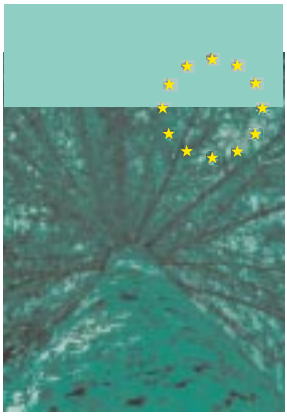
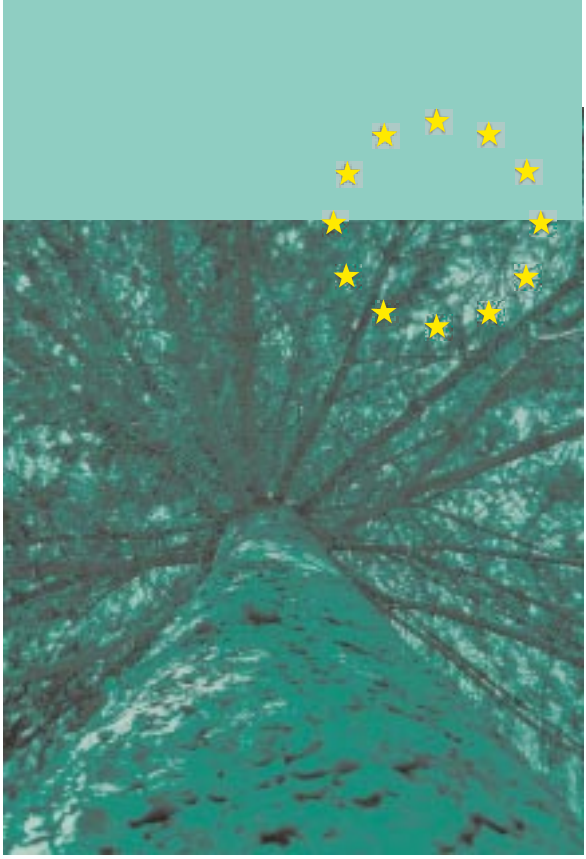


Forest and forestry in European Union countries



Forest and forestry in European Union countries

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Preface

The empirical and practical nature of forest research reflects its two primary functions: explanatory and predictive. The first of these functions is a constant endeavour to better understand, explain and describe the reality that is forestry, while the second, based on causative and consecutive interactions, helps formulate the methods and principles for rationally shaping this reality in line with expectations. Thus, every advance, whether this be regarding the structure and functional properties of forests, or links with their natural, social and economic surroundings, will inevitably give rise to new research questions and challenges. An obvious recent example of this is the concept of sustainable, multifunctional forest management that has now replaced the previous model of monofunctional raw-materials management. This concept has been fully recognised at global level and embraced in the final documents of the 1992 Rio Earth Summit (UN Conference on Environment and Development) and the Declarations and Resolutions of successive Ministerial Conferences on the Protection of Forests in Europe (MCPFE).

The active participation of Polish representatives in the international forum has also borne fruit in the inclusion of Polish forestry within the sphere of European initiatives and cooperation with regard to forests. A particular 'internationalisation' of Polish forestry came about at the time of the country's accession to the European Union. While it is true that the European Community has no prerogatives where the shaping of a unified forest policy is concerned (each Member State retaining the right to autonomy and its own domestic solutions), many elements and measures enshrined in forest policy nevertheless found direct expression in the EU Forest Strategy and have indirectly affected agricultural policies, nature conservation, environmental protection, trade and transport. Likewise, such EU documents as the Lisbon Strategy (for a more innovative and competitive European economy), or the Gothenburg Strategy for Sustainable Development (seeking to better EU living standards through economic growth and improvements to the environment and social integration), are exerting an influence on forest management. Finally, the very processes of liberalisation of commercial relations and the globalisation of the forest products market are encouraging interaction between the forest economies of Member States.

The initiatives on forests emerging under the auspices of the EU embrace a considerable diversity of forest structure, as well as different organisational and functional principles of forestry in the Member States, fostering an understandable interest on the part of foresters in what is happening to

forests and forestry throughout the EU. This is reflected in, among other things, the steadily growing number of publications in the forestry journals of EU Member States.

The desire to better acquaint Polish foresters with the aforesaid information on forests and forestry in different EU countries was a major premise behind the Forest Research Institute in Warsaw announcing its intention to issue the present publication – an event that took place before the end of 2004. This was also intended to mark the 75th anniversary of the Institute's founding. In order to provide information as reliable and up-to-date as possible, the Institute turned to the appropriate individuals and institutions in each of the Member States, as well as to the Agriculture and Environment Directorates General at the European Commission. In each case, the Institute's request was for compiled information to be submitted in English. In the case of Germany, the individual Länder were also approached, in view of that country's far-reaching decentralisation of both policy on forests and the principles governing forestry management. In turn, in order to obtain as reasonably cohesive picture of forestry practices in the Member States as possible, the Institute sent the authors an outline of the planned report, with such sections as: a general characterisation of forests, organisational and legal aspects of forestry, education and training in forestry, and forestry research.

Any disparity in the studies returned is thus in part a natural reflection of particular authors' personal preferences and interests, but first and foremost a consequence of the varied natural, economic and social conditions affecting forest structure in the different Member States, as well as the various goals and tasks that have been assigned to those forests and the people responsible for them. This diversity in European forestry is one of its undoubted strengths stimulating the acquisition of relevant information and know-how, as well as enriching the data compiled on prerequisites and their natural consequences. At the same time, this provides opportunities for broader EU-wide cooperation. The studies presented here provide a unique guide to forests and forest issues in the EU (even though it must be noted that some of the information presented in the course of the year may now require updating – an inevitable consequence of the ongoing dynamic organisational and functional changes in forestry in several of the Member States).

The study we are pleased to present is the result of the hard work and considerable dedication of a large number of people, to whom our most sincere thanks go out. First and foremost, we would like to express our gratitude to the authors for their agreeing to our request and showing the greatest possible understanding for it. The work of the translators is also gratefully acknowledged, as is the contribution of all who worked to bring this book to its final form in both editorial and technical terms. Particular thanks are also due to the Director General of Poland's State Forests National Forest Holding, for undertaking the publication work and for the considerable co-financing of the book that the State Forests Information Centre was willing to extend. Without this, it is doubtful whether the Institute's initial concept could have been achieved.

It is our profound hope that this book will gain a favourable reception with Readers and offer all who turn to it a wealth of insights.

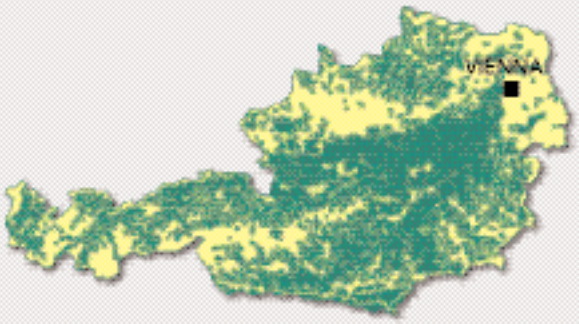
Professor Andrzej Klocek
Director
Forest Research Institute

I. Forest and forestry in individual European Union countries

★ Austria

Robert Jandl, Harald Mauser and Klemens Schadauer

The Republic of Austria (Republik Österreich), territory: 83,900 km², population: 7.9 million, capital city: Vienna.



1. Forest characteristics

Forest cover

Austria is among the European countries with the highest forest cover.

Table 1. Forest area in Austria

Area (ha)		Forest cover (%)
Forest area	3,960,000	47.2
Total land area	**8,385,828**	

The dominant tree species in Austria is Norway spruce, while the most important species among deciduous trees is beech. Numerous strategies are being pursued to increase the share of mixed-species forests and to enhance the proportion of deciduous trees. Nevertheless, pure or almost pure spruce forests are common in Austria (Tables 2 and 3).

Forestry has a long tradition in Austria, and only 3% of forest shows no impact of human intervention. Approximately 40% of forest is 'moderately altered'. Short-rotation plantations play a minor role. Closest to natural state are protection forests growing at high elevations which are hardly of any economic value.

Robert Jandl, Harald Mauser and **Klemens Schadauer** – Federal Office and Research Centre for Forests.

Forests are an important element of Austria's landscape, economy and culture. Most of the Austrian forests are managed for their commercial function. Forests are also used for hunting while some areas are used for grazing. Recreation and tourism are another, mainly non-commercial, use of forests. Austrian forests are a model of multiple-purpose forestry.

Table 2. Common tree species in Austrian forests and their areal contribution to the forest area

Tree species			Area ('000s ha)		Percent
	Common name	Scientific name			
Coniferous trees	Norway spruce	*Picea abies*	1,810	±31	53.7
	Silver fir	*Abies alba*	78	± 4	2.3
	Larch	*Larix decidua*	155	± 6	4.6
	Scots pine	*Pinus sylvestris*	166	± 8	4.9
	Black pine	*Pinus nigra*	23	± 4	0.7
	Stone pine	*Pinus cembra*	18	± 3	0.5
	Other coniferous species	–	5	± 1	0.2
	Total		**2,255**	**±36**	**66.9**
Deciduous trees	Beech	*Fagus sylvatica*	323	±12	9.6
	Oak	*Quercus spp.*	66	± 5	2.0
	Other deciduous hardwood species	–	269	± 9	8.0
	Other deciduous softwood species	–	144	± 6	4.3
	Total		**802**	**±19**	**23.8**
Other areas	Gaps (>500 m^2)	–	35	± 3	1.1
	Gaps (50–500 m^2)	–	195	± 6	5.8
	Shrubs inside stand	–	57	± 3	1.7
	Shrub area	–	26	± 3	0.8
Total*			**3,370**	**±44**	**100.0**

* Production forest + protection forest with yield + coppice forest.

Table 3. Area of pure and mixed-species forests in Austria

Specification	Area ('000s ha)		Percent
Pure stands			
Proportion of coniferous species >8/10	1,857	±34	62.2
Proportion of deciduous species >8/10	373	±14	12.5
Mixed forests			
Proportion of coniferous species 6/10–8/10	438	±14	14.7
Proportion of deciduous species 5/10–8/10	316	±12	10.6
Total*	**2,984**	**±41**	**100.0**

* Production forest without gaps and areas covered with shrubs.

Volume and increment

The standing crop of Austrian forests has been increasing steadily for many years. The annual increment of 31 million cubic meters is only harvested to the tune of about 60%. Growth rates are shown to be increasing on account of the 'fertilising' effects of the deposition of atmospheric nitrogen compounds, the effect of rising CO_2-levels in the atmosphere, favourable weather conditions and the postponement of thinning interventions. The increase in the standing crop concerns all forest ownership types.

Table 4. Volume and increment in the production forests of Austria

Production forest	Volume ('000s m³)		Percent	Volume (m³/ha)		Increment ('000s m³)		Percent	Increment (m³/ha/year)	
High forest	1,081,427	±17,429	98.8	330	±2.8	30,581	±503	97.8	9.4	±0.1
Coppice forest	13,303	± 1,523	1.2	144	±7.7	674	± 81	2.2	7.1	±0.4
Total	**1,094,730**	**±17,373**	**100.0**	**324**	**±2.8**	**31,255**	**±503**	**100.0**	**9.3**	**±0.1**

2. Forest management

Logging and wood processing

About 95% of the indigenous wood harvested is processed in Austria or used as firewood. The sawing, paper and wood-processing industries are of high economic importance. About two thirds of the amount of sawnwood, paper, cardboards and chipboards produced are exported primarily to the EU member countries.

Table 5. Austrian forest harvest statistics (m³ of wood) for 2002; total harvest and main products

	Coniferous trees	Deciduous trees	Total m³
Harvest	**12,669,923**	**2,175,516**	**14,845,439**
Timber	10,899,839	909,629	11,809,468
Saw wood	7,362,530	402,105	7,764,635
Pulp	2,135,804	491,051	2,626,855
Fuelwood	1,770,084	1,265,887	3,035,971

3. Legal and organisational forms of forest holdings

Forest ownership

The Austrian forestry sector is characterised by a very high degree of fragmentation of forest ownership (Table 6). The 3.96 million hectares of forest land are managed by about 214,000 forest owners, of whom 99 % manage less than 200 hectares. 65% of forest

Table 6. Forest ownership in Austria

Ownership category	Area ('000s ha)		Percent
Small private woodlands (<200 ha)	**2,130**	±39	**53.8**
Private forest (200–1000 ha)	401	±21	10.1
Private forest (>1000 ha)	710	±28	17.9
Political community (>200 ha)	129	±12	3.3
Total	**1,240**	**±36**	**31.3**
Austrian Federal Forest Company	**591**	±26	**14.9**
Total forest area	**3,961**	**±46**	**100.0**

holdings cover less than 5 hectares. About one third of the entire forest area is owned by large forest enterprises.

In comparison with other countries, Austria has an exceptionally high share of forests in private hands, at approximately 80% by area. While one fifth of forests are owned by public authorities, the majority of public forests are under the management of the Austrian Federal Forest Company (Österreichische Bundesforste AG). This company takes care of forest lands (15% of the total forest area), rivers, lakes and hunting grounds (covering a total of 10% of Austria). 4% are other national, provincial or municipal forests.

About 50% of Austria's forests are on family farms with less than 200 hectares. Agriculture is often the main target, and a substantial proportion of forestry products serve to meet owners' needs as regards construction and fuelwood.

Forest law

Austria is a federal state composed of nine provinces (Länder). Legislative power is divided between the federal state and the provinces, with the federal parliament playing a major role. Under the Austrian constitution (Article 10), forestry is subject to federal legislation and administration. The current Federal Forest Act is Forstgesetz 1975, BGBl. No.440, recently amended by BGBl.I No.78/2003. The amendment of 2002 puts a stronger emphasis on the principle of sustainability.

The Federal Forest Act aims at the protection of forest as a whole, with its four main functions (commercial, protective, welfare and recreational), on a sustainable basis. Protection is the key function for more than 30% of the forest area.

The main provisions of the forest law concern:

- protection of forest and soil and its efficiency;
- obligatory reforestation and limitation of clear-felling;
- general restrictions concerning exploitation, i.e. limitation of clear-cutting areas to 2 hectares, and an obligation to obtain permits for clear cuts exceeding 0.5 hectare;
- special restrictions on utilisation in protection forests;
- a ban on the devastation of forests and an obligation to protect forests against air pollution, fires and pests;

- an obligation to carry out sustainable forest management (qualified forest personnel must be employed).

Forests are generally accessible to the public. However, public access to forests is limited in respect of areas being afforested and those where forest management operations, such as harvesting, are going on.

In the year 2002, the level of financial support for forestry from the federal budget was at about EUR 7,133,000, while the EU was the source of some EUR 7,704,000.

The structure and tasks of the national forest administration

There are three levels of forest administration in Austria. At federal level, the Minister of Agriculture, Forestry, Environment and Water Management has jurisdiction over forestry. In the provinces, the governor (Landeshauptmann) is the competent authority to deal with forest issues. The governor also acts as a general authority in matters, such as hunting, nature protection or trade and industry and is assisted by the forestry department (Landesforstdirektion), a special unit within the provincial administration. Formally, this department has only consulting functions. The same applies to the local level: the district commissioner (Bezirkshauptmann) is responsible for forestry issues. In his duties he is assisted by the forestry inspectorate (Bezirksforstinspektion).

The Forestry Department of the Ministry consists of 5 units, including the Torrent and Avalanche Control Service. This unit manages a network of service stations distributed all over Austria and is entrusted with assessing the risks of natural hazards caused by torrents, avalanches and erosion. Risk management and the protection of human living space are the duties of these service stations.

The Federal Office and Research Centre for Forests (BFW) reports to the Forestry Department. In addition to conducting research, it acts as a federal authority for the enforcement of the National Act on Forest Reproductive Material and the National Act on Plant Protection, as regards trees and wood products. It also comprises two federal forest training centres that deal with more than 10,000 course participants every year. Other institutions reporting to the Forestry Department are three Forestry Schools providing vocational training for forest wardens and foresters.

Private owners associations

In Austria, the representation of group interests is transferred from the state to self-governing bodies called 'chambers' (Kammern). Chambers are statutory interest organisations established under public law and with obligatory membership. They engage in the representation of group interests, provide consulting to foresters and forest owners, and assist in the appropriation of subsidies. They act as powerful and effective lobbyists, but also behave as semi-public institutions which discharge state functions.

At federal level, the agrarian and forestry interests are represented by the Conference of the Presidents of the Chambers of Agriculture (Präsidentenkonferenz der Landwirtschaftskammern), while at province and district levels – by subunits.

In addition to the statutory interest organisations, there is a network of interest groups based on voluntary membership. The most important voluntary interest groups in the Austrian forestry sector are the Austrian Federation of Forest Owners Associations (Hauptverband der Land und Forstwirtschaftsbetriebe Österreichs) and the Austrian Forest Association (Österreichischer Forstverein).

The Austrian Federation of Forest Owners Associations takes care of the interests of private farm and forest owners. Thanks to the high degree of organisation, approximately 80 per cent of larger estates have joined various associations. The Federation is a powerful player in Austria's forest policy. The Federation's main effort is to protect the private owners' rights and to counteract any restrictions on the owners so that they may dispose freely of their private forest property.

The Austrian Forest Association is open to forest owners, as well as to forest professionals working in private enterprises, chambers and administration. Traditionally, about two thirds of the potential members belong to the Association.

4. Education in Forestry

Besides the training of forest workers, forestry education comprises three different levels and approaches:

- the Technical School for Forest Wardens: 1-year training, 30 graduates per year;
- the Technical High School of Forestry: students enter the school at the age of 15 and leave it after 5 years of study with general qualifications for enrolment into university (Matura). 73 students finish studies every year;
- Academic education at the University of Natural Resources and Applied Life Sciences (Universität für Bodenkultur – BOKU) in Vienna: in the academic year 2001/2002, 47 students graduated from BOKU. At present, BOKU faces a sharp decline in the number of enrolments and graduations at the Forestry Department because students are discouraged by the University administration to undertake forestry studies due to job shortages in the forestry sector.

5. Forest Research

Forest research is conducted at the University of Natural Resources and Applied Life Sciences (BOKU) in Vienna, and at the Federal Office and Research Centre for Forests (BFW). The BFW places much emphasis on applied research in line with the requirements of the national forest policy, as well as on basic and applied research within the framework of national and international cooperation. Research at the BFW covers forest ecology, silviculture and forest productivity, genetics and forest reproductive material, forest protection, inventory and monitoring, and natural hazards. Among the 275 employees of the BFW, about 200 are engaged in research (75 of them with academic degrees).

As a result of the reorganisation performed in recent years, the BFW is expanding its scope of research beyond forestry and natural hazards to include landscape research. The main areas of research are:

- Natural Resources and their Economic Use,
- Biodiversity and Long-term Ecosystem Research,
- Global and Regional Climate Change,
- Habitat Management and Nature Conservation,
- Natural Hazards and Management of Georisks,
- Landscape Development and Conservation,
- Inventory Methods and Monitoring.

Of the total BFW-budget of EUR 14.5 million, about EUR 9.1 million is appropriated for research and scientific activity. The external funding of research comes from EU sources and totals about EUR 0.5 million, annually. As a subordinate institution with no legal status, the BFW had to transfer all other external funds to the Ministry. This situation was to change on 1st January 2005, with the BFW becoming an independent institution constituted and operating under public law. In accordance with its new legal status, the BFW can obtain external funds and use them for its own purposes.

★ Belgium

The Kingdom of Belgium (Dutch: Koninkrijk België, French: Royaume de Belgique, German: Königreich Belgien), territory: 30,500 km², population: 10.3 million, capital city: Brussels.

Brussels

Stéphane Vanwijnsberghe and Serge Kempeneers

Introduction

Belgium is a federal state consisting of 3 Regions: The City of Brussels, Flanders and Wallonia, each having its own legislative Regional Council.

The City of Brussels
Territory: 161.8 km², population: 1 million

Stéphane Vanwijnsberghe – Engineer, Head of Forest Department, Green Areas Division. **Serge Kempeneers** – Director, Head of Green Areas Division.

1. Forest characteristics

In the City of Brussels region (total area 16,178 ha), forests cover 1,725 ha, i.e. 10.7% of its total territory. The forest area comprises the Brussels section of the Sonian Forest (1,655 ha) and several smaller woods.

The predominant tree species are: beech (*Fagus sylvatica*) – 74%, pendiculate oak (*Quercus robur*) – 16%, Scots pine (*Pinus sylvestris*) – 4% and European larch (*Larix decidua*) – 2.5%.

Other broadleaved trees (2%) are mainly: chestnut (*Castanea sativa*), birch (*Betula pendula)* and poplar *(Populus tremula*). Among coniferous species, the most common is Corsican pine *(Pinus nigra subsp. laricio var. Corsicana)* – 1%, and Douglas fir *(Pseudotsuga menziesii)* – 0.5%. The annual increment of stands amounts to 8.5 m^3/ha.

Public access is permitted to forests throughout the Brussels Region except for areas under special protection:

- nature reserves (63 ha, 3.7% of the total forest area),
- forest reserve (160 ha, 9.3% of the total forest area),
- zones under strict protection (95 ha, 5% of the total forest area).

In all these areas, forest utilisation and management operations are banned and access by the public is restricted.

2. Legal and organisational forms of forest holdings

The Brussels Institute for Management of the Environment (IBGE-BIM), a government institution, manages the environment in the Brussels Region. The IBGE-BIM uses public funds, which are allocated by the Regional Parliament.

