Forest sustainability in Estonia

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1. Introduction

The combustion of wood for energy purpose is not considered to contribute to the augmentation of greenhouse gases concentration in the atmosphere, as long as the CO2 emissions released during the combustion of wood are balanced by the growth of new trees. It is therefore essential to investigate if the forests in the region where the wood used for energy purpose are managed in a sustainable way, avoiding resources associated with overexploitation of forests, land use change, depletion of carbon stocks, etc...

In this framework, literature research was carried out to produce a summary of forest management in Estonia, including general condition, management and sustainability assessment.

2. Estonia forests overview

2.1. Location and distribution

Estonia is the smallest country of the Baltic States with an area of 45,227 km^2 composed mostly of plain, hilly area in the center, wetlands and lakes (25% of the area) and some 1,500 islands and islets in the Baltic Sea, the largest is Saaremaa Island. Estonia is situated on the eastern shores of the Baltic Sea and borders to the Gulf of Finland in the north, to Russia in the east and to Latvia in the south.

There are two administrative levels in Estonia. At regional levels, the country is divided into 15 districts, or counties (*maakond*), which are the largest administrative subdivisions. Each county has its own government (*maavalitsus*) and county governor (*maavanem*) who represents the national government at the regional level (Figure 1). At the lowest level, there are about 227 municipalities (*omavalitsus*) that are a unit of self-government with their representative and executive bodies. The country can also be described on three statistical levels called NUTS (Nomenclature of Territorial Units for Statistics), which have been defined at the European level (see Table 1 and Figure 2).

Table 1 : Administrative regions and sub-regions of Estonia (NUTS I, NUTS II, NUTS III)

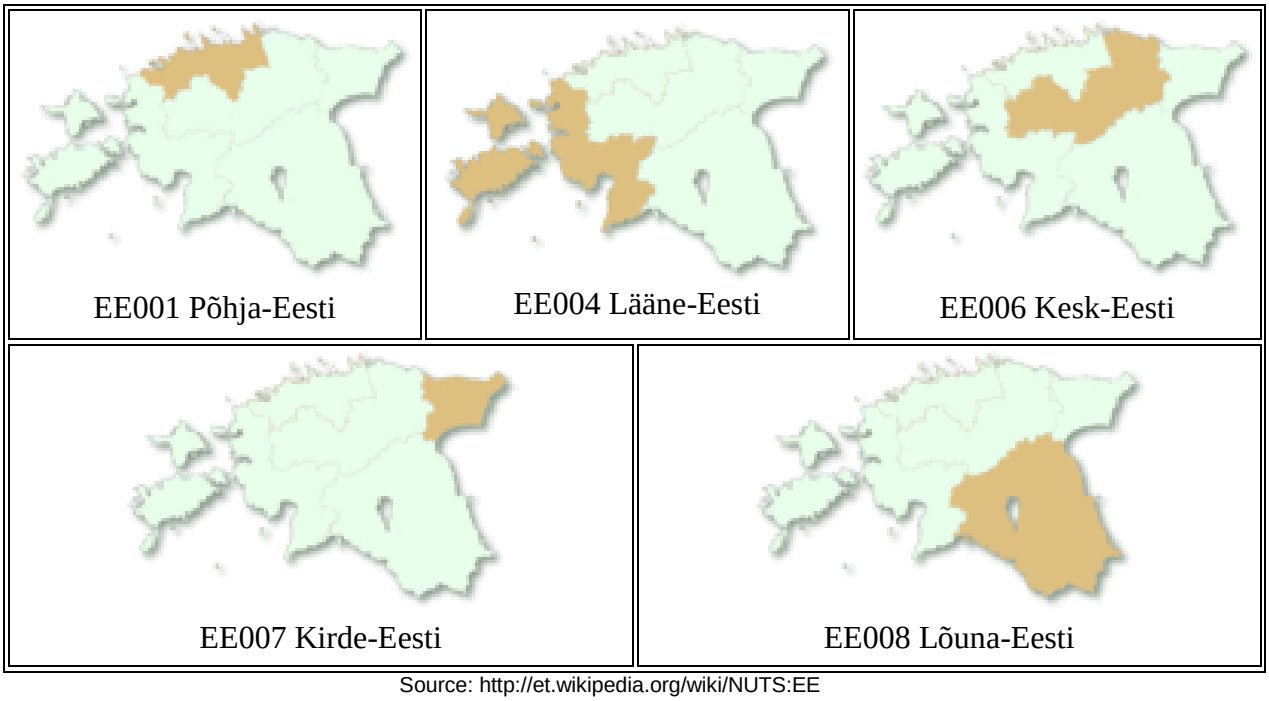
Level	**Subdivisions**	
NUTS 1 and 2	The whole country	
NUTS 3	Name	Counties
EE001	Põhja-Eesti	Harjumaa
EE004	Lääne-Eesti	Hiiu-, Lääne-, Pärnu-, Saaremaa
EE006	Kesk-Eesti	Järva-, Lääne-Viru-, Raplamaa
EE007	Kirde-Eesti	Ida-Virumaa
EE008	Lõuna-Eesti	Jõgeva-, Põlva-, Tartu-, Valga-, Viljandi-, Võrumaa

Source : http://et.wikipedia.org/wiki/NUTS:EE

Figure 1 : General map of Estonia

Source: Ezilon.com

Figure 2 : NTUTS 3 map of Estonia



Source: http://et.wikipedia.org/wiki/NUTS:EE

According to the last available forest national inventory (NFI) based on forest resource, forested area cover 2,253,300 ha in 2013 (about 49.8% of Estonia is forested). These figure included 126,900 ha of other wooded land. The following **Error! Not a valid bookmark self-reference.** shows the figures estimated by FAO in 2010 from extrapolation.

Table 2 : Forested area in Estonia

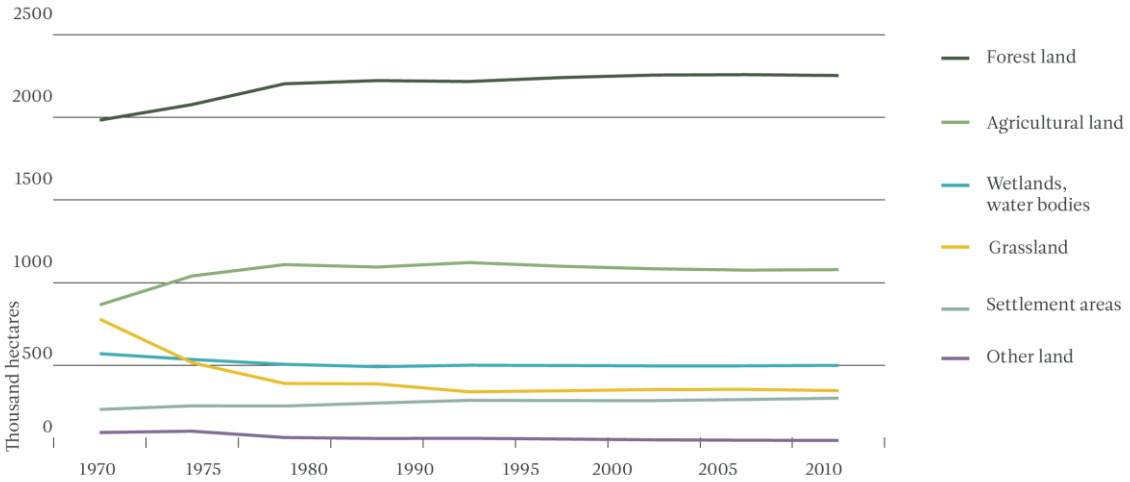
Area in 1000ha	Estonia
Forested Area	2,217
Other wooded land	133
Other land	1,883
Inland water bodies	284
Total area	4,523

Source : GLOBAL FOREST RESOURCES ASSESSMENT 2010. COUNTRY REPORT. ESTONIA

The following figure presents the change in land use in Estonia. We can see that[1] :

- Forest area has increased by 14% over the last 40 years
- The use of agricultural land has been on the upturn since joining the European Union
- The area of settlements and infrastructure has expanded and is continuing to grow.
- As of the 1970s, the area of grasslands has decreased by more than twice.

Figure 3 : Change in land use during the period 1970-2010

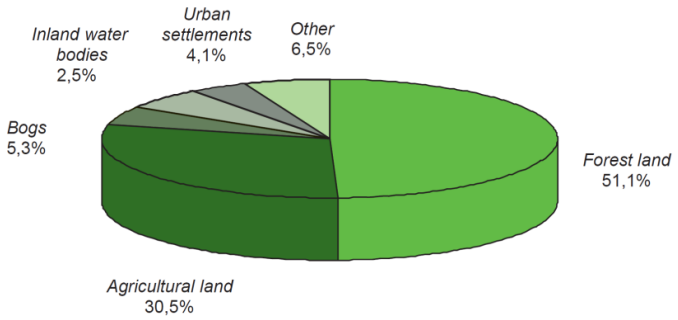


Source : Estonian environmental indicators 2012. http://www.keskkonnainfo.ee/failid/KTK_indicators_2012.pdf

Following the METS YEARBOOK FOREST 2013, the percentage of area occupied by the different land uses is represented on the Figure 4.

[1] Estonian environmental indicators 2012

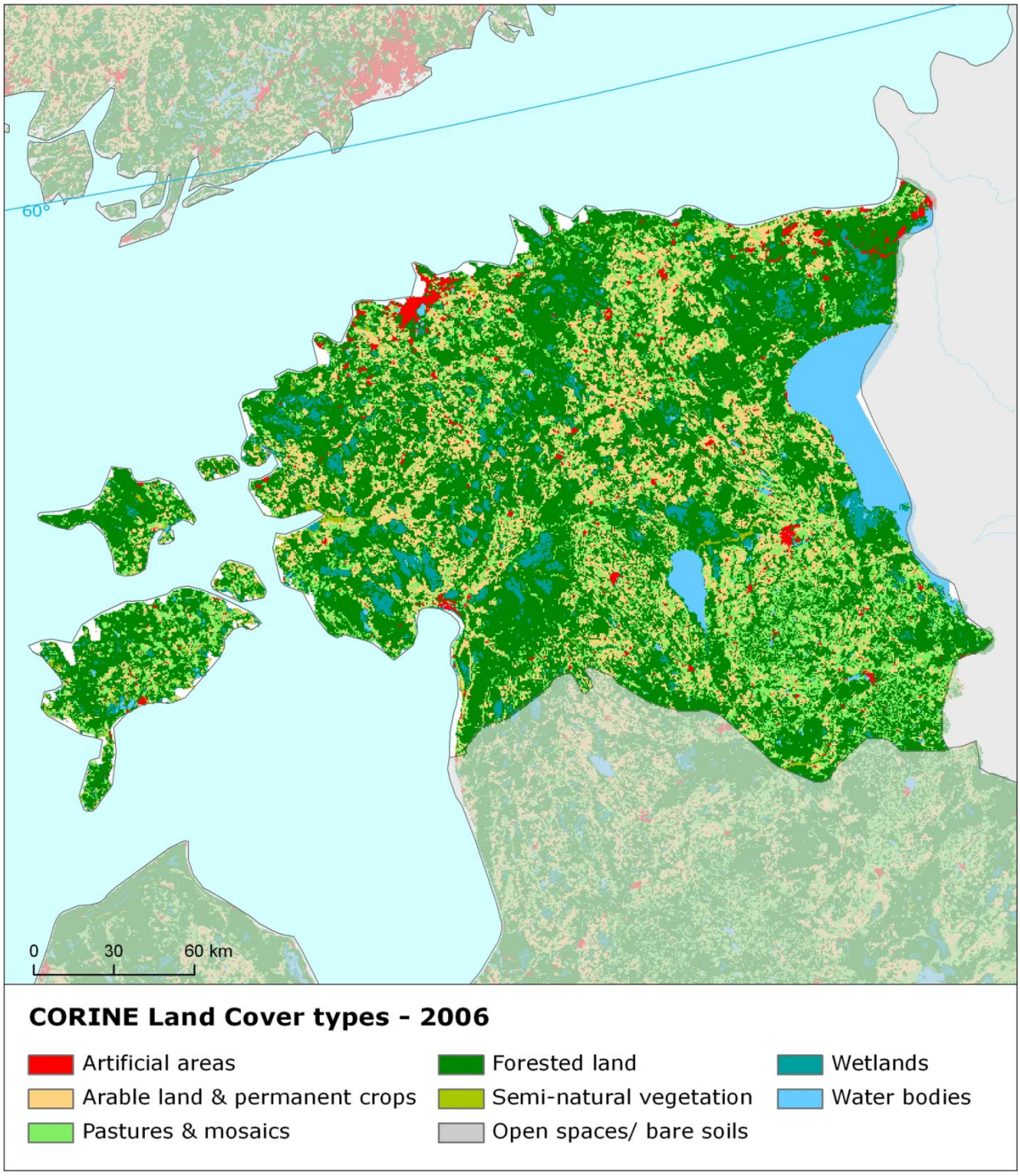
Figure 4 : Total area of Estonia by land categories



Source : METS YEARBOOK FOREST 2013. http://www.keskkonnainfo.ee/failid/Mets_2013.pdf. Note that METS informed that forests cover 2 233 900 ha.

Figure 5**Error! Reference source not found.** presents the generalised continental land cover. As can be seen on this map, forests are distributed uniformly over the whole country. Pastures are located mainly in the south of the land compared with arable lands and permanent crops that are presents in the north. This map also shows the dominance of forested areas. Corine 2012 can be consulted at this website : http://ks.keskkonnainfo.ee/website/Corineservice/

Figure 5 : Land cover in Estonia

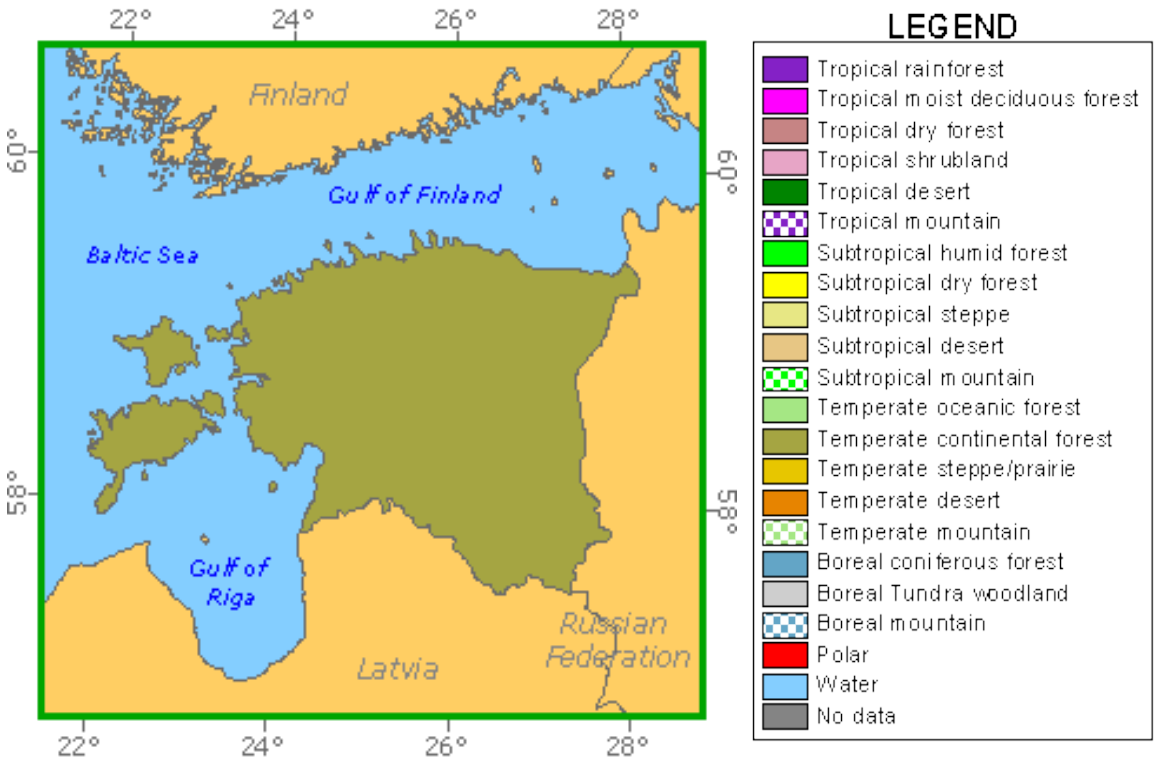


Source: http://www.eea.europa.eu/data-and-maps/figures/land-cover-2006-and-changes/Estonia

2.2. Ecological zones

The Estonian climate is quite mild for its latitude with average temperatures not exceeding 18 ° C in summer and freezing in mid-December to late February. Rainfall is generally between 500 and 700 mm per year. July and August are the wettest months.

Figure 6 : Ecological zones in Estonia



Source : http://www.fao.org/forestry/country/19971/en/est/

According to FAO, the entire territory of Estonia is characterized by a unique type of ecological zone : temperate continental forest zone.

The ecological zone " temperate continental forest " is as its name indicates naturally adapted to forest vegetation that are present there spontaneously. As this area is also well suited to agriculture, a part of it has long been cleared for agriculture, which explains that the forest represent about half of the area of the country. However, large forests remain on the whole territory.

