

- 1) the height of the trees is at least 1,3 m and the canopy density at least 30 per cent;
- 2) it is managed for obtaining timber or other forest produce, or woody vegetation is maintained there for the use in the ways specified in this Act.

According to the Forest Act (FA) **forest management** is the reforestation, and use of forest, and forest protection.

#### Forest notification

(1) The owner of a forest is required to submit a forest notification to the County Environment Service, which contains information on the following:

- 1) the types of cutting planned, reforestation, construction and renewal of forest draining systems and forest roads, and measures on fulfilling nature and heritage conservation requirements (including the maintenance of key habitats) in the course of this work;
- 2) forest damages.

### TYPES OF CONSERVATION/PROTECTION AREAS

**National park** – protected area of special national importance designated for the protection of, research into, and promotion of awareness of, the natural and cultural heritage of the area, including the ecosystems, biological diversity, landscapes, and heritage related to national culture. The territory of a national park is divided into strict nature reserves, special management zones and restricted management zones.

**Nature reserve** – protected area designated for the preservation, protection and studying of natural processes, habitats of rare and threatened or protected species, abiotic natural objects, landscapes and single natural objects of nature conservation or scientific value. The territory of a nature reserve is divided into strict nature reserves, special management zones and restricted management zones.

**Protected landscape** (nature park) – protected area with a natural or cultural heritage landscape that is rare or characteristic of Estonia. Protected landscapes are designated for nature conservation, cultural or recreational purposes, and their territory is divided into special management zones and restricted management zones. Parks, arboreta and botanical gardens designated as protected natural objects are also regarded as specific types of protected landscape.

**Programme area** – area included in a local, national or international programme for the purpose of organising monitoring, scientific research and educational work and for combining the conservation and use of natural resources; its territory is divided into strict nature reserves, special management zones, restricted management zones and general zones of programme area.

## ZONES OF CONSERVATION/PROTECTION AREAS

**Strict nature reserve** – all activities and visiting of the area without special permit is prohibited; belong to the category of protected forests.

**Special management zone** – economic activities are prohibited; belong to the category of protected forests; when all activities except visiting of the area are prohibited – **special management zone left to natural development**; when also thinning of the tree and shrub layer can be allowed in conformity to the protection objective – **special management zone maintained**.

**Restricted management zone** – certain economic activities are allowed by protection rules, belong to the category of protection forests. While protection rules prohibit clear cutting in narrow (30 m) cutting areas, shelterwood cutting within a period of at least 40 years, and also selection cutting and improvement cutting, are, as a rule, permitted in a restricted management zone. In a special management zone, forests of a programme area can belong to the category of protected, protection or commercial forest.

## FOREST CATEGORIES

**Protected forests** – strictly protected forests requiring long-term or special protection for the fulfilment of important protection or conservation functions; sanitary and shelterwood cutting is allowed, as well as reforestation either through natural regeneration or planting.

**Protection forests** – forests the essential function of which is to protect soil, infiltration areas, drinking water, human settlements, roads, landscapes and/or protected natural objects; sanitary and shelterwood cutting is allowed, as well as reforestation through planting.

**Commercial forests** – forests that have not been designated as protection forests or protected forests.

**Woodland key habitats** – the Forest Act defines a key habitat as a part of commercial forest that requiring protection and where the probability of occurrence of endangered, vulnerable or rare species is great. Key habitats include biotopes such as small water bodies and springs, small mires, burnt woodlands, bog islands, ravines, overgrown former gardens, wooded meadows and coppices of old-growth forest.

**Potential woodland key habitat** is an area that will soon (within a few decades) become a key habitat if it is managed in such a way as to promote its biodiversity values.

## FOREST CLASSIFICATION ACCORDING TO THEIR NATURALNESS

**Old-growth forest** – forest without traces of human impact (ditching, cutting etc); the stand is natural and its composition is characteristic of the site type; a lot (more than 30 m<sup>3</sup>/ha) of standing and lying dead wood in different (more than two) stages of decay. Usually old (overmature) forest, young stands (age less than 50 years) contain old live or dead trees of earlier generations.

**Natural forest** – forest of uneven age (the age differs by more than one age class) that is of natural origin and has a species composition characteristic of the site, can contain traces of earlier cuttings (very old stumps are visible), but they no longer influence the present structure of the stand. Relatively young stands contain at least a few trees from earlier generations, there is also lying wood in different stages of decay.