One of the tasks of the IBGE-BIM is to manage public green areas, including parks, natural reserves and forests. These woods and forests are the property of the Region, Municipalities or other public institutions. There are no privately owned forests in the Region.

3. Education in forestry

Degrees obtained at any of the three levels of education in forestry (technical, college, university) are valid throughout the whole of Belgium.

The IBGE-BIM employs a staff of thirty eight – both in office administration (four employees) and in the field (thirty four employees). Research, carried out in collaboration with universities, is financed by the IBGE-BIM. The major research areas concern the anthropogenic impact on soil compaction, as well as the condition of beech stands and attacks by insect pests.

Flanders

Beatrijs Van der Aa and Jos Van Slycken

1. Forest characteristics

Forest cover and species composition

The total forest area of Flanders is 150,000 hectares, with an 11% forestation index. 50% of these forest areas are broadleaved forests, 36% coniferous forests and of 11% mixed forests.

territory: 13,500 km^2,
population: 6.2 million,
capital city: Brussels.

The area for reforestation is approximately 0.6% and open areas within the forest cover constitute 1.7%. The distribution of different forest types in Flanders is presented in Fig. 1. (Source: Forest inventory 2000).

66% of the forests in Flanders have a tree cover >2/3, 26% – between 1/3 and 2/3, and 6% <1/3. The high percentage of forests with a cover >2/3 can be explained by the high share of young forests (the age of 55% of the forests in Flanders is below 40 years) (Forest inventory 2000).

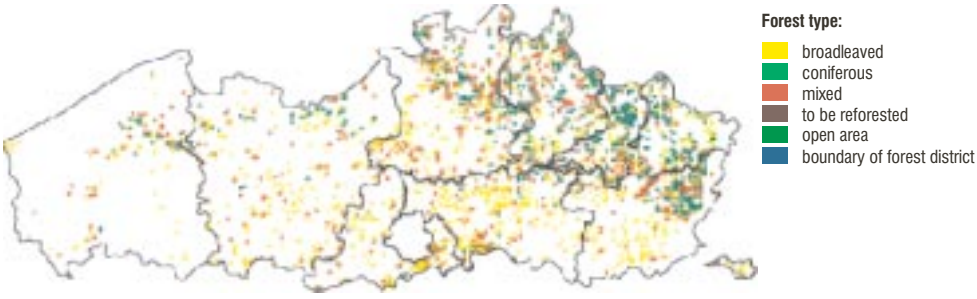


Fig. 1. Distribution of different forest types in Flanders (Source: Forest inventory 2000)

Beatrijs Van der Aa and **Jos Van Slycken** – Institute for Forestry and Game Management, Gaverstraat 4, B 9500 Geraardsbergen, Belgium. Beatrijs.Vanderaa@inbo.be Jos.Vanslycken@inbo.be.

Volume and increment

The total standing volume in the Flemish forests consists of 46% of softwood, 16% of poplar and 38% of other hardwood species (of which 5% constitutes American red oak) (NARA 2003).

The total standing volume in Flanders is 31,584,000 m^3, i.e. 216 m^3/ha on average. Scots pine, constituting 28%, has the largest share of standing volume (Fig. 2). This is followed by poplar, with 16%. For forests based on these two species, forestry policy stimulates conversion by, for instance, lower (or no) subsidies for afforestation with both these species. In the future, their share is expected to decrease, which will affect supplies to the timber processing sector.

As regards age distribution, conifers have the major share in the age classes 21–40 years and 41–60 years, in contrast to the age class 0–20 years. The current share of exotic species in standing volume is 39%. The management objective for public forests is a reduction in the share of exotic species to 20%.

Recent data on the annual increment in Flanders is presently not available, which makes it very difficult to assess the ratio of annual harvest to annual increment. According to the Management Vision of the Forests and Green Areas Division, the mean annual increment for all forests in Flanders is estimated at 5 m^3/ha; this figure would be even higher for public forests.

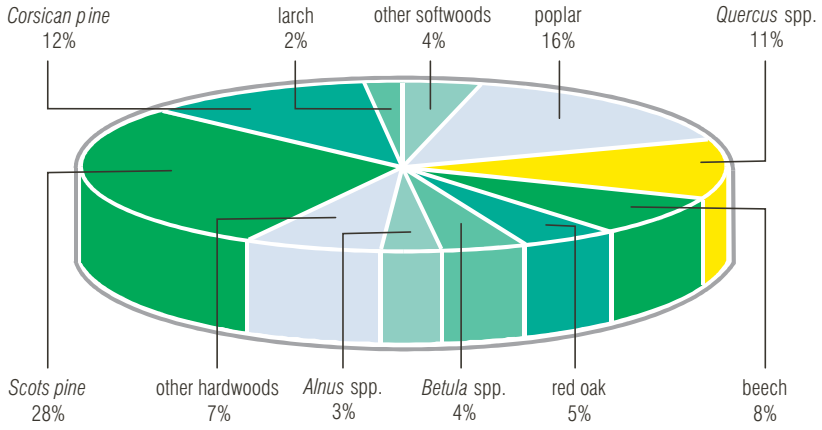


Fig. 2. Distribution of standing volume by species (Source: AMINAL, Forests and Green Areas Division, NARA 2003)

2. Logging and wood processing

Data on the annual wood harvest is only available for public forests and forest owners groups, which means that information is unavailable on wood harvested in more than half of the forest areas.

As regards the volume of wood sold from public forests and forest owners groups, a trend towards increasing volumes has been recorded. This trend is not necessarily the result of more intensive harvesting. Other factors are:

- the increase in the forest area managed by the Forest and Green Area Division;
- the Forests and Green Areas Division including under public sales wood that originated in areas administered by the Nature Division. This wood is a by-product of nature conservation management, e.g. deforestation for restoration of species-rich grasslands, etc.

In 2004, just over 90,000 m³ of wood was sold from state-owned forests, 44,000 m³ came from other public forests and 33,000 m³ from the forest groups, a total of 167,000 m³.

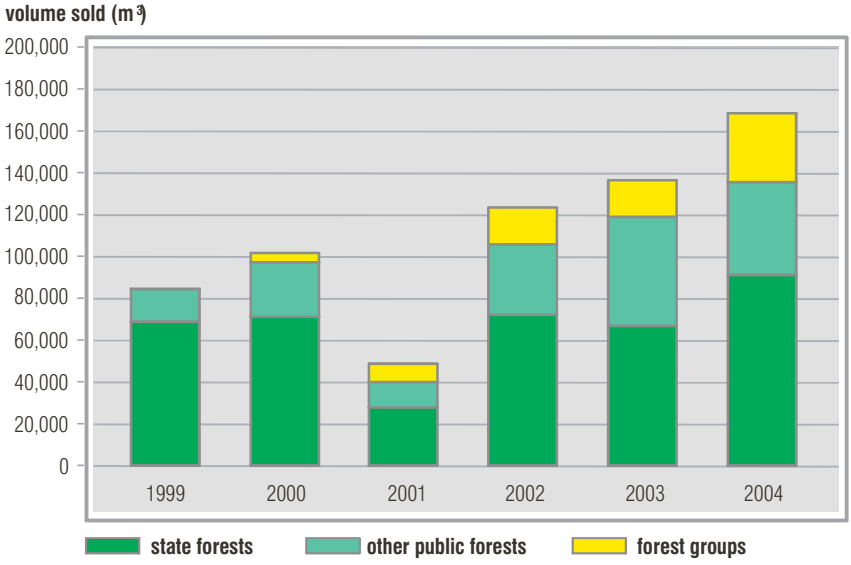


Fig. 3. Evolution of wood sales (in m³/year) from public forests (state-owned forests and other public forests) and forest owners groups (Source: Forests and Green Areas Division, NARA 2005)

Converting the figures for public forests into m³/ha, the total annual wood harvest in 2004 amounted to 3.7 m³/ha, which is approximately comparable with the figures for neighbouring countries (Fig. 4). Thus it may be said that in Flanders too, the annual increment is significantly higher than the annual harvest.

Forest exploitation is mostly carried out manually by means of power tools (saws), whereas the logs are extracted by means of machinery (tractors). Due to a low level of investment, most of the harvesting operations are carried out by means of these too heavy tractors. However, increasing use has recently been made of fully mechanised harvesting machines (harvesters and forwarders), which are capable of felling, lopping, debarking and sawing, thus allowing for quick and economical operations.

Approximately 8 such harvesters are presently in operation in Flanders. This number will probably increase similarly as in neighbouring countries. (NARA 2005).

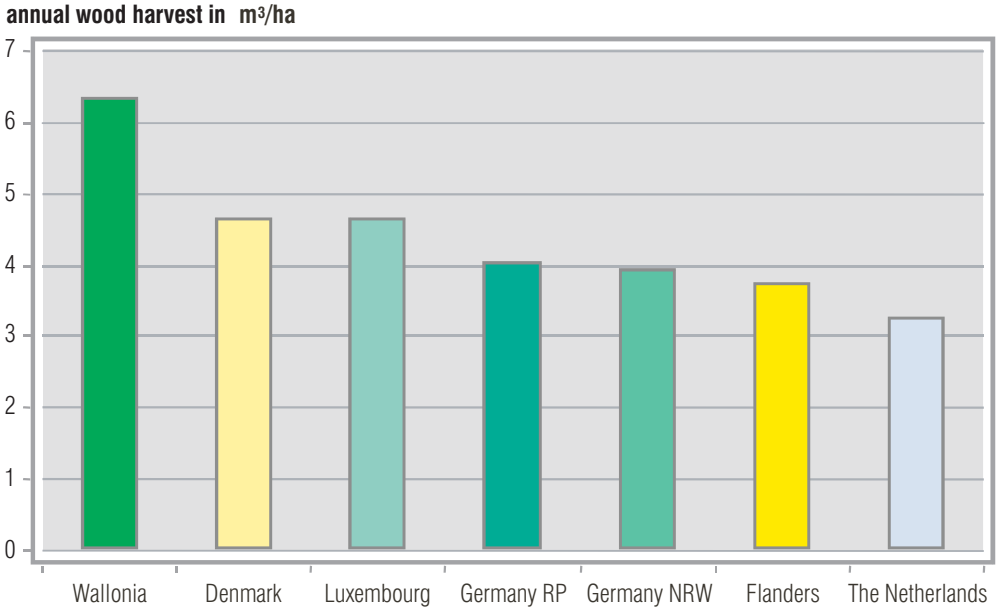


Fig. 4. Comparison of the annual wood harvest in m³/ha in Flanders and neighbouring regions/ countries (Source: European Forest Institute)

3. Forest protection

Wood production is not given the same priority throughout the Flemish forests and is variously categorised under specific regulations, which may or may not limit the wood harvest within a specific category.

No wood harvesting is carried out in nature reserves. The situation is presently not too clear for forests within the Flemish Ecological Network (VEN), as nature management plans have still to be developed. Forests situated in the VEN may be subject to the restrictions imposed by the nature management plans, which will probably aim at a reduction of wood harvesting (e.g. aiming at an increase in dead wood volume). Wood production will in any case be a secondary priority in these forests, since nature conservation and nature development issues are the primary objectives for these areas.

It should also be noted that those forest sites that lie within the area of the Habitats Directive and which are not designated as reserves or not covered by the VEN, are included in that 65% of the forest area where wood production is a secondary priority. Indeed, restrictions can be imposed in these areas to protect habitats considered of international importance.

However, in those forest areas resulting from afforestation of agricultural land, wood production is the primary function, although these forests constitute only a very small (0.5%) share of the total forest area.

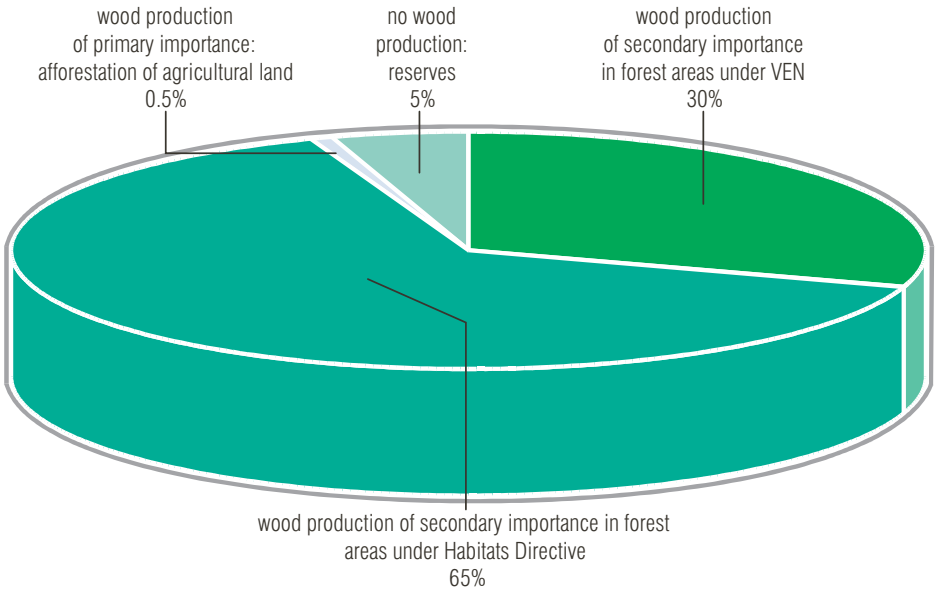


Fig. 5. Priorities of wood production in the forest areas of Flanders (Source: Leyman & Vandekerkhove, 2002; NARA 2003)

4. Legal and organisational aspects of forest holdings

In Flanders, there are approximately 150,000 hectares of forest area, 75% of which constitutes the property of approximately 100,000 private owners (1.5 ha per owner).

55% of forests have forests roads, 19% are provided with tourist information boards, 17% feature lakes and ponds for fishing, 13% of woodland have benches, 13% – sunbathing areas and playgrounds, and 11% – carparks.

Another positive finding is the absence of garbage in 77% of forests. In addition, 79% show no soil compaction beyond designated forest tracks. Problems concerning these two issues were found in only 5% and 4% of forests, respectively.

Recreational facilities are reasonably evenly distributed over the various forest types (broadleaved, coniferous and mixed forests).

Exceptions are the high share of broadleaved forests with sunbathing areas and playgrounds (18%), fishponds (25%) and fencing (33%), compared to coniferous forests (with sunbathing areas and playgrounds 7%, fishponds 9% and fencing 18%) followed by mixed forests (with sunbathing areas and playgrounds 9%, fishponds 12% and fencing 24%).

The first regional forest inventory in Flanders assessed the availability of recreational infrastructure in combination with any possible negative effects from recreation, such as garbage and soil compaction beyond forest tracks.

Forest law

Since 1991, a new Forest Act has been in force in Flanders, this applying to the environmental, ecological, social, scientific and productive functions of all forests (private and public).

The following Regulations concern the implementation of sustainable forest management:

- BVR 08/12/2002 (BS 18/12/2002) on the recognition of wood buyers and forest operators;
- BVR 27/06/2003 (BS 10/09/2003) on forest management plans;
- BVR 27/06/2003 (BS 10/09/2003) on the establishment of criteria for sustainable forest management in the Flemish Region;
- BVR 27/06/2003 (BS 10/09/2003) on the provision of subsidies for management of public and private forests;
- BVR 27/06/2003 (BS 10/09/2003) on the recognition and subsidising of forest groups and co-operation between the forest authorities and forest groups (NARA 2005).

The Flemish Government supports forest protection and sustainable forest management on a global scale by:

- Managing its own wood production;
- Entering into international co-operation on forest protection and sustainable forest management;
- Promoting the use of certified wood (FSC).

In 2002, the Flemish Government set up the Flemish Fund for Tropical Forest (VFTB), which in 2002 founded 9 and in 2003 subsequent 10 small-scale sustainable forest management projects in several developing nations (www.groenhart.be; NARA 2005).

5. Structure and tasks of the regional forest administration

In Flanders, forests are administered by the Forests and Green Areas Division (Afdeling Bos en Groen). This Division and the Nature Division are parts of the Administration of Environment, Nature, Land and Water Management (AMINAL). They are subordinated to the Minister of the Environment. The responsibilities of the Forests and Green Areas Division are much broader then mere management of state-owned forests. It is also responsible for the management of parks and other public green areas, inland fisheries, game management and bird protection. Conservation of the existing forest areas is the main task of the forest service. Forest management in Flanders is aimed at expanding the existing forest areas by 10,000 hectares. In addition, afforestation of 10,000 hectares of former agricultural land is also planned. Under these main tasks, priorities in Flanders are improvements in both the natural environmental and living conditions for urban and industrial populations. For this reason, the Division strives to ensure an integrated and sustainable combination of recreational, landscape, economic and ecological roles for all forests, whether in urban or rural areas.

The Forests and Green Areas Division is responsible for technical management of state-owned and other public forests (marking for thinning, inventories). It is also responsible for supervising management of private forests (approval of management plans, felling permits, subsidies). The Division employs a staff of approximately 400.

Private owners associations

Due to the fragmented nature of forest ownership, groups of private forest owners (forest groups) have been established. These forest owners associations oversee voluntary co-operation between the large number of private forest owners and public forest managers. Their objective is implementation of improved and more coherent forest management practices. The above-mentioned Regulation on recognition of forest groups came into force in 2003 and the current pilot projects are now under the management of these independent, recognised forest owners groups.

Since January 2004, two forest owners groups have been provisionally approved for a period of three years. Beginning in January 2005, another 5 forest owners groups were to commence operations. In order to provide forest owners throughout the whole Flemish territory the opportunity to obtain support from these forest groups, new pilot projects will be started in the near future. Ultimately, the Forests and Green Areas Division expects that a regional network of 19 forest groups will cover the whole territory by 2006. The forest groups which are already recognised and have commenced operations represent approximately 15,000 forest owners, who are kept informed about the practical aspects of forest management, the relevant legislation and the activities of other forest groups. This number of forest owners currently manage a total of approximately 12,859 hectares of forests which constitutes 22% of the total forest area of operations of the forest groups (Fig. 6).

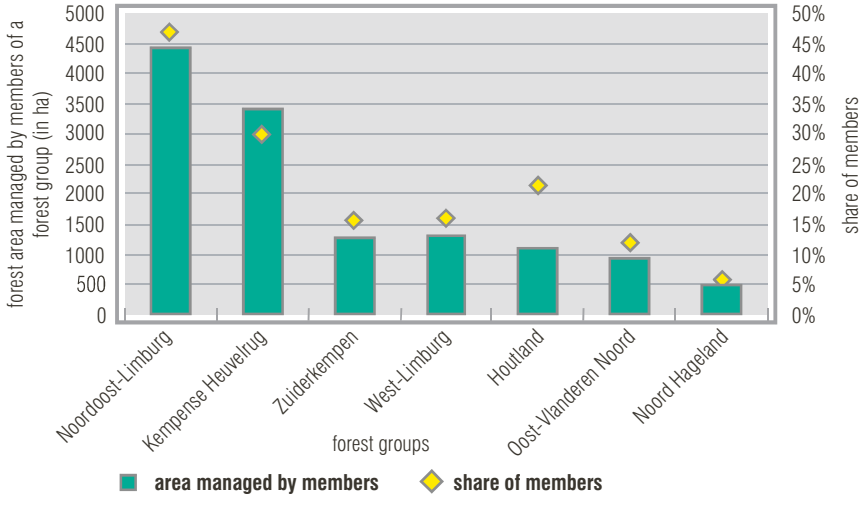


Fig. 6. The area managed by members of forest groups and the share of mebers of forest groups (Source: AMINAL, Forests and Green Area Division)

6. Education in forestry

Technical schools

There are no secondary or technical schools to provide an exclusively forestry related-education; however, certain technical schools offer education in the field of Green Management. Besides these technical schools, the most professional education in forestry is provided by the Inverde vzw Centre, which was established in March 1992 by the Flemish Community, as well as by two other non-governmental organisations, the Association for Forests in Flanders (Vereniging voor Bos in Vlaanderen) and the Centre for Private Forestry (Centrum voor Privé-bosbouw).

The 'Inverde vzw' Centre conducts a broad range of field work addressing both the forestry sector and the general public, by means of:

- specific and specialised training, additional training and retraining of officials (higher officials, foresters, nature protection rangers;
- specific and specialised training, additional training and retraining of people employed in the forestry sector;
- information, training and guidance for private forest-owners;
- general forestry information and education for the general public;
- supporting the exchange of know-how between private owners, the organisers and owners of the chain of wood supplies and the administrative authorities.

At regular intervals, the 'Inverde vzw' Centre runs technical, non-university level courses. These can be both theoretical and/or practical and cover all issues related to forests and forest-management, such as recognition of (indigenous) tree species, close-to-nature forestry, dendrology, marking for thinning, and forest-inventory. The 'forestry skills' course combines all these subjects. This course includes the bulk of the required subject matter for people intending to become forest or nature protection rangers in the Flemish Community. The Centre's courses, such as the series of courses for forestry workers and training-courses in chainsaw, brush cutter and tractor operation, are mostly practically oriented. Besides the above-mentioned courses, workshops and campaigns are organised for the two non-governmental organisations that co-founded the Centre. These involve several activities a year, often with hundreds of participants in attendance.

University education

Forestry education at university level (Bachelor's and Master's degrees) is offered by two Universities, namely the **University of Gent**, in its Forest and Water Management Department at the Faculty of Bioscience Engineering, and the **Catholic University of Leuven**, in its Department of Land Management at the Faculty of Applied Bioscience and Engineering.