According to data METS YEARBOOK FOREST 2013 Table 3, the forest is composed very largely of modified and semi-natural (57%), primary forest (42.8%) and productive plantation (0.2 %).

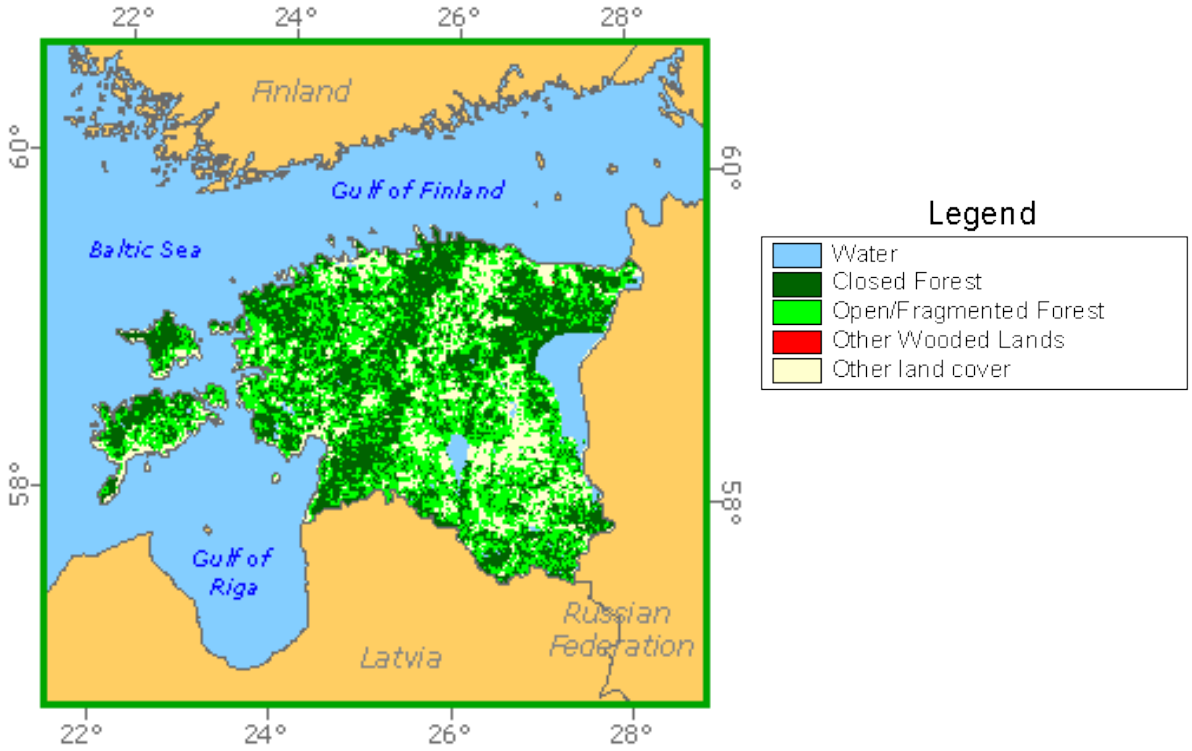
Table 3 : Forested area in Estonia

Categories of naturalness	*Area (thousand hectare)*	*Percentage of the total forested area*
Primary	956.1	42.8 %
of this natural forest	*54.7*	*2.4 %*
Modified natural	1,103.4	49.4 %
Semi-natural	169.9	7.6 %
Productive plantation	4.6	0.2 %
Total forest land area	**2,233.9**	**100 %**

Source: National Forest Inventory 2012, Estonian Environment Agency

Figure 7 shows the forest types in Estonia. The closed forests are distributed uniformly in the area of the country compared to fragmented forests which are largely in the southeastern.

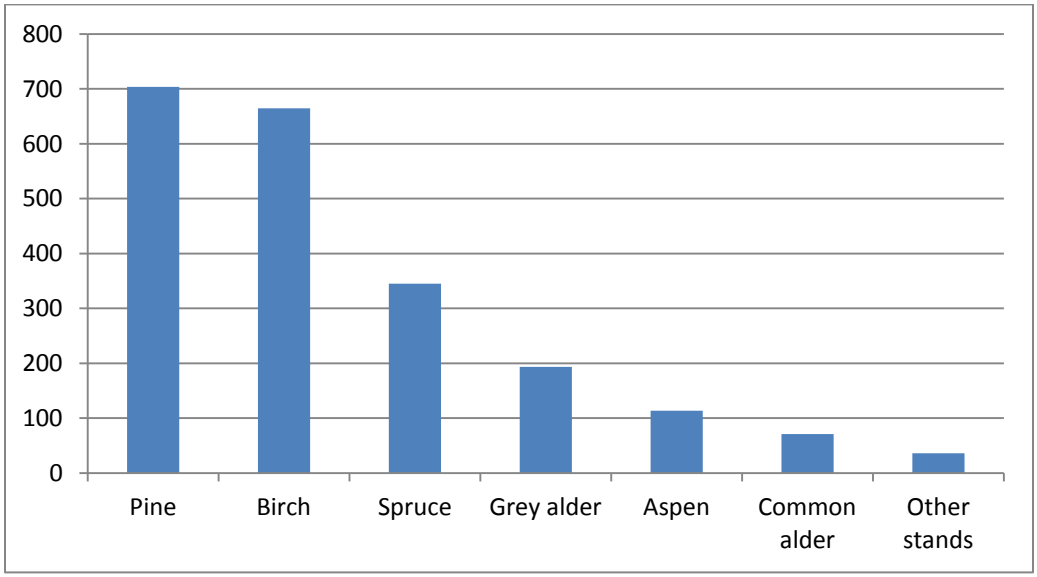
Figure 7 : Natural forest formations in Estonia



Source: http://www.fao.org/forestry/country/18314/en/est/

The repartition of the main tree species throughout the country is presented on Figure 8. Three major tree species and formations are found in Estonian forests: pines, birch and spruce. Each of those species covers about 33.1%, 31.3% and 16.2% of the total forested area.

Figure 8 : Area of forest by predominant species (in thousand ha)



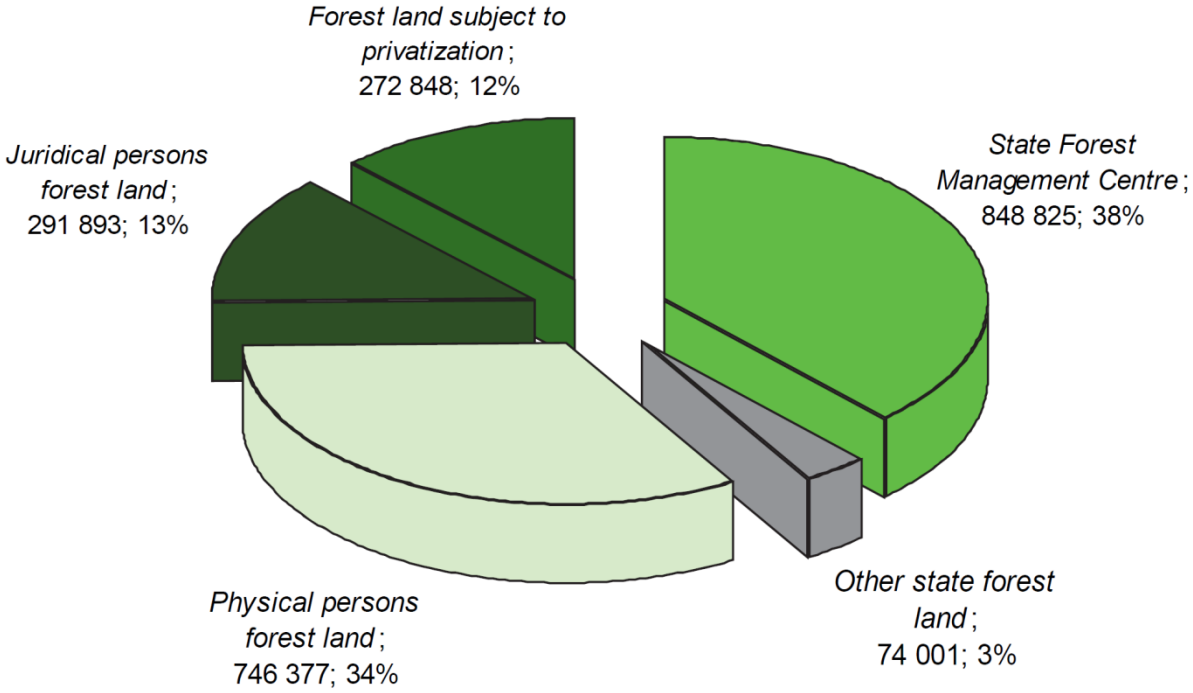
Source : Statistical database of natural resources and their use. http://pub.stat.ee

2.3. Forest ownership

Under soviet rule, from 1940 to 1991, Estonian farmland was nationalized and farm forests became the property of the state. At the time of the Soviet Union's dissolution in 1991, Estonia regained independence and forestlands had been re-privatized. Long-term loans created conditions for the privatization of forest land and timber industry. There were approximately 100,000 private forest owners in Estonia includes very small owners.

The distribution of the Estonian forest per ownership classes is presented on Figure 9. An important part of the forest area is privately owned : 34% is owned by private physical persons, 13% by private juridical persons and 12% for forest land subject to privatization[2]. A total of 59% of the forest area is in possession of private owners. The remaining 41% are owned by State (i.e. 38% by the State Forest Management Centre *"RMK"* and 3% by other state forest land).

Figure 9 : Distribution of forest land area by ownerships categories (2012)



Source : *NFI 2012*

The average size of the private forest properties is about 12.5 ha. The situation presents a very fragmented division of forest estates[3]. Only around 40% of all private forest owners live near their property.

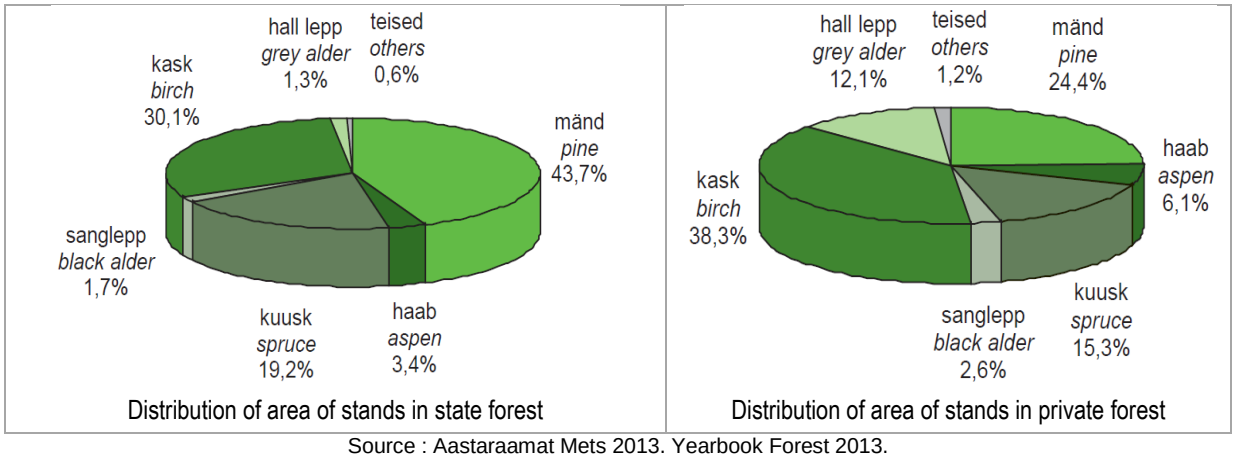
In state-owned forests, conifers constitute more than 60% of the area and the pine is the dominant species (Figure 10). Private forests shows a largest proportion of broadleaves in the forest areas

[2] This is the owners who have not yet officially recognized. The origin of this status is due to the restoration of the various plots after the independence of the country to their previous owners (owners before the abolition of the private property by the Soviets in 1940). See Hain H., 2005. Social, ecological and economic impacts of forest certification: case study of FSC certified Estonian State Forest Management Center.

[3] Jaanus Aun, 2013. Private forestry in Estonia Private Forest Centre, member of the board. PWP presentation.

where birch is the first most species encountered following by Scots pine (24.4%) and Norway spruce (15.3%). In addition, grey and black alder are important on private land, and alder is also a major species in the wood industry.

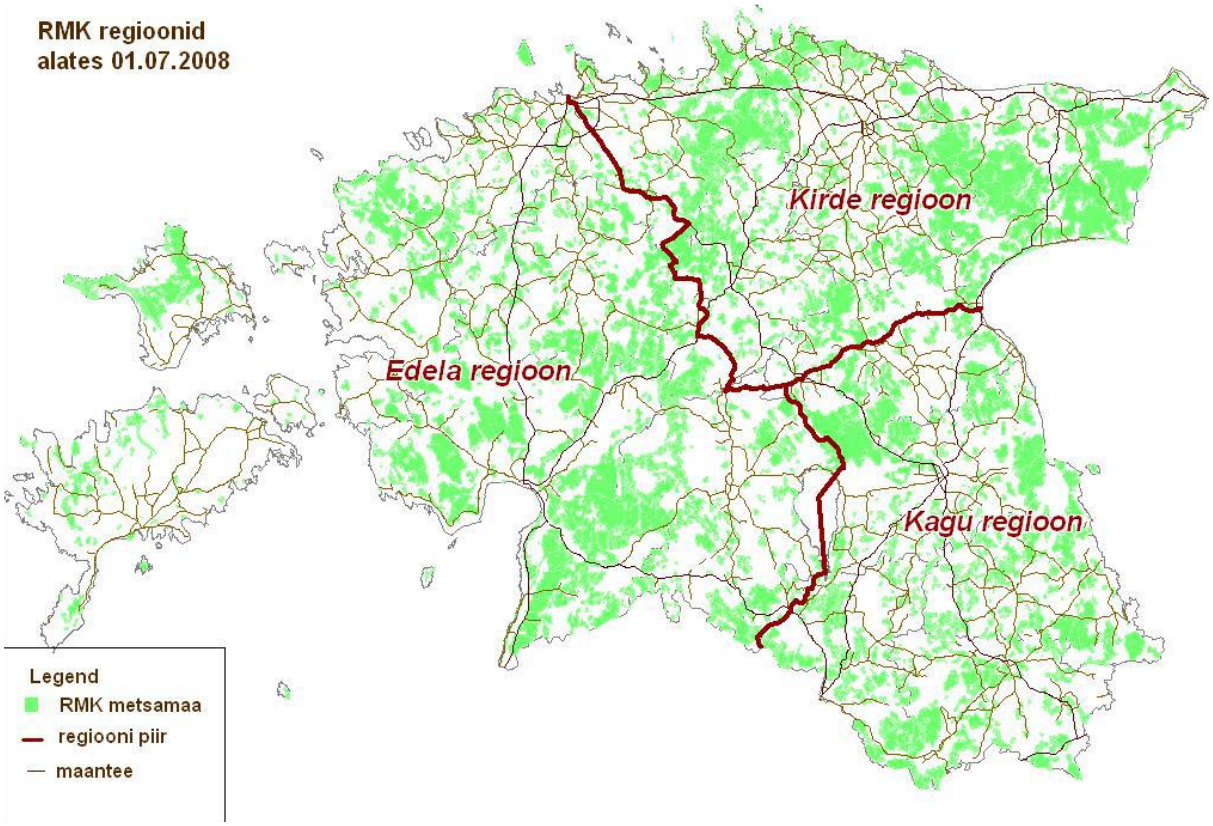
Figure 10 : Species proportion by ownership



Source : Aastaraamat Mets 2013. Yearbook Forest 2013.

Figure 11 shows the distribution of state forests and other in Estonia. When we compare with Figure 7, we see that state forest correspond to a majority of closed forests.

Figure 11 : State forested area (2008)



Source: Ulvar Kaubi 2011. State Forest Management and Use for Energy in Estonia. Timber Marketing Department

2.4. Competent authorities

The institutional framework for forestry is mainly governed by Ministry of Environment who is competent to[4]:

- develop Estonian forestry and hunting policies through Forest Department;
- collect, process and aggregate data about Estonian nature including forests and forestry through Environmental Information Centre;
- be responsible for the supervision of compliance to the law through its governmental authorities.