**Recovering forest** – forest that has come into existence as a result of human activities; quite a lot of traces of earlier cuttings but their effect on the present structure of the stand is so insignificant that a natural forest would develop in 20–30 years if the stand is left untouched. There are already dead and decaying trees at places.

**Commercial forest** – forests where cuttings have had a strong effect on the species composition and structure of the stand; natural-like conditions would not develop within at least one forest generation. No or very little lying wood.

## PRODUCTIVITY, INCREMENT, FELLING

**Gross annual increment (GAI)** – gross annual increment (GAI) – average annual volume of increment over the reference period of all trees, including the increment of trees which have been felled or died during the reference period.

**Net annual increment (NAI)** – average annual volume over the given reference period of gross annual increment less that natural losses of all trees.

**Natural losses** – average annual losses of the growing stock during the given reference period due to mortality from causes other than felling by man;

**Annual felling** – average annual standing volume of all trees, living or dead, measured overbark, that are felled during the given reference period, including the volume of trees or part of trees that are not removed from the forest.

**Annual removals** – average annual volumes of timber that are removed from the forest.

## CATEGORIES OF PROTECTED SPECIES

**Category I species** – particularly threatened and/or rare; need protection and their protection is in most cases arranged through the establishment of small so-called species conservation areas. Causing damage to the habitats, breeding or nesting sites, migration routes and sites of growth of all the protected species of this category is prohibited. Studying, tagging, improvement of living conditions, taking from the wild, propagation, *exsitu* keeping and cultivation of such species, and also taking photos, filming and soundrecording in the nesting and breeding sites of animals, is allowed only with a permit issued in accordance with a procedure established by the Government of the Republic. Public disclosure of information on the exact site or habitat of the species is prohibited. Species of Category I are listed the Protected Natural Objects Act.

**Category II species** – less rare and also less threatened in comparison with those of category I. These species require protection due to their local distribution, small number of sites, small number of specimens or the occurrence of several directly endangering factors. Transactions with species of Category II, gathering of plants and fungi, destruction of sites of species or causing damage to the sites to such extent that sets the preservation of the species in the site in danger, is prohibited. In the case of animals, it is prohibited to catch, kill and keep the animals, to disturb them in a manner that endangers them, and also to destroy their breeding sites or permanent habitats to the extent that sets the preservation of the species in danger. It is prohibited to disclose information on the exact site or habitat of the species if the information can lead to causing damage to the object. For securing the preservation of a site or permanent habitat of a species of Category II, a protected area may be established. Research into and studying of the species is performed on the basis of special permits. The list of protected species of Category II was approved by Regulation No. 462 of 15 December 1994 of the Government of the Republic.

**Category III species** – have a broader range of distribution but are still threatened and require protection in order to prevent their extinction. It is prohibited to cause damage to the sites of protected plants and fungi of this category, to gather plants and fungi from the wild to the extent that sets the preservation of the species in the particular site in danger, and also to perform transactions with these species. It is also prohibited to catch, keep, kill or disturb in an endangering manner and to perform transactions with the animals. Special permits for the activities listed above are issued in accordance with the procedure established by the Government of the Republic. A protected area may be established in the site or permanent habitat of the species when the preservation of the species in the particular site cannot be ensured by other protection measures. The list of protected species of Category III was approved by Decree No. 18 of 30 March 1995 of the Minister of the Environment.

## OTHERS

**Other wooded land** – land either with a tree crown cover (or equivalent stocking level) of 5–10 percent of trees able to reach the height of 5 m at maturity in situ; or a crown cover (or equivalent stocking level) of more than 10 percent of trees not able to reach the height of 5 m at maturity in situ (e.g. dwarf or stunted trees) and shrub or bush cover. Excludes: areas having the tree, shrub or bush cover specified above but of less than 0,5 ha and width of 20 m, which are classified under “other land”; land predominantly used for agricultural practices.

**Plantations** – forest stands established by planting or/and seeding in the process of afforestation or reforestation. They are either:

- of introduced species (all planted stands), or,
- intensively managed stands of indigenous species which meet all the following criteria: one or two species at plantation, even age class, regular spacing.

Excludes: stands which were established as plantations but which have been without intensive management for a significant period of time. These should be considered semi-natural.

**Seminatural forests** – forest that is neither “forest undisturbed by man” nor “plantation” as defined separately.

**Forests undisturbed by man** – forest that shows natural dynamics, such as natural tree composition, occurrence of dead wood, natural age structure and natural regeneration processes, the area of which is large enough to maintain its natural characteristics and where there has been no known significant human intervention or where the last significant human intervention was long enough ago to have allowed the natural species composition and processes to have become re-established.