The Faculty of Bioscience Engineering (University of Gent, Forests and Water Management Department) consists of 4 divisions:

- Forestry Laboratory,
- Forest Management and Spatial Information Techniques Laboratory,
- Wood Biology and Technology Laboratory,
- Hydrology and Water Management Laboratory.

At the Forestry Laboratory, three research teams specialise in various aspects of forest ecology and forest policy, and collaborate on integrating their knowledge in various forestry applications. This Laboratory's expertise, gained over the last 30 years, is currently being applied in forest conversion, afforestation of polluted sites, close-to-nature forest management, short-rotation forestry and private forest owners' participation.

At the Forest Management and Spatial Information Techniques Laboratory, the courses provided include:

- Dendrology and Forest Inventory,
- Forest Management Planning,
- Remote Sensing,
- Tropical Forestry,
- GIS-Basics and GIS-Vegetation Applications.

The Wood Biology and Technology Laboratory specialises in:

- Forest exploitation,
- Wood anatomy and identification,
- Material properties of wood,
- Processing of wood and its final products.

The Forest, Nature and Landscape Research Laboratory at the Catholic University of Leuven focuses on the following fields of research:

- Methods and rate of plant dispersal in nature and relevant knowledge within the framework of forest expansion, nature development and restoration;
- The anthropogenic impact on landscapes and evaluation methods for the same;
- The social, ecological, and economic functions of landscapes;
- The use of satellite-imagery in order to obtain useful information about the growth and the vitality of natural ecosystems;
- Carbon dioxide absorption by forests and their contribution to reducing the greenhouse effect;
- Acquisition and processing of ecosystems data in geographic information systems;
- Development of measurement methods and indicators for sustainable forest management.

Subjects currently covered include: criteria and indicators for sustainable forest management, indicators of tree architecture, life cycle assessment, land-use impact assessment, water balance, energy analysis, carbon sequestration and mitigation of greenhouse effect, decision supporting systems, ecology of dry land forests.

7. Forest research

The Institute for Forestry and Game Management

The sole government forest research establishment in Flanders, the Institute for Forestry and Game Management (IBW-IFG), was founded on March 13th 1991 as a scientific research institute of the Flemish Community. It incorporates the former Government Poplar Research Station (Geraardsbergen) founded in 1948 as a private research station of the Swedish Match Company, and the Government Research Station for Silviculture and Hydrobiology (Groenendaal-Hoeilaart) founded in 1896. The basic mission of the Institute is to organise scientific, policy-oriented research and provide scientific advice to forestry, inland fisheries and game management, the latter including exotic and expansive species.

The Institute consists of a Forestry Division and a Game Management Division. Forest and forestry research focuses on the following fields:

- Forest ecology and forest development: methodological and ecological research in forest reserves, monitoring of natural processes in strict forests reserves, forest management research oriented towards natural regeneration and transformation of homogeneous and even-aged forests, biodiversity;
- Conservation and use of forest genetic resources: conservation of genetic resources for endangered tree species, study of genetic diversity, selection and production of valuable forest reproductive material, phytopathological support for reproduction and selection programmes, molecular genetics with regard to reproduction and conservation of genetic diversity;
- Site research: research on the habitat requirements of tree species and forest types, soil restoration, soil contamination, techniques for afforestation and reforestation, mineral and hydrological cycling in forest ecosystems, socio-economic aspects of afforestation of agricultural land;
- Forest protection: monitoring of forest health, study of biotic and abiotic stresses, influence of long-range, transboundary air pollution on forest ecosystems, intensive monitoring of air pollution in forests;
- Wood technology and wood quality: evaluating the wood quality of selected forest reproductive materials, the inheritability of wood properties, wood properties in relation to changes in forest policy, wood chains;
- Selection and reproduction of poplar.

Additionally, in collaboration with forest administration, the Institute plays a leading role in the International UN Co-operative Programme on Forests, runs the Forest Soil Co-ordinating Centre with the EU support and is involved in several related working parties. The Forestry Division also participates in several EU funded research projects.

The Institute also manages nurseries, seed orchards, container-based nurseries, laboratories for soil and water analysis, pathological and molecular analysis laboratories, *in vitro* facilities, a measuring tower for air pollution effects on forests, GIS and GPS facilities and a library. The research results are disseminated through publications in national and international scientific journals, at seminars, meetings, and study tours, but also through its

Table 1. Funding structure for forest-related research (2003)

Total annual amount of funding for forest research	EUR 4,697,000
Forest research funding is shared between:	
Regional public funding	EUR 3,841,000
External funding	EUR 428,000
External funding includes:	
EU funding	EUR 109,000
Other sources	EUR 319,000

own channels: scientific reports, an annual activity report, a newsletter and its website (www.ibw.lin.vlaanderen.be).

The research is conducted by a staff of 59 (researchers are required to have an academic, M.Sc. or equivalent, or higher degree), including 35 directly responsible for forestry issues, 22 of which have a degree in forestry, while 13 have degrees in other disciplines (biology, geology, biometry). They are technically assisted by a further staff of 62, of which 47 are involved in forestry research. Sources of research financing are presented in Table 1.

A process of improving administrative policy is currently underway. This includes preparation of a merger between the two Flemish Scientific Institutes, with a view to handling environmental, natural and energy-related policies and establishing the Institute for Nature and Forestry Research (INBO), this being a joint research programme that has already been drawn up for 2005. The major directions of its forestry research are outlined below.

The Policy Memorandum on the Environment and Nature 2004–2009 emphasises correct and prompt implementation of European and international commitments. Flanders has assumed important obligations with regard to submitting reports concerning implementation of international legal instruments, such as EU Directives and International Conventions and Treaties. The INBO's role in the fulfilment of these obligations will be to provide scientific support and advice.

Within its strategic objectives, the INBO shall respond to the new needs ensuing from European and worldwide developments with regard to biodiversity, the environment, energy demand, climate and related policies. To summarise, these new initiatives concentrate on three issues: (1) stricter biological monitoring, (2) sustainable use of biodiversity and open areas, and (3) climate change resulting from the greenhouse effect.

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Wallonia

Antonina Arkuszewska

1. Forest characteristics

Since 1866, the area of forests in the Walloon Region has systematically increased from 315,648 hectares to 468,889 hectares. Stand conversion from coppices to standard and the replacing of weak broadleaved stands of coniferous forest has been even more rapid (Table 1).

Earlier statistics unfortunately did not provide any detailed information on broadleaved stands. The share of coniferous species in 1984, excluding Christmas tree plantations, which are treated as cultivation, is presented in Table 2.

territory: 16,800 km^2,
population: 3.8 million,
capital city: Namur.

Table 1. Changes in forest categories during the past century

Forest category	1895	1929	1984
High broadleaved forest	40,638	49,471	101,778
High broadleaved forest with coppices in the second storey	189,677	166,605	99,701
Coppice forest	104,724	84,988	37,757
Total broadleaved forests	**335,040**	**301,064**	**239,236**
Coniferous forests	55,935	135,777	247,653
Grand total of forest area	**390,975**	**436,841**	**486,889**

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Table 2. Species and age structure of coniferous stands

Age, years	Spruce	Douglas fir	Pine	Larch	Total	
	ha				ha	%
1–9	17,130	3,630	115	350	21,225	9.0
10–19	36,376	4,057	1,133	1,077	42,643	18.2
20–29	42,008	2,127	3,437	4,709	52,281	22.5
30–39	23,898	427	2,386	1,993	28,704	12.3
40–49	20,563	11	2,084	326	22,984	9.9
50–59	18,789	29	2,114	121	21,053	9.0
60–69	10,256	195	1,893	0	12,344	5.3
70–79	6,515	58	1,260	0	7,833	3.5
80–89	2,370	0	931	0	3,301	1.4
90 years and more	1,580		350	40	1,970	0.9
Age unknown	9,480	182	1,141	547	11,350	5.0
Clear-cuts	6,366	39	581	0	6,986	3.0
Total	**195,331**	**10,755**	**17,425**	**9,163**	**232,674**	**100.0**
%	**83.9**	**4.6**	**7.5**	**4.0**	**100.0**	**X**

Table 3. Changes in growing stock ('000s m^3)

Category	Public forests		Private forests		Total	
	1984	1994	1984	1994	1984	1994
Coniferous	27,262	27,616	32,578	33,080	59,840	60,696
Broadleaved	24,995	25,589	20,360	19,117	45,355	44,706
Total	**52,257**	**53,205**	**52,938**	**52,197**	**105,195**	**105,402**

Younger plantations are much more uneven in terms of species composition: to a major extent pine has replaced Douglas fir, which was mixed with larch and broadleaves: maple, ash, and cherry. Standing stock was estimated during the 1984 inventory on public and private forests (Table 3). Standing stock is very stable which, considering the windthrows of 1990, means there is a tendency among foresters to capitalise stocks, especially of coniferous stands.

Based on the volume in 1984 (205 m^3/ha in high broadleaved stands, 167 m^3/ha in high broadleaved stands with coppices in the second storey, 71 m^3/ha in coppice stands and 262 m^3/ha in coniferous stands) and the forest area, the growing stock is estimated at approximately 62 million m^3 for 1895 and 79 million m^3 for 1929. However, if the data obtained in 1950 is used instead, the volume of stock can be estimated at 24 million m^3 in 1895 and 32 million m^3 in 1929. It is safe to say that growing stock has tripled in the course of the last hundred years, whereas since 1929 it has increased two-fold.

The data on wood resources in public forests during the period 1986–1991 is as follows:

Table 4. The annual harvesting in public forests (m^3)

Harvesting	1986–1991 mean		m^3/ha of usable forest area	m^3/ha of total forest area
Broadleaved	541,556	31.1%	3.83	2.17
logs	296,243	17.0%	2.09	1.18
other	245,313	14.1%	1.73	0.98
Coniferous	1,198,118	68.9%	11.68	4.79
Total	**1,739,674**	**100.0%**	**7.13**	**6.96**

Notes: Other – tops and stems with a girth of over 70 cm.

Table 5. The annual harvesting of broadleaved timber by diameter class

Species	Timber volume (m^3) by diameter class (girth in cm)							Total (m^3)
	70–99	100–119	120–149	150–179	180–199	200–249	250 and more	
Beech	12,211	9,683	21,962	33,578	25,224	47,168	10,180	160,006
Oaks	17,862	13,414	20,106	17,064	8,249	10,367	2,740	89,802
Ash	1,231	712	1,297	1,136	621	925	215	6,137
Maples	554	372	595	442	183	139	13	2,298
Cherry	332	399	632	498	159	102	5	2,127
Other	16,565	7,118	6,126	2,799	1,061	1,447	758	35,874
Total	**48,755**	**31,698**	**50,718**	**55,517**	**35,497**	**60,148**	**13,911**	**296,244**

Table 5 and Table 6 present the distribution, by species and diameter class, of the timber volume harvested.

The share of beech and oak in broadleaved merchantable timber is 54% and 30.3%, respectively. Beech wood accounts for nearly the whole of very thick wood (with a girth of over 180 cm) whereas oak is the dominant wood in the medium diameter classes. Valuable broadleaved species (ash, maple, cherry) account for only 3.6% of timber volume.

Among coniferous species, the share of spruce is 90% and even higher as regards thick wood. The share of pine on the coniferous wood market is less than 5%, due to the poor productivity of pine stands and also lack of interest on the part of buyers.

Revenue from sales of wood accounts for almost 90% of total forest revenue and of this 70% originates in sales of coniferous wood, which constitutes 70% of the resources and provides 60% of forest income, although conifers cover less than 42% of productive areas. This also explains the choice of these species in reforestation of private and municipal forests. Revenue from 1 hectare of coniferous forest is 2.8 times higher than that of broadleaved forests (14,078 francs/ha and 4,944 francs/ha, respectively) due to more intensive harvesting (11.7 m^3/ha from coniferous forests and 3.8 m^3/ha from broadleaved forests), although the average price is lower (1,205 francs/m^3 for coniferous and 1,292 francs/m^3 for broadleaved forests).

Table 6. Annual harvesting of coniferous timber by diameter class (m^3)

Species	Timber volume (m^3) by diameter class (girth in cm)								
	20–39	40–69	70–89	90–119	120–149	150–179	180–199	200 and more	Total
Spruce	41,085	160,936	152,050	319,852	254,227	114,383	25,041	12,842	1,080,416
Douglas fir	4,595	14,029	5,499	2,671	830	548	392	1,040	29,604
Fir	463	960	380	373	239	145	54	49	2,663
Pine	2,813	13,229	11,294	16,822	8,910	3,015	495	161	56,739
Larch	932	11,242	8,186	4,753	1,048	234	61	73	26,529
Other	247	827	401	276	169	81	143	31	2,175
Total	**50,135**	**201,223**	**177,810**	**344,747**	**265,423**	**118,406**	**26,186**	**14,196**	**1,198,126**

2. Legal and organisational forms of forest holdings

Forest ownership

Public (state-owned, regional and municipal) forests constitute approximately 50% of all forest land. In public forests, the situation favours forest management, because the size of the average forest complex exceeds 500 hectares, while the average size of private forest plots is approximately 40 hectares.

Table 7. Number of owners and area of forests by size category (1994)

Area (ha)	Region			Municipality			Other			Total		
	NO	NP	Area (ha)	NO	NP	Area (ha)	NO	NP	Area (ha)	NO	NP	Area (ha)
<1	–	–	–	0	0	0	77	125	40	77	125	40
1–5	–	–	–	4	5	14	103	427	268	107	432	282
6–10	–	–	–	4	5	35	51	360	350	55	365	385
11–20	–	–	–	7	10	96	23	157	314	30	167	410
21–50	–	–	–	9	32	306	10	40	306	19	72	612
51–100	–	–	–	19	93	1,272	9	151	667	28	244	1,940
101–500	–	–	–	42	569	12,074	5	72	632	47	641	12,707
501–1000	–	–	–	23	658	17,606	0	0	0	23	658	17,606
1001–1500	–	–	–	15	446	18,692	1	6	1,285	16	452	19,976
1501–2000	–	–	–	11	446	19,558	0	0	0	11	446	19,558
2001–5000	–	–	–	28	1,366	87,779	1	18	2,639	29	1,384	90,418
>5000	1	754	56,714	5	310	32,381	0	0	0	6	1,064	89,095
Total	**1**	**754**	**56,714**	**167**	**3,940**	**189,813**	**280**	**1,356**	**6,501**	**448**	**6,050**	**253,029**

Notes: **NO** – number of owners, **NP** – number of forest plots.

Table 8. Number of owners and area of private forests by size category (1993)

Category (ha)	Area (ha)	Number of owners	Mean size (ha)
<1	25,345	72,900	0.35
1–5	49,437	24,168	2.05
6–10	24,009	3,534	6.79
11–20	29,431	2,192	13.43
21–50	34,846	1,134	30.73
51–100	35,504	519	68.41
>100	63,801	309	206.48
Total	**262,373**	**104,756**	**2.50**

Assuming that the minimum size necessary to carry out proper management is 100 hectares, then 98% of the area fulfils this criterion. Smaller properties are mainly found in the area of suburban municipalities close to forest regions and form suburban forests, fulfilling first and foremost a social function.

The area of municipal forest properties has increased from 267 hectares (in 1970) to 1,120 hectares (in 1993), while that of forests owned by Centres of Social Assistance has increased from 52 hectares to 95 hectares. In private forests, one may see an ongoing process of property fragmentation (Table 8). The average area of private forest properties has decreased from 3.32 hectares (in 1959) to 2.50 hectares (in 1993). At the same time, the share of properties with an area over 20 hectares has decreased from 63% to 50%. The problem of forest property fragmentation is partly alleviated by the activities of forest cooperatives. The Walloon Region acts to encourage its owners to join such groups.

Since 1972, legal regulations have ensured the general public free access to forests. In private forests, such access is at the initiative of the forest owners. In urban areas, where such a function is essential, recreational forests constitute only 25,000 hectares of public forest areas *i.e.* 10%. In other areas, there are 82 sites, totalling 65 hectares, which are specially set aside for tourists, with such facilities as nature trails. Numerous museums devoted to forestry and administered by regional authorities have also been established.

Forest law

The Act of 1854 laid down the legal principles for forest management and included the Forest Code, which required preparation of forest management plans for all forests, in accordance with the Code.

The protection of forest zones is regulated by various legal acts:

- The Forest Code;
- The Act of 28 December 1931, the so-called padlocks law (*de cadenas*) restricting excessive cutting in those private forests that affect the public interest;
- The Walloon Region Spatial Management, Town Planning and National Heritage Code requiring permits to be obtained for deforestation in forest zones or afforestation in rural

or urban zones, as well as specifying the conditions and procedures for granting special protection status to 'valuable sites under state control' or 'special trees';
- The 1973 Nature Protection Act, which introduced a definition of 'forest reserves' and 'natural reserves'.

The Region occupies an area of 330,000 hectares, with almost 20% of its territory constituting Special Protection Areas for Birds (Directive 79/409 EEC).

The Decree of 16 February 1995 introduced a regulation concerning mobility in forests, for the purpose of eliminating the negative effects of uncontrolled tourism in forests and especially that caused by motor vehicles. The aim of the Constant Wood Resources Inventory is to estimate the state of forest areas and timber stock, including changes to the same.

Other legal acts that have an indirect effect on forest management include:
- The Hunting Decree of 14 July 1994, aimed at securing a balance between game populations and the condition of forests;
- Regulations setting up protection zones around underground water intakes;
- The Plant Protection Act on conservation of endangered plant species.
- On 10 March 1995, the Wallonia Parliament introduced a Programme for the Environment and Sustainable Development, a section of which refers to forests.

Structure and tasks of the regional forest administration

The management of public forests in Wallonia is subordinated to the Department of Nature and Forests under the General Directorate of Natural Resources and Environment. This Department is structured into 7 regional directorates, managing 36 districts. At the request of owners, these same services organise the management of forest and wildlife and nature protection in private forests. The Department of Nature and Forests administers the Nature Forests and Woods Research Centre, with its headquarters in Gembloux and branch offices in Harchies, Marloie, Mons and Robertville. The Centre consists of the following three scientific directorates:
- Directorate of Nature, Hunting and Fisheries,
- Directorate of Forest Biology;
- Directorate of Wood Technology.

Private forest owners are represented by the Royal Forestry Society of Belgium (La Société Royale Forestiere de Belgique). It plays an informative role by publishing a bulletin entitled Silva Belgica, as well as organising conferences and scientific trips. It offers its members liability insurance against forest fire. The Society has established a Syndicate of Walloon Forest Owners (Syndicat des Propriétaires Forestiers de Wallonie) at regional level, which examines forest policy issues regarding the private sector. Numerous forest owners are members of forest cooperatives other than the Royal Society. These organise joint sales of wood and collective purchases of planting materials.

3. Forest education

At institutional level, education is provided under Federal but not regional competitions. Education in forestry is available at all levels: eleven secondary, technical schools provide education at both lower and higher levels and two other schools provide higher level education but not at academic level. However, a five-year university programme on forestry is provided at two agricultural faculties, leading to an engineering diploma in water and forest management. Besides forest management, the science and applied science faculties at various universities in the Walloon Region provide the necessary education and research for teaching a full range of relevant knowledge on forest ecosystems.

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Translated by *Marta Topczewska*

Cyprus

Xenophon Hadjikyriacou

The Republic of Cyprus
(Greek: Κυπρος, Kýpros;
Turkish: Kıbrıs),
territory: 9,251 km², population: 780,000,
capital city: Nicosia.

Introduction

Cyprus is the third largest Mediterranean island after Sicily and Sardinia, with a population of **780,000**. It occupies 925,100 hectares, of which 41.7% is under forest or other natural vegetation. Four geographical regions can be identified, with different geological formations and other interesting features:

- **the Troodos range** is a dome-shaped highland of mainly infertile igneous rocks situated in the central-western part of the island, with Mount Olympus rising to 1,951 m a.s.l.;
- **the Pendadaktylos range** (1,024 m a.s.l.), situated in the north, is mainly built of limestone. It is a beautiful mountain area composed of a succession of mostly allochthonous sedimentary formations ranging in age from the Permian to the Middle Miocene;
- **the 'Messaoria' or Central Plain** is situated between the Troodos and Pendadaktylos ranges and has a low relief (not exceeding 180 m) near Nicosia, the capital. This plain is composed of flysch-type rocks carried by rivers from the Troodos and Pendadaktylos ranges, and was formed during the Holocene period;
- **the coastlands** form valleys that surround the country almost entirely: the Kyrenia Valley with its narrow coasts is in the north; the Larnaka and Limassol Valleys are in the south; the Pafos and Chrysochou Valleys are in the west, and the Famagusta Valley is in the east. The soils are alluvial and fertile, and are suitable for agriculture.

Cyprus has an intense Mediterranean climate characterised by hot, dry summers and rainy, rather changeable winters, separated by short, autumn and spring seasons.

The average annual rainfall increases with an ascent of the south-western windward slopes from 450 mm to nearly 1,100 mm at the top of the central Troodos massif. On the

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leeward slopes, the average annual rainfall decreases steadily northwards and eastwards to, as little as, 300–350 mm on the central plain and in the flat, south-eastern parts of the island.

1. Forest characteristics

Forest area and species composition

Forests and other wooded lands cover 385,600 hectares, or 41.7% of the country's land area, according to the 1999 vegetation map, and with regard to the FAO definition of a forest area.

The forests of Cyprus (state-owned and private) are natural or semi-natural, consisting mainly of Brutia pine (*Pinus brutia*), while black pine (*Pinus nigra ssp. Pallasiana*) covers the higher slopes of the Troodos range. Other species are cypress, juniper, plane and alder, and golden oak (*Quercus alnifolia*), which is endemic. Cedars of the endemic species *Cedrus brevifolia* also occur in the Paphos Forest.