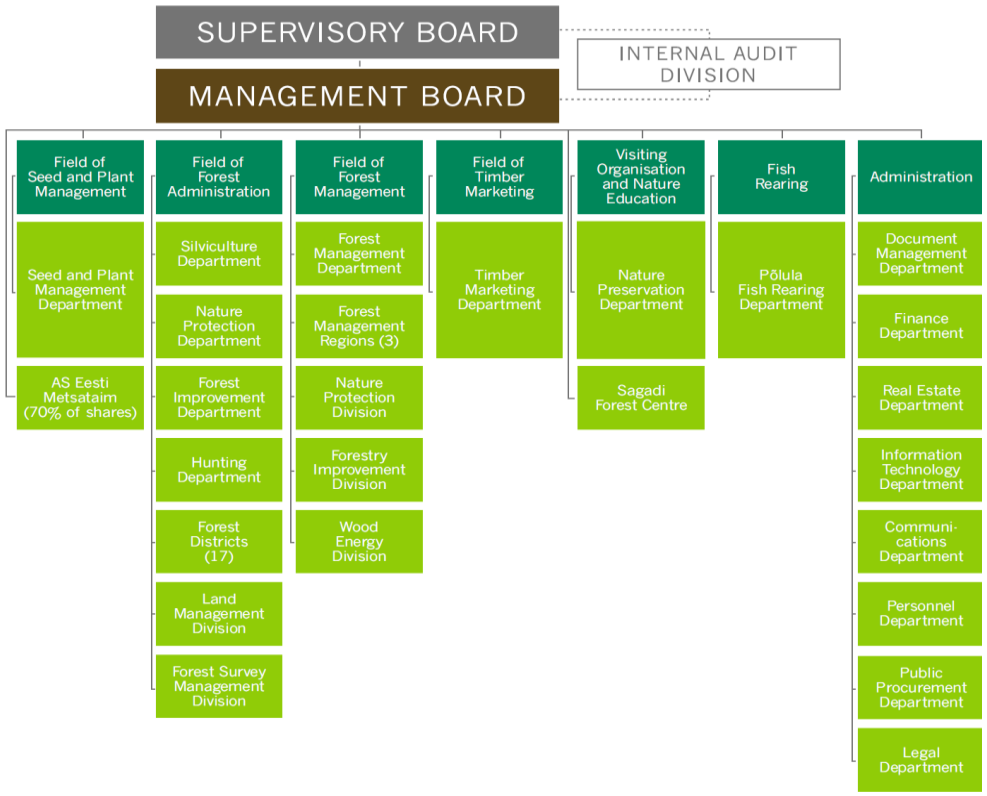
But some specific aspects of forestry is also covered by other ministries:

- Ministry of Agriculture for agricultural and rural policies
- Ministry of Communications and Economic Affairs for economic, industrial and fuel policies
- Ministry of Education and Research for education and research policies
- Ministry of Finance for fiscal policy

The competences and responsibilities are also divided between public and nongovernmental administrations trough different policies, acts and action plans.

Public forest administrations *(For further information see http://www.rmk.ee/)*
The state forests are maintained, grown and managed by the State Forest Management Centre (RMK). RMK's operating areas are: forest administration, forest management, timber marketing, preservation of the natural environment and recreation management, seed and plant management.

Figure 12 : Organisation of the RMK



Source : http://www.rmk.ee/organisation/publications-by-rmk/annual-reports-of-rmk

[4] Source: Private Forestry in Estonia. http://www.eramets.ee/static/files/1232.Private%20Forestry%20In%20Estonia.pdf

Non-governmental forest administrations[5]

Foundation Private Forest Centre (PFC) governed by representatives of private forest owners as well as civil servants. The foundation is under the Ministry of Environment. This is a private legal body but financed by the state.

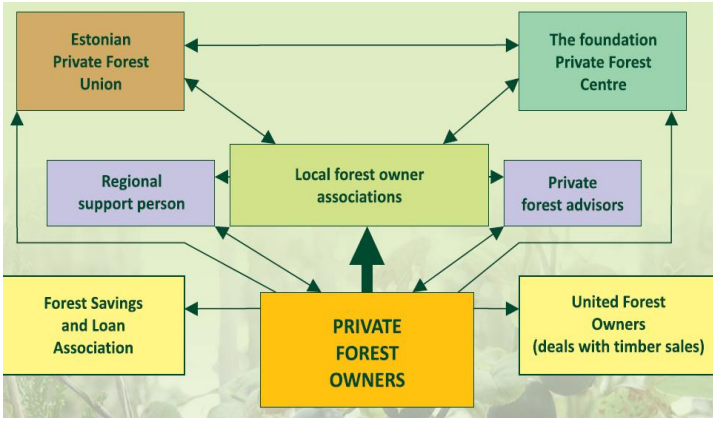
The main objectives of Centre are:

- to achieve more environmental friendly forest usage and effective forest economy with educating forest owners and consultants;
- to provide support to the private forest owners' and associations for their non-profit and profit activities;
- to provide international cooperation and communication between Estonian and foreign forest owners, forest organizations and funds all around the world.

The main activities of the PFC are the following[6]:

- arranging financial support for private forestry and the private forest owners;
- applying for funding for forestry projects and programmes;
- compiling, systemizing, analyzing and publishing of information related to private forestry;
- preparing proposals for forestry and rural life development policy (relevant strategic documents and legal acts);
- cooperating with other state and local governmental institutions and international organizations involved in private forestry.

Figure 13 : Participants of Private Forestry Support System



Source: Private Forestry in Estonia. http://www.eramets.ee/static/files/1232.Private%20Forestry%20In%20Estonia.pdf

The Estonian Private Forest Union (EPFU) is an umbrella organization for the private forest owners' local organizations. Union has 30 member organizations all over Estonia. The main purpose of the EPFU is to represent the interests of private forest owners and Participates in the development of Estonian forest policy and in the legislative process.

United Forest Owners which is concentrated on timber sales and has the followings tasks: responsible for finding the most profitable and trustworthy buyer for the timber of private forest owners, organises auction, helps private owners with organising forest felling and regeneration.

Forest Savings and Loan Association which aims at increasing the independence of private forest owners and developing private forestry holds the money of and loans money to the members, provides financial counselling.

[5] http://www.eramets.ee/en/activities-3/

[6] http://www.eramets.ee/en/activities-3/

The Estonian Forest Industries Association is a nonprofits association, connecting companies and organizations engaged in acquisition of forests, chemical and mechanical processing of wood as well as marketing.

Legal Framework[7]

The Estonian Forest Policy was approved in 1997. Three long-term principal objectives for the Estonian forestry sector are fixed in the document:

- sustainable forestry,
- efficiency in forest management,
- the area of state-owned forests shall be at least 20 percent of the area of the mainland of the Estonia

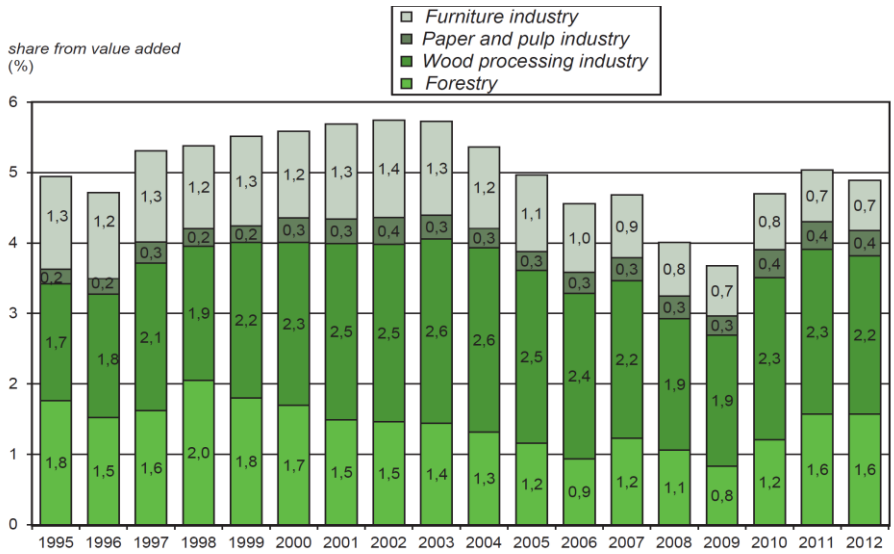
The Forest Act (last revised in 2006) provides the legal framework for the management of the forests

The Nature Conservation Act provides the legal framework for nature conservation and management of protected areas, including the protected forest area network.

2.5. Overview of wood-related industry

According to METS YEARBOOK FOREST 2013 forestry sector contributes to 4.9% of the Gross domestic product[8] (in current prices). This contribution has declined from 2003 to 2009. Estonia has significantly less contribution to GDP in manufacture of paper and pulp compared with the level of manufacture of wood processing (Figure 14). After the crisis, share of GDP taken by forest sector has increased to reach about 5% in 2011 and has slightly diminished in 2012.

Figure 14 : Share of forest industry from gross domestic product in 1995–2012 (by current prices)



Source : METS YEARBOOK FOREST 2013. http://www.keskkonnainfo.ee/failid/Mets_2013.pdf.

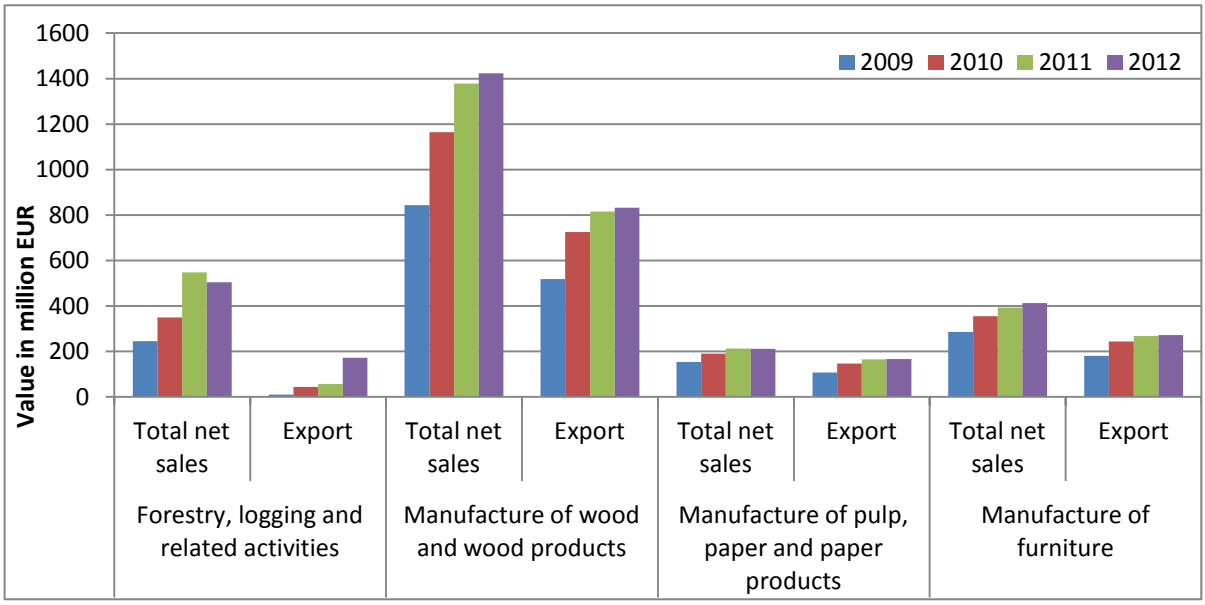
The total and exportation incomes following the forestry activities are presented in the Figure 15. These financial indicators have increased in all sectors since the crisis. This industry has had the

[7]Estonian Forest Policy.http://www.zgs.si/fileadmin/zgs/main/img/CE/biomasa/BIOMASA_ANG_PROJEKTI/PDF_predstavitve/Estonia.pdf

[8]contribution of forest sector to GDP indicated as gross value added of forestry in percentage of total gross value added.

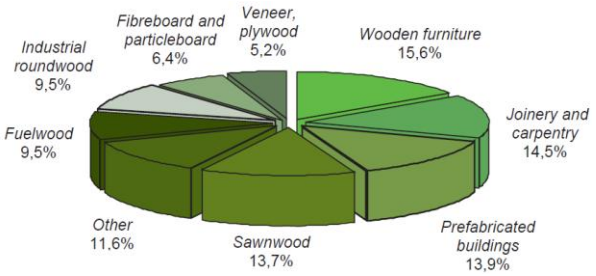
quickest recovery from the global economic crisis. The total forest exportation reaches about 1445 million EUR in 2012. More than 50% of the net sales and exportations came from manufacture of wood and wood products. In 2013, in this sector the revenues from exportation/importation can be summarized on the Figure 16 and Figure 17. The four main sectors of exportation are wooden furniture, joinery and carpentry, prefabricated building and sawnwood. The other sectors are less represented. The major importation activity that generates revenues is sawnwood because it represents 45.4% of revenues from import of wood and wooden articles in 2013.

Figure 15 : Total net sales and export by forest sectors from 2009-2012



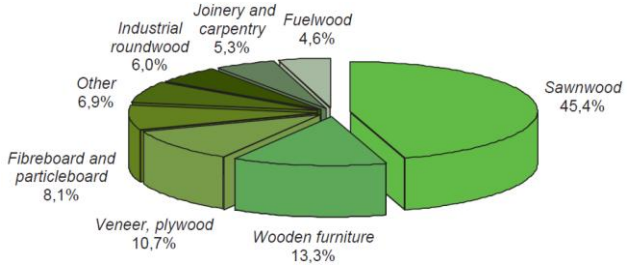
Source : Calculated from METS YEARBOOK FOREST 2013. http://www.keskkonnainfo.ee/failid/Mets_2013.pdf.

Figure 16 : Distribution of revenues (EUR) from export of wood and wooden articles in 2013



Source : METS YEARBOOK FOREST 2013. http://www.keskkonnainfo.ee/failid/Mets_2013.pdf.

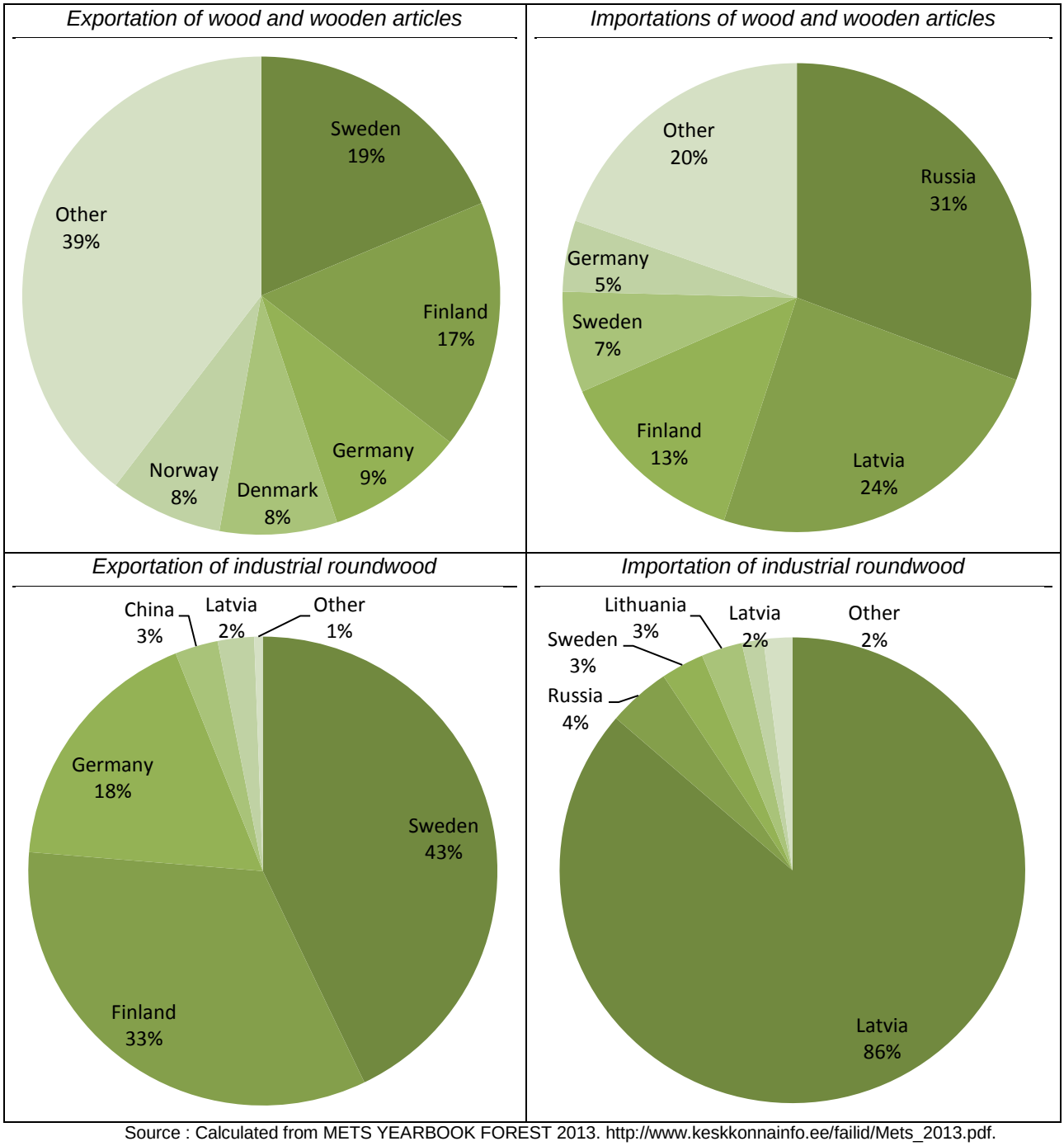
Figure 17 : Distribution of revenues (EUR) from import of wood and wooden articles in 2013



Source : METS YEARBOOK FOREST 2013. http://www.keskkonnainfo.ee/failid/Mets_2013.pdf.

The Scandinavian countries are the major trade partners of Estonia for exportation of wood (Figure 18), wooden articles and industrial roundwood (Sweden is the first trade partner in each case). The results from importation are more mitigated because Russia and Latvia are the major trade partners for the wood and wooden articles and only Latvia for industrial roundwood.

Figure 18 : Largest trading partners of Estonian forest sector for import-export in 2013 (percentage of the total import-export in Euros)



Source : Calculated from METS YEARBOOK FOREST 2013. http://www.keskkonnainfo.ee/failid/Mets_2013.pdf.

