

# ESTONIAN FORESTS AND FORESTRY

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## GENERAL INFORMATION

Estonia is situated in the north-east of Europe, on the coast of the Baltic Sea. Geologically Estonia lies on the southern slope of the Fennoscandian shield. The dominating bedrock is Ordovician-Silurian limestone in the northern and Devonian sandstone in the southern part of Estonia. Quaternary deposits are unevenly distributed, almost lacking on the northern coast and being up to 100-200 m thick in the south. Estonian landscapes are very mosaic. Plains dominate in the northern and western parts, hiller regions with numerous lakes can be found in the south-east. Such variety of landscapes and the extremely mosaic pattern of soil types form conditions for rich flora (over 8,800 species are known at present) and fauna (over 12,000 species known) (National Report..., 1992).

## FORESTS

### FOREST AREA

The Estonian forests belong to the belt of mixed and coniferous forests with relatively favourable growth conditions. At the present time forest land covers about 47.6 % of land surface: an area of 20,166 million hectares (Forestry, 1994). The total area of stands is 1,920 million ha. In addition there are 53,500 ha of young cultivated forests and forest nurseries, 23,000 ha of treeless areas or hollows in forests, 20,700 ha of clearcutting areas, 3,300 ha of very thinly scattered forests and about 300 ha of burnt forests or woodlands. The total is more than recorded at the beginning of this century. Only during the last 50 years has the area of forest stands more than doubled and the growing stock has increased 2.4 times. This was caused by the natural afforestation of agricultural lands, drained

Table 1. Total area of Estonian forest stands and the volume of growing stock

Year	1940	1958	1975	1983	1988	1991	1994
Area of forest stands (100 ha)	852.7	1311.9	1655.5	1812.2	1815.6	1915	1920
Total volume of growing stock (million m <sup>3</sup> )	108.2	135.2	196.2	237.1	259.7	270	284.5

wetlands and quarries, above all by the extensive silvicultural activities - forest sowing and planting. In the post war years, the area of sown and planted forests was almost twice as big as the

yearly clear-felled area. In addition to the afforestation of cut areas and wasteland, extensive forest cultures covered some of the depleted oil-shale and phosphorite quarries. However, the forced collectivization of agriculture after World War II and diminishing of rural populations during and after the war created conditions for the expansion of forest-covered area. Only some countries have seen steady expansion of forest area during the present century and many, particularly in developing countries, have seen a rapid decrease.

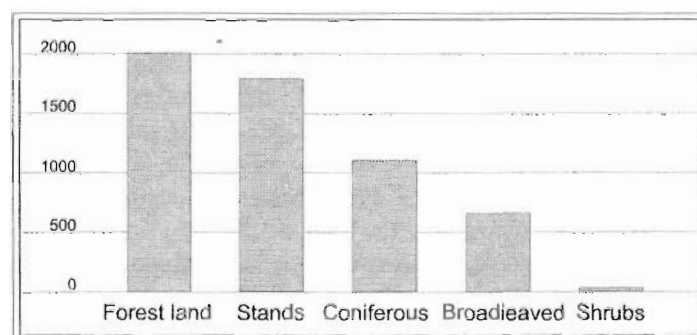


Fig. 1. Area of Estonian forest land, stands, share of coniferous and broadleaved forests in 1994 (in thousands of ha) (Forestry, 1994)

### TREE SPECIES

Eighty seven native and over 500 introduced species of tree and shrubs have been recorded in Estonia. The main tree species is Scots pine (*Pinus sylvestris*), which covers 38% of the whole forest area. Pine forests dominate in the north, north-west and south-east parts of Estonia. Birch forests are well represented throughout the country. Spruce trees are well represented especially in central Estonia. As for the mixed broadleaved forests, these are found mainly in West-Estonia,

Table 2. Total area, volume of growing stock and annual increment of forests with the different main tree species in Estonia in 1994 according to the data of forest survey

	Pine	Spruce	Birch	Aspen	Alder
Area of forest stands (1000 ha)	731.7	457.6	585.3	31.5	82.9
Total volume of growing stock (million m <sup>3</sup> )	111.2	71.7	77	6.5	11.2
Annual increment of the stands (million m <sup>3</sup> )	3.06	2.38	2.75	0.19	0.62

on islands and by the seaside. Pure stands are limited to the cultivated forests and to sites where growing conditions are extreme, for example pine stands on dry sandy soils and bogs, or birch stands in extensive swamps.