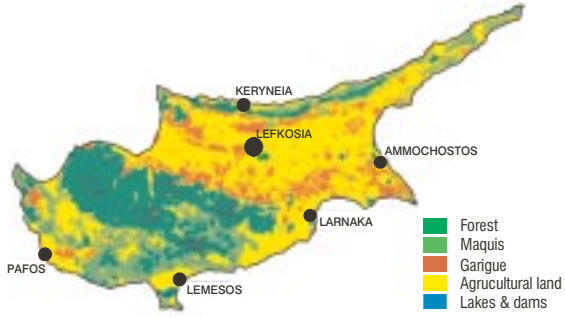

Fig. 1. Cyprus forest and other wooded land

Volume and increment

The latest statistical data available on volume and increment are given in the table below, by type of forest and related management:

Table 1. Volume and increment by forest and management type

Classification according to forest type and management	Area (ha)	% of total forest area	Growing stock (m^3/ha)	Mean annual increment (m^3/ha)
– high forest	170,600	44.24	200	1.00
– coppice	1,000	0.26	44	0.63
– maquis, garigue	214,000	55.50	n.a.*	n.a.*
Total forest and other wooded land	**385,600**	**100.00**	**n.a.***	**n.a.***

* n.a.: not available.

2. Forest protection

Cyprus's present classification by reference to forest law does not match the IUCN categories of forest management. However, it serves, in a broader sense, the IUCN's forest management objectives in line with the forest policy and forestry practice in Cyprus. The management of Cypriot forest resources is based on the multiple-use principle, whilst certain forest areas are National Parks, Nature Reserves and other forms of nature protection.

Thus, the area of forests playing a productive function cannot be defined in terms of the difference between total forest and other wooded land areas and the areas under protection, as it refers to the forest area corresponding to the IUCN categories III to VI. Furthermore, there is no institutional instrument or management categorisation for private forests. The following table shows areas corresponding to IUCN categories.

Table 2. Areas corresponding to IUCN categories

Forms of nature protection by IUCN category:	Forest and other wooded land*	
	ha	%
– IUCN categories I and II (1)	12,000	3.1
– IUCN categories III to VI (2)	145,000	37.5
Total (1)+(2)	**157,000**	**40.6**

* Data refer only to State-owned forest and other State-owned wooded land.

In accordance with the Forest Law (14 of 1967, 49 of 1987, 44 of 1991, 27(I) of 1999, 124(I) of 2001) and the complementary Forest Regulations of 1967 thereto, the State-owned forest areas are divided into two categories, as follows:

- **Major State Forests**, which are classified into:
  - **The Permanent Forest Reserves,** managed mainly for timber production and covering 91,200 hectares. The currently exploitable area managed for timber production is recently estimated at 43,200 hectares. The area of 3,800 hectares is classified as plantations, and the remaining 44,200 hectares are of low standing volume;
  - **The National Forest Parks,** which are managed for nature protection and recreation; and
  - **The Nature Reserve Areas**, which are managed exclusively for the protection of flora and fauna.
- **Minor State Forests**, which are further classified, according to their use and management purposes, into: multiple-use forests, municipal forests, communal forests, pastures and grasslands and forest nursery.

3. Legal and organisational aspects of forest holding

Forest ownership

State-owned forests account for 40.6% of the forest area, while forests growing on private and common land[1] make up 59.4%, as is shown in the table below. State-owned forests and some forested common land are managed exclusively by the Department of Forests, while private forests have never been under management due to the lack of any specific policies for their regulation. It should be mentioned that 'private forest holdings' have not been recorded as income-generating units in agricultural censuses, at least during the second half of the 20th century. This confirms the trend towards the abandonment of private forests and neglect by their owners – a reflection of the low profitability and high costs of exploitation. In general, private forestry is simply not present in Cyprus; hence, no private forest owners associations exist.

Private forests consist of holdings usually very small in size, having been acquired by inheritance from parents and even grandparents[2]. Forest vegetation grows almost exclusively on former agricultural lands, meadows and pastures, mainly situated on hilly and mountainous areas at elevations between 700 and 1,200 m. Their average size ranges between 2.1 hectares in mountainous areas and 4.4 hectares in the dry land and vineyard zones (Philippides and Papayiannis, 1983; Papayiannis and Markou, 1999). They are scattered in many parts of the island and mostly occur along the boundary limit of the State-owned forests (Philippides and Papayiannis, 1983). The unclear land tenure and fragmentation of the holdings have raised problems regarding the establishment of any functional management system of private forests.

Table 3. Ownership structure of forests

Type of ownership	Forest and other wooded land	
	ha	%
– public	156,600	40.6
– private	229,000	59.4
Total forest and other wooded land	**385,600**	**100.0**

* [1] In Cyprus, 'common land', referred to as 'hali land', consists of mostly unfertile land scattered throughout the island, not regularly exploited. It has never been claimed due to heavy property and farming taxes imposed by the Ottomans during the period from 1571 to 1878 A.C. (Thirgood, 1987). Later on, the British declared them 'common lands' owned by the State and made them available to the people for use, in accordance with a settlement that still exists (Ioannou, 1991). Part of this land has gradually turned to forest.

[2] The land tenure of a part of this land is unclear, because ownership has been split in the process of inheritance among many family members who are unknown to one other.

Forest law and public access to forests

The Forest Law has been amended from time to time since its first enactment in 1879, its last amendment dating back to 2003. The current Forest Law No. 14/1967 to 78A(I)/2003 mainly refers to the State-owned forests. However, though to a far lesser degree, it also encompasses private forests: the Cyprus Forest Industries Co. Ltd. and Private Forest Industries (sawmills). In other words, it covers the whole forestry sector.

The regime of property rights has a greater or lesser effect on the use of forest resources and people's access to forestry products and services in Cyprus. It is especially concerned with hunting/shooting, mushroom- and herb-collection, and grazing. The framework of property rights, as regards forestry benefits, are categorised in line with land ownership into State-owned forest or private forest.

In respect of the State-owned forests and any private forest land that is placed under government control, Forest Law regulates the felling, processing and collecting of any WFP (Wood Forest Product) or NWFP (Non-Wood Forest Product). The recreational values of the State-owned forests represent a public good, with permits being granted for any transaction or trade activity.

The NWFPs are specifically defined in the law as: leaves, flowers, fruits, seeds, roots, bark, charcoal, grass, plants, moss, fungus, lichens, gums, oils, resin, pitch, tar, honey, wax, humus, earth, sand, gravel, stones, rocks, minerals and water. The law provides that these have to be collected in accordance with picking permits, and it does not draw a distinction between private and commercial uses. However, it is customary for products, such as mushrooms, edible herbs, aromatic and medicinal plants to be collected freely. Moreover, the inhabitants of certain villages have the privilege of gathering fuelwood for their own domestic needs only from the State-owned forests, after a license has been issued without any fee or charge.

In private forests and other private wooded land, the owners of the land are free to exploit both, their forest resources and the land. However, the legislation regulates the felling of trees, as well as the transport and export of timber.

Game, as well as shooting/hunting rights are traditionally public (State-owned) property in Cyprus. The State issues shooting/hunting permits and generally identifies hunting areas. The Game and Fauna Fund, a semi governmental organisation, exercises control over hunting and game management in Cyprus. The hunters are organised into local clubs and generally have free access to private property and State land, except when these are fenced.

The use of forest resources and especially the exploitation of timber face certain problems deriving from the adverse dry climatic conditions prevailing on the island. These conditions have an impact on the growing stock of the forests, and keep the production of wood at very low levels. In addition, the global market liberalisation encourages the import of cheaper raw material, a fact that has eliminated the competitiveness of the local timber market. This situation leads to alternative policies, and, more specifically, to conservation policies taking a more holistic and equitable approach.

On the other hand, there is no information available on NWFP commodities and no control mechanisms available to assist the competent authorities in ascertaining the source

of these products. Sometimes sellers/collectors may obtain extraordinary remuneration for their 'products'. The present situation may harbour illegal practices in favour of a few people at the expense of both, the wider community and the environment.

Public access is allowed on both private and state-owned forests and other wooded land. In private forests, notwithstanding the relevant legislation, it is customary for any person to be able to enter and remain on any private forest land for reasonable recreational purposes. In addition, the general public has the right to access and make reasonable use of the traditional public paths that cross forest land. The Forest Law (1967) regulates access to the State-owned forests. It provides that the forest paths and roads within the State--owned forests are constructed exclusively for the administration, protection and management of forests. However, the Director of the Department of Forests may decide under special circumstances to prohibit access to a specific forest road.

The lighting of a fire is strictly prohibited in State-owned forests and in rural areas as well. The Forest Law provides that the lighting of a fire for cooking is only allowed in constructed hearths within picnic and camping sites. Picnicking is free anywhere, while camping requires a fee to be paid and is allowed in specified areas only.

On the basis of the above, it can be firmly concluded that there is unrestricted access for people to almost all forest and other wooded land for recreation on the island. Forests contribute significantly to the tourist product, and offer multidimensional opportunities for socioeconomic development, especially in rural areas.

The Council of Ministers (in cooperation with the Director of the Forestry Department) may dispose of any State-owned forest land through grants, or land-leases to any legal entity where this is deemed necessary. Minor State Forest land can be assigned for special management purposes, either for protection, recreation or other special uses. Moreover, Minor State Forest land may be placed under the control and management of any local authority for the purpose of obtaining fuel, timber and other forest produce, or for recreation.

Forest administration and management

Forestry is the responsibility of the Department of Forests under the Ministry of Agriculture, Natural Resources and Environment. The Department of Forests administers the State-owned forests, implements the government's policy with regard to forests and is responsible for the fulfilment of forest development plans. Furthermore, it provides technical assistance and carries out reforestation on private and public lands.

Forestry in Cyprus has, for many years, been based on a multiple-use principle. In ancient times, the forest area was more extensive and the population smaller; timber was felled for building houses and ships, and forests were a source of food, fodder and also served other basic needs. Their capacity to satisfy people's requirements was not questioned and sustainability was not an issue. Timber production based on the principle of 'sustained yield' was introduced by European foresters in the 19th century, and was practiced in Cyprus throughout the 20th century.

In recent years, the importance of forests as a rich source of benefits, including biodiversity, climate amelioration, water supply and purification, amenity and scenery, has been recognised, and the sustainability concept extended to include them. Forest management

is now focused on the protection of forests, so that their capacity to provide goods and services of all kinds – wood and non-wood forest products (WFPs, NWFPs), landscape quality, protection of water supplies, rural life and village communities – is not impaired. With effective conservation and sound management, the forest resources offer multidimensional opportunities for socio-economic development, especially in rural areas. Until the 1980s, most of the work of the Department of Forests had been concerned with the protection and management of State-owned forests, although its remit was more general, in line with the official forest policy. In recent years, it has entered into close cooperation with the Cyprus Fire Brigade as regards fire-fighting, on the basis of a common Action Plan that covers rural areas across the island.

Forest policy is laid down in the National Forest Policy Statement, adopted in 2002 as a tool for implementing the National Forest Programme (NFP) in line with a new forest strategy. It replaces the previous official policy statement, which was issued in 1950 and confirmed after gaining independence in 1960. The new strategy, known as the Rural Betterment Strategy, is based on the multiple uses of forest resources. It aims at improving the condition of forests, conserving soils and watersheds, protecting biodiversity and heritage sites, and promoting eco-tourism and the sustainable production of wood and non-wood forest products (WFPs, NWFPs).

4. Forest economy

Forest contribution to the national economy

The forests of Cyprus are an important national resource that contributes significantly to the beauty of the landscape, the preservation of national heritage, the protection of water supplies, rural life and village communities, and the general well-being of Cypriot citizens. Although national timber production is negligible compared to the import of raw wood materials, the indirect value of non-market benefits is very significant, affecting both the national economy and the prosperity of citizens. Monetary valuation of these benefits creates methodological and measurement problems, mainly due to lack of data, etc. However, this constraint should in no way limit their significance in policy-making and tourism and/or recreational activities and planning.

Gross Domestic Product and employment

The annual contribution of forestry to the economy of Cyprus is negligible. In 2001, it accounted for only 0.026% of GDP. The share of the timber-based industries is more significant and amounted to 1.1% of GDP in the same period: 0.6% being due to the woodworking industries (sawmilling, wood-based panels, wooden pallets) and 0.5% to the construction of wooden furniture. The contribution of the furniture industry has been reasonably stable over the last five years, despite the growing furniture imports (Statistical Service, 2001).

In 2001, the 651 people working in forestry represented 0.2% of total national employment. All these people were given jobs by the government in general management and protection of forests (as foresters, workers and fireguards). There were also a limited number of people working in small exploitation enterprises. In turn, the workforce in the wood-based industry accounted for 5,941 jobs, or 1.9 % of overall employment (Statistical Service, 2001).

International trade

In 2000, total wood consumption in Cyprus was of 640,439 m^3, or 0.95 m^3 per capita (UN-ECE/FAO, 2000). The wood industries are largely based on imported timber, which accounts for 97.8% of consumption. Imported fuelwood in turn represents 92.7% of total fuelwood consumption. Cyprus is in fact a net importer of all wood-based products, these making up 97.1% of the overall wood market. Exports are almost nil. These data confirm the present trend in the wood market towards a shift to imported final products, while the wood-based industries shrink gradually (FAOSTAT, 2004, Statistical Service, 2001). This is, however, a characteristic of the national economy as a whole over the last two decades, reflected in a decline in the primary and secondary sectors, and attendant shift towards the tertiary sector (especially the provision of tourism services).

Other forest-based industries: tourism and green belts

The contribution of other non-wood forest-based industries or activities and the indirect forest benefits to GDP are not thoroughly acknowledged and there are very few relevant data available (Giorgio and Gabriilides, 1999; Costantinides, 1999). The honey-making and hunting industries are fully acknowledged and their contribution to GDP is estimated at around 0.036% and 0.079%, respectively. The tourism-recreation, watershed protection and agricultural benefits provided by forests are acknowledged, but not estimated in monetary terms. The same is true of numerous other valuable features relating to indirect use of forests, such as protection of soil and water resources, conservation of biological diversity, support for agricultural productivity, carbon sequestration and mitigation of global warming, combating desertification and protection of coastal resources and fisheries. None of these are included in the statistics, but they are of increasing importance to society (Costantinides, 1999).

5. Forest Education

The Cyprus Forestry College is a Government International Institution in Tertiary Education. Since its establishment in 1951, the College has trained students from Africa, Europe, Asia, the Middle East, the Pacific, Latin America, and the Caribbean in the general principles of forestry and forestry practices. As of the end of 2002, there were 778 college graduates, 309 of them being overseas students. The Cyprus Forestry College is participating in the European *Erasmus* and *Leonardo da Vinci* programmes.

Since the College is an international training institution, the language of instruction is English. The College is residential, boasting its own accommodation, boarding and transport facilities.

The Cyprus Forestry College offers the following courses:

- a three-year Forestry Course, leading to the award of a Diploma in Forestry,
- a six-month Post-Diploma Course, leading to the award of a Higher Diploma in Forestry, and
- a Short-training Course, leading to the award of a Certificate in Forestry.

6. Forest research

The Research Section of the Department carries out only applied forest research dealing mainly with practical matters, such as: seed collection, seed viability, germination capacity, the protection of forest genetic resources (*in situ* and *ex situ*), natural regeneration problems, the establishment and management of seed orchards and clone banks, the monitoring of air pollution's effects on forests, etc.

There are no laboratories or qualified personnel for research in the academic sense. The Section is manned by one professional and three 'sub-professional' foresters.

★ The Czech Republic (CR)

Petr Zahradnik

Česká Republica,
territory: 78,900 km², population: 10.2 million,
capital city: Prague.

Introduction

Forestry represents a substantial part of the national economy of the Czech Republic. Employing approximately 30,000 people, it contributes 0.6% to Gross Domestic Product. After adding the related wood-processing industry (furniture, paper and pulp, etc.), the figure rises to around 15%. Forests cover roughly one third of the Czech Republic.

The Forest Act classifies forest as a national asset that is an irreplaceable part of the environment. The Czech Republic has cooperated actively in the Pan-European and world-wide process of forest protection based on sustainable management principles. Information on the results of the undertaken actions and the state of forestry is thoroughly processed by the Ministry of Agriculture every year, and then, it is published in a Report on the State of Forests and Forestry in the Czech Republic (as presented at the Ministry of Agriculture website: www.mze.cz).

In 2001, the Forest Management Institute at Brandýs n. Labem started a forest inventory in the CR which was completed in 2004. This inventory investigates the state of the forest at a given time, using a 2×2 km experimental plot network, thereby allowing its repetition at any time in the future. This is a unique process in the history of the Czech forestry, as the data are to be investigated using unified mathematical and statistical methods before being

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[1] Information on the results of the undertaken actions and the state of forestry is collected by the Ministry of Agriculture every year, and then, it is published in a Report on the State of Forests and Forestry in the Czech Republic and made available at the Ministry of Agriculture website (www.mze.cz).

processed for both CR territory and regional and natural forest areas. The principal data are directly investigated by means of the latest field devices, mainly involving the mapping of particular experimental plots and the measuring of parameters of individual trees. Other forest environment data, such as terrain characteristics, descriptions of individual tree species, grass and herb species, soils and the quality of forest roads are given verbally. Other data on the state and development of the CR forests will be derived from the processed results.

1. Forest characteristics

In 2002, the forests of the Czech Republic covered 2,643,058 hectares, *i.e.* 33.5% of the total area of the country. During the last more than 100 years, the forest area in the CR has increased steadily, including 14,000 hectares in the last 10 years (Fig. 1). At present, the proportion of land covered with coniferous species is 76.1%, and that with broadleaves is 22.8% (the remaining areas are non-forested clearings). The largest area is still covered by spruce – 53.8%, followed by pine (17.4%), oak (6.5%) and beech (6.2%). The last few years have seen the share of broadleaves increasing, mainly at the expense of spruce (Fig. 2), which is a positive phenomenon.

Forest cover in the Czech Republic is more or less well balanced, even though there are, in general, fewer forests at lower altitudes (Fig. 2).

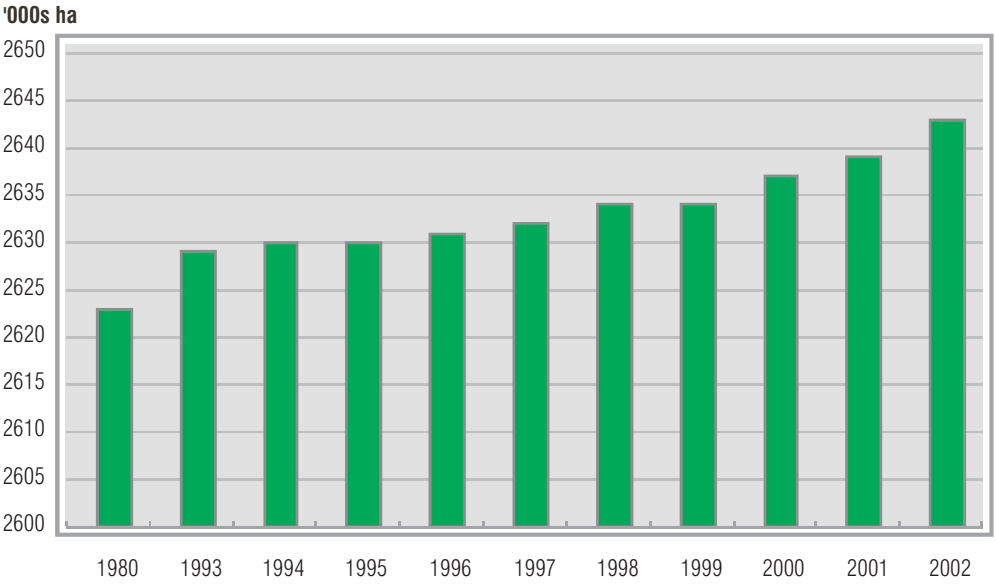


Fig. 1. Changes in forest land area in 1980–2002

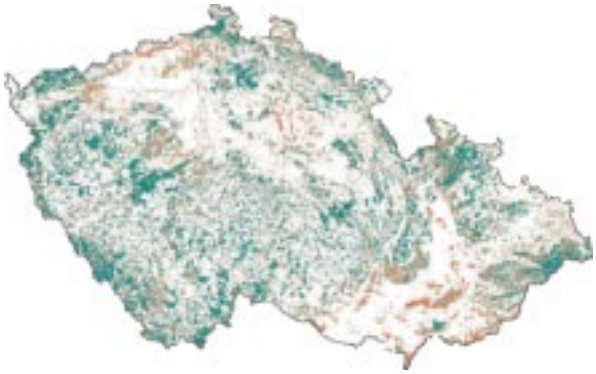


Fig. 2. Forest cover (green – conifers, red – broadleaves)

Forest categories

The categorisation of forests according to their functions is based on the Forest Act. A distinction is drawn between productive forests, protection forests and special-purpose forests. Protection forests are those growing at extremely unfavourable sites (e.g. debris, steep slopes, non-stabilised sediments and sands, peatlands, tailings, spoil banks, etc.), at high-elevations and in the dwarf mountain pine zone. Forests in spring water protection zones and in areas with healing natural mineral waters, forests in national parks and national nature reserves are all classified as special purpose forests, as are forests in the landscape protection areas and natural reserves, health-resort forests, suburban forests with enhanced recreational functions, and those serving research and educational purposes. These are also forests with enhanced soil-and-water-protection functions, with climatic or landscape-forming functions, or those of value in preserving biodiversity (for example within the NATURA 2000 network), forests in certified reserves and pheasantries, as well as forests requiring special management because of the public functions they play. At present, 76% of forests are productive forests, 3.5% are protection forests, and the remaining 20.5% are special-purpose forests. Developments in recent years have entailed an increase in the area of special-purpose forests at the expense of productive forests, and this trend will certainly continue in the coming years.