Estonia as an integral value chain of wood processing from forestry and logging to wood processing, production of wood products, production of paper and paper products and furniture production, which consists of about 2000 enterprises[9].

As we see on Table 4, the employment rate in forestry in Estonia reach the value of 5.6% of the total number of employed (i.e. 34,900 persons). This level has risen 90s until 2003 to reach a rate of 7.8% and then decreased until 2008 (5.1%) increased again until 2013.

The main sector of employment is the wood industry that represents a percentage of 46.4% of the employment in forest sector following by furniture industry (27.2%) and forestry (20.7%). Paper industry is the lower sector of employment with 5.7%. Before 1995 the sector of the wood industry was lower than that of furniture industry and forestry. The latter two sectors have decrease year by year compared to the wood sector which increased significantly from 90s until 2005 to decline slightly thereafter. The paper industry sector has remained stable at around 5%.

Table 4 : Forestry employment indicators

Field of activity	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
	Employed persons (1000 persons, annual average)																								
*Forestry**	10,8	9,8	9,3	8,1	7,7	9,4	7,5	7,4	9,5	9,6	8,9	9,1	9,4	10,3	9,0	7,4	6,1	6,4	8,0	7,1	5,3	5,8	5,7	7,1	7,2
Manufacturing	213,9	211,8	201,7	183,9	154,1	143,9	157,4	147,7	133,7	130,1	122,8	130,2	131,7	127,9	132,0	135,6	137,1	133,4	130,8	133,9	112,2	106,6	119,1	115,5	116,4
*wood industry***	6,6	6,4	6,6	7,3	8,7	11,7	17,3	16,4	20,1	19,4	18,0	20,8	18,8	19,2	23,2	24,4	22,2	22,2	20,1	15,4	14,0	12,6	14,6	16,1	16,2
*paper industry****	2,8	2,7	2,6	2,3	1,6	1,0	2,0	2,0	1,6	1,5	1,7	2,2	2,2	2,8	1,9	1,5	1,6	2,1	1,6	1,8	1,8	0,7	0,8	1,5	2,0
*furniture industry*****	14,6	14,1	13,8	13,3	11,8	10,6	11,2	11,9	10,0	10,9	10,6	11,3	9,6	9,9	12,8	12,4	11,1	11,2	10,3	8,9	9,3	9,9	9,9	8,7	9,5
*Total forest sector******	34,8	33,1	32,3	31,1	29,7	32,7	37,9	37,7	41,2	41,5	39,2	43,4	40,0	42,2	46,9	45,6	41,1	41,9	40,0	33,2	30,4	29,0	31,0	33,4	34,9
Total employed	837,9	825,8	806,6	761,4	698,9	675,4	633,4	619,3	617,2	606,5	579,3	585,3	589,6	589,9	602,9	601,9	615,6	651,7	657,6	656,0	593,9	568,0	603,2	614,9	621,3
	Share from the total number of employed in forest sector (%)																								
Forestry	31,0	29,7	28,8	26,1	25,7	28,6	19,8	19,7	23,2	23,3	22,7	21,0	23,5	24,4	19,2	16,2	14,9	15,3	20,0	21,4	17,4	20,0	18,4	21,3	20,7
Wood industry	19,0	19,4	20,5	23,5	29,1	35,8	45,5	43,4	48,7	46,8	46,0	47,9	47,1	45,4	49,5	53,4	54,1	53,0	50,3	46,3	46,0	43,4	47,0	48,1	46,4
Paper industry	8,0	8,2	7,9	7,6	5,4	3,2	5,2	5,2	3,9	3,7	4,3	5,2	5,4	6,7	4,0	3,2	4,0	5,0	3,9	5,6	6,0	2,4	2,6	4,5	5,7
Furniture industry	42,0	42,6	42,7	42,8	39,7	32,4	29,5	31,6	24,3	26,3	27,0	26,0	24,0	23,5	27,3	27,2	27,0	26,7	25,8	26,8	30,6	34,2	32,0	26,1	27,2
	Share fom the total number of employed (%)																								
Forestry	1,3	1,2	1,2	1,1	1,1	1,4	1,2	1,2	1,5	1,6	1,5	1,6	1,6	1,7	1,5	1,2	1,0	1,0	1,2	1,1	0,9	1,0	0,9	1,2	1,2
Manufacturing industry	25,5	25,6	25,0	24,2	22,0	21,3	24,9	23,8	21,7	21,5	21,2	22,2	22,3	21,7	21,9	22,5	22,3	20,5	19,9	20,4	18,9	18,8	19,7	18,8	18,7
wood industry	0,8	0,8	0,8	1,0	1,2	1,7	2,7	2,6	3,2	3,2	3,1	3,6	3,2	3,2	3,8	4,0	3,6	3,4	3,1	2,3	2,4	2,2	2,4	2,6	2,6
paper industry	0,3	0,3	0,3	0,3	0,2	0,2	0,3	0,3	0,3	0,3	0,3	0,4	0,4	0,5	0,3	0,2	0,3	0,3	0,2	0,3	0,3	0,1	0,1	0,2	0,3
furniture industry	1,7	1,7	1,7	1,7	1,7	1,6	1,8	1,9	1,6	1,8	1,8	1,9	1,6	1,7	2,1	2,1	1,8	1,7	1,6	1,4	1,6	1,7	1,6	1,4	1,5
Total forest sector	4,2	4,0	4,0	4,1	4,3	4,8	6,0	6,1	6,7	6,8	6,8	7,4	6,8	7,1	7,8	7,6	6,7	6,4	6,1	5,1	5,1	5,1	5,1	5,4	5,6

1989–1996: employed persons aged 15–69, 1997–2013 employed persons aged 15–74

* *Forestry, logging and related service activities (NACE 02)*

** *Manufacture of wood and of products of wood and cork, except furniture (NACE 16) + Manufacture of pulp, paper and paper products (NACE 17)*

*** *Manufacture of furniture (NACE 31)*

**** *Forest sector=total NACE categories 02, 16, 17, 31*

NACE=Statistical Classification of Economic Activities in the European Community

Source : METS YEARBOOK FOREST 2013. http://www.keskkonnainfo.ee/failid/Mets_2013.pdf.

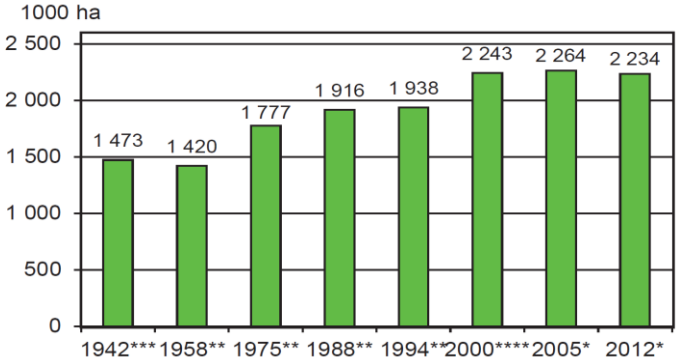
3. Sustainability of Estonia forest

3.1. Evolution of forest area and risk of conversion

Between 1942 and 2005, forest area in Estonia has increased 1.5 times (Figure 19) with a slight decrease between 2000 and 2012.

[9] Competitiveness of Estonian forest and wood cluster. Executive summary. 13 June 2013.

Figure 19 : Changing of forest land area in 1942–2012



* SMI, *NFI* ** *Standwise forest inventory*
*** *published in Akadeemilise metsaseltsi toimetised V*
**** *NFI 2000 figures were updated in 2011*

Source : METS YEARBOOK FOREST 2013. http://www.keskkonnainfo.ee/failid/Mets_2013.pdf.

The area of Estonian forest land has remained stable between 2.2–2.3 million hectares during the last decade. A forest growth after the Second World War until the end of the 1980s was due to both forestation of arable lands following the forced collectivisation and afforestation and also the land improvement operations from 1950s (like transforming mires into suitable land for forest growth). In 1990s another conversion of arable lands in forests was caused by an important decline in agricultural production. After the 2000s, forest growth has been slowed down due to the recovery of agricultural activities that have been improved by European Union subsidies (joint agricultural policy) that helped to take many areas that had started to afforest back into use. Over the past ten years, the area of forest land has slightly decreased caused by infrastructure development and expansion of settlements[10].

Comparison with EUROSTAT gives a comparable trend (Table 5) :

- between 1990 and 2000, Estonia gained about 153,000 ha of forest a year (+0.73%/year).
- between 2000 and 2005 the forest's increase was lower and reached 0.08%/year.
- between 2005 and 2010, an important decrease of 0.44%/year is observed.

Table 5 : Forest area evolution from 1990 to 2010

Area (1000 hectares)	***Period***			
	1990	**2000**	**2005**	**2010**
Forest	2,090	2,243	2,252	2,203
Other wooded land	88	94	110	134
Total area	4,523	4,523	4,523	4,523
Percentage of forested area	46.21%	49.58%	49.79%	48.71%
Evolution of forest area (between period)	/	153	10	-49
Annual change	/	15.26	1.9	-9.8
Annual rate change	/	0.73%	0.08%	-0.44%

Source : Calculated from http://appsso.eurostat.ec.europa.eu

The detail of the evolution between 1998 and 2012 is described on **Error! Reference source not found.** for private forests and on **Error! Reference source not found.** for state forests.

Forest planting accounted for the majority of the reforestation work compared with sowing and natural regeneration. In 2000–2010, an average of 6000 hectares of forest was planted in a year: The area of

[10] Estonian Environmental indicators 2012. Estonian Environment Information Centre Tallinn 2013

reforestation works have increased rapidly in the past three years. In 2010–2012, an average of 8,600 hectares of forest was planted in a year. Of all saplings planted, 69% were spruce, 20% pine and 10% birch saplings and less than 1% for other species. The annual average area of forest sowing was 1,250 hectares. Natural forest regeneration was facilitated (including by sowing seeds, planting saplings and restricting the growth of competing vegetation) on around 1,500 hectares per year.

The other part of the reforestation include land category of afforested area with sowing and planting. On these lands, the main source of reforestation come from felling site which passed from 5,500 ha/year in 1991 to 10,000 in 2013.

Table 6 : Reforestation in Estonia from 1991 to 2013

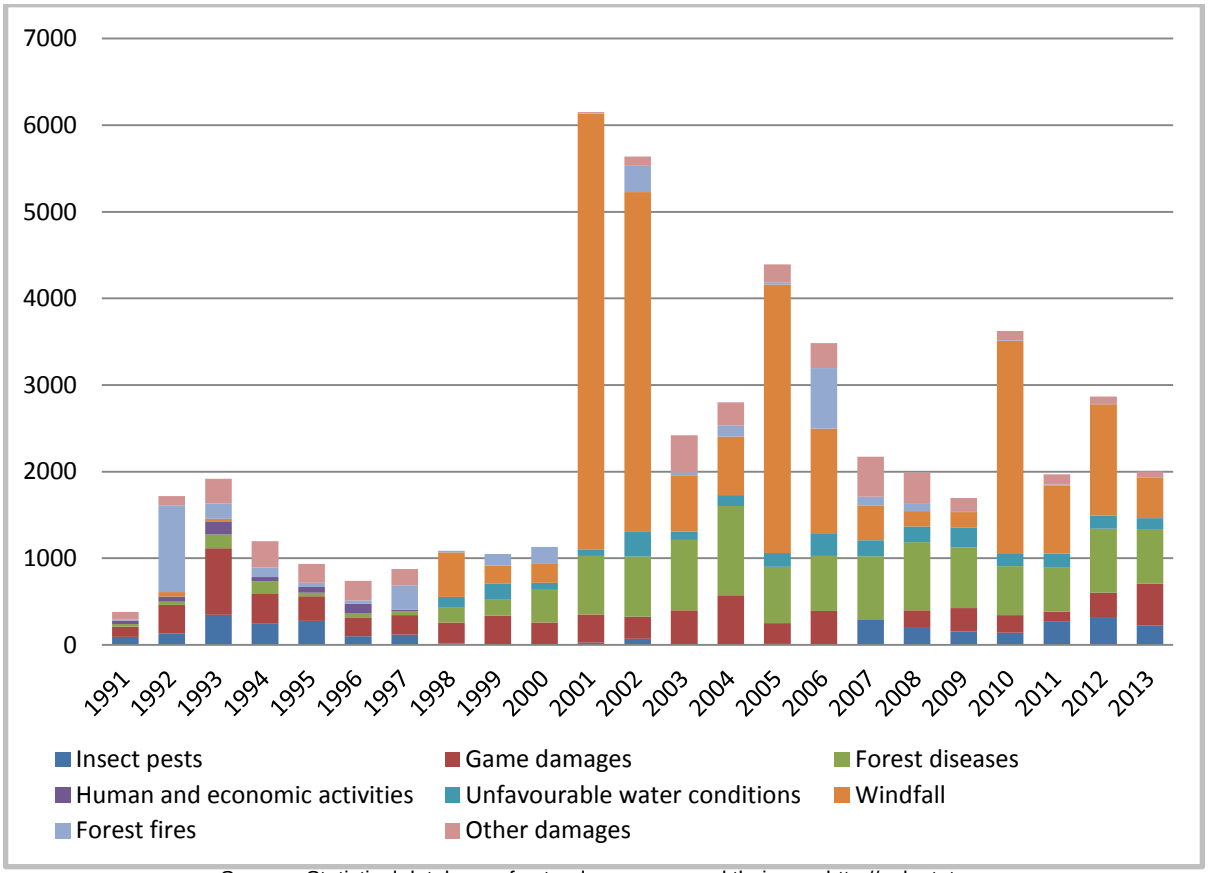
Year	Reforestation works								Land category of afforested areas (sowing and planting)				
	Planting					Sowing	Natural regeneration	Total reforestation works	Felling site	Opencast pits	Reconstructed areas	Fields	Total land category of afforested areas
	Spruce	Pine	Birch	Other	Total planting								
1991	n.a	n.a.	n.a.	n.a.	5,499.0	1,215.0	1,027.0	7,741.0	5,630.0	319	196	569	6,714.0
1992	n.a.	n.a.	n.a.	n.a.	3,041.9	780	532.2	4,354.1	3,607.2	52.2	82	80.5	3,821.9
1993	n.a.	n.a.	n.a.	n.a.	2,889.1	1,061.8	524	4,474.9	3,646.5	156.3	85.2	62.9	3,950.9
1994	n.a.	n.a.	n.a.	n.a.	2,933.5	1,252.1	627.5	4,813.1	3,887.7	174.7	91.3	31.9	4,185.6
1995	n.a.	n.a.	n.a.	n.a.	2,981.5	1,303.0	968.1	5,252.6	4,019.4	184.5	44.3	36.3	4,284.5
1996	n.a.	n.a.	n.a.	n.a.	3,003.2	1,392.3	1,012.4	5,407.9	4,097.0	180.1	44.7	73.7	4,395.5
1997	n.a.	n.a.	n.a.	n.a.	3,493.8	1,441.3	1,129.3	6,064.4	4,542.0	243.3	34.1	115.7	4,935.1
1998	n.a.	n.a.	n.a.	n.a.	3,814.3	1,679.3	1,346.6	6,840.2	5,035.7	312.5	22.8	84.8	5,495.6***
1999	3,286.6	842.3	319.5	64.7	4,513.1	1,622.5	1,999.2	8,134.8	5,715.2	308.2	19.2	91	6,133.6
2000	3,433.2	1,024.5	459.6	43.5	4,960.8	1,697.6	2,503.1	9,161.5	6,167.7	305	19.7	145.2	6,637.6
2001	3,690.2	1,348.6	755.1	10.7	5,804.6	1,280.1	2,726.9	9,811.6	6,441.1	434.8	24.9	183.9	7,084.7
2002	3,557.1	1,141.4	921	29.5	5,649.0	1,203.9	3,151.6	10,004.5	6,404.7	321.5	3.2	123.4	6,852.8
2003	4,044.5	1,163.5	746.8	74.3	6,029.1	1,694.8	3,583.4	11,307.3	7,158.0	177.9	4.6	88.5	7,723.9***
2004	4,571.5	961.2	691.2	38.9	6,262.8	1,309.2	2,978.8	10,550.8	7,179.7	127.2	0	93.2	7,571.9***
2005	4,405.1	890.2	644.4	87.5	6,027.2	1,311.5	845.3	8,184.0	6,490.9	173.1	0	519.7	7,338.6***
2006	4,377.5	906.6	858.4	76.8	6,219.3	1,533.4	639.4	8,392.2	6,559.4	44	0	816.1	7,752.8***
2007	4,097.5	1,088.9	680.6	40.4	5,907.4	907.5	823.9	7,638.8	6,786.3	0	0	0	6,814.9***
2008	4,792.2	1,054.5	711.6	61.6	6,619.9	1,234.0	807.8	8,661.7	7,609.9	212.6	22.2	0	7,844.7***
2009	4,442.9	997.2	520.1	70.9	6,031.0	1,084.1	1,112.4	8,227.4	6,939.6	147.7	6.8	0	7,115.1***
2010	4,644.5	1,185.9	502.8	32.8	6,366.0	1,274.4	1,180.8	8,821.3	7,478.8	134.5	23.1	0	7,640.4***
2011	4,774.7	1,731.9	583.2	39.5	7,129.3	1,038.7	1,409.5	9,577.5	7,999.4	117.1	10.3	4.1	8,168.0***
2012	5,703.5	2,633.2	580.8	39.8	8,957.3	1,241.9	1,305.0	11,504.2	9,953.1	129.9	15.4	3.6	10,199.2***
2013	6,539.6	2,530.7	668.8	39.6	9,778.7	855.9	2,137.2	12,771.8	10,002.2	248.7	11.3	333.7	10,634.6***

*Actual figures for State Forest Management Centre. Figures of private owners and other owners are planned activities which are registered by Environmental Board.** Contains area of afforestation works on other lands

Source : METS YEARBOOK FOREST 2013. http://www.keskkonnainfo.ee/failid/Mets_2013.pdf.