**Soil cover** – an upper set of horizons that are related through the same cycle of pedogenic processes (the organic top layer, A, E, and B horizons until parent material).

## USEFUL CONTACTS

### **Estonian Fund for Nature**

Riia 185A, 50002 Tartu, Estonia  
Phone +372 7 428 443, Fax: +372 7 428 166  
e-mail: elf@elfond.ee, www.elfond.ee

### **Estonian Green Movement**

PO Box 318, 50002 Tartu, Estonia  
Phone: +372 7 422 532, Fax: +372 7 422 084  
e-mail: info@roheline.ee, www.roheline.ee

### **Union of Protected Areas of Estonia**

PO Box 30 Viitna, Kadrina vald, 45202  
Lääne-Viru county, Estonia  
Phone: +372 56 458 361  
e-mail: ekal@neti.ee, www.ekal.org.ee

### **Estonian Forest Survey Center**

Iva 12, 12618 Tallinn, Estonia  
Phone: +372 6 771 301, Fax: +372 6 771 300  
e-mail: info@emkk.ee, www.emkk.ee

### **Statistical Office of Estonia**

Endla 15, 15174 Tallinn, Estonia  
Phone: +372 6259 300, Fax: +372 6259 370  
e-mail: stat@stat.ee, www.stat.ee

### **State Forest Management Center**

Viljandi mnt. 18b, 11216 Tallinn, Estonia  
Phone +372 628 1500, Fax +372 628 1510  
e-mail: rmk@rmk.ee, www.rmk.ee

### **Trade Union of Estonian Forest Workers**

Rävala pst. 4, 10143 Tallinn, Estonia  
Phone +372 6419 187, Fax: +372 6312 624  
e-mail: ay.metsa@neti.ee, <http://kodu.neti.ee/~fa003a/>

### **Union of Private Forest Owners**

Lai 39/41, 10133 Tallinn, Estonia  
Phone +372 641 1148, Fax +372 625 62 00  
e-mail: toomas.lemming@erametsaliit.ee,  
www.erametsaliit.ee

### **Estonian Forest Industries Association**

Marja 9, Tallinn 10617  
Phone: +372 656 7643, Fax: +372 656 7644  
e-mail: info@emtl.ee, www.emtl.ee

### **Forest Research Institute**

#### **Estonian Agricultural University**

Kreutzwaldi 5, 51014 Tartu, Estonia  
Phone: +372 7 313 168, Fax: +372 7 313 153  
e-mail: ptrei@eau.ee, www.eau.ee/~muurim/

### **Faculty of Forestry**

#### **Estonian Agricultural University**

Kreutzwaldi 5, 51014 Tartu, , Estonia  
Phone/Fax: +372 7 313 156  
e-mail: vreisner@eau.ee , www.eau.ee/~met

### **Center of Forest Protection and Silviculture**

#### **Estonian Ministry of the Environment**

Rõõmu tee 2, 51013 Tartu, Estonia  
Phone. +372 7 339 713, Fax +372 7339 464  
e-mail: mmk@metsad.ee, www.metsad.ee

### **Estonian Ministry of the Environment**

Toompuiestee 24, 15172 Tallinn, Estonia  
Phone +372 6262 805, Fax +372 6262801  
e-mail: min@ekm.envir.ee, www.envir.ee

## **Annex IMPLEMENTATION OF THE COMMITMENTS OF RESOLUTIONS L1 AND L2**

### **Implementation of Lisbon Resolutions**

#### **Lisbon Resolution L1:**

*“People, Forests and Forestry – Enhancement of Socio-Economic Aspects of SFM”*

#### **General approach for implementation of L1:**

The Estonian Forest Act (December 1998) constitutes the basis for the legal framework of the country for the protection and sustainable management of Estonian forests. In 2002–2003 amendments to the act concerning private forestry and environment protection were prepared.

According to the Estonian Forest Policy (1997) the functions of the state as the public authority and as a forest owner and manager were separated and on the basis of the former forest districts and forest nurseries the State Forest Management Center was established. The activities of the center have been successful and most of the targets set in the action plan were fulfilled, including different activities to increase the awareness of the benefits of sustainable forestry for the society.

Forest policy formulation and implementation is the responsibility of the Estonian Ministry of the Environment and its regional authorities.

The national data collection system of forestry and forest resource assessment – the State Register of Forest Resources (Metsaregister) is in the process of implementation. The development of instruments for the monitoring of sustainable forest management is in the stage of elaboration

The future development of the Estonian forestry is agreed in the Forestry Development Programme for the next ten years (approved by the Parliament in November 2002).