Volume, increment and harvest

The average age of forest tree species is 63 years (62 years in the case of broadleaved trees). This age structure is not yet satisfactory for it being unbalanced. The age classes IV and V (61–80 and 81–100 years of age, respectively) are over-represented, while class III (41–60) is under-represented. This in part reflects the insect-induced calamities in the past.

The average rotation period is 111 years for productive forests, 124 – for the special-purpose forests and 153 – for protection forests. The average regeneration period is 30 years.

The current, average stocking of production forests is 90%, of protection forests – 81% and of special-purpose forests – 89%.

In recent years, stand volume and increments have shown some increase. The average volume per hectare of forest land is 242.5 m^3; and 250.4 m^3 for forested area without clearings. The average volume of timber felled is 11,500,000 m^3 over bark per year, or 4.4 m^3 over bark per hectare, annually. Average growth is 16,800,000 m^3 over bark annually, while the total current increment is 20,200,000 m^3 over bark. The total average increment per hectare of forest area is 6.5 m^3 over bark per year, while the total current increment is of 7.8 m^3 over bark annually.

Over the last 70 years, the total supplies of timber have more than doubled. At present, they reach the value of 641,000,000 m^3 (Fig. 3).

Over the past five years, there has been sort of a levelling out of the total amount felled (Fig. 4). In 2002, a total of 14,540,000 m^3 of timber was harvested. Of this, 13,010,000 m^3 came from coniferous and 1,530,000 m^3 from broadleaved stands. After recalculation, we arrive at 1.432 m^3 of timber per capita and 5.50 m^3 per hectare.

In 2002, tending operations were carried out over 138,000 hectares of forest. In the same year, 22,000 hectares of land were reforested, nearly 4,000 hectares of this entailing natural regeneration.

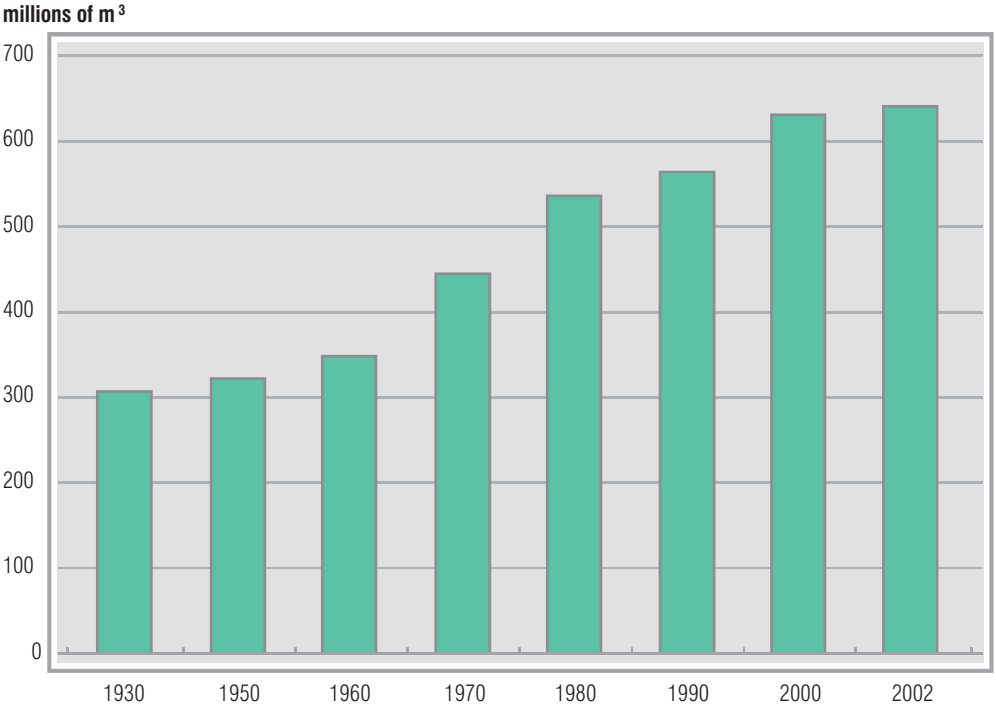


Fig. 3. Growing stock volume in 1930–2002

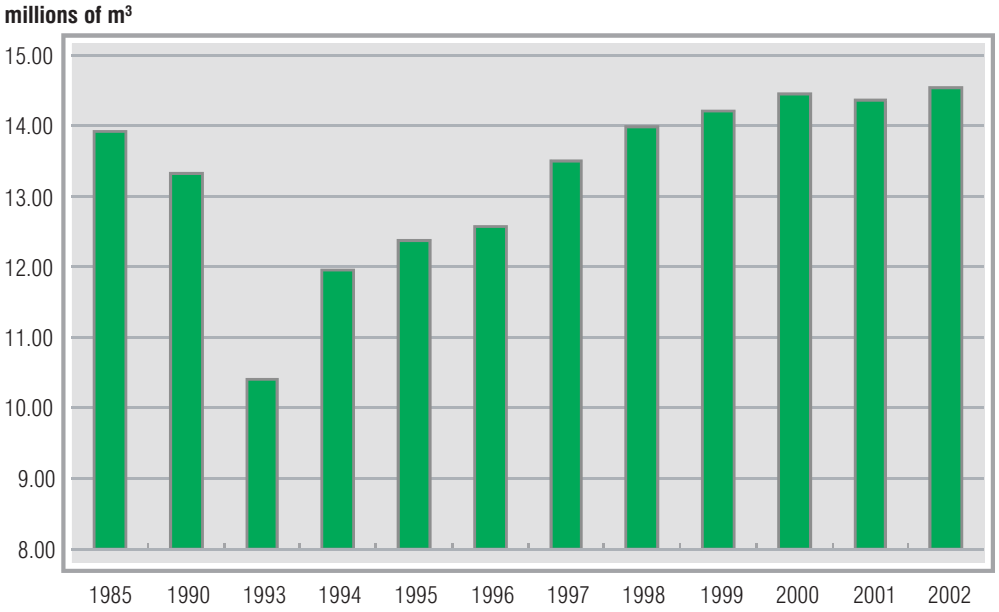


Fig. 4. Volume felled annually in the period 1985–2002

2. Legal and organisational forms of forest holdings

Forest ownership

Restoration of ownership rights, or the rights to use land with a view to forest functions being served is governed by Act no. 229/1991. After more than 10 years of enforcement of the Act, more than 50,000 claims to an area of 355,000 hectares have been filed, of which 46,000 cases (involving 29,000 hectares) have been concluded. In many cases, the claims in question were found to have been false. At present, about 1,800 cases are still subject to legal actions at the competent land offices or courts.

Restitution of the rights to use, on the basis of the entries in property registers, as well as enforcement of owners' claims thereto is required in 136,000 cases. At present, roughly 4,000 cases remain undecided on account of their unclear legal status (for instance inheritance, joint ownership shares, etc.).

Except claims for the restoration of the ownership title to land in accordance with the restitution acts, controversial proceedings are held in court. According to the claimants, the confiscation of lands after the Second World War was illegal. While there are only a few such complaints, they represent large areas of forest land.

The issue of the restitution of church property has yet not been decided. The former church property is estimated at approximately 170,000 thousand hectares of forest land, which represents 6.5% of the entire area of such land in the CR.

Forests under the state administration account for 60.7% of the forest area in the CR; while municipal and regional forests represent 15.0% of the total, forests of forest cooperatives – 1.0%, and other private forests – 23.3%.

The state institutions in charge of forest management are listed in the following table.

Table 1. State-owned entities in charge of forest management

Specification	Forest area	
	'000s ha	%
Forests of the Czech Republic, joint-stock company	1,396	86.2
Military Forests and Farms, joint-stock company	127	7.8
Krkonoše National Park	29	1.8
Šumava National Park	48	3.0
Podyjí National Park	5	0.3
České Švýcarsko National Park	8	0.5
Office of the President of the Czech Republic	6	0.4
Total	**1,619**	**100.0**

In 2000, forests belonging to universities and colleges providing education in forestry were included in this category; however at present they belong to individual regions (a total of approximately 20,000 hectares, or about 0.3% of the total forest area).

The private ownership structure is unfavourable from the viewpoint of effective forest management. More than 75% of private owners have lands with area smaller than one hectare. Only 0.3% of landowners have more than 50 hectares. The average area of private forest plots is 3 hectares.

The structure of municipal forest lands is much more favourable. The cases where municipalities manage estates smaller than one hectare are rare. More than 50% of the plots do not reach 11 hectares, and less than 1% of them extend over more than 1,000 hectares. The average area of municipal forest property is 78 hectares.

The Forests of the Czech Republic, a state-owned enterprise is the main organisation in charge of forest management in the CR. It was established by the Ministry of Agriculture in 1992 and has been reorganised several times ever since. Its headquarters is in Hradec Králové. It has a two-tier organisational structure. The first tier comprises the General Directorate (generální ředitelství) and 13 Regional Inspectorates. The second tier of the organisational structure consists of 85 forest administration units (forest districts), 5 forest enterprises, 1 seed farm and 7 regional water boards. Apart from standard forest management, the Forests of the CR enterprise takes care of roughly 20,000 watercourses. It also functions as a professional forest manager as regards small-scale ownership and provides forest protection services. Reforestation, silvicultural and logging operations for the CR Forests are performed by joint-stock companies, or other entities.

Legal basis of forest management

Act no. 289/1995 on forests with later amendments and supplements (*i.e.* the Forest Act) is the principal legislative standard in forestry. The Minister of Agriculture also has issued some legislative regulations complementing the Forest Act included in 10 different decrees. 2003 brought the adoption of Act no. 149/2003 on the introduction of reproductive material of forest tree species, important species and artificial hybrids certified for forest regeneration and reforestation, as well as the amendment of some related laws (the Act on trade in the reproductive material of forest tree species); this Act was followed by an executive decree. The CR legislation on forestry is fully compatible with the EU legislation. A list of all legislative regulations concerning forest management is presented in Appendix 1. Some other Acts are more or less related to forest management, mainly Act no. 114/1992 on the protection of nature and landscape, which is focused especially on forests in the National Parks. Wildlife management is in turn embodied in Act no.449/2001 on wildlife management, as well as in two decrees of the Minister of Agriculture.

It is necessary to emphasise that the legislative provisions include a duty on owners of the forests larger than 50 hectares to manage those forests in line with forest management plans (FMPs). An FMP is drawn up for forests with an area of up to 20,000 hectares. It sets the obligatory indicators, such as the maximal felling volume and the minimal proportion of ameliorative reinforcing tree species. For State-owned forests and municipal forests with stands under 40 years of age, a minimal area of obligatory tending operations has been specified. Owners of forests smaller than 50 hectares can use an FMP also. If they do not do so, forest management schemes (FMSs) are worked out for them in line with the state administration's demands. After the handing over of a protocol, a forest owner is deemed to have complied with the FMS. The obligatory indicators for areas larger than 3 hectares are: tota! maximal felling volume and the required proportion of ameliorative reinforcing tree species during stand regeneration, or just the maximal felling volume in the case of estates smaller than 3 hectares. If an owner fails to comply with an FMS, he or she must apply to the state administration for a permission to harvest more than 3 m^3 of timber per hectare in a year. A FMP or FMS is usually planned for a period of 10 years. The owner pays the costs related to the preparation of an FMP, while the costs related to an FMS are paid by the State.

The owner is obliged to assure forest management in cooperation with a forest manager. If the owner finds no one to perform the task, the state administration appoints a forest manager and pays for the work done.

A forest owner can claim compensation if the management work requires compliance with some restrictions. Moreover, the State supports forest management through grants for:

- technologies that are environmentally friendly or close-to-nature,
- the tending of stands under 40 years,
- proportional enhancement of ameliorative reinforcing tree species,
- regeneration measures for forests damaged by air pollution and forests declining due to anthropogenic impacts,
- regeneration measures for stands with unsuitable or substitute tree-species composition,
- measures supporting reforestation in mountainous areas,
- forest protection,

- measures ensuring the non-wood functions of forest,
- measures for controlling forest pests and also in the case of other unpredictable circumstances and extraordinary damage affecting the condition of forests,
- associations of small forest owners and the management work in the forests belonging to members of such associations,
- the drawing up of plans.

Every year, the Ministry of Agriculture publishes obligatory regulations regarding the allocation of grants for a given year and supervises their use. In 2002, financial means worth a total of 785 million crowns were released from the state budget for the above mentioned purposes.

Forest institutions:

Forest Societies

- The Czech Academy of Agricultural Sciences – a scientific advisory body to the Minister and the Ministry of Agriculture headquarters (www.cazv.cz).
- The Czech Forestry Society – a voluntary, non-political, social and professional organisation, associating natural and legal persons whose professional work is or was related to forest or who are forest owners (www.cesles.cz).

State administration

Bodies of the state administration specified under the Forest Act in its currently binding form are:

- The Ministry of Agriculture,
- regional offices,
- municipalities with extended competences.

The body approved by the Minister of the Environment's special legislative regulation is responsible for state administration of the forests in National Parks. The Ministry of the Environment also exercises supreme state supervision.

Private owners associations:

- The Association of Owners of Municipal and Private Forests is a voluntary organisation established with the view to managing municipal forests, associating municipal forest owners, legal persons and owners of private forests. The Association supports the interests of non-state forest owners as regards the process of creating forest policy and legislation, also ensuring methodological assistance in managing forest estates, advisory activities, trips and seminars on forestry subjects (www.svol.cz).
- The Association of Forest Owners and Entrepreneurs in Forestry deals with forestry issues, provides advising to private forest owners in the field of management, subsidies, legislation, economics and tax issues.
- The Czech Forestry Unity is a voluntary professional organisation associating regular members, active and retired professional foresters, and forest school students.
- The Czech Association of Entrepreneurs in Forestry represents firms involved in forestry, and the wood and paper industries (www.caplh.cz).
- The Czech Forestry Association associates legal persons employed in forestry.

- The National Forestry Committee is a special voluntary and non-profit organisation associating professionals from all fields of forestry and related branches, especially where these are interested in the environment.
- The Association of Forest Workers in Nurseries of the CR associates natural and legal persons in a civil society foundation set around the activities of several producers of the planting stock of different tree species (www.lesniskolky.cz).
- The Association of Mensurational Offices is an association of legal and natural persons who are licensed to prepare FMPs and FMSs (www.taxace.cz).
- The Czech Chamber of Professional Forest Managers associates all interested persons, natural or legal, who have the licence of professional forest manager (www.ckolh.cz).

3. Education in forestry

Forest education in the Czech Republic has a long tradition. The first forest school in Bohemia focused on enhancing the forest staff skills was established as early as in 1773 at Blatno in the Krušné Mts. (for 20–30 apprentices in a year). The school was dissolved in 1791 due to its founder's departure. During the 19th century, some forest technical schools were established, only to disappear subsequently. Stable forest education began to develop only when the independent Czechoslovakia was founded in 1918.

The Faculty of Forest and the Environment (FFE) of the Czech University of Agriculture (CUA) in Prague (www.lf.czu.cz) was opened in 1919 and closed in 1965, when it was transformed into the Institute of Applied Ecology and Ecotechnics. In 1990, the University was reopened. In 1935, the Czechoslovakian state authorities gave over the castle at Kostelec n. Černy Lesy together with the surrounding forests, the former property of the Liechtenstein family, for the teaching of future forest engineers. This castle, having been greatly modernised, is still serving the students of the forestry faculty (and of the Czech University of Agriculture as well). At present, the study here is divided into three branches – forestry, landscape engineering and wood-production. The departments are as follows:

- Department of Ecology,
- Department of Silviculture,
- Department of Dendrology and the Breeding of Forest Tree Species,
- Department of Forest Management,
- Department of Forest Protection,
- Department of Harvesting and Wood-processing,
- Institute of Wood Engineering,
- Department of Economics and Forest Management,
- Department of Water Management,
- Department of Construction,
- Department of Biotechnical Landscape Arrangements,
- Truba Breeding Station and Arboretum,
- Institute of Applied Ecology.

At present, there are 17 professors, 15 associate professors, 50 assistant professors and 50 scientific, technical and administrative staff at the FFE of the CUA. Approximately 1,000 students are pursuing education in the Faculty.

Research is concentrated on four research objectives, and various research projects from grant agencies. The research objectives are:

- the use of exotic forest tree species in multifunctional forest management and in forest complexes– woods of the CR,
- multifunctional forest management in limited socio-economic and natural conditions,
- possibilities for enhancing ecological stability, water retention and accumulation in the environment,
- regeneration of the functional forest ecosystems of the Krušné Mts.

The Faculty of Forestry and Wood Technology at the Mendel University of Agriculture and Forestry in Brno (www.mendelu.cz) was also established in 1919 and (except for the years 1939–1945 during which all Czech universities were closed), its activities have not been disrupted. At present, the Faculty has 8 professors, 16 associate professors, 100 assistant professors, 2 assistants, 7 scientific staff and 94 other employees within the University. In 2003, nearly 1,500 students were studying there.

Education can be pursued under three study programmes – forestry engineering, landscape engineering and wood technology engineering. The Faculty has the following departments:

- Department of Geodesy and Photogrammetry,
- Department of Geology and Pedology,
- Department of Mathematics,
- Department of Wood Science,
- Department of Forest Botany, Dendrology and Typology,
- Department of Languages,
- Department of Economics and Management of Forestry and the Forest Products Industry,
- Department of Forest Engineering and Reclamation,
- Department of Forestry and Forest Products Technology,
- Department of Forest Protection and Hunting,
- Department of Forest Establishment and Silviculture,
- Department of Forest Management,
- Department of Primary Wood Conversion,
- Department of Furniture and Special Wood Products,
- Institute of Forest Ecology.

The Faculty participates in the implementation of two research objectives:

- Timber from anthropogenicly-impacted forests – its properties, use and influence on the environment.
- Sustainable management of forests and the landscape – from conception to implementation.

The University cooperates on many grant projects.

On the basis of the Bologna Conference of the Representatives of Universities and Technical Schools, the two universities offer full and part-time courses of study for a Bachelor's, Master's and Doctor's degree, fully complying with the European standard.

The CR has 12 technical schools of forestry *inter alia* in Hranice, Písek, Šluknov, Žlutice, Vimperk.

4. Forest research

The first forest research institute in the independent Czechoslovakia was established by virtue of the Minister of Agriculture's decision of 31 October 1921, reflecting the circumstances of an outbreak of nun moth necessitating the establishment of an Institute for Forest Protection. In the years 1922–1933, other forest research institutes were established – the Biochemical Institute (Prague, 1922), the Institute of Forest Management and Forest Economics (Brno, 1923), the Silvicultural Institute (Brno, 1923) and the Institute of Forest Policy and Management (Brno, 1933).

Since 1929, representatives of the forest research institutes have become IUFRO members. After the World War II, the restoration of forest research commenced and many new institutions dealing with dendrology and geobotany, amelioration, harvesting and technologies, forest transport and construction were established. The integration processes had gradually led to the foundation of the Forestry and Game Management Research Institute (FGMRI) at Jíloviště-Strnady (January 1, 1959).

After the big changes that occurred at the Jíloviště–Strnady FGMRI in 1989, it was transformed from a planning unit into a contributory organisation in 1992. The number of employees decreased from 500 to 190, and the number of research fields was reduced. At present, the FGMRI specialises in the following fields:

- silviculture (including forest establishment),
- biology and breeding of forest tree species (including forest seed management),
- forest ecology,
- forest protection,
- forest policy.

The FGMRI comprises experimental laboratories, a forestry information centre, an international accredited seed control laboratory, an accredited laboratory for reproduction material health, and a reference laboratory for testing the biological effectiveness of pesticides for forestry.

There are also two research stations – at Opočno (silviculture) and Uherské Hradištì (reproduction resources), plus three designated working sites at Znojmo, Frýdek-Místek and Plzeň-Bolevec and a demonstration plot at Březka.

In 2004, two research projects were implemented, as follows:

- forest stabilisation functions in biotopes damaged by anthropogenic activities in the changing environmental conditions,
- the breeding of forest tree species and preservation of gene resources of valuable and threatened populations, using biotechnological methods and molecular biology, as well as experience from seed management in forestry.

In 2003, the FGMRI was working on 103 projects, including 13 projects for the National Agency for Agricultural Research (NAZV), 3 research projects, 7 projects of grant agencies and 49 continuous subjects and expertises.

The ninety-three employees are university graduates, of which 47 from the forestry faculty and 30 with a scientific degree.

Denmark

Frans Richard Bach

The Kingdom of Denmark (Kongeriget Danmark), territory: 43,100 km², population: 5.2 million, capital city: Copenhagen.

1. Forest characteristics

Forest cover

Compared to other European Union member states, Denmark's forest area is small, relatively scattered and non-homogeneous. The most recent national forest inventory, taken in 2000, calculated total forest area to be 486,000 hectares, the equivalent of 11% of the country's total land area. The historical development of forest areas in Denmark is shown in Fig. 1. Due to overexploitation and agricultural expansion, the area reached its minimum ever level during the Napoleonic Wars around 1800.Though still small, the Danish forest area has increased considerably over the last 200 years.