In terms of damages on Estonian forests, the area damaged has fluctuated over the time (Figure 20). There were many years of important losses like in 2001, 2002, 2005 and 2010. The levels of damaged forest stands are still high and the most effect comes from windfall and forest diseases. The damages from fire remain very punctual.

Figure 20 : Destroyed forest stands in Estonia (ha)



Source : Statistical database of natural resources and their use. http://pub.stat.ee

The FSC risk assessment platform www.globalforestregistry.org considers that Estonia is at low risk in terms of conversion of forest to other land uses, because the following criterion is verified at the country level:

- There is no net loss AND no significant rate of loss (> 0.5% per year) of natural forests and other naturally wooded ecosystems such as savannahs taking place in the eco-region in question.

3.2. Living wood volumes and removals

Table 7 shows the evolution volume of live trees in Estonia (1990 to 2010). According to the available data, the growing stock volume has increased between 1990 and 2000 and decrease after that. The growing stock in other wooded lands remains small compared to the growing stock in forests and remained stable since 2000. Since 1990, increment in forests available for wood supply remain stable and in the other hand the felling in forests available for wood supply largely increased from 1990 to 2000 and decreased after 2005 to 2010. Therefore the felling in percent of net increment increased by 69.67% for the period 1990-2010 and stabilised slightly above the European value.

Table 7 : Evolution of wood volume from 1990 to 2010 (volume in 1000m^3)

	1990	*2000*	*2005*	*2010*
Growing stock in forests and on other wooded land	375,537	463,000	460,500	447,200
Growing stock of forests	375,000	458,300	455,000	441,400
Growing stock of other wooded land	537	4,700	5,500	5,800
Growing stock in forests available for wood supply	352,000	427,500	414,400	398,300
Increment in forests available for wood supply	10,530	11,768	11,361	11,201
Felling in forests available for wood supply	3,770	12,412	6,662	5,714
Felling in percent of net increment	35.80%	105.47%	58.64%	51.01%
Felling in percent of net increment for EU 28	56.10%	61.00%	65.0%	62.70%

Source : http://epp.eurostat.ec.europa.eu

With this large felling between 1990 and 2000 that exceeds net increment[11], the years after have been impacted. According to Estonian Environmental Review 2013 founded on http://www.keskkonnaagentuur.ee, the reasons for such an increase were:

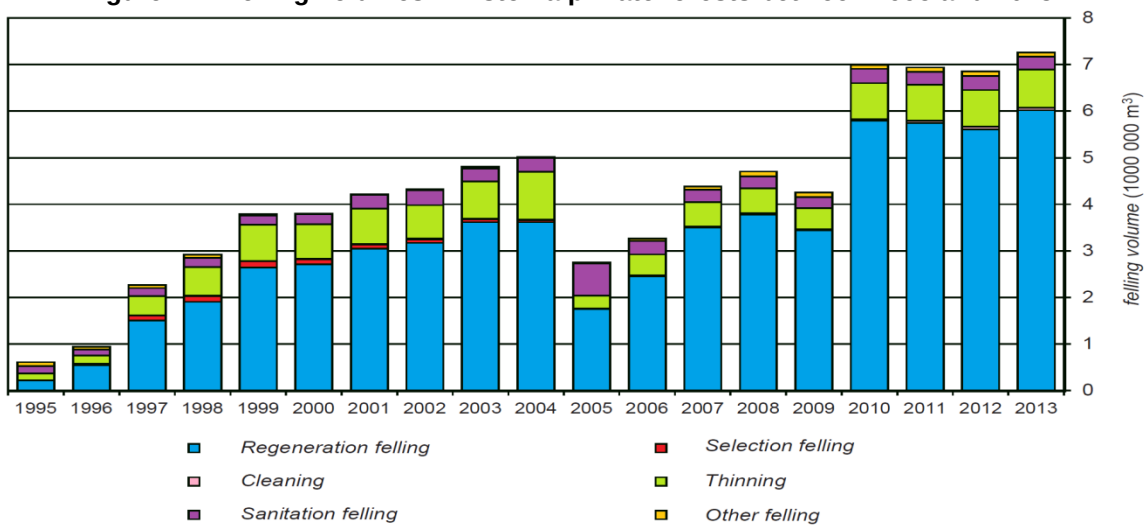
- *the high percentage of mature stands that had not been actively managed in the previous decade*
- *the active management of lands that had been transferred into private ownership as a result of the land reform*
- *the rapid development of mechanical wood processing and high demand for wood products, especially in the real estate and construction sectors.*

Add to these facts, the damage caused by windstorms and low reforestation between the years 2000-2009, the growing stock in forest has decreased. Nevertheless efforts have been made the last years with a large reforestation and a more sustainable forestry with the Forestry Development Plan until 2020 made in 2011 (see point 2.8). In addition, felling has not exceeded increment in the last ten years.

Felling evolution by types for state and private forests can be founded on the Figure 21 and In state forest volume of felling was stable between 1995 and 2003 around 3 million m^3. After 2003, the volume decreases slightly until 2005 and from 2008 to 2013 increased to a level of felling about 3.5 million m^3. The majority of the felling comes from regeneration felling.

[11] If forest is felled over a long period than can be grown in the same time, it will endanger the biodiversity of forests and the sustainability of the supply of raw material wood. Conversely, low rates of use indicate that the accumulated wood resources are used inefficiently.

Figure 22 : Felling volumes in Estonia private forests between 1995 and 2013



Source : Statistical Office of Estonia, Estonian Environment Agency in METS YEARBOOK FOREST 2013. http://www.keskkonnainfo.ee/failid/Mets_2013.pdf. Note that these figures are the Planned felling which are registered by Environmental Board

In private forest felling increased from 1995 to 2004 to reach the value of 5 million m^3. The annual felling decreased in 2005.

According to the rapport Estonian Environmental Review 2013 "*in order to meet the need for raw material, the imports of timber logs increased. This situation was brought about by the tax system that put private forest owners at a disadvantage, decreasing the uptake of unused forest land and increasing the cost of forest harvesting. Forest harvesting was also affected by mild and short winters because an unfrozen and soft surface makes the felling and transport of wood difficult. The timber market of the Baltic Sea region was also thrown into disarray by the "January storm" of 2005 — the market became saturated with cheap wind-damaged timber. All efforts were concentrated on eliminating the damage caused by the storm. The consequences of the storm were still affecting the market in 2006 and the prices of wood only recovered in 2007. In the context of decreased felling volumes, a sudden increase in the import of timber logs from Russia helped to alleviate the industry's demand for raw material. In June 2007, the Russian Federation established higher export tariffs on timber logs; this was followed by a so-called railway embargo in the wake of the April 2007 civil unrest, which in effect closed the primary transport route for timber logs.*"

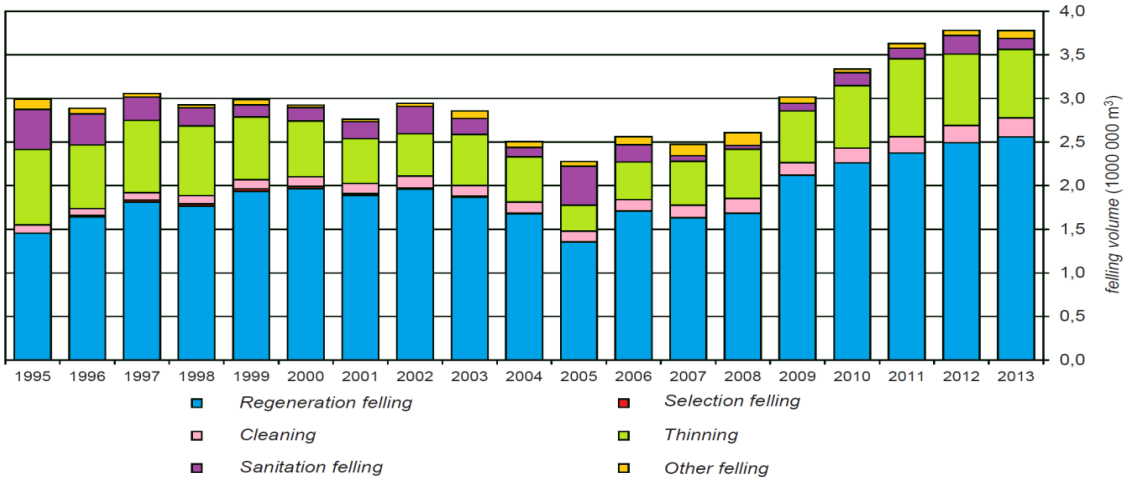
So in 2007, only 4.4 million m^3 of forest was felled in private forest. In 2008, felling volumes increased to about 4.7, 4.2 million m^3 in 2009 and 7.0 million m^3 in 2010. According to METS YEARBOOK FOREST 2013, the volumes of felled forest reached 6.9 to 7.3 million m^3 in 2011 to 2013, respectively. Like the state forests, the main source of the felling comes from regeneration felling.

We see on Figure 23 that references from National Forest Inventory (NFI) are not the same compared with the previous (Statistical Office of Estonia). The years before 2004 are overestimated and after 2004 are underestimated by NFI.

Figure 23 : Felling volumes in Estonia between 1999 and 2011 (NFI)

respectively.

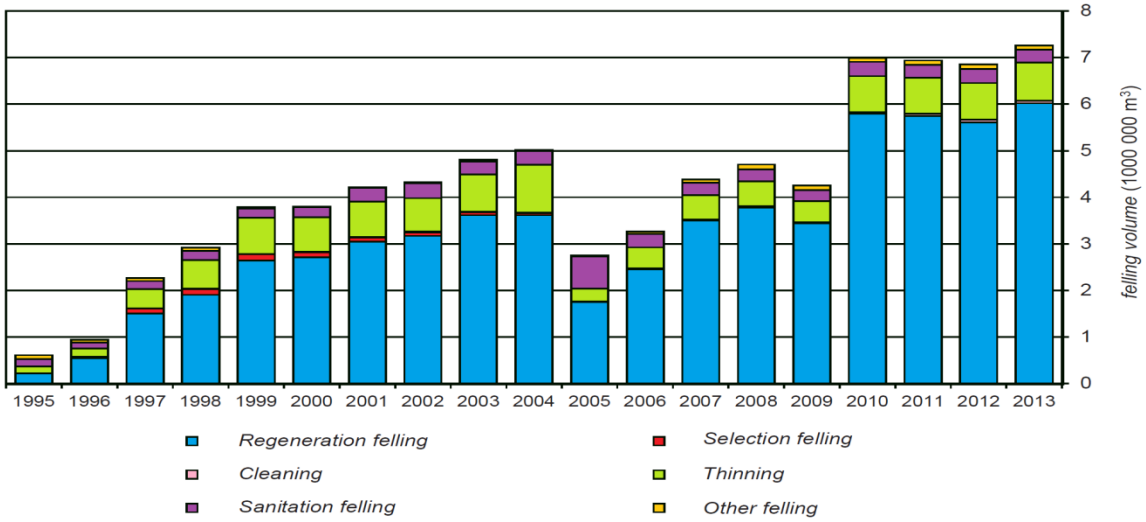
Figure 21 : Felling volumes in Estonia state forests between 1995 and 2013



Source : Statistical Office of Estonia, Estonian Environment Agency in METS YEARBOOK FOREST 2013. http://www.keskkonnainfo.ee/failid/Mets_2013.pdf

In state forest volume of felling was stable between 1995 and 2003 around 3 million m^3. After 2003, the volume decreases slightly until 2005 and from 2008 to 2013 increased to a level of felling about 3.5 million m^3. The majority of the felling comes from regeneration felling.

Figure 22 : Felling volumes in Estonia private forests between 1995 and 2013



Source : Statistical Office of Estonia, Estonian Environment Agency in METS YEARBOOK FOREST 2013. http://www.keskkonnainfo.ee/failid/Mets_2013.pdf. Note that these figures are the Planned felling which are registered by Environmental Board

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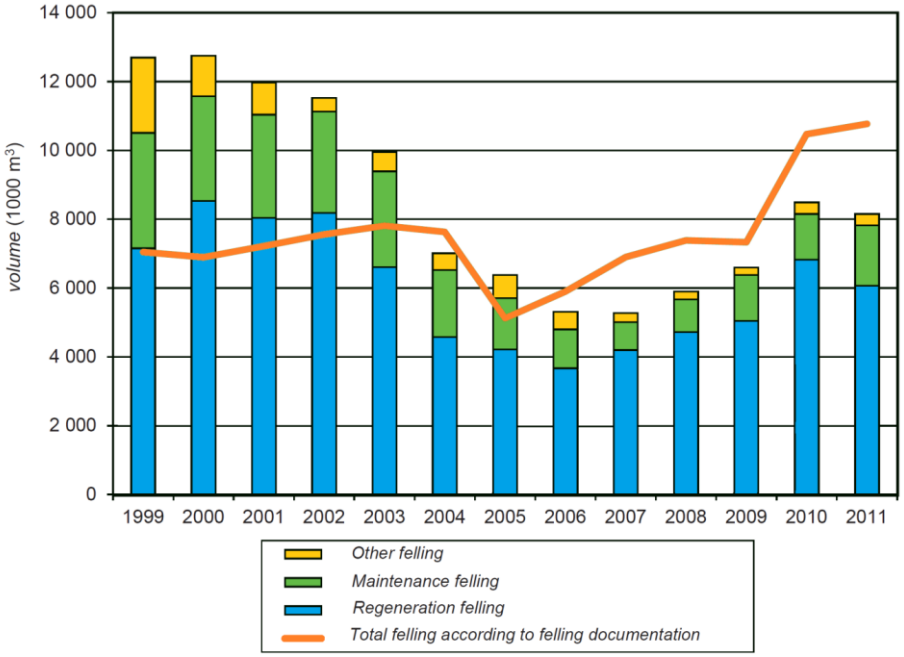
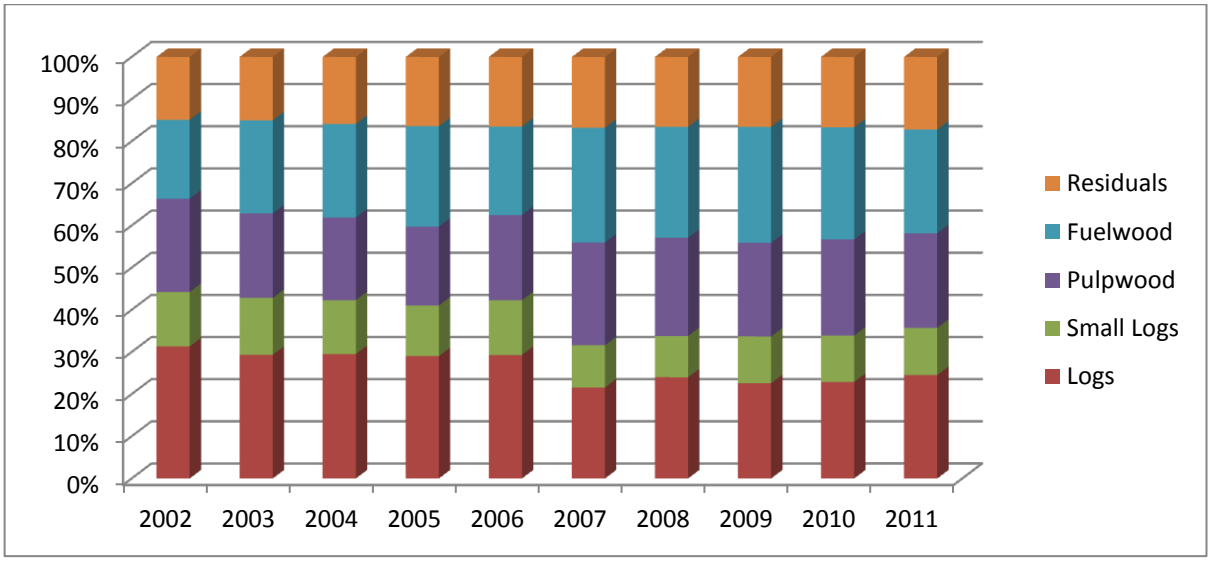


Source : Estonian Environment Agency, NFIin METS YEARBOOK FOREST 2013.
http://www.keskkonnainfo.ee/failid/Mets_2013.pdf

The Figure 24 shows the felling percentage by assortment. Logs were the bigger source of felling between 2002 and 2006 (an average of 30) followed by fuelwood and pulpwood (21.5 and 20% of felling respectively). This trend has changed last years because fuelwood passed behind logs

removals between 2007 and 2011 with 26.5% of felling compared with 23% for logs. Small logs and residuals are less important and represent a felling average of 16 and 12% respectively.