Table 3. Data on the average age, volume of growing stock and annual increment of the stands with the different main tree species in Estonia in 1994 according to the data of forest survey

Tree species	Average age of the stands (yr)	Average volume of growing stock (m <sup>3</sup> /ha)	Average annual increment of the stands (m <sup>3</sup> /ha)
Pine	62	157	4.33
Spruce	52	173	5.74
Larch	41	139	6.45
Oak	75	122	2.3
Ash	53	153	4.34
Birch	44	136	4.87
Aspen	47	212	6.3
Black alder	44	150	4.92
White alder	29	138	7.57

### STATE OF FORESTS, DISEASES AND PESTS

In Estonia, the problems of forest protection have an important role. During the 1980s and 1990s the state of forests has worsened in general. Already in 1988 a network for monitoring of forests on ICP-Forest level was established with a density of 16x16 km, with 92 permanent sample points and more than 2,250 sample trees. In 1992 the percentage of healthy trees was 29%, about 35% of the trees were slightly and about 38% medium and heavily damaged. In 1994 the percentage of healthy pine trees was 35 and spruce trees 66%. Percentage of slightly and medium damaged pine and spruce trees was respectively 53 and 34% (Fig. 2 and 3).

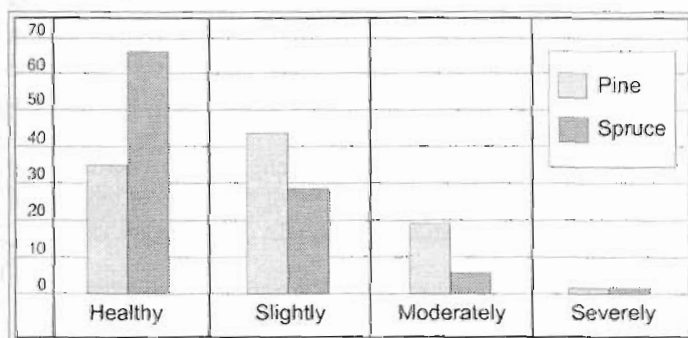


Fig. 2. Percentage distribution of pine and spruce trees by defoliation classes in 1994 in monitoring sample plots

The local heavily damaged forest area is assessed each year during the special inventory by regional forest pathologist. In 1994 the area of observed stands was more than 6,000 ha. The main reasons of local forest damages are root rot because of *Heterobasidion annosum*, shoot blight *Ascolalyx abietina*, bark beetles *Ips typographus*, pine weevils *Pissodes piniphilus*, elk damages in middle age spruce and young pine and broadleaved stands, in the north-east also the local air pollution.

Active measures of forest protection - a combination of biological and chemical means are carried out in state forests on

an area of 4,000-6,000 ha (1990 - 5,532 ha, 1991 - 4,897 ha). The dominating measures, used for forest protection, are biotechnological favour of useful bird and insect species, treatment with bacteria or hormone preparation suspensions according to the special forest pathological analyses and assessments.

The area of heavily damaged stands, felled in order of sanitary final cuts or dead forests, was in 1994 registered as 1196 ha. The main reasons for forest destruction were the game damages - 345.2 ha, unfavourable weather conditions - 303.3 ha and insect damages, often due to bark beetle on spruce - 242.4 ha.

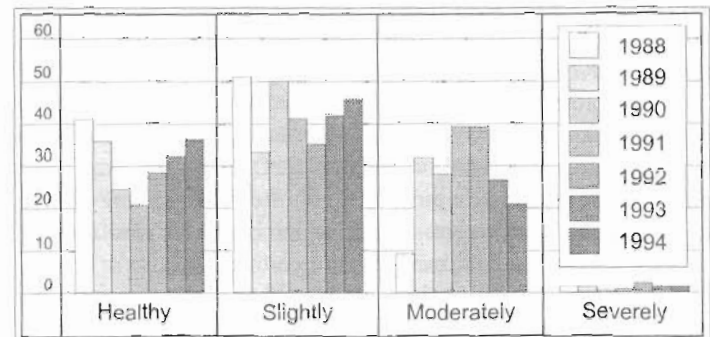


Fig. 3. Percentage distribution of pine trees by defoliation classes in 1988 - 1994.