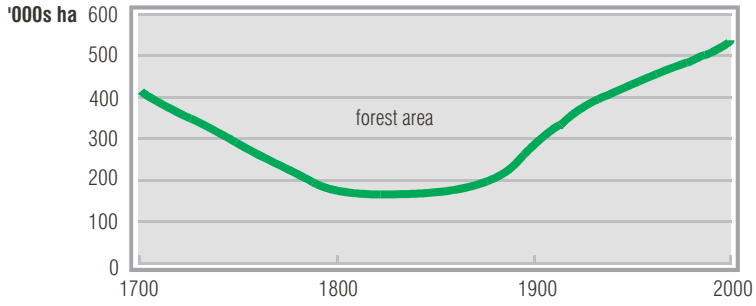


Fig. 1. Historical development of the Danish forest area, 1700–2000 (Source: www.skoveniskolen.dk)

Frans Richard Bach – Miljøministeriet Skov-og Naturstyrelsen, Haraldsgade 53, DK – 2100 Copenhagen (København Ø).

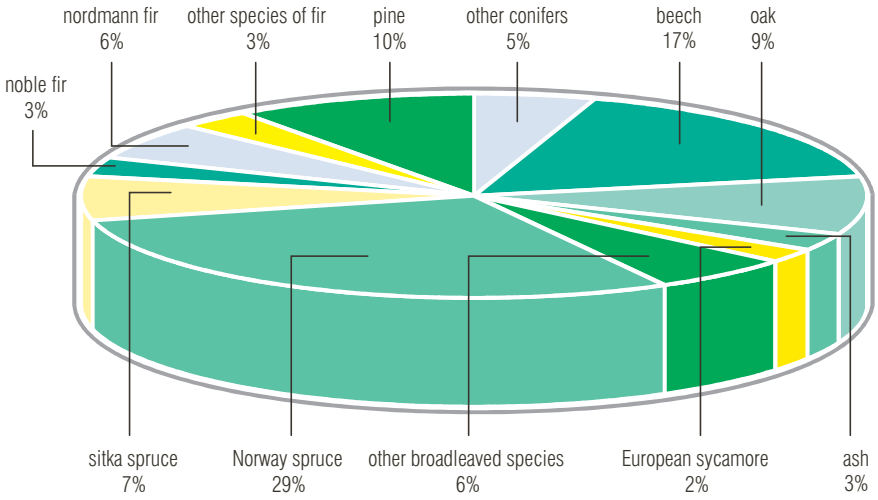


Fig. 2. Overview of Danish forests by tree species in 2000 (Source: Statistics Denmark)

This development has been promoted through various programmes. Afforestation programmes are still in place and the forest area continues to increase. Fig. 2. shows a current overview of forest by species.

Species composition

The breakdown in forest areas by species is a reflection of historical developments. Afforestation has mainly taken place in the western parts of the country, where soils are relatively poor. Here, conifers have been the only viable option – at least until a stable forest climate becomes established. Consequently, Norway spruce has become the main tree species, though this species, like most other conifers, is not indigenous to Denmark, but rather brought in from other European countries. For many years, forestry based on conifers also proved more economically viable than forestry based on broadleaves, a factor that further promoted this direction of development, with the result that conifers also expanded into the naturally occurring broadleaved forest of the central and eastern parts of the country. Fig. 3 shows the impact of afforestation on the areas occupied by the two main types of tree, 1881–2000.

As can be seen, the total area of broadleaved forest was almost constant for more than 100 years. However, various policy efforts, plus developments connected with markets, costs and methodologies making hardwood relatively more attractive, have led to an increase since 1990 in the areas featuring broadleaved species. Subsidies have been provided for conversions from coniferous forest to broadleaved forest, and most afforestation activity has been based on broadleaved species. The government has undertaken afforestation on state-owned land, while also providing subsidies for afforestation on private land. These activities have been co-funded through the EU Rural Development Programme. The impact of this afforestation programme is indicated in Fig. 4.

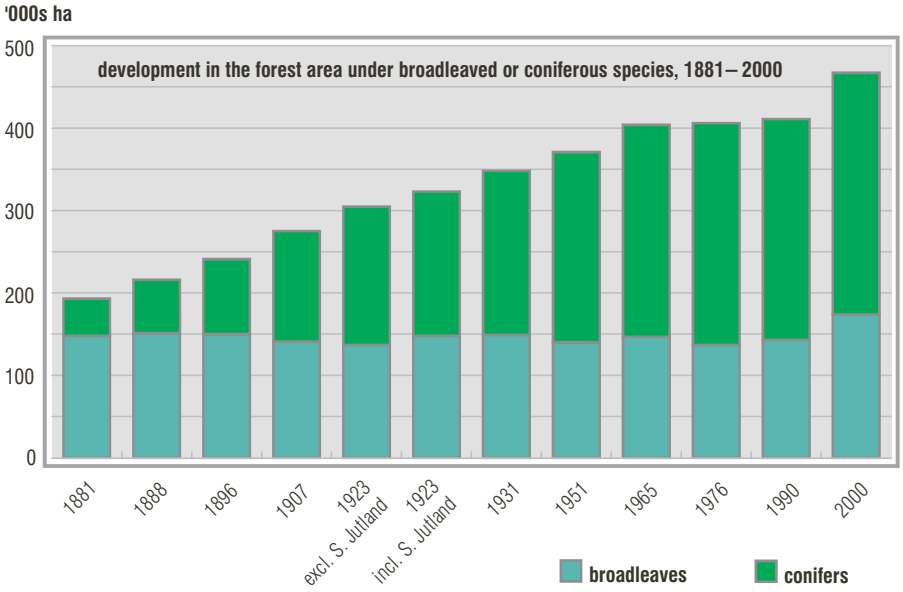


Fig. 3. Impact of afforestation on areas under various tree species (Sources: various, incl. Statistics Denmark)

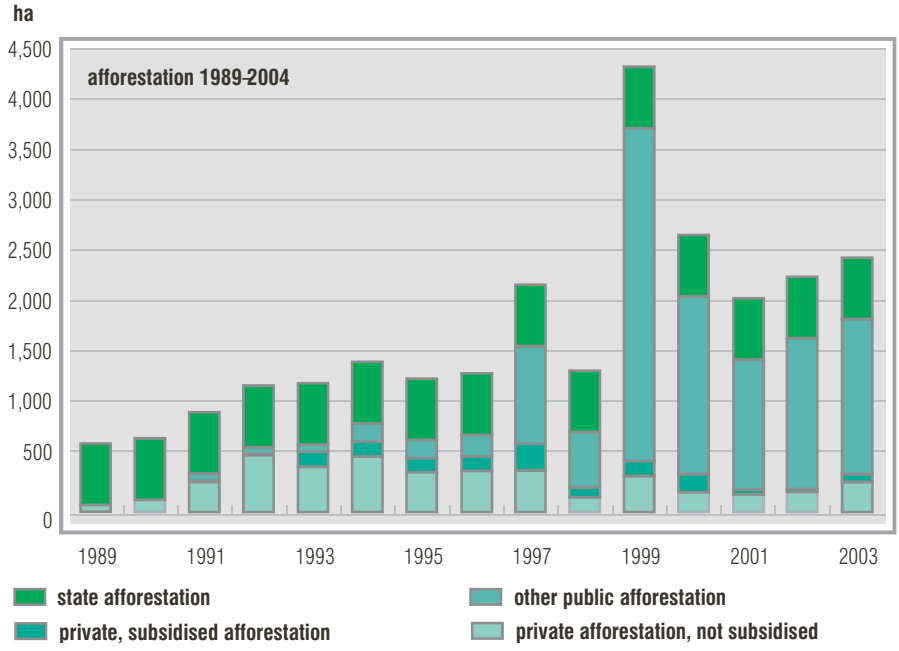


Fig. 4. Afforestation in Denmark (Source: Danish Forest and Nature Agency)

Volume and increment

Fig. 5 shows annual wood harvest in the years 1993–2003 in cubic meters.

As can be seen, average annual harvest is approximately 2 million m^3. However, wind damage does occur and the impact of the December 1999 storms is clearly shown by the figures. A similar disaster hit Denmark in January 2005. Annual cuts of the above dimensions are far below the annual increment, an estimated 4.5 million m^3 in the period 1990–1999 and 5.2 million m^3 in the years 2000–2009. As a result, the standing volume of timber in forests has been increasing (e.g. from 65 million m^3 (146 m^3 per hectare) in 1990 to 78 million m^3 (37% broadleaved, 63% coniferous, 160 m^3 per ha).

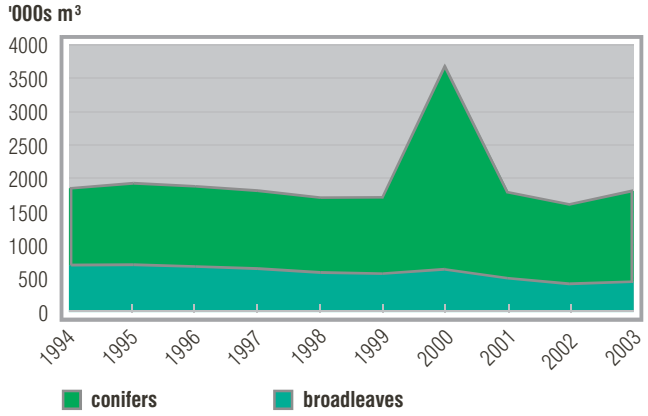


Fig. 5. Wood harvest 1994–2003 (Source: Statistics Denmark)

2. Logging and wood processing

Not all the increment is available for logging. The age distribution of forests is uneven, and much increment is in young stands. Furthermore, some forests are subject to logging restrictions.

The forest sector is currently working to overcome a number of economic constraints. In particular, timber prices have decreased, as Fig. 6 makes clear.

As Fig. 7 shows, the economic importance of wood production has decreased, compared with other income opportunities in forests, such as the production of Christmas trees and decorative greenery, or else subsidiary incomes that mainly include payment for hunting rights and house rentals.

While the Danish forests provide for an annual cut of around 2 million m^3, the annual consumption in Denmark is approximately 8 million m^3. Consequently, Denmark is a large net importer of timber products. However, consumption, manufacturing, production and trade together form a complex context. While the primary forest industry is a minor one, wood processing is in general economically quite important. Denmark is a net importer of wood products, but it is also an exporter as shown in Table 1.

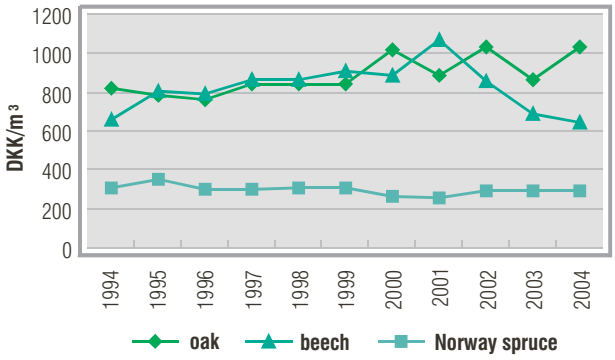


Fig. 6. Price development for main species 1994–2004 (till 2002 – fixed prices, 2003–2004 – forecast) (Source: Danish Forest Association and Forest & Landscape, Denmark)

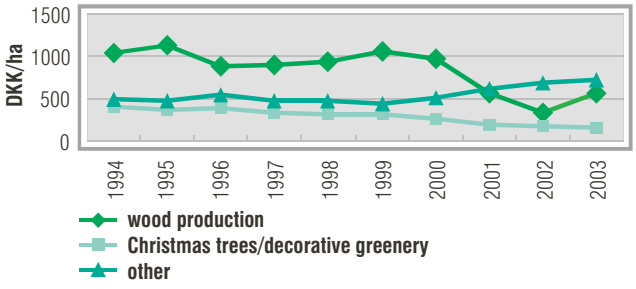


Fig. 7. Development of sources of income in the private forest sector (Source: Danish Forest Association)

Table 1. Import and export of timber. Average figures 1994–2003, excluding fuel wood (Based on FAOSTAT)

	Sawn wood		Round wood	
	Annual export, m³	Annual import, m³	Annual export, m³	Annual import, m³
Softwood	250,000	3,200,000	180,000	200,000
Hardwood	30,000	430,000	430,000	380,000

Source: *FAOSTAT*

Fig. 8 indicates the value of exports and imports of manufactured and non-manufactured wood products. Clearly, this figure shows a lower value for exports compared with imports, which is explained by Denmark being a small country in forestry terms, but with a relatively high consumption of wood and wooden products. However, the difference between the value of exports and imports is surprisingly small. This reflects the export of large volumes of highly manufactured wooden products, and thus the importance of the Danish wood processing industry.

The development of the wood-processing industry, which is currently worth DKK 35 billion in revenue is shown in Fig. 9.

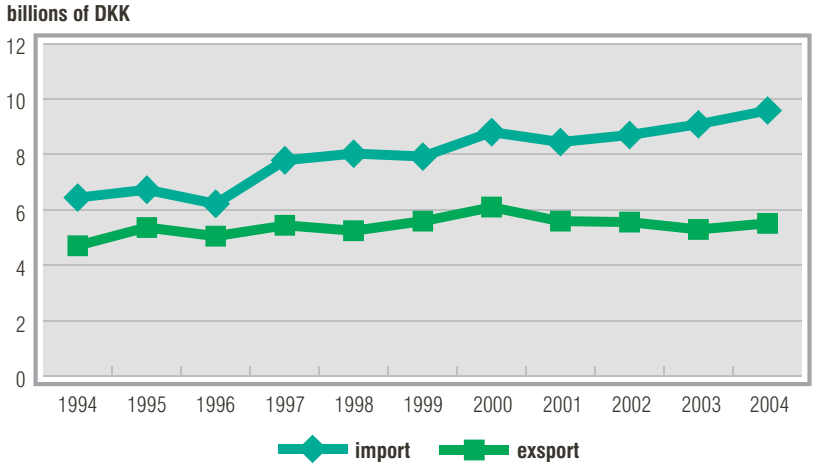


Fig. 8. Value of imports and exports of manufactured and non-manufactured wood products 1994–2004 (Source: Statistics Denmark)

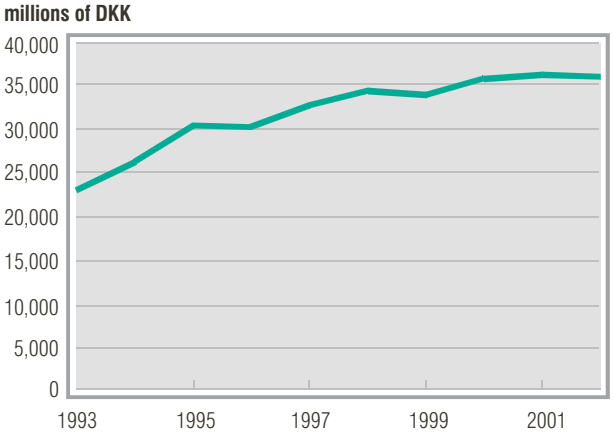


Fig. 9. Revenue (fixed 2002 prices) from the wood-processing industry, 1993–2002 (Source: Forest & Landscape, Denmark)

3. Nature protection

Approximately 85% of Denmark's forest areas are forest reserves. This type of forest is legally protected and may not be converted to other types of land use. A number of programmes have been implemented, including legal protection schemes and voluntary agreements with forest owners aiming at various protection schemes ranging from special management regimes through to strict nature reserves (with zero management).

Approximately 17,000–18,000 hectares come under such protection. The protected forest areas will be greatly expanded in the future.

One major challenge is the implementation of Natura 2000 in Denmark. Mapping and registration of forests for Natura 2000 areas was begun in May 2005. It is expected that 50,000–70,000 hectares of forest are located within Natura 2000 areas, of which 14,000 hectares are likely to be included in one kind of specific protection scheme or another. Some 9,000 hectares of this will probably be privately-owned forest. To supplement this protection, forest areas that are particularly valuable in terms of nature, but not protected under the NATURA 2000 scheme, will in any case be registered and made subject to protection through voluntary agreement.

Socio-economic importance of forests

The primary forest sector contributes only approximately 1% to Denmark's Gross Domestic Product at factor costs, and employs only approximately 4,000 persons – or less than 0.2% of the labour force. Although the primary forest sector provides only a limited contribution to the economy, there are some trickle-down economic benefits for the wood-processing industry, which is much larger and employs many more people.

Though covering only 11% of the land area, the forests are an important element in the landscape, and important in terms of landscape amenities. One particularly important social function of Danish forests is accommodation of public recreation. Annually, the forests receive 75 million recreational visits, making them the most important habitat for public recreation. Studies show that people are willing to pay more for housing when it is near a forest area. Many forest owners own forest not only for economic reasons, but also in order to gain access to personal recreational opportunities, as shown in Fig. 10 below, which is based on a study of private forest owners. Obviously, the larger the forest, the more its economic importance.

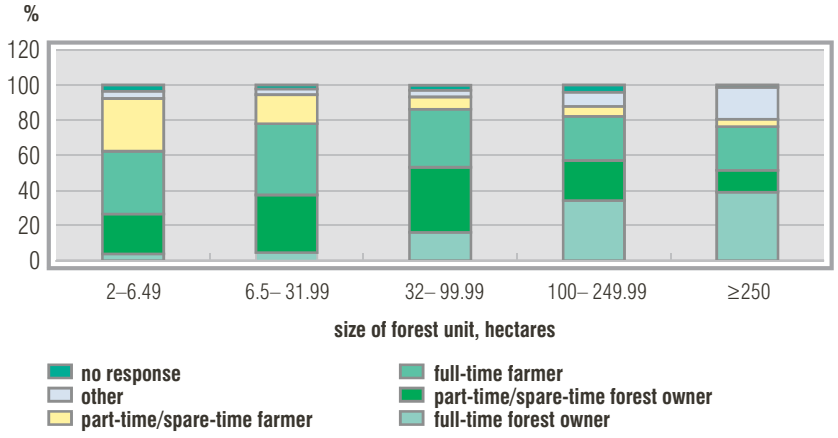


Fig. 10. Results of a questionnaire study among forest owners on how they see their situation (Source: Forest & Landscape, Denmark)

Ecology and environment

Since Denmark was once a country covered by forests, much of its flora and fauna are typical for this original type of habitat.

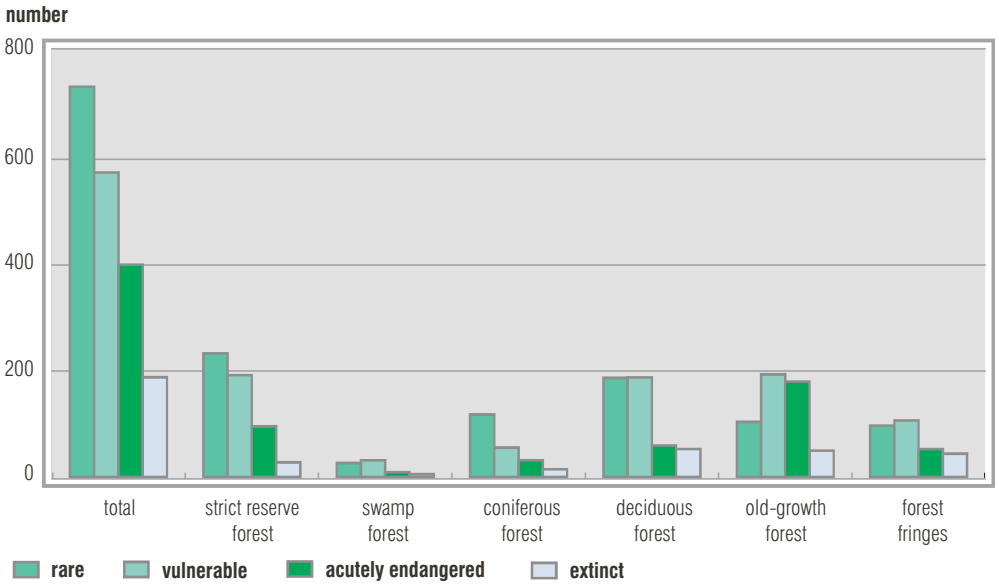


Fig. 11. Presence and status of Red List species in forests (Source: Forest & Landscape, Denmark)

Forests also support positive environmental features other than biodiversity and ecology. Groundwater resources are well protected under forest areas and the Danish water authorities take advantage of this in water planning. Carbon sequestration is also important and the Danish afforestation programme will contribute to Denmark's compliance with the Kyoto Protocol.

Public access to forests

Public access to forests for recreational purposes is not regulated by the Forest Act, but by the Nature Protection Act. The public enjoys legal access to all forests covering more than 5 hectares. In private forests, such access is only granted during daylight hours and on paths, roads, etc., whereas these limitations do not apply to publicly-owned forests.

Financing

Afforestation and nature-protection initiatives are costly. Funding is required for information activities, compensation for loss of ownership, subsidies for various management, afforestation and silviculture activities, planning, etc. In 2005, almost DKK 100 million was

allocated for these purposes. This will increase to DKK 150 million in the coming years. The EU Rural Development Programme contributes to this financing.

4. Legal and organisational forms of forest holdings

Forest ownership

As indicated in Fig. 12 below, most Danish forests are privately owned.