Figure 24 : Felling in percentage by assortments in 2002-2011



Source : Estonian Environment Agency, NFIin METS YEARBOOK FOREST 2013. http://www.keskkonnainfo.ee/failid/Mets_2013.pdf.

The **Error! Not a valid bookmark self-reference.** shows the roundwood removals by type of wood. The softwood removals are constantly above the hardwood removals. Indeed, there is a constant proportion of 60% of softwood removals and 40% of hardwood removals over the years. Eurostat data seem to come from the NFI source because the figures are similar.

Table 8 : Roundwood removals by type of wood (volume in 1000m^3)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Coniferous	4300	3500	3250	2736	2930	3254	4284	4293	4347	4365
Non-Coniferous	2500	2000	2150	1764	1931	2147	2916	2817	2943	3123
Total	6800	5500	5400	4500	4861	5401	7200	7110	7290	7488

Source : http://epp.eurostat.ec.europa.eu

Since 1958 we note a positive net change of forested volume for all the main species (**Error! Not a valid bookmark self-reference.**) The three species showed the most significant increase are pine (119.66 million m^3), birch (100.99 million m^3) and spruce (38.98 million m^3). Unfortunately since 2000, there are a decrease of spruce (-7.94 million m3) and grey alder (-5.17 million m^3).

Table 9 : Evolution of forested volume by the main species (million m^3)

Species/year	1958	1975	1988	1994	2000	2005	2012	Net change (1958-2012)	Net change (2000-2012)
Pine	55.45	81.75	105.96	111.22	162.48	163.00	175.11	+119.66	+12.63
Birch	25.48	44.22	65.06	77.00	121.66	118.88	126.47	+100.99	+4.80
Spruce	42.87	57.70	69.07	71.67	89.80	84.46	81.85	+38.98	-7.94
Grey alder	2.34	4.53	8.18	11.25	36.64	35.32	31.46	+29.13	-5.17
Aspen	2.80	4.13	5.37	6.46	29.12	31.00	30.71	+27.9	+1.59
Black alder	1.58	2.66	3.52	4.10	13.25	15.03	18.46	+16.87	+5.20

Others	0.66	1.13	2.48	2.78	5.34	6.80	6.24	+5.58	+0.90

Source : Estonian Environment Agency, NFIin METS YEARBOOK FOREST 2013.
http://www.keskkonnainfo.ee/failid/Mets_2013.pdf.

3.3. Protection of ecosystems and biodiversity

According to Estonian nature conservation (*http://www.envir.ee/en/nature-conservation*): "*In 1994, Estonia ratified the Convention on Biological Diversity. It is the largest convention on nature conservation and covers all traditional aspects of nature conservation along with environmental protection covering anything from gene protection to the protection of ecosystems. The entire country is responsible for implementing this convention to sustain a healthy and habitable environment. This directive is the basis for the Estonian Nature Conservation Act.*

The evolution of protected areas since 2000 to 2012 is presented in the Table 10 (without Natura 2000 protection). The total protected areas increases by years showing the interest of Estonia to protect the forests (518,200 ha in 2013).

Protected areas with old protection regulation decrease with time to be distributed in the other categories of protection.

Table 10 : Nature protection areas (ha)

Year	Types	Nature conservation area	Landscape conservation areas and nature park	National Park	Protected areas with old protection regulation	Forests monument, forests stands and arboretum (specific parks)	Total
2013	Land	246167	185042	129341	27822	4521	592893
	Aquatic	14022	10787	68532	385		93726
	TOTAL	260189	195829	197873	28207	4521	686619
2012	Land	244367	184155	129474	27772	4496	590264
	Aquatic	13847	10611	67345	380		92183
	TOTAL	258214	194766	196819	28152	4496	682447
2011	Land	244367	184155	129474	27772	4496	590264
	Aquatic	13847	10611	67345	380		92183
	TOTAL	258214	194766	196819	28152	4496	682447
2010	Land	244367	184155	129474	27813	4496	590306
	Aquatic	13847	10611	67345	379		92182
	TOTAL	258214	194766	196819	28192	4496	682488
2009	Land	244376	180316	129474	31911	4531	590608
	Aquatic	13814	10576	67345	353		92087
	TOTAL	258189	190891	196819	32264	4531	682695
2008	Land	244122	180387	129474	31911	4547	590441
	Aquatic	13807	10576	67345	353		92080
	TOTAL	257929	190962	196819	32264	4547	682522
2007	Land	244105	180338	129370	31901	4619	590333
	Aquatic	13824	10626	67449	353		92253
	TOTAL	257929	190964	196819	32254	4619	682586
2006	Land	186800	193605	129370	38747	4558	553080
	Aquatic	12544	7057	67449	379		87429
	TOTAL	199343	200662	196819	39126	4558	640508
2005	Land	164586	181079	128120	50665	4378	528827

	Aquatic	10286	6586	67449	366		84687
	TOTAL	174872	187665	195569	51031	4378	613514
2004	Land	140552	159555	125317	62232	5711	493367
	Aquatic	8084	6529	67498	363		82474
	TOTAL	148636	166084	192816	62595	5711	575842
2003	Land	150181	138571	102884	93926	5126	490688
	Aquatic	34270	6529	41319	363		82481
	TOTAL	184451	145099	144203	94290	5126	573169
2002	Land	147445	135935	102877	98932	5493	490681
	Aquatic	32528.4	6532	41320	1984.6		82365.3
	TOTAL	179973	142468	144197	100917	5493	573047
2001	Land	134671	135761	102812	98844	4127	476215
	Aquatic	34953	6687	41380	2106		85126
	TOTAL	169624	142448	144192	100950	4127	561341
2000	Land	120439	131397	102804	106996	4127	465763
	Aquatic	32503	6199	41380	1563		81645
	TOTAL	152942	137596	144184	108559	4127	547408

Source : http://loodus.keskkonnainfo.ee/eelis/default.aspx?id=-214649373&state=1;-164545161;est;eelisand

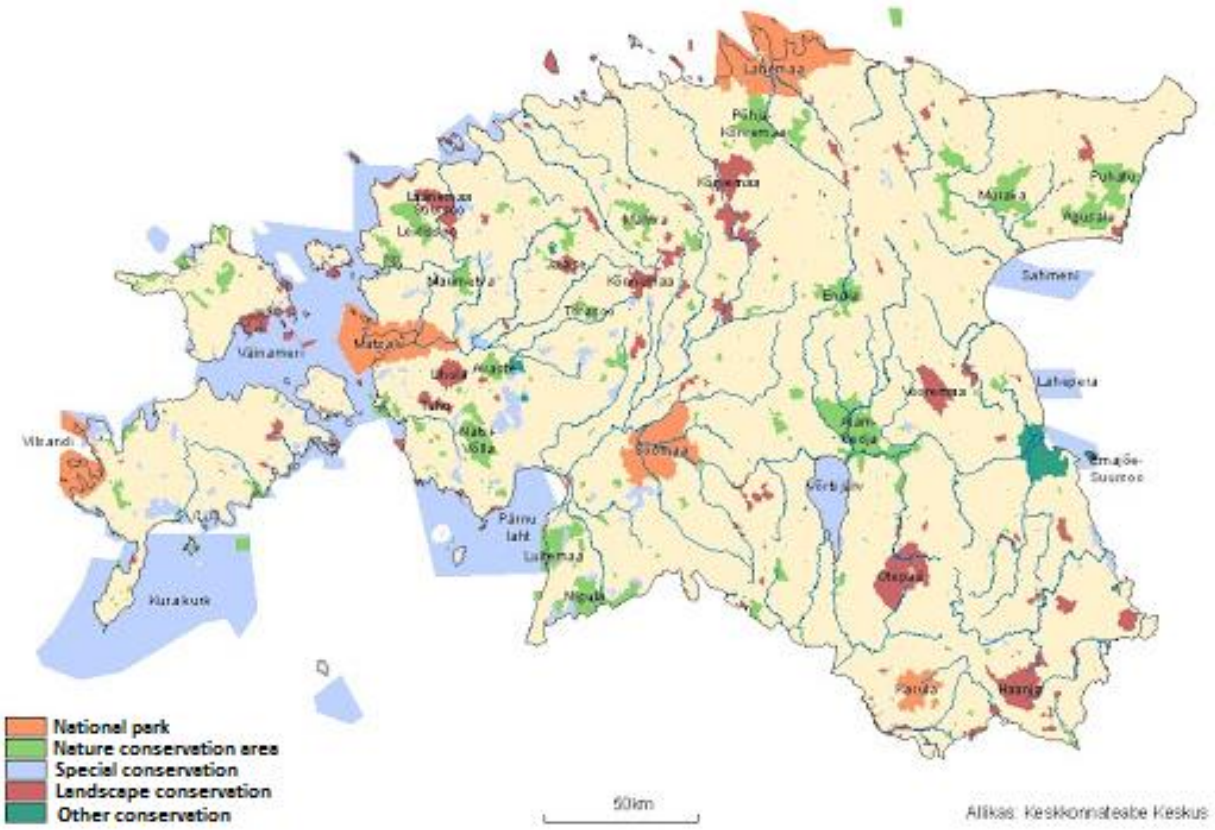
According Estonian nature conservation, the total area under protection is 1,548,124 hectares, which makes up to 22% of the total area (including territorial sea). 18% of the land is under protection. On 31 December 2013, Estonia had a total amount of 3,883 protected natural sites[12]:

- 138 nature conservation areas;
- 151 landscape conservation areas;
- 5 national parks;
- 111 protected areas with old protection regulation;
- 540 parks and forest stands;
- 344 special conservation areas;
- 1,350 species protection sites;
- 21 natural objects protected at the local government level;
- 1,223 separate protected natural objects.

The main locations are given at the following figures.

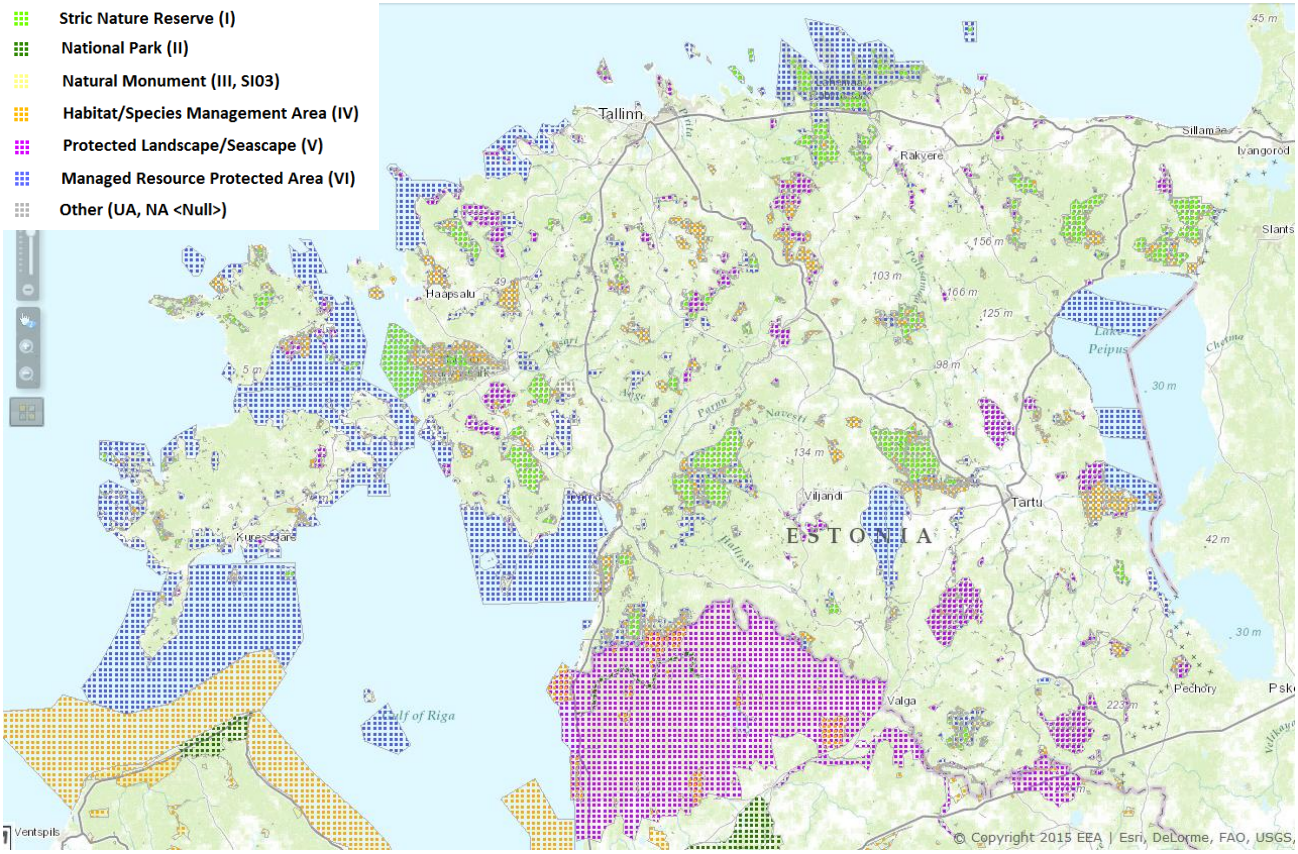
Figure 25 : Location of the protected area in Estonia

12



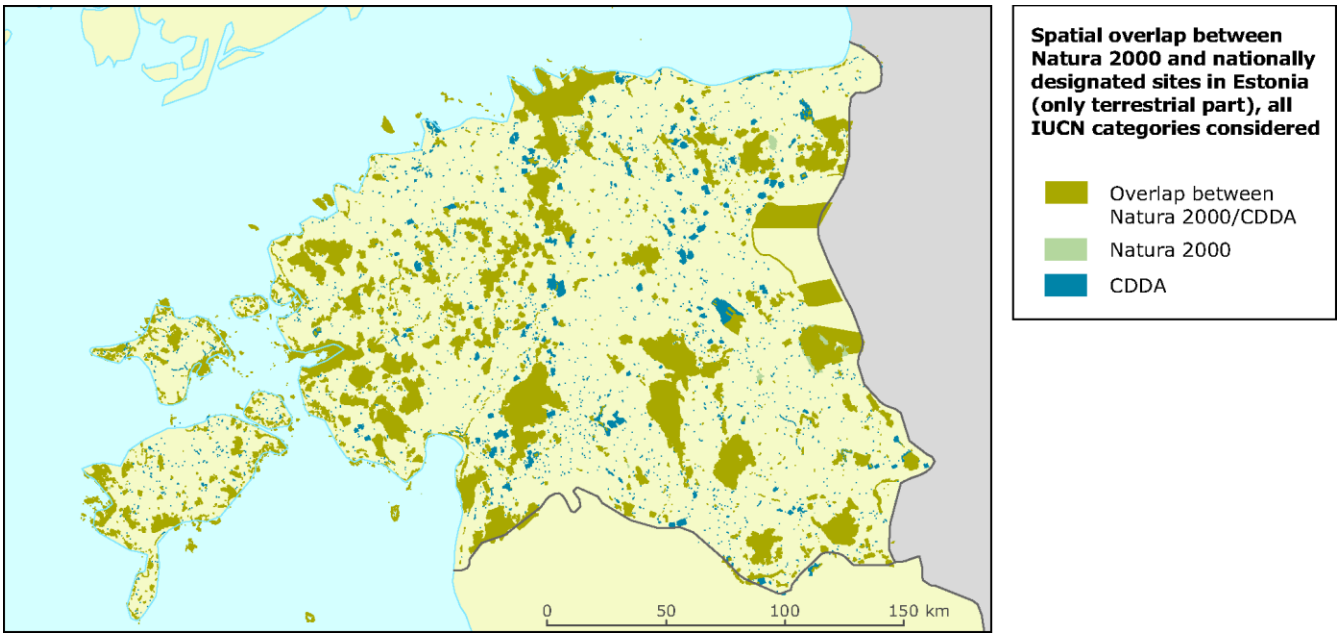
Source: http://maekaardid.blogspot.co.uk/2013/08/kaart-kaitse-ja-hoiualad-eestis.html

Figure 26 : Location of the protected area in Estonia (Natura 2000 Network Viewer)