#### **Main actors and instruments used:**

All the interest groups and citizens were entitled to participate in determining the main directions of forestry development and had the possibility to participate in workgroups of the Estonian Forestry Development Programme for 2001–2010.

#### **Lisbon Resolution L2:**

*“Pan-European Criteria, Indicators and Operational Level Guidelines for SFM”*

#### **Main measures taken to implement the commitment:**

The Estonian Forest Act (Dec. 1998) constitutes the legal framework for the national system of forestry and forest resource assessment – establishment of the State Register of Forest Resources.

The development of instruments for the monitoring of sustainable forest management is in the stage of elaboration.

The network of permanent sample plots for the National Forest Inventory was established and carried out in 1999–2001. The assessment of forest resources and forest management was carried out on the basis of 7734 permanent sample plots in 2001.

The existing and prospective protected areas were inventoried in 1999–2001. Proposals for the extension of the Forest Protection Area Network by about 32000 ha of new areas, mainly in public forests, were formulated.

**Main actors and instruments used:**

Forest policy formulation and implementation in the fields of forest resource assessment, monitoring and evaluation of forest management activities is the responsibility of the Estonian Ministry of the Environment and its regional authorities.

**Main instruments used:**

National Forest Inventory, State Register of Forest Resources, stand-wise forest inventory and Forest Management Planning, Monitoring System of Sustainable Forest Management (in an early stage of implementation)

**Resolution L1: Actions**

*Number of Action: 1. Develop, at adequate levels, a dialogue with the public and efficient programmes to increase awareness of the benefits of sustainable forestry for society.*

**Main measures taken to implement the commitment:**

Elaboration and approval of the Forest Act in December 1998.

Various traditional forestry-related measures of the public awareness programme of the Ministry of the Environment (courses for journalists, workshops, publications, excursions, annual forest fair events, demonstration areas).

Reorganization of the public forest administration in 1998–1999. According to the Estonian Forest Policy (1997) the functions of the state as the public authority and as a forest owner and manager were separated and on the basis of the former forest districts and forest nurseries the State Forest Management Center was established. The activities of the center have been successful and most of the targets set in the action plan were fulfilled, including different activities to increase the awareness of the benefits of sustainable forestry for the society.

Measures of the Ministry of the Environment, the Private Forest Center and the Forest Owners' Association (partly subsidised extension services and training courses for private forest owners, demonstration areas), with the aim of safeguarding the principles of sustainable forest management in private forests.

All the interest groups and citizens were entitled to participate in determining the main directions of forestry development and had the possibility to participate in workgroups of the Estonian Forestry Development Programme for 2001–2010.

The public has the right to free access to all the Estonian forests, regardless of ownership.

*Number of Action: 2. Continue to develop the conditions for the participation of relevant stakeholders in the development of forest policies and programmes.*

**Main measures taken to implement the commitment:**

Implementation of the Estonian Forest Policy (1997) and finding means to achieve the minimisation of the public sector functions in forestry and the increase of public awareness.

Approval of the Forest Act in Dec 1998. The FA expresses the need of participation of all relevant stakeholders – environmental NGO-s, the Private Forest Center, the Forest Owners' Association, the Forest Industry Association and representatives of local communities in the development of the Estonian Forestry Development Programme 2001–2010.

On the regional level the input of relevant stakeholders in the development of forestry issues and programmes is arranged by their participation in the work of County Forestry Councils.

*Number of Action: 4 Adapt education and training systems and programmes contributing to the development of a highly skilled, multidisciplinary workforce, also enhancing the involvement of women in forest related activities.*

### **Main measures taken to implement the commitment:**

Development of education and training systems and programmes in the Luua Higher Forestry School to satisfy the changed needs of different employers.

According to the Bologna Declaration the 3+2 system will be introduced in the nearest future at the university level and more attention will be paid to the social and ecological aspects. All professions are open to women.

*Number of Action: 6. Promote the development of education and training programmes, especially directed to forest owners and managers, focusing on new opportunities and techniques for the production of goods and services from forests under sustainable management.*

### **Main measures taken to implement the commitment:**

New curricula in two separate branches of professional forestry education in the Faculty of Forestry of the Estonian Agricultural University and at the Luua Higher Forestry School were developed.

State-funded forest management planning, extension services and training courses for private forest owners and demonstration areas are focusing on new opportunities and techniques for the production of goods and services from forests under sustainable management.