### FOREST OWNERSHIP

Forest ownership has been largely influenced by historical changes. In 1940, the share of the state owned forest land was about 690,000 ha and 190,000 ha of forest land were privately owned. The communal forests were represented only by 42,400 ha. After World War II, collectivization deprived more than 140,000 farmers of their land.

On 1 January 1993, the total area of state forest land comprised 1,170,100 ha - 57.9%, forest land in collective farms 781,200 ha - 38.6%, and private farms 70,500 ha - 3.5% (Forest and Forest Products..., 1994). However, the division between the different ownership categories varies greatly in different regions of the country. In addition there are numerous trees and shrubs on agricultural land - 136,400 ha. Private forests are the property of individual owners. In January 1994 there were 10,179 private farms with a total area of 252,200 ha in Estonia. The average farm had 25.4 ha land and 8.4 ha forest land. In the near future, the restitution of farmland, the emerging of new farmsteads and changing ownership patterns will change the structure of forest ownership. After the reprivatization process is completed, it is estimated that about a half of the forest land should be privatized. Up to 1990 state forest enterprises owned almost two thirds (60.1% in 1988), the agricultural collective farms 37.5% and others 3% of the total forest land area. State forest enterprises owned 81.9% of the mature stands. In 1991, 55,000 ha of forest land was privately owned and this area is increasing. To date the average area of holdings is too small, shape or location of some is unsuitable for effective forest management, utilization and protection. The problem is, that a big share of forest owners do not live near their own forests, they do not have enough knowledge, financial

resources and equipment to manage their own forests. Private foresters organizations, supervision service and assistance structures are developing, but some farmers are not active and this system is in the initial stage of establishment.

Although half of the area of forests is to be reprivatized, the immediate environmental impact of the change in ownership should be minimal. For sustainable forest management it is important that all the forests to be returned have the map materials, taxation descriptions and management operations plans. Costs for management planning and forest pathology services in private forests are covered by state.

## FOREST MANAGEMENT

### TREE BREEDING

Our forest policy provides the necessary legal framework to ensure the conservation of the forest genetic resources according to the Resolution Helsinki 2. On the republican level 514 elite trees of Scots pine, 215 elite trees of Norway spruce, 13 elite trees of different species of larch and 10 elite trees of silver birch have been examined and certified for use.

The creation of seed orchards is important to improve the supply of indigenous reproductive material. At present time there are the following areas of vegetative seed orchards:

- Scots pine - 180 ha - 503 clones;
- Norway spruce - 32 ha - 178 clones;
- larches - 3,3 ha - 41 clones;
- Douglas fir - 0,6 ha - 18 clones.

Since 1985 ten gene pool reserves have been set up in the republic with the total area of 3,540 ha. All over Estonia geographical and test successor plantations, considering common pine, spruce, birch and alder have been established.

### FOREST NURSERIES

In 1990 the quantity of seeds collected in state forest enterprises in Estonia was 22,793 kg (853 kg in 1991 and 1,077 kg in 1994) of which 216 (43) kg pine seeds were collected from vegetative plantations. There were 170 (238 in 1991) forest nurseries with a total area of 296 ha and 23 greenhouses (61 in 1991) for seedlings growing in 1994. 9,188,000 pine seedlings and 15,182,000 spruce sets were grown in 1990 (Forestry and Forest Products..., 1994).

### ESTABLISHMENT OF STANDS - REGENERATION AND AFFORESTATION

Due to the long tradition of silvicultural activities in Estonia, the positive impact of professional schools and intensive research work, about 30% of forests are established using some of the silvicultural activities. The management activities, used to establish the new forest stands, are to contribute to the natural regeneration, sowing and planting.