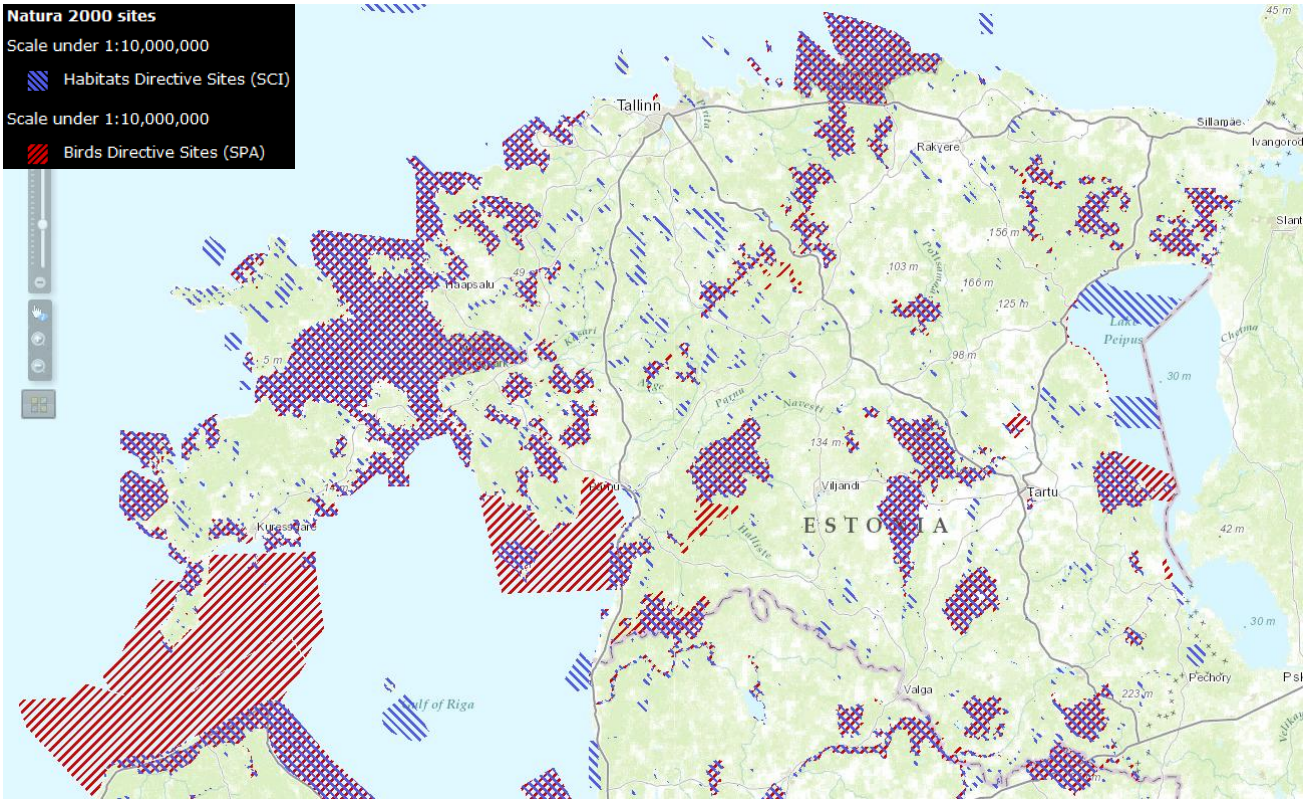
Source : http://natura2000.eea.europa.eu/#

Figure 27 : Protected areas Estonia overlap



Source : http://www.eea.europa.eu/data-and-maps/figures/spatial-overlap-between-natura-2000

Figure 28 : Natura 2000 Network Viewer



Source : http://natura2000.eea.europa.eu/#

The MCPFE (Ministerial Conference on the Protection of Forests in Europe) has produced Assessment Guidelines for Protected and Protective Forest and Other Wooded Land in Europe. The total extend of forested protected area in Estonia register by MCPFE is around 486,000 ha (classes 1.1.-1.3 & 2.)[13]. This is about 21.6% of the forest land.

Table 11 : Identification of the MCPFE Classes

1. Main Management Objective "Biodiversity"	1.1: "No Active Intervention"
	1.2: "Minimum Intervention"
	1.3. "Conservation Through Active Management"
2. Main Management Objective: "Protection of Landscapes and Specific Natural Elements"	
3. Main Management Objective : "Protective Functions"	

Source: MCPFE assessment guidelines for protected and protective forest and other wooded land in Europe

When we compared by source provided by EU-27 DG Environment Natura 2000 network covers 467,000 ha of forests (i.e. about 20.7% of the country forests).

[13] The State of Mediterranean Forests 2013

Regarding Estonian forests, protection is mostly based on the Nature Conservation Act and Forest Act. The Forest Act excludes previously used forest categories (conversation forest, protection forest and commercial forest). NFI 2010 lists about 690,000 hectares (25.4% of the total forest land). Approximately 35.7% of these protected forests are managed by the State Forest Management Centre, and about 19.6% of other forests[14].

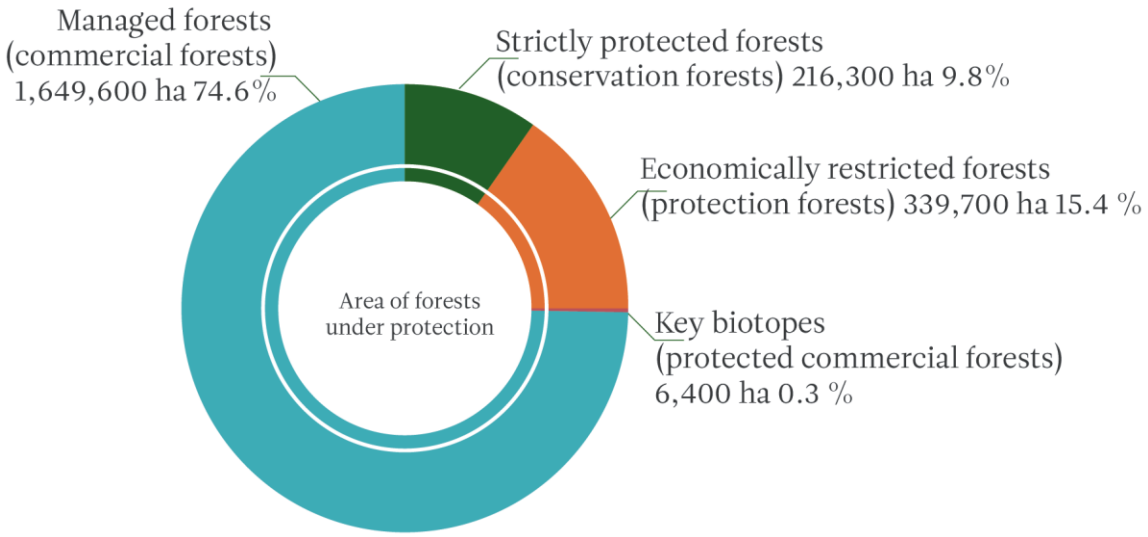
The main objective for Estonian protected forests has changed over time[15]:

- The forest policy (1997) : to increase the area of strictly protected forests to 4% of the total area of forest land
- The Estonian forestry development plan 2010 (passed in 2002) : to increase this indicator to 10%. The same objective has also been set in the new
- Estonian forestry development plan 2020 : the same objective than the previous plan

According to the results of the NFI 2010 (Figure 29), the objective has been achieved because strictly protected forests constitute 9.8% of Estonian forest land.

The Estonian forestry development plan 2010 emphasizes, however, that the typological representativeness of strictly protected forest lands should be improved.

Figure 29 : Share of protected forests in Estonia in 2010



Source: Estonian environmental indicators 2012. http://www.keskkonnainfo.ee/failid/KTK_indicators_2012.pdf. Note : Strictly protected forests include reserves of protected areas and special management zones, special management zones of species protection site, habitats of I category protected species, key biotopes protected with a contract or located on state land and intended protection areas according to the planned mode. Economically restricted forest consists of limited management zones of protected areas, limited management zones of species protection site, special conservation areas, water protection zone forests, infiltration zone forests, forests designated with a plan to the protection of the status of environment, intended protection areas according to the planned mode and protection areas without updated protection rules. Key habitats are areas of up to seven hectares, which need protection outside a protected natural object due to the high probability of the occurrence of narrowly adapted, endangered, vulnerable or rare species.

[14] Estonian Environmental Review 2013. http://www.keskkonnaagentuur.ee

[15] Estonian environmental indicators 2012. http://www.keskkonnainfo.ee/failid/KTK_indicators_2012.pdf

National strategies and programs

The Estonian Environmental Strategy 2030[16] is a strategy for developing the sphere of the environment which builds upon the principles of "Sustainable Estonia 21" and serves as the basis for the preparation and revision of all sector-specific development plans within the sphere of the environment. Environmental Strategy 2030 is implemented through The National Environmental Action Plan of Estonia 2007-2013. Environmental Strategy deals with the areas specified in the Sixth Environmental Action Plan of the European Union.
The areas are:
1. The environment, health and quality of life: provides objectives and measures relating to environmental health;
2. Preservation of the diversity of landscapes and biodiversity: provides objectives and measures relating to nature conservation;
3. Sustainable use of natural resources and reduction of waste generation: provides objectives and measures relating to the utilisation of major natural resources, and waste management;
4. Climate change mitigation and quality of ambient air: provides objectives and measures relating to energy and transport;
5. Environmental management: provides objectives and measures to deal with environmental management questions, methodological instructions of sector-specific working groups and creating links between and harmonisation of the results of these working groups.
6. Resource efficiency is reflected and implemented under the sustainable use of natural resources in the Environmental Strategy and its action plan.

Forestry Development Plan until 2020 (2011). The principal goals are to safeguard the productivity and viability of forests and ensure the varied and effective use of forests. In order to achieve these aims, it is important to procure wood in the amount of the increment, to increase the volume of reforestation, to keep at least 10% of forestland area under strict protection and to enhance the variety of protected forests. The share of strictly protected forests in the total area of forests was 10% already in 2010, but further efforts are required to ensure that a variety of forests are represented in the strictly protected areas[17].

Nature Conservation Development Plan 2020 (in the process of approval) Objective is to ensure systematised and reasoned nature conservation and management of biodiversity protection, resource saving and optimised use and regulation of distributing revenue based on single political guidance paper.

The Development Programme for the Fuel and Energy Sector up to year 2015 provides that

- the share of wood and peat should increase in the total energy balance up to 13% by the year 2010,

[16] ESTONIA country profile on resource efficiency policies.PDF

[17] In 2009 County Environmental Departments and State Nature Conservation Centre were merged and the number of regional forest officers decreased. The structure and operating principles of State Forest Management Centre (RMK) were reorganized and 17 forest districts were established instead of 62 before. A Forest Council, comprising representatives of forestry institutions and NGOs, was established to facilitate implementation of Forestry Development Plan.

- the commitment to increase the share of renewable in electricity production up to 5.1% by the year 2012,
- by the year 2020 the combined heat and power production from biomass should gain the level of 20% of the total electricity production

Source of subsidies

National supports

- Most of the funding is allocated for supporting the development of forest management plans, group and private advisory services and reforestation;
- Since 2000 national supports are granted from the state budget for the development of private forestry;
- Supports are granted for private forest owners for sustainable management of forests and forest regeneration with the aim of ensuring sustainability;
- Supports are targeted at the development of joint activities of regional private forest owners.

European Union Support.

Applications for applying the European Union as well as national forestry support are submitted to the Private Forest Centre.

European Union supports are forestry measures provided in the Estonian Rural Development Plan 2007–2013 financed from the European Agricultural Fund for Rural Development (the EAFRD) and co-financed from the state budget of Estonia.

European Union forestry measures:

1. Natura 2000 support for private forest land.
2. Investment support for improving the economic value of forests.
3. Investment support for restoration of damaged forest.
4. Investment support for prevention of forest fires.

3.4. Protection of water

The MCPFE (Ministerial Conference on the Protection of Forests in Europe) has defined a quantitative indicator to assess the performances of the reporting countries in terms of conservation of the forests' protective functions, especially regarding soil and water (MCPFE class 3 as per Table 11). It is based on the surface of forest land specifically dedicated to protective functions, as defined by the following criteria[18]:

- *The management is clearly directed to protect soil and its properties or water quality and quantity or other forest ecosystem functions, or to protect infrastructure and managed natural resources against natural hazards*
- *Forests and other wooded lands are explicitly designated to fulfil protective functions in management plans or other legally authorised equivalents*
- *Any operation negatively affecting soil or water or the ability to protect other ecosystem functions, or the ability to protect infrastructure and managed natural resources against natural hazards is prevented*

[18] MCPFE assessment guidelines for protected and protective forest and other wooded land in Europe http://www.unece.org/fileadmin/DAM/timber/publications/2002-guidelines-protected-forest.pdf

Table 12 : Forest land dedicated to soil, water and other forest ecosystem functions as per MCPFE class 3

Year	Land dedicated to soil, water and other forest ecosystem functions (1000 ha)	Percentage of the forest land
2010	99	4.4%
2005	165.2	7.3%
2000	267	11.8%
1990	n.a.	n.a.

Source : Full State of Europe's Forests 2011 Report, by the Ministerial Conference on the Protection of Forests in Europe

According to Estonian Environmental Review 2013. (http://www.keskkonnaagentuur.ee), *"One of the objectives of the Estonian Environmental Strategy 2030 is to improve the status of surface water (including coastal waters) and groundwater (to achieve the "good" status) and to maintain the status of water bodies that already have "good" or "high" status. The evaluation of the status of groundwater is based on the concentrations of nitrates, pesticides and other hazardous substances. The general status of surface water bodies is assessed based on the ecological status of these water bodies and chemical indicators; the assessment includes the monitoring of the biota and the quality of surface water.*

These objectives stem from directives of the European Parliament and the Council and are aimed at maintaining the aquatic environment natural or semi-natural conditions.

These objectives provide guidance on how to prevent deterioration of water bodies status and to avoid pollution from densely populated areas and agricultural lands (nitrates). Main directives regulating water issues: Water Framework Directive (2000/60/EC); Marine Strategy Framework Directive (2008/56/EC); Urban Waste Water Treatment Directive (91/271/EEC); Nitrates Directive (91/676/EEC) as well as certain international conventions, such as the Convention on the Protection of the Marine Environment of the Baltic Sea Area (the governing body of the convention is called HELCOM) and the Baltic Sea Action Plan. Estonia has transposed the requirements of the water directives with the Water Act and other legal acts adopted under the Act (e.g. Regulation No 99 of 11 November 2012 of the Government of the Republic "Requirements for waste water treatment and discharge of effluent and rainwater into recipients, rainwater pollution limits and compliance monitoring measures" etc).

The Public Water Supply and Sewerage Act, regulating the organisation of the public water supply and collection and treatment of waste water, rain water, drainage water and other soil and surface water through the public water supply and sewerage system, provides the rights and obligations of the state, local governments, water companies and clients".

3.5. Protection of soils

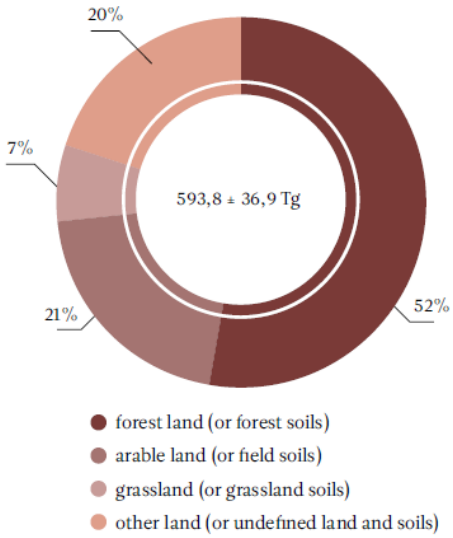
As described in the previous section, the MCPFE (Ministerial Conference on the Protection of Forests in Europe) has defined a quantitative indicator of to assess the performances of the reporting countries in terms of conservation of the forests' protective functions, especially regarding soil and water (MCPFE class 3 as per Table 11). The conservation areas are presented on Table 12.

According to Estonian Environmental Review 2013. (http://www.keskkonnaagentuur.ee), *"There is no comprehensive legislation on soil protection in Estonia. The Earth's Crust Act makes a reference to*

soil protection, while the Land Improvement Act and the Plant Protection Act include provisions on soil monitoring. One of the objectives of the Estonian Environmental Strategy 2030 is to ensure the environmentally sound use of soil and the protection of soil against being covered as a result of construction activities".

As we see on Figure 30, forest account for 52% of the carbon stocks in soils (about 300 Tg of C).

Figure 30 : Organic carbon stocks in Estonian soils (Mg ha-1)



Source : Estonian Environmental Review 2013. http://www.keskkonnaagentuur.ee

3.6. Protection of carbon stocks

In forest land the carbon stocks mainly includes:

- living above ground and below ground woody biomass,
- soil organic carbon,
- carbon in litter.

As we see on the previous figure, most of the carbon in Estonia's forests is stored in the soil (300 million tonnes of carbon). In 2013, wooden biomass contained 190 million tonnes of carbon.

Table 13 : Biomass and carbon storage in wooden biomass on forest land in 2013 by tree species (in thousand tons)

	Wooden biomass on forest land	Carbon storage in wooden biomass on forest land
Pine	108,040	55,101
Spruce	84,772	43,234
Birch	99,431	47,727
Aspen	23,233	11,152
Grey alder	30,741	14,756
Common alder	20,189	9,691
Willow	4,842	2,324
Other tree	14,990	7,195
Total	386,239	191,179

Source : http://pub.stat.ee/px-web.2001/Dialog/Saveshow.asp

Other data were reported by Estonia to the Ministerial Conference on the Protection of Forests in Europe (MCPFE) in the framework of Full State of Europe's Forests 2011 Report[19]. We can see a constant augmentation of carbon stock between 1990 and 2010 (Table 14).