There are more than 25,000 individual forest units in Denmark. Consequently, most of these are very small. As Fig. 13 shows, most of small private forests are the property of

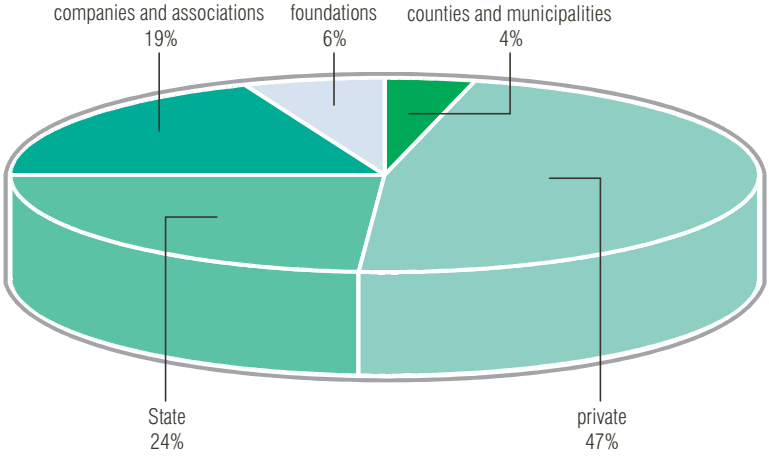


Fig. 12. Danish forest areas by ownership category (Source: Statistics Denmark)

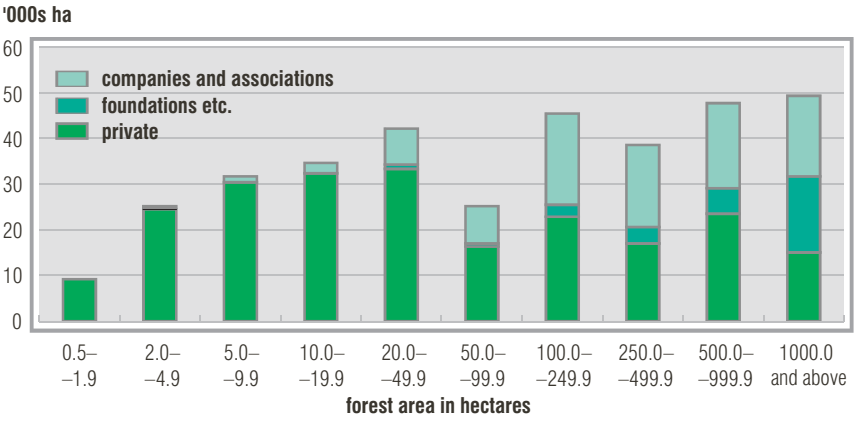


Fig. 13. Distribution of forest areas under private ownership by type and size categories (Source: Statistics Denmark)

private individuals, while larger management units are more and more commonly under institutional ownership.

The balance between privately-owned and publicly-owned forest has been quite stable for many years. Where the former category is concerned, the proportion under institutional ownership is growing, while personal ownership is decreasing.

The National Forest Programme 2002

Since the 1980s, Denmark's forest policy has been based on policy documents endorsed at political level. The most recent strategy is the 2002 National Forest Programme, which was developed through a consultative process, involving stakeholder organisations and the general public. The programme lists a number of specific objectives, as indicated below:

Nature and environment	Long-term conversion to near-to-natural forest management principles, with the most important management objective by 2040 being 10% of the national forest area providing biodiversity.
Economy	Development of sustainable economic framework conditions for the forest sector.
Social concern	Maintenance and development of forests as a benefit for public welfare through opportunities for outdoor recreation and the experiencing of nature in forests.
Afforestation	Forest landscapes should cover 20–25% of Denmark after one tree generation (80–100 years) – and the scope and potential for natural habitats and processes should be strengthened in this effort.
Knowledge	Effective information sharing – access to updated and relevant knowledge as a basis for forest policy development and implementation through research, education, awareness-raising and the dissemination of information.
International objective	Promotion of sustainable forest management at global and regional levels.

The measures to be applied in implementing the National Forest Programme are:

- adaptation of legislation,
- dialogue,
- research and development,
- awareness-raising, dissemination of information and training,
- economic incentives,
- international co-operation.

Close-to-nature forest management

The concept of close-to-nature forest management is central to Denmark's National Forest Programme. Though this is not synonymous with the concept of sustainable forest management, the two are closely related. Close-to-nature forest management is a narrower concept, which relates only to actual forest operations. Where this forestry concept is

supplemented with a number of special considerations for ecological, economic and social factors, which is more broadly defined as sustainable forest management may be achieved.

The primary goal of close-to-nature forest management is to ensure economically sustainable wood production through the selection of species adapted or adaptable to local conditions. Another principle to be applied is maximum utilisation of the natural processes in the forest ecosystem, such as natural regeneration and continuity in forest cover. In this way, maintenance and improvement of the forest climate and soil conditions, genetic resources and consequently natural regeneration potentials and productivity will be supported. A forest managed in line with these principles will typically consist of a mixture of different tree species in different age groups, within which the use of pesticides and other ancillary materials is limited. It will be more robust and resistant to climate change, more diverse biologically and have more functions in terms of environmental protection.

The close-to-nature forest management concept also has a pronounced economic objective, though the Danish experience with the concept is at present limited, ensuring that the possible economic and environmental advantages and disadvantages are still being intensively debated, so that additional research and development efforts are required.

In the state-owned forests, an action plan for close-to-nature forest management was recently issued and is already being implemented. This is a long-term process expected to last over a period of one tree generation (80–100 years).

The voluntary certification schemes currently underway in Denmark also prescribe close-to-nature forest management. These market-based schemes are expected to gain more widespread use in Denmark in the coming years. It was also recently decided that a certification process should be put into operation in state forests.

The concept of close-to-nature forest management is based on a set of guidelines agreed upon by a wide range of stakeholder organisations of the forest sector. These guidelines refer to Pan-European criteria and indicators for sustainable forest management and include guidelines for:

- selection of species well adapted to local conditions, especially native species;
- single tree management among larger trees,
- maintenance of the productivity, stability and regeneration potential of forests by avoiding interventions that may damage the climate, soil conditions or biodiversity of the forest (for instance clear-cutting and the use of pesticides),
- the utilisation of natural regeneration and differentiation in forest management,
- development towards forests with a mixture of different tree species in different age groups.

Forest law

A major step towards implementing the National Forest Programme was a new Forest Act that came into force on 1 October 2004. The Forest Act attempts to simplify rules and regulations concerning forestry. This is aimed at promoting close-to-nature forest management. Compliance with the previous legislation required from forest managers and owners to adhere to quite strict rules in terms of forest management, silviculture, etc. In contrast, they will now have more freedom of choice, making it easier to “work with nature”.

The new Forest Act also includes detailed provisions for the Natura 2000 process and protection of other naturally valuable forest areas.

5. Structure and task of forest administration

The Danish Forest and Nature Agency

The Danish Forest and Nature Agency is the central forest authority responsible for enforcement of forest legislation, administration of subsidies, etc. It is a section of the Ministry of the Environment and consequently also responsible for formulating forest policy with regard to a number of international and regional issues. Furthermore, the Agency is responsible for the management of 192,000 hectares of state-owned land, of which 109,000 hectares is forest.

The Agency has a central office in Copenhagen with 230 employees, as well as 20 forest districts throughout the country, 6 of which are also regional centres. These districts have approximately 800 employees, of which 500–600 are forest workers. This Agency is not only engaged in forestry. It is also fully or partly responsible for a wide range of other issues, including, *i.a.*, nature protection, spatial planning, GMOs in agriculture, fresh water, landscapes, nature protection, public recreation, hunting, etc. The Agency's turnover in 2004 was DKK 840 million, of which DKK 550 million came from income – mainly from forestry – while the remaining DKK 290 million represented Government allocations.

Private forest owners associations

Denmark's private forest owners are organised within the Danish Forest Association. Smaller forest units may also be associated with Danish Forestry Extension, which also provides consultancy services on forest management, silviculture, etc. Such services are also provided by other organisations, such as DDH (Hedeselskabet) and others. These organisations may also assist in marketing and procurement. There are a number of organisations representing the timber industry, trade, retailing, etc. A number of "green" organisations are active in Denmark and participate in the debate on forest policies. These include WWF-Denmark, the Danish Society for Nature Conservation, Nepenthes, DOF (the Birdlife partner) and Greenpeace. Other users of forests – mainly of forest recreational opportunities – are represented in the Danish Outdoor Council, which is also an important forest stakeholder organisation.

6. Research and education in forestry

Danish forest research institutions have been merging over the past 15 years and in 2004, a number of institutions were merged to establish Forest & Landscape Denmark, an independent centre with its offices at the Royal Veterinary and Agricultural University of Denmark (KVL). This Centre undertakes research, education, extension and consultancy

services in the areas of forest, landscape and planning. Forest & Landscape has some 300 employees and an annual budget of about EUR 20 million. The Centre has seven locations throughout Denmark. Forest & Landscape Denmark engages in:

- research and development,
- education and training,
- monitoring,
- consultancy services and extension,
- ministerial services,
- development and environmental assistance.

Forest & Landscape Denmark is responsible for the national monitoring of forests and for forest statistics in Denmark, for developing and maintaining the Arboreta at Hørsholm and Charlottenlund, and for performing national, long-term forest trials.

In co-operation with the National Environmental Research Institute, Forest & Landscape Denmark is also developing methodologies for the monitoring and protection of forest biodiversity. In the coming years, forest-related research will concentrate on:

- environmental economics and environmental sociology,
- the environment and health, including outdoor recreation,
- the sustainable use of natural resources, including the development of close-to-nature forest management practices,
- environment and energy technology,
- the consequences of climate change.

Forest & Landscape Denmark is also developing Denmark's new national forest inventory, which will be based on sample plots. Previous inventories were drawn up on the basis of questionnaires sent to forest owners every ten years. The most recent inventory was carried out in 2000.

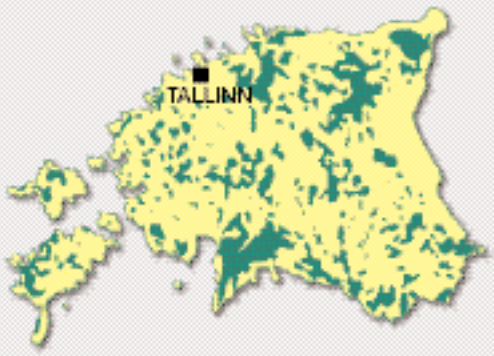
Forest & Landscape Denmark provides a wide range of educational opportunities such as forest worker, forest and landscape engineer and forest science education at B.Sc., M.Sc. and Ph.D. levels. Several other institutes and universities throughout the country also contribute to forest research and education, for instance universities providing biological science courses.

It should be emphasised that several programmes have also been launched with a view to providing information to the public and improving public awareness levels. These programmes target the general public, teachers and schoolchildren.

★ Estonia

Paavo Kaimre

The Republic of Estonia (Eesti or Eesti Vabariik), territory: 45,200 km², population: 1.35 million, capital city: Tallinn.



1. Forest characteristics

Forests cover more than half (51.9% or 2.27 million hectares) of Estonia's mainland territory. As the population density of Estonia is rather low (31.2 inhabitants per km²), this equates to 1.68 hectares of forest land and 335 cubic meters of growing stock per capita. These indicators surpass the World and European averages, as well as the corresponding indicators for many other European countries. The forest area available to supply wood is 2.11 million hectares (about 93% of the total).

The Estonian Forest Act categorises forest land, in terms of soil productivity, into productive forest land (with an annual increment of at least 1 m³/ha), and other wooded land (non-productive forest land and scrub land). The area of forests and the development of forest resources have been monitored for a long time, mainly on the basis of stand-by-stand forest inventories, but since 1999, National Forest Inventories (NFI) based on a sampling method have also been carried out. Under the NFIs, statistical methods are used to provide country-level information about forests operatively and economically.

During the second half of the 20th century, the area of forest land increased steadily and quite fast (from 1.42 million hectares in 1958 to 2.27 million hectares in 2003). The forest area increased as a result of the afforestation of unused agricultural land and the drainage of bogs between the 1960s and the 1980s.

In fact, the steady and fast aforementioned increase in forest area during the last 60 years was a 2.5-fold one (from 0.9 million hectares in 1940 to 2.27 million hectares in 2003), and was associated with more than a quadrupling of the growing stock (from 108 in 1940 to 451 million m³ in 2003).

Paavo Kaimre – Associate Professor, Director of the Institute of Forestry and Rural Engineering, Estonian Agricultural University.

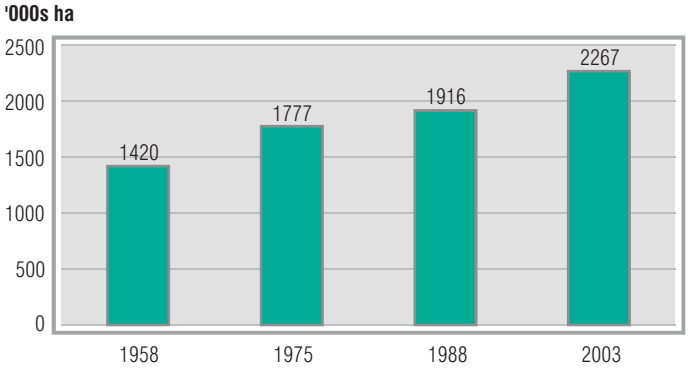


Fig. 1. Changes in the area of forest land (Sources: Centre of Forest Protection and Silviculture; Estonian Forest Survey Centre)

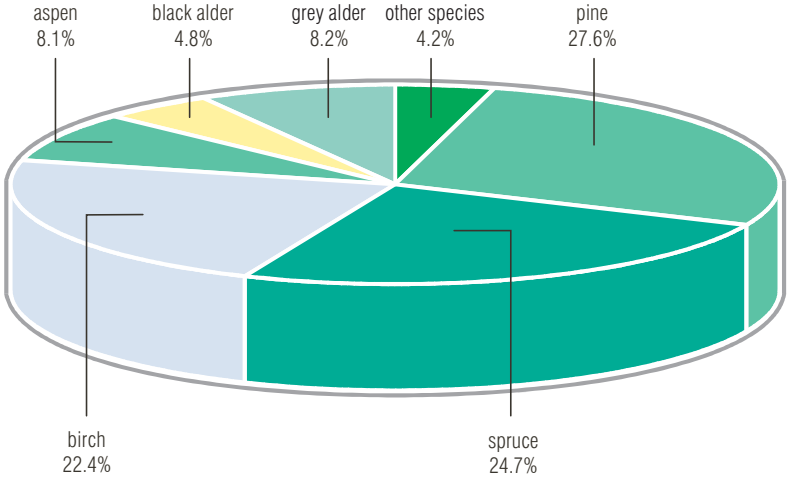


Fig. 2. Distribution of growing stock by tree species (Source: Centre of Forest Protection and Silviculture)

The main tree species in Estonia are Scots pine, Norway spruce and birch species. The coniferous forests prevail in state-run forest districts (62.1% of the total forest area), on account of the artificial regeneration and forest management activities. In privately-owned forests, the share of coniferous stands is 46.6%. The non-state-owned forests feature the dominance of birch stands with the major share of grey alder.

The growing stock of pine stands is 124 million m^3, of Norway spruce stands 111 million m^3 and of birch species (*Betula pendula* and *B. pubescens*) 101 million m^3. Grey alder and aspen also cover considerable areas and account for a significant volume (e.g. of 37 million m^3 in the case of grey alder), though they are less important from the economic point of view, as the demand for timber from these species is marginal as compared with the resources.

Stands are therefore under-exploited. The average volume of growing stock is 199 m^3 per hectare. The highest average level of stock (255 m^3) is noted in aspen stands, compared with the lowest in those with birch (167 m^3 per hectare).

2. Forest utilisation

Logging

The optimum annual felling volume in Estonian forests in the years 2001–2010 is calculated at 12.6 million m^3 over bark (Estonian Forestry Development Programme till the year 2010). For decades before the 1990s, the average annual felling volume remained at about 3 million m^3, before decreasing to 2 million m^3 in 1992 (at the time of general economic recession). The rapid increase in volume felled in the 1990s mainly took place in private forests (from 0.6 million m^3 in 1995 to 8.3 million m^3 in 2001). By contrast, volume harvested in the state-owned forests remained stable (at 3.0–3.5 million m^3 per year). This increase was driven by the progressing land reform, the reorientation of foreign trade, the restructuring and privatisation of the forest industry and the increased domestic demand for wood products. The intensity of felling has been higher in private forests (e.g. 5.99 m^3/ha in 2003 compared with 3.44 m^3/ha in the Forest Districts).

The annual average felling during the last few years has been 11.5–12.7 million m^3, the estimated annual increment being a comparable figure of 12.2 million m^3. The average figures are more or less in balance, however the forest management of certain private holdings has not been sustainable. To achieve sustainable management, the preparation of forest management plans is considered an effective measure and can be financed from public funds. The reforestation of clear-cut areas assumed rather moderate proportions in private forests during the 1990s. This was a source of disquiet for the forest administration, which has sought to find different solutions to the problem. A new version of the Forest Act which is intended to promote sustainable forest management is being prepared by the Ministry of the Environment.

The forests of Estonia are diverse in nature and offer a variety of different possibilities as regards utilisation. Forests are divided into three categories in line with the main purposes they serve.

- protected forests (134,600 hectares or 5.9% of forest land) maintain natural objects and processes;
- protection forests (441,500 hectares or 19.5% of forest land) protect the state of the environment and commercial forests;
- commercial forests fulfil the economic goals in forestry. The owner of a forest chooses the way a forest is used in commercial terms. In commercial forests, 9,700 hectares of key woodland biotopes have been registered with a view to their being subjected to obligatory special management regimes.

The right to use forest (to pick berries, mushrooms, nuts, ornamental branches, herbs, etc.) is granted to all under the Forest Act. The picking of berries, mushrooms and herbs plus studies and research, recreation and sports, hunting and timber procurement are just a few

of the possible means of forest utilisation. Hunting is one of the more traditional uses (there are 14,500 hunters in Estonia), and hunting tourism by foreigners has gained in popularity in recent years. The picking of fruits (bilberries, lingberries and cranberries) and mushrooms has not lost its importance, even in economic terms. However, from among the large number of edible mushrooms, only chanterelles are picked and traded in larger quantities.

Wood processing

The forest sector – forestry, the wood processing industry, the pulp and paper industry and the furniture industry (figures include other types of furniture as well) – is interlinked with many other sectors, e.g. transport, energy and tourism. After the deep recession at the beginning of the transition to the market economy, the forest-sector companies experienced a rapid and steady recovery in the 1990s. The development of the sector has stabilised in recent years; its share in Gross Domestic Product (GDP) has remained at the level of 6%. Especially quick development has taken place in the wood-processing industry, thanks to the investments in sawmilling and further processing in the last 10 years (their share in GDP has grown from 0.9% in 1993 to 2.6% in 2003). The development in forestry (from 1.2% to 1.7% of GDP) and furniture (from 1.0% to 1.4% in 1993 and 2003, respectively) has not been so dynamic. The pulp and paper industry has not regained the position it had in the 1980s (accounting for only 0.4% of GDP in 2003).

The forest sector's overall share in GDP has remained stable over the last 3 years, while growth in volumes is not visible because of the rapid development of other sectors (especially subcontracting in the manufacturing of electronic devices). The share of the

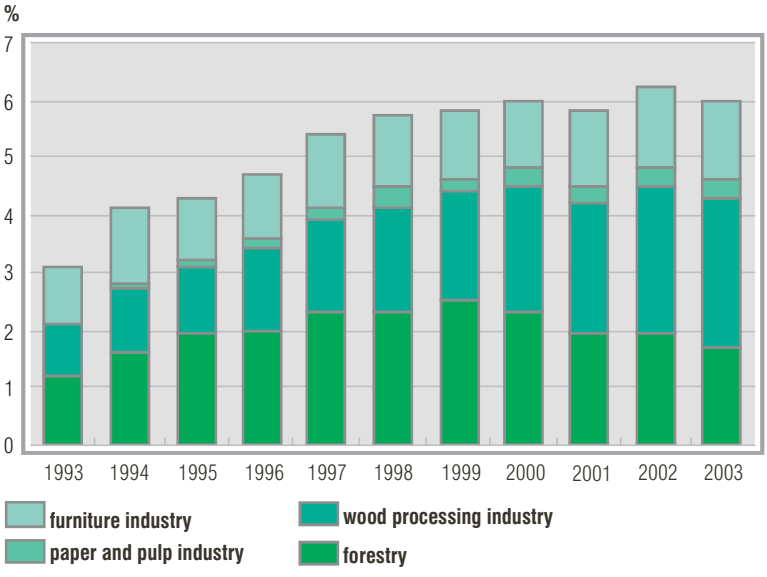


Fig. 3. Share of the forest sector in GDP (at current prices) in the years 1993-2003 (Source: Statistical Office of Estonia)

forest industry in added value in the manufacturing industry has been growing since 1993, to reach the high level of 23%. The forest sector is one of the 3 main exporting sectors and the most important one in balancing the overall trade deficit.

From the social development's point of view, forestry is especially important in ensuring employment in rural areas. Approximately 30,500 people work in the sector's companies (accounting for 5.1% of all employed). The employment in forestry has remained stable during the last decade – at about 9,000 people, or 1.4% of total employment. The greatest increase took place in the wood-processing industry – here the employment has tripled in the last decade from 7,700 (1.1%) in 1993 to 22,000 (3.6%) in 2003.

The extremely rapid changes in the period of transition created a need to define and collectively recognise the development priorities of forestry. These priorities were fixed in the Estonian Forest Policy adopted by the country's parliament in the summer of 1997. To co-ordinate the implementation of the Forest Policy, a long-term forestry development programme was compiled by experts and representatives of interest groups. The Forestry Development Programme by the year 2010 was in turn approved by the Parliament in late 2002.