The conditions for developing natural regeneration vary considerably in different site types. We can observe a good natural regeneration of spruce in pre-mature and mature birch, pine and not very dense spruce stands. On the average, natural regeneration occurs in final cutting time with 15-25% of forests, although due to nature conditions it is possible by using special

cutting systems and soil mineralization in years with abundant seeds to reach 30-40%.

In a lot of dense stands there is no chance for natural regeneration. According to the Forest Act (1993), after final felling, during 5 years new trees must be planted. In Estonia, the area of clear cuts is permissible only to 5 ha, in some stands, for example in pine, birch or ash forest, we are using the small-area shelterwood cutting, sometimes by using seed trees. In clear cut areas we are using sowing or planting. This is a very positive trend, that by choice of cultivated tree species, the basis became the original Estonian site-type system of E. Lihmus.

In 1990 the total area of cultivated forests in state forest enterprises was 5,909 ha, of which 1,880 ha of pine, 3,715 ha of spruce, 253 ha of birch, 15 ha of oak and 20 ha of larch were cultivated (Forest and Forest Products..., 1994). In 1994 4,813 ha of land was reforested, 4,186 ha were planted, and natural forest renewal contributed to 627 ha. According to the land categories, in 1990 reforested areas are as follows: clearcut areas - 3,888 ha, former quarries and other land - 175 ha, reconstruction of forest stands of low value - 91.3 ha.

The silvicultural activities in the oil-shale and phosphorite quarries are important problems of forestry and nature conservation. The total area of the leveled scatterings of the mines and the forest cultures on them is more than 7,100 ha. The leading species of trees must be chosen so, that they suit best the artificial soils, both from the ecological and economical point of view. Nowadays pine cultures form 80% of those, followed by birch - 12%, larch - 6%, alder - 1%, and other. 52 species of trees and bushes have been used as experimental species. The most productive species in the majority of recultivated areas have been larches, silver birch and alder.

The share of pine cultures in Estonia has decreased in the recent years due to a complex of reasons, many of them can be the danger of wild damages and problems connected with growing of healthy pine seedlings in our nurseries. In the period 1961-1975 pine cultures formed 52% of the total land, in 1976 43%, then in 1990 only 32%.

In the future the natural regeneration of spruce and broadleaved species must receive more attention in the system of natural forest management, especially in protected forests.

### CUT SYSTEMS, FELLING AND TRANSPORTATION

Today, almost 70% of all forests in Estonia are managed and used commercially. Most of the timber is stored by final cutting, mainly from restricted cut areas in mature stands in commercial forests. Some of the timber comes from maintenance felling in protected forests, where natural forestry systems according to the principles of single tree management are used, likewise from intermediate cutting.

The total volume of annual cuts was in all forests of Estonia approximately 2.8 to 3.6 million m<sup>3</sup> during the past ten years. Because of difficult market situation and property reform (in former private forests it was necessary to prevent all cuttings until the legal owners or their successors appear), in 1992 and 1993 the volume of cuts in Estonia was abnormally low.

In 1994 the total volume of all cuts was 3.6 million m<sup>3</sup>,

from this 77.9% (2.8 million m<sup>3</sup>) on state owned land, 12.4% (450,800 m<sup>3</sup>) on private farm land and 9.7% (351,900 m<sup>3</sup>) on collective farm and agricultural enterprise land (Forestry, 1994).

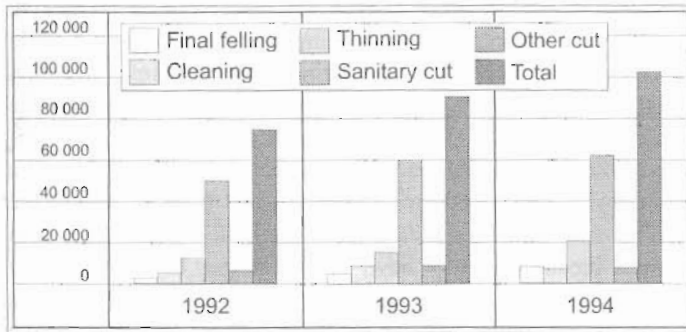


Fig. 4. Distribution of felling area (in hectares) by types of felling in Estonia in 1992-1994