Table 14 : Estimated carbon stock in Estonian forests between 1990 and 2010 (in million t)

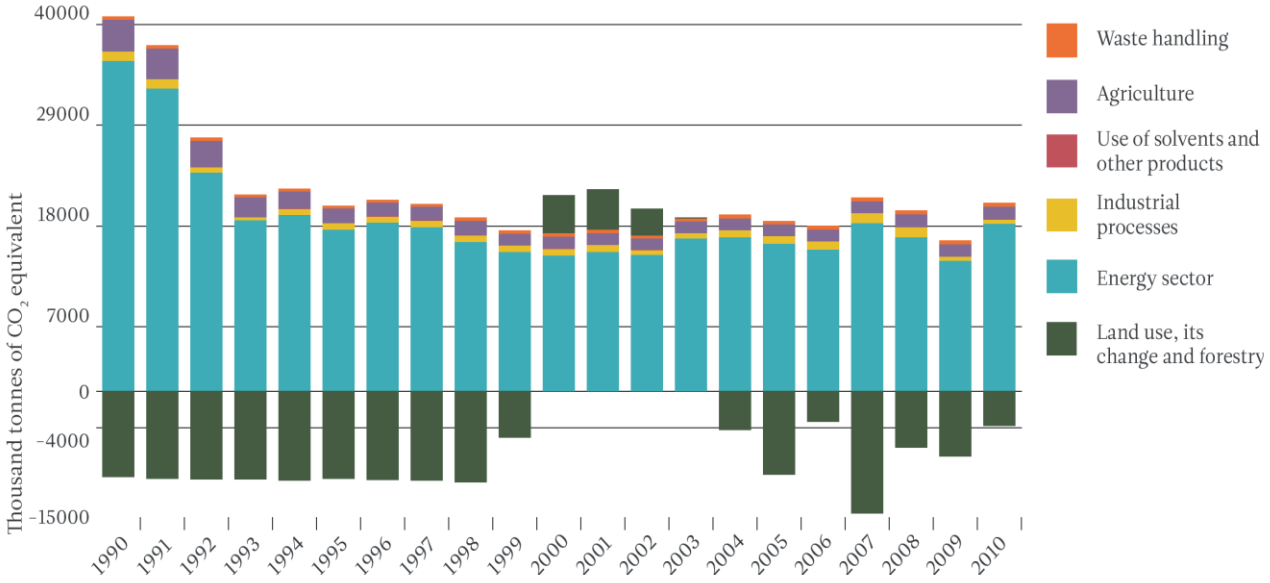
Year	Carbon in above-ground and below-ground living biomass		Carbon in deadwood and litter		Soil carbon
	Above-ground	Below-ground	Deadwood	Litter	
2010	128,884	33,607	11,791	n.a	343,597
2005	132,719	34,564	10,354	n.a	351,224
2000	133,634	34,693	8,323	n.a	349,820
1990	109,255	28,367	6,818	n.a	325,958

Source : Full State of Europe's Forests 2011 Report, by the Ministerial Conference on the Protection of Forests in Europe

Carbon has increased for 30 years: in above-ground biomass it was 128.9 million metric tonnes of carbon in year 1990 and has increased up to 109.2 million metric tonnes of carbon in 2010, the levels in below ground-biomass at these years were 28.4 and 33.6 respectively (both estimates had increase by 18% in average). The less significant increase is for the carbon stock stored in the dead wood, as dead wood has increased by 5.4% from 1990 to 2010.

Forests and land use change used to be a carbon sink between 1990 and 1999 as well as between 2004 and 2010, while they have been a carbon source between 2000 and 2003 compared with the period 2000-2003 (Figure 31). The reasons for these carbon emissions were mentioned in paragraph 2.6 (a major felling, storms, low reforestation, conversion of forest land to agricultural land, etc.). However, after 2004 the forests recovered their carbon sink capacity due to the efforts made by the government to protect forests, develop legislation, plan and strategies. Efforts have also been made to introduce a better integrated management in the forest areas.

Figure 31 : Emissions and binding of greenhouse gases by sectors in 1990–2010



Source : Estonian environmental indicators 2012. http://www.keskkonnainfo.ee/failid/KTK_indicators_2012.pdf

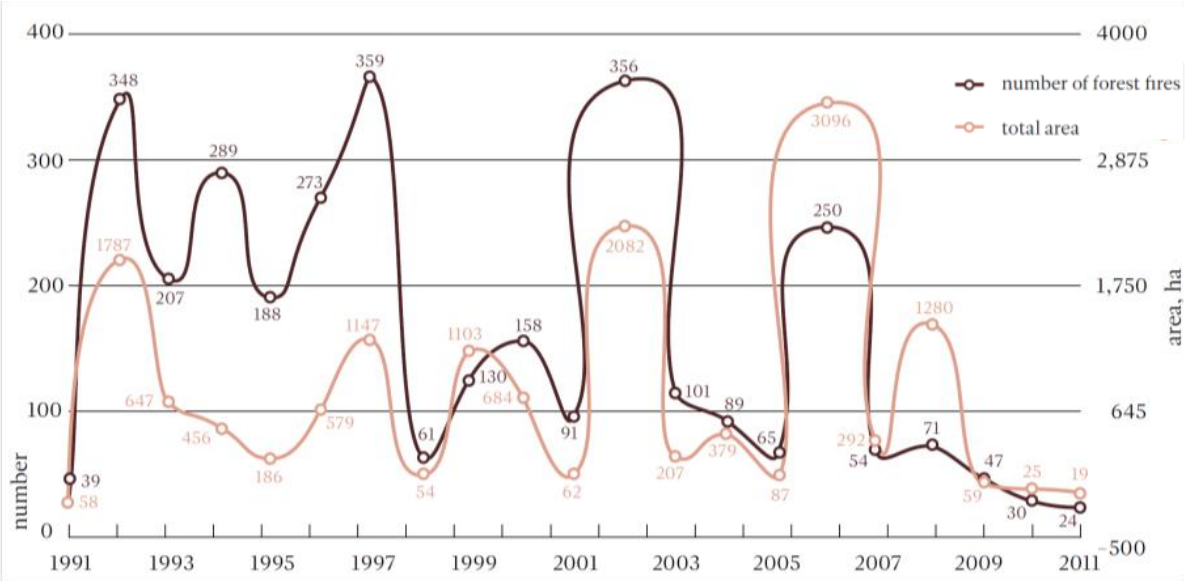
[19] http://www.foresteurope.org/full_SoEF

3.7. Protection of air quality

Concerning forests, the main impact on air quality relates to fire. It includes wild fire (which are unintended) and prescribed fire (which is used as part of forest management under controlled conditions).

Forest fires impact on Estonian forests is less important compared with other factors except in the early 90s (see **Error! Reference source not found.**, page 22 and Figure 20). Number of forest fires and area burned can be seen on Figure 32.

Figure 32 : Number of forest fires and area, 1991–2011



Source : Estonian Environmental Review 2013. http://www.keskkonnaagentuur.ee

According to Estonian Environmental Review 2013 (http://www.keskkonnaagentuur.ee), *"most wildfires are attributed to human sources. The greatest number of forest fires occurs in forests that are situated close to larger cities and towns in Harju and Ida-Viru counties. Natural factors, such as lightning, only cause wildfires in isolated cases. Most forest fires are caused by careless visitors (holiday-makers, berry-pickers, children, etc.). Other causes include arson and negligent forestry works, etc. Weather patterns can also increase the risk of wildfires. The risk of wildfire is very high during prolonged dry spells. During the very dry summer of 2006, an average of more than 12 hectares of forest was destroyed by each wildfire. In 2008, the area of forest destroyed per wildfire was 18 hectares — more than in any year in the previous 16-year period".*

Prescribed burning as voluntary management technique in forestry is not allowed in Estonia[20]. Indeed, it seems that the national authorities and the public are opposed to prescribe burning[21].

[20] Laarmann D., Korjus H., Sims A., Kangur A., Stanturf S.A., 2013. Initial effects of restoring natural forest structures in Estonia. Forest Ecology and Management 304: 303–311.

[21] FAO, 2007. Fire Management: Global Assessment 2006 : a Thematic Study Prepared in the Framework of the Global Forest Resources Assessment 2005

3.8. Illegal logging

Since 2002, information about illegal logging is available in the Environmental Inspectorate. Since then this authority evaluates the quantity of illegally harvested timber and determines the environmental damage caused by cuttings.

In 2013, eleven cases of illegal logging were recorded (Table 15) with 276 m^3 of wood were cut and an environmental damage of 48,473 €. In 2012, the number of cases was 9 and there was a volume of 149 m^3 of illegally harvested timber and the amount of environmental damage was 69,809 €. Illegal logging accounted for 0.002% of the total felling. Since 2000, we note a huge decrease of:

- 98.9% of offences
- 99.8% of illegal cutting volume
- 99.3% of the amount of damages

The entire database made by Environmental Inspectorate was abandoned as a relatively small number of violations were observed. Therefore, from 1 January 2008, the records of illegal logging by types of offenders are not registered.

The FSC risk assessment platform www.globalforestregistry.org considers Estonia as at low risk in terms of illegal logging, because the following criteria are all verified:

- Evidence of enforcement of logging related laws in the district [22]
- There is evidence in the district demonstrating the legality of harvests and wood purchases that includes robust and effective system for granting licenses and harvest permits [23]
- There is little or no evidence or reporting of illegal harvesting in the district of origin[24]
- There is a low perception of corruption related to the granting or issuing of harvesting permits and other areas of law enforcement related to harvesting and wood trade[25]

Table 15 : Illegal logging in 2001–2013

Year	*Indicator*	*Owner*	*Subject of restitution/ privatization*	*Thief/ unknown*	*Agent*	*Total*
2001*	number of offences	217	42	751		1 010
	amount of timber (m3)	62 874	4 028	68 585		135 487
	environmental damage (EUR)	3 502 564	143 923	3 115 898		6 762 385
2002	number of offences	224	35	578		837
	amount of timber (m3)	58 054	3 820	65 222		127 096
	environmental damage (EUR)	3 757 589	84 699	2 378 076		6 220 364
2003	number of offences	230	25	434		689
	amount of timber (m3)	54 626	1 142	56 233		112 001
	environmental damage (EUR)	3 295 620	43 273	1 408 925		4 747 818
2004	number of offences	255	16	273		544
	amount of timber (m3)	49 873	1 447	40 803		92 123
	environmental damage (EUR)	2 512 523	56 232	1 681 930		4 250 685
2005	number of offences	73	1	62		136

[22] www.illegal-logging.info ; www.eia-international.org ; http://www.ahec-europe.org/
[23] www.illegal-logging.info ; www.eia-international.org ; http://www.ahec-europe.org/
[24] www.illegal-logging.info ; www.eia-international.org ; http://www.ahec-europe.org/
[25] http://www.transparency.org/cpi2012/results

	amount of timber (m3)	19 965	7	6 810		26 782
	environmental damage (EUR)	866 943	771	226 641		1 094 354
2006	number of offences	20	5	27	18	70
	amount of timber (m3)	3 863	124	3 778	1 459	9 224
	environmental damage (EUR)	219 359	3 991	136 537	1 028 860	425 643
2007	number of offences	19	1	12	11	43
	amount of timber (m3)	908	19	203	233	1 363
	environmental damage (EUR)	58 457	3515	28 415	87 968	96 009
2008	number of offences	**	**	**	**	32
	amount of timber (m3)	**	**	**	**	3 229
	environmental damage (EUR)	**	**	**	**	153 672
2009	number of offences	**	**	**	**	10
	amount of timber (m3)	**	**	**	**	530
	environmental damage (EUR)	**	**	**	**	21 406
2010	number of offences	**	**	**	**	22
	amount of timber (m3)	**	**	**	**	350
	environmental damage (EUR)	**	**	**	**	74 765
2011	number of offences	**	**	**	**	22
	amount of timber (m3)	**	**	**	**	1 502
	environmental damage (EUR)	**	**	**	**	100 766
2012	number of offences	**	**	**	**	9
	amount of timber (m3)	**	**	**	**	149
	environmental damage (EUR)	**	**	**	**	69 809
2013	number of offences	**	**	**	**	11
	amount of timber (m3)	**	**	**	**	276
	environmental damage (EUR)	**	**	**	**	48 473

*Data for year 2001 include Enviromental Inspectorate's data (data of Police Department is not included)

**Since 1.01.2008 records by type of offenders are not registered.

Source : Estonian Environment Agency, NFIin METS YEARBOOK FOREST 2013. http://www.keskkonnainfo.ee/failid/Mets_2013.pdf.

3.9. Civil rights and traditional rights

The FSC risk assessment platform www.globalforestregistry.org considers Estonia as at low risk in terms of violation of civil and traditional rights, because the following criteria are all verified:

- There is no UN Security Council ban on timber exports from the country concerned
- The country or district is not designated a source of conflict timber (e.g. USAID Type 1 conflict)
- There is no evidence of child labor or violation of ILO Fundamental Principles and Rights at work taking place in forest areas in the district concerned
- There are recognized and equitable processes in place to resolve conflicts of substantial magnitude pertaining to traditional rights including use rights, cultural interests or traditional cultural identity in the district concerned
- There is no evidence of violation of the ILO Convention 169 on Indigenous and Tribal Peoples taking place in the forest areas in the district concerned

3.10. Forest certification

The main forest certification schemes used in Estonia are:
- PEFC (Programme for the Endorsement of Forest Certification), a global certification system that ensures sustainable forest management
- FSC (Forest Stewardship Council[26]), which is specifically suitable for small private owners

The Estonian standard PEFC certified 1,836,259 hectares of forest (November 2014)[27], which means 81.5% of the forest area. According to http://www.eramets.ee, *"the Estonian Forest Certification Council (EMSN) was set up as a non-profit organization on the 29th of October 2001 on the initiative of private forest owners and with the participation of other interest groups and stakeholders. The overall objective of the Estonian forest certification scheme is to support the implementation of sustainable forestry in Estonia. Sustainable forestry implies three main elements: ecological balanced, respect towards cultural and social values and economical efficiency. The implementation of the scheme must follow the PEFC International standards in forest management and chain-of-custody and has to ensure that wood signed with the PEFC logo won't mix with wood from uncertified resources. The origin of the wood has to be clear at any stage of production."*

Almost 1,176,988 hectares of forests are certified according FSC certification scheme in November 2014[28], which means 52.2% of the forest area. According to http://www.eramets.ee, *"the goal of the non-profit organization FSC Estonia (FSC EE) is to promote ecological balanced, socially fair and economically efficient forestry in Estonia. FSC and FSC EE have among others the following objectives:*

- *support and promote the good management of forests and their ecosystems, which won't harm at any stage the stock, ecosystems or human interests connected with forests*
- *support and promotion of the Estonian FSC standard*
- *working towards better understanding for good forest management, certification and marking of forest products*
- *guide and help forest management consultants, forest managers and all other persons interested in the diverse aspects of forestry and forest management*

4. Conclusions

Estonia's forest land is estimated to cover more than 2,253 million hectares, which is about 49.8% of the country land area. The broadleaf species are slightly dominant (a majority of birch and spruce) compared with softwoods (dominated by the pine).

In 2012, as much as 59% of the forest land is private (34% is owned by private physical persons, 13% by private juridical persons and 12% for forest land subject to privatization), while 41% of the forest land is public (38% by State Forest Management Centre and 3% by other state forest land). In state forests the conifers predominate, while in private forests the proportion of broadleaves is higher.

According to FAO's Global Forest Resources Assessment, there has been an average annual increase by 0.08%/year between 2000 and 2010 but decrease by 0.44%/year from 2005 until 2010. This figure is below the 0.5%/year that considered a significant rate of loss.

[26] www.fsc.org

[27] http://www.pefc.org/images/documents/PEFC_Global_Certificates_-_November_2014.pdf

[28] https://ic.fsc.org/facts-figures.839.htm

The estimated volume of standing trees has increased since 1990 to reach more than 447.200.000 m^3 in 2010. However there is an important felling in percent of net increment between 1990 and 2000, these felling have impacted the growing stock of forests for the following years. The reasons of this important level of felling can be explained by the high percentage of mature stands that had not been actively managed in the previous decade, the active management of lands that had been transferred into private ownership as a result of the land reform, the rapid development of mechanical wood processing and high demand for wood products, especially in the real estate and construction sectors. The forest growth was also slowed by windstorms and low reforestation compared with the recent years.

Because of the diminution of the volume of live trees in the period 2000-2003, an emission of the estimated carbon stock in forests has been recorded. Nevertheless, an 18% increase of above and below ground biomass was recorded between 1990 and 2010. Carbon sink capacity recovering was due to the efforts made by the government to protect forests, develop legislation, plan and strategies. Efforts have also been made to introduce a better integrated management in the forest areas.

Estonia has various types of conservation lands dedicated to the protection of biodiversity, including nature conservation areas, landscape conservation areas, national parks, parks and forest stands, Natura 2000 and other protection status. According to the Ministerial Conference on the Protection of Forests in Europe, about 21.6% of the Estonian forests have a protection status in terms of biodiversity (MCPFE Classes 1.1-1.3 and Class 2). Protected areas as Natura 2000 have been accounted by EU-27 DG Environment and covers 467,000 ha of forests (i.e. about 20.7% of the country forests). According to the results of the National Forest Inventory 2010, the objective has been achieved because strictly protected forests constitute 9.8% of Estonian forest land.

According to the Ministerial Conference on the Protection of Forests in Europe, forest land specifically dedicated to soil, water and other forest ecosystem functions (in accordance with MCPFE class 3 definition) covers about 4.4% of the forests in Estonia.

The damages from fire remain very punctual and prescribed fires are not allowed in Estonia.

The FSC risk assessment platform www.globalforestregistry.org considers Estonia is at low risk in terms of violation of illegal logging and in terms of violation of traditional and civil rights.

The forest certification systems are largely developed in Estonia, with 81.5% of the forest land certified PEFC and 52.2% under FSC certification

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