*Number of Action: 7. Encourage comparative studies of wood and non-wood substitutes, considering their complete life-cycles and strive for conditions favourable for the production, marketing and consumption of wood and other products and services from forests under sustainable management, as viable alternatives to competing products using non-renewable natural resources, generating more employment and income.*

### **Main measures taken to implement the commitment:**

Research and development projects for the use of renewable and wood energy promoted and started in the Faculty of Forestry of the Estonian Agricultural University under the framework of Baltic Agenda 21 forestry measures.

Amendments are planned to the property and tax legislation to improve the efficiency of forest management and to favour the production, marketing and consumption of wood and other products.

*Number of Action: 10. Promote the incorporation of the results of assessment and valuation of wood and non-wood forest goods and services into national economic and natural resource accounting systems.*

### **Main measures taken to implement the commitment:**

According the Forest Act (1998) the fulfilment of all multiple-use forestry functions must be guaranteed.

The national data collection system of forestry and forest resource assessment – the State Register of Forest Resources, is going to collect information on some indicators mentioned above.

*Number of Action: 11. Evaluate the potential impacts of quality assurance systems and programmes such as voluntary and independent forest certification systems on sustainable forest management in the line of the proposals for action agreed by the Intergovernmental Panel on Forests (IPF).*

### **Main measures taken to implement the commitment:**

The Estonian National Standard for Sustainable Forest Management was developed in 2000.

The State Forest Management Center was awarded with FSC certificate in 2002.

The ISO 14001-compatible environmental management system and state forest information system were elaborated and implemented in the State Forest Management Center also in 2002.

## **Resolution L2: Actions**

*Number of Action: 1 Promote the development and implementation of national criteria and indicators using the Pan-European criteria and indicators as a reference framework, and taking into account specific country conditions and integrate them into national forest programmes or other relevant policy frameworks.*

**Main measures taken to implement the commitment:**

The Estonian National Standard for Sustainable Forest Management was developed in 2000, using Pan-European criteria and indicators as a reference framework.

Pan-European criteria and indicators were used to develop the national data collection and processing system for forestry and forest resource assessment – the State Register of Forest Resources.

*Number of Action: 2. Improve the quality and promote the necessary adaptations of national data collection systems, to fulfil the needs of information for national and international reporting on*

**Main measures taken to implement the commitment:**

The national data collection system of forestry and forest resource assessment – the State Register of Forest Resources is in the process of implementation. The development of instruments for the monitoring of sustainable forest management is in the stage of elaboration.

The ISO 14001-compatible environmental management system and state forest information system (the database of forest resources and new accounting system in the State Forest Management Center) was established in 2002. Environmental impacts in the organisation's all business areas were assessed.

The network of permanent sample plots for the National Forest Inventory was established and carried out in 1999–2001. The assessment of forest resources and forest management was carried out on the basis of 7734 permanent sample plots in 2001.

The large-scale survey of the condition of forests under the International Co-operative Programme on the Assessment and Monitoring of Air Pollution Effects on Forests started in Estonia already in 1988 and in 1998–2001 forest damages in 91 level I and 7 level II sample plots were assessed.

The existing and prospective protected areas were inventoried in 1999–2001. Proposals for the extension of the Forest Protection Area Network by about 32 000 ha of new areas, mainly in public forests, were formulated.

19 509 ha of key habitats were selected and inventoried in 1999–2002.

Estonian areas for the NATURA network have been pre-selected.

Statistical Yearbook of Forest containing all the available forestry-related information has been published annually since 1994.

*Number of Action: Evaluate, at a national level, the development over time in measurable indicators with respect to the agreed developed objectives in order to assess progress made in sustainable forest management.*

**Main measures taken to implement the commitment:**

The network of indicators and indices for the national data collection system of forestry and forest resource assessment – the State Register of Forest Resources has been developed.

The system of indicators for biodiversity assessment in key habitats and indicators for the selection of valuable areas were developed and the respective areas were inventoried.

*Number of Action: Encourage the adaptation of the "Pan-European Operational Level Guidelines for Sustainable Forest Management" to the specific national, sub-national and local economic, ecological, social and cultural conditions, with participation of the interested parties.*

**Main measures taken to implement the commitment:**

The Estonian National Standard for Sustainable Forest Management partly taking into consideration the "Pan-European Operational Level Guidelines for Sustainable Forest Management" was developed in 2000.

**Main difficulties in the implementation of commitments:**

Lack of willingness for better mutual understanding, cooperation and more coordinated approach of different forestry-related interest groups in the forest policy formulation and implementation. Lack of capacity and funding of the public forest administration.