### CLEARING AND THINNING

Intermediate cutting comprises cleaning, thinning and sanitary cuts. Dense new and young forest should be cleared and thinned. Clearing is a thinning of thicket stage and young stands. A young forest is generally cleared, if it has reached a height of 2-5 m, usually without utilization of the cleared trees. In 1994, 7,038 ha of young stands on state forests were cleared. Thinning is used to regulate the species distribution of forests,

Table 3. Volume of cuts in Estonian forests in 1992 and 1994, in comparison with the period 1986-1990

Forest owner	Volume of cuts in 1000 m <sup>3</sup>	Cuts in % of total annual growing stock	Cuts in % of average cuts of 1986-1990
1992 annual			
State forests	1724.5	1.02	74
Agricultural collective enterprises and farms	346.9	0.33	42.5
Total	2071.4	0.73	65.3
1994 annual			
State forests	2820.5	1.67	121
Agricultural collective enterprises and farms	802.7	0.76	98.3
Total	3623.2	1.36	115.1
Period 1986 - 1990 annual			
State forests	2330.9	1.42	
Agricultural collective enterprises and farms	816.5	0.86	
Total	3147.4	1.21	

to cut the damaged trees and to make room for young or perspective trees, previously mostly for spruce or pine, at present more for birch, oak or ash, depending of site conditions. The volume of annual thinning is about 1.2-1.3 million m<sup>3</sup> (1.0 million m<sup>3</sup> in state forests) (Forest and Forest Products..., 1994). In 1994, 1576,000 m<sup>3</sup> of trees were thinned (Forestry, 1994). The volume of thinning and sanitary cuts should be more extensive (about 25%) than today. The forest industry should concentrate more on using this raw material.

### FINAL FELLING

The volume of annual final cuts in state forests during past ten years was about 1.2-1.5 million m<sup>3</sup> (in all forests 1.6-2.0 million m<sup>3</sup>) (Forest and Forest Products..., 1994). Considering the volume of all Estonian timber resources this is not much. Annual increment of forest resources is about 9.2 million m<sup>3</sup> and this is increasing. In 1992 the amount of final cuts was only 49% and the volume of thinning and sanitary cuts 47% (other cuts 4%). In 1994 the share of final cuts was 50% (1.8 million m<sup>3</sup>). In state forests the share of final cuts was 57.8%, in private farm land 21.8%, and in collective farms land and in agricultural enterprises 20.3%. (Forestry, 1994) In conformity with the "Project of Development of the Estonian Forest Complex", the annual volume of cuts is planned to reach - 3,943,000 m<sup>3</sup> by 2000 and 4,949,000 m<sup>3</sup> by 2020. By about 2040 a normal age structure of stands is achievable.

### DRAINAGE, FERTILIZATION, FOREST ROADS

Drainage of swamp forest is one important way of achieving a long-time increase of Estonian timber production. Throughout the last one and a half centuries forest drainage with ditches has been the most important measure for increasing the productivity of forest sites, as more than a half of the forest areas are excessively moist. During recent decades new drainage of forests has been carried out at a satisfactory speed and the drainage network covers over 480,000 ha of forest land. So annual increment has increased by 800,000 m<sup>3</sup>, but the problems of managing the drained forests have been solved only partially.

Forest soil fertilization is one way to increase the productivity of forests in suitable stands, which grow on areas with unfavourable nutrient supply. In the 80s the annual area of forest land fertilized was estimated to be 1,500 ha. Since 1986, due to economic and ecological reasons, it is to be renounced of forest fertilization.

The total length of forest roads is 12,000 km. In the 80s the annual length of constructed forest roads was 300-420 km. On the average, there are 7 m of roads per 1 ha of forest land. Because of financial reasons, only 150 km of forest roads were constructed during 1994.

### ENVIRONMENTAL ASPECTS OF FORESTS AND BIODIVERSITY

At the UN Conference on Environment and Development in Rio de Janeiro in 1992, forest management and conservation became one of the most central themes. The Forest Declaration has established a platform for the development of a forest

policy. In Resolution Helsinki 1, the general guidelines for the sustainable management of the forests in Europe are formulated.

Estonian forest management adopted the general guidelines of Rio and Helsinki. It is characterized by multiple and sustainable use of forests, in which consideration is made with regard to environmental protection, landscape, natural and cultural heritage, as well as recreational activities. The natural processes of the forest ecosystem, protecting the forest soils, water and regeneration, conserving the genetical and all biological diversity, must not be disturbed by exploitation of the forests.

The Law on Protected Areas, Species and Natural Monuments sets out the following categories of protected areas in Estonia - national park, nature reserve, reserve and program area. The zones within protected areas are - nature preserve (no forest management activities allowed), area of special protection (permissible only some measures) and area of limited management (permissible limited complex of activities). Today there are 4 state nature reserves, 4 national parks, 1 biosphere reserve and 479 various protected areas, including 13 landscape reserves in Estonia (Nature Conservation..., 1994). The biggest is Lahemaa National Park, founded in 1971, with the area of 64,900 ha. 70% of the territory of the national park is covered by forests. There are 228 protected animal and 134 plant species in Estonia. A lot of animal and plant species are inhabitants of Estonian forests. Some of these are rare, or threatened with extinction, and in order to survive they should receive a special consideration in the forest management planning and management. The forests are also an important part of the landscape. The aim of forest management should be to preserve the diversity of genofond, species and forest ecosystems.

In Estonia the national strategy for the retention of biodiversity of forests assumes a change in the principal function of forests from mainly timber production to multi-functional forests. According to the forest policy it is to be expected that the percentage of forests by afforestation of unused land, abandoned agricultural land, some of the depleted oil-shale and phosphorite quarries, and meliorated forest areas will increase.

The part of cultivated forests in Estonia is about 30%. The previous management aim was to provide a large volume of timber with exploitation of fast-growing and highly productive monoculture. A part of these forests, especially in previous agricultural land, is characterized by increased susceptibility to disease, for example root rot, and wind damage. Fortunately, in a large part of cultivated forests, due to the natural regeneration of broadleaved species, the diversity of stands is not very low.

In order to follow the main principles of forest protection, multifunctional management and the maintenance of biodiversity of forests, more than 514,600 ha of Estonian forests are being managed like a preserve or protected area. Reserve and protective forests comprise 28% of the area. Profitable forests (with the main function to produce timber wood) - 72%. The main objective in protected forests is the nature conservation (rare animal or plants), water, soil or atmosphere protection. In the protected forest areas we are using the special

sustainable natural management system, according to the principles of single tree and group management, without clear cutting. Renewal of forests takes place in the the natural way, although in our northern conditions it is difficult to receive good natural regeneration in a number of site types. Estonia intends to comply with the requirements of the Rio Convention on biological diversity. In the future it is planned to increase the area of preserve forests, to conserve the biodiversity of forests.

Estonia is interested in international cooperation for the protection of tree genetic resources. For that purpose, 10 genetic fund reservations have been established and 752 plus trees with the best breeding quality have been selected. In Estonia, as in all East European countries, some protected forest areas are subject to reprivatization. The private owners sometimes have radically different objectives to those, provided by the area management and protection plan. According to the forest law, the state should compensate forest owners their economic loss due to protective regime.

## ADMINISTRATION

The central institution for forest management in Estonia is the State Forest Department in the system of the Ministry of the Environment, which deals with the strategic and conception problems of forest management, legislative activities and cooperation with the other branches of national development and economy. The main regional offices control the observation of legal regulations, administer and manage the state forests, likewise advise the forest management in private forests. There are 16 district forest departments and 185 forest districts.

In the system of State Forest Department there are also the Estonian Institute of Forestry and Nature Conservation, engaged in research and development work, connected with the management and conservation of forests under changing ecological conditions, regeneration, silvicultural and management measures, likewise connected with nature conservation. An important role for forestry development in different directions have the Estonian State Service of Forest Protection, collecting information about forest damages and planning the measures for forest protection in state and private forests, Estonian Centre of Forest Tree Breeding, Information Centre, Training Centres in Sagadi and Rapina, and State Hunting Districts. Forest management plans for all forest owners are drawn up for 10 year periods by the Estonian Forest Survey Centre.

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