The EU enlargement process and concomitant requirements have significantly affected and will affect developments in Estonian forestry. Pursuant to the EU Habitats Directive, a preliminary selection of areas suitable for protection of species and habitats has been carried out. The principles of the Pan-European forest conferences were also taken account of, as the long-term Development Programme was defined.

3. Legal and organisational forms of forest holdings

Forest ownership

After the regaining of independence in 1991, the restitution and privatisation processes started. By the end of 2003, 3.3 million hectares of land (including 1.7 million hectares under forest) had been registered in the Land Cadastre. Over the next few years, 1.0 million hectares of land (including 0.5 million hectares under forest) will be registered to complete the land reform. State-owned forests are predominantly managed (over 841,000 hectares) by the State Forest Management Centre, which coordinates forest-management activities in 66 forest districts. 63,000 hectares are in the hands of other state institutions, such as the Agricultural University, forestry or agricultural higher schools and the Ministry of Defence. The average area of a state-run Forest District is 18,000 hectares, of which 13,600 hectares (or 75%) are forest land.

The 802,600 hectares of private forest is mostly owned and managed by individuals (80%), but forest companies are increasing their share. Private forest ownership is characterised by its dispersion among no fewer than 70,000 owners, ensuring that the average holding is small, of around 11.8 hectares. About 80% of private holdings have less than 20 hectares of forest land. In addition, local municipalities owned approximately 2,400 hectares of forest land by the end of 2003.

The ownership structure of forest land as of the end of 2003 is shown in Fig. 4.

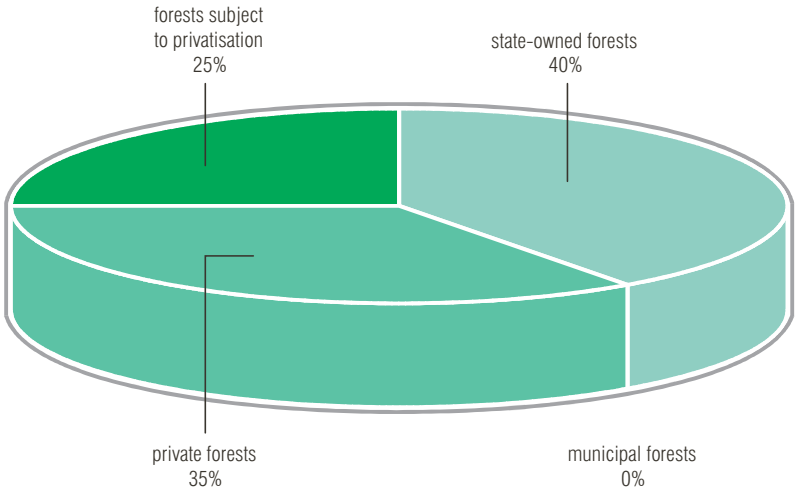


Fig. 4. Ownerships structure of forest land (Source: Centre of Forest Protection and Silviculture)

Forest administration

Estonia's Forest Policy, as passed by the Parliament (Riigikogu) in June 1997, defines the objectives and role of state forest institutions. The main role of the State was seen to lie in a) formulation of forest policy, b) formulation of legislation and law enforcement, c) the provisioning of necessary infrastructure and other services at national level. The management of state forests was also defined as a task of the State.

In Estonia, forestry and forestry issues are the responsibility of the Ministry of the Environment. General forestry-related administrative structures under the Ministry of the Environment can be divided into two groups. The first group, consisting of the Forest Department, 15 County Environmental Departments, the Centre for Forest Protection and Silviculture and the Environmental Inspectorate, are in charge of normative and supervisory functions. In turn, the second group, including the State Forest Management Centre and the Tartu Nursery, perform mostly commercial functions.

The Forest Department is a policy and legislation development unit and has a statutory role to co-ordinate forest-policy implementation and evaluate its effectiveness. The Department gathers and analyses forestry-related information and is responsible for the coordination of long-term forestry development programmes and strategies. Specifically, the Forest Department's tasks are:

- to co-ordinate National Forestry Programmes;
- to prepare regulations for incorporating the concepts of sustainable and efficient forest management into practice, and to integrate biodiversity conservation with forest protection;
- to coordinate private forest owners' extension and support services.

The County Environmental Departments (CEDs) are responsible for the implementation of environmental policies in the regions. Duties connected with forestry concern:

- data-collection as regards natural resources, with reporting to the Ministry of the Environment and County governors;
- the review and approval of forest notifications;
- preliminary forest-health evaluation;
- the inventorying of Key Habitats and proposals to the Ministry of the Environment as regards the signing of the Key Habitat protection contracts with forest owners;
- the management of forests which are in the process of being privatised until their privatisation is completed;
- the evaluation of the quality of forest regeneration and proposals for reforestation at the owners' expense.

The Centre for Forest Protection and Silviculture is a government office, under the jurisdiction of the Estonian Ministry of the Environment, which participates in the drafting of legislation on the sustainable and multifunctional management of forests, forest protection, forest seed management, forest tree breeding, game management and the management of protection forests. The Centre collects and prepares information on the fulfilment of international agreements regarding the protection and sustainable management of forests that have been ratified by the Republic of Estonia. The Centre's activities are connected with Estonian forests under all forms of ownership and forest categories.

The Environmental Inspectorate is a law-enforcement agency dealing with supervision and control for compliance with environmental legislation. Its role is also to investigate violations of forest legislation. The State Forest Management Centre manages the state-owned forests as regards both, timber production and recreational services.

The role of the Ministry of Agriculture (MA) in support of private forest owners will increase in the coming years with the implementation of the Rural Development Programme for the years 2000–2006 – which forms the basis for the EU's SAPARD aid programme for Estonia. SAPARD encompasses measure no 8 "Forestry" (afforestation of abandoned agricultural land), wherein the beneficiaries are private forest owners. The implementation agency for SAPARD is the Agricultural Registers and Information Board – a government institution reporting to the Ministry of Agriculture

The Ministry of Agriculture has commenced with the preparation of the new Rural Development Plan for 2004–2006, also participating in the formulation of the Single Programming Document for 2004–2006, which forms the basis for the use of EU Structural Funds. The proposed support in forestry includes the restocking of woodlands (reforestation) and tending of young stands. The total level of public support to forestry in 2004 was of EEK 24 million (20 million of which came from EU funds and EEK 4 million as a national contribution), while the share of public co-financing – 50%–80% of the total cost.

4. Education and research

Forestry education in Estonia is provided at vocational and university levels. Luua Forestry School is a vocational training institution which trains forest technicians, forwarder operators, forestry specialists, specialists in the wood and wood products trade and landscape architecture. In 2004, some 41 students graduated from the Luua Forestry School.

At the Estonian Agricultural University students can obtain a Bachelor's, Master's or Doctoral degree in forestry. There are bachelor programmes in forest management and in forest technology. The curriculum of natural resource management also includes many forestry-related subjects, as forests are considered to be among Estonia's most important natural resources. In 2002, the study Programmes were made in line with the Bologna process and the so-called 3+2 system. During the first three academic years, students obtain a Bachelor's degree before continuing with the Master's Programme. Forestry curricula were accredited by foreign experts in 1999, the curriculum on Nature Resources Management in 2004. All curricula have obtained full accreditation.

In January 2005, the Forestry Research Institute, Faculty of Forestry and Faculty of Land Engineering were merged to become the Institute of Forestry and Rural Engineering. This means that forest research and higher forestry education fall within one organisation, administratively. Altogether, approximately 50 researchers and teachers work with forestry--related topics at the Estonian Agricultural University. The names of the departments reflect the main areas of forest research and education carried out at the Institute. These are the Department of Forest Biology, the Department of Eco-physiology, the Department of Silviculture, the Department of Forest Management Planning and the Department of Forest Technology.

Research in Estonia is financed from government funds as targeted financing. Research groups apply for funds, and proposals are evaluated by experts who make suggestions concerning financing. In forestry, there are 3 larger projects (duration of 4 years) financed by the Ministry of Education and Science. These themes are: The ecophysiological basis of tree tolerance to stress: structural-functional relationships of lignification processes and production, Sustainable and close-to-nature management of the Estonian Forests and The impact of natural disturbances and anthropogenic factors on the dynamics and diversity of forest ecosystems.

The Estonian Science Foundation grant aids short-time research projects. The grants are intended to cover field and laboratory experiments, conference fees, travel costs, etc. The main partners for researchers in R&D activities are the State Forest Management Centre, the Estonian Private Forestry Centre, the Estonian Federation of Forest Industries, the Ministry of the Environment and the Ministry of Agriculture.

The Estonian Agricultural University is a member of IUFRO and EFI, while the Institute of Forestry and Rural Engineering co-operates with many European research and educational institutions.

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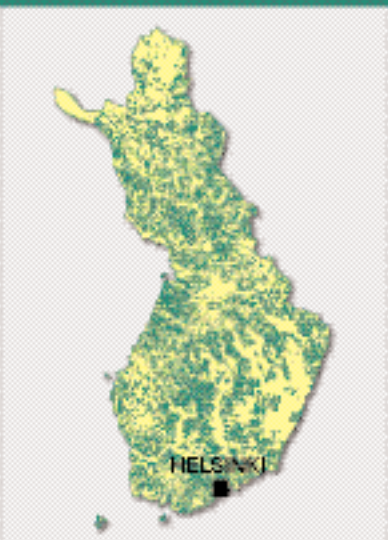
★ Finland

Jari Parviainen

Suomi,
territory: 338,100 km²,
population: 5.2 million,
capital city: Helsinki.



1. Forest characteristics

Forest area

Forests are a part of the Finnish cultural heritage. Finns have become accustomed to living in the forest; they have sought protection against the enemy in it and have gone there to find tranquillity. Forests are an integral part of the Finnish landscape, a place for recreation, a habitat and a necessity for many species and an economic and renewable natural resource in the Finnish economy.

Finland is Europe's most heavily forested country, with over three thirds of the land area (23 million hectares) under forest cover. There are additional 3 million hectares of sparsely wooded forest areas and treeless open mires and rocky land, so forest land accounts for 86% of the total land area. The forest area per inhabitant is 4.3 hectares, which is the highest figure in Europe.

Finland is located in the boreal forest zone, which is characterised by a short growing season and a limited number of tree species. Thanks to the Gulf Stream, however, the conditions here are more favourable than in other places at the same latitude. The equivalent regions in Canada and Russia – tundra and taiga – have more harsh conditions and hence different vegetation (Fig. 1).

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Fig. 1. The vegetation zones in the northern part of Europe and Finland

Species composition

Finland has a small number of species, due to the high European mountains extending from east to west that have prevented plant species from returning north after the Last Ice Age. Only four coniferous and just over 20 deciduous tree species grow in the wild in Finland.

The commonest species and, at the same time, the ones of the greatest economic significance, are the Scots pine (*Pinus sylvestris*), Norway spruce (*Picea abies*), silver birch (*Betula pendula*) and downy birch (*Betula pubescens*) (Fig. 2). Other naturally-occurring coniferous trees include juniper (*Juniperus communis*) and yew (*Taxus baccata*), while deciduous trees also include aspen (*Populus tremula*), grey alder (*Alnus incana*), common alder (*Alnus glutinosa*), rowan (*Sorbus aucuparia*), sallow (*Salix spp.*), European white elm (*Ulmus laevis*), wytch elm (*Ulmus glabra*), small-leaved lime (*Tilia cordata*), ash (*Fraxinus excelsior*), oak (*Quercus robur*), bird cherry (*Prunus padus*), Norway maple (*Acer platanoides*) and crab apple (*Malus silvestris*). Beech (*Fagus sylvatica*), which is common in most European countries, does not grow naturally in Finland at all.

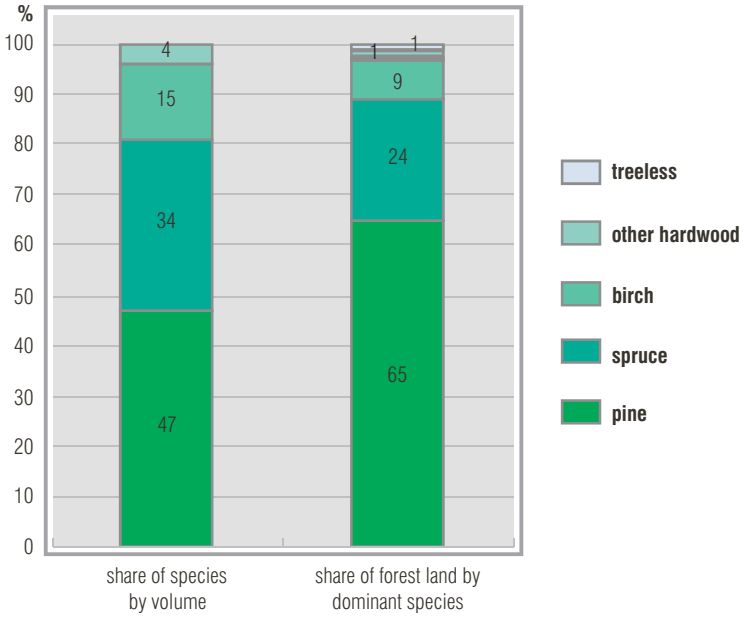


Fig. 2. Distribution of major tree species in Finland by dominance and volume (Source: Finnish Statistical Yearbook of Forestry 2003)

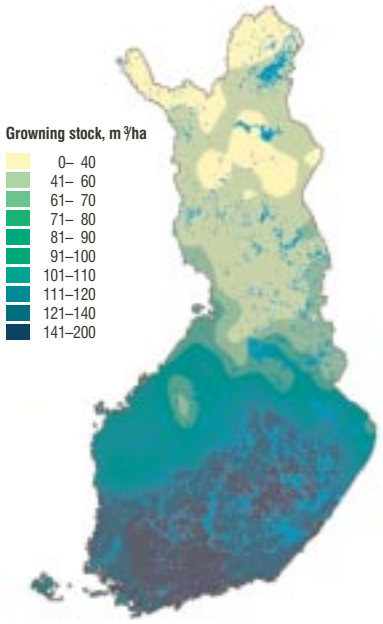
Volume and increment

Due to Finland's northern location and forest ownership structure, Finnish forestry operates under exceptional conditions. Finland extends over 1,100 km from north to south, ensuring that growing conditions in the north and south differ considerably. The growing season in southern Finland lasts for a maximum of five months, while that in the north goes on for just three months. Consequently, annual increments in the forests of southern Finland are three times as great as those in the north (Fig. 3).

The tree line on the Finnish side of the border in northern Lapland is often a strip of tens of kilometres in width extending to areas rich in forests. To the north of the line, the land is bare, with shrubs and stunted trees or trees less than two metres in height. Moving further south, we reach the treeline when the height of individual trees exceeds about two metres. To preserve the treeline, an Act on forest preservation was passed in 1922, preventing imprudent use of forest and a potential shift of the treeline further south.

Finnish forestry relies on the use of tree species that are native to Finland. The aim is to ensure production of high-quality raw material, while at the same time retaining biological diversity in Finnish forests, and suitable conditions for different forest uses.

Finnish forests are what are known as semi-natural forests, which means that they are no longer untouched by man, but still have a tree species structure similar to the original. Studies on the history of forestry show that human influence on forests in Finland – as in Central Europe – has been extensive, and of long duration. There are practically no



Region	Volume, m³/ha on average	Annual increment m³/ha/year on average
Southern Finland	125	5.4
Northern Finland	62	2.0

Fig. 3. Mean volume of growing stock on productive and low-productivity forest land (Source: Finnish Statistical Yearbook of Forestry 2003)

untouched, primeval forests left in Finland; though a few can be found in some protected areas in Lapland and the eastern part of the country. From the 18th century through to the beginning of the 20th century, Finnish forests were used for tar production, for mining industry purposes and extensively in slash-and-burn agriculture. According to the studies by Professor Heikinheimo in 1915, by the beginning of the 20th century, 50–75% of Finnish forests had been cleared by burning in the name of slash-and-burn agriculture.

2. Forest management

Since the beginning of the 20th century on, Finnish forest structures have been greatly affected by timber being used as a raw material for the forest industry. Despite the extensive use of forests, no exotic foreign tree species have been imported to or planted in Finland. Most of Finnish reforestation has taken place through natural means. About 30% of Finnish forests have been reforested through planting and seeding, while all other forests have come to regenerate naturally (Fig. 4). Foreign trees have only been grown on an experimental scale for special purposes.

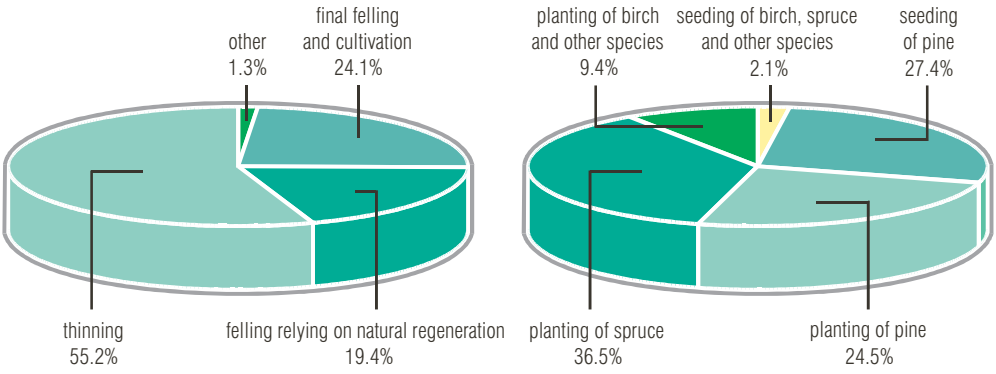


Fig. 4. Felling and regeneration methods in Finland (Source: Finnish Statistical Yearbook of Forestry 2003)

Production forests are managed through thinning carried out 2–3 times during the rotation period, *i.e.* during the life of a stand. Thinning is also carried out with a view to preserving forest diversity, and the survival of living organisms is also considered. The economic yield can be increased by up to 50% by thinning. This is because competing trees that are cut in thinning allow better trees to prosper, thus increasing their value. Thinning also lets more light into the forests, speeds up the nutrients recycling in the soil and makes room for the creation of a mixed forest stand with conifersous and broadleaved trees. A thinned forest can serve as a multipurpose one.

The Finnish, or broadly Scandinavian forest management model differs from that used in, for example, Canada and Russia, where forests are not thinned, but rather subject to clear-cutting with heavy machinery when the stand is mature enough. Because of Finland's small-scale forestry and high-tech machinery, the average cutting area is of only 1.2 hectares, *i.e.* equivalent to those in, for example, Germany, Austria or France.

Trees are cut using the cut-to-length method, meaning that the trunks are stripped of branches and cut to appropriate length, while they are still in the forest. The branches and crowns are left on site, with a view to a stable recycling of nutrients being maintained. To some extent, small trees and crowns can be utilised as fuel wood if they are located close to heat and power station units. The cut-to-length method is well-suited to Finnish conditions, because the terrain is flat and thinning is commonplace. However, it is the full--tree method that is used instead in the majority of the boreal forest countries. This means that the cut logs are transported from forests to a processing terminal as they are, and cut to lengths only there.

Sustainable forestry has been under systematic development in Finland ever since the end of the Second World War. This has been accomplished through forestry planning and national forestry programmes. Government measures, legislation and the actions taken, as well as cooperation between private forest owners have supported this process. During the last 40 years, tree growth has exceeded cutting by 20%–30% every year (Fig. 5). Currently, the growing stock volume in Finnish forests is higher than at any time since independence – in excess of 2,000 million m^3. The annual increment is 81 million m^3.

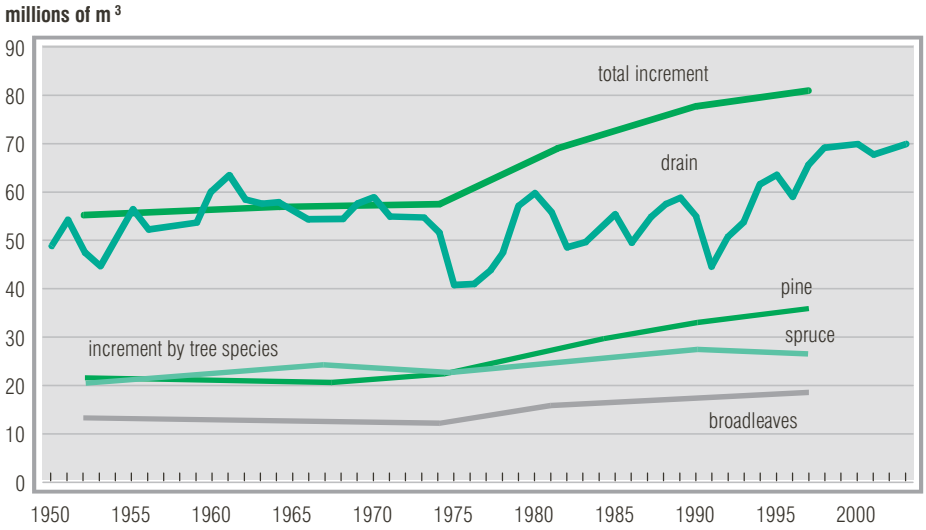


Fig. 5. Total increment and harvest in Finland during 1920-2003 (Source: Finnish Statistical Yearbook of Forestry 2003)

3. Forest protection

Forest protection and biodiversity have been given special attention during the last few decades, alongside timber production. Thanks to numerous protection programmes and decisions, protected forest areas have increased during the last 30 years almost threefold. In 2002, 7.2% of Finnish forests were strictly protected, and 12.3% either protected or in restricted forestry use. This has left Finnish forests protected to a greater extent than those of any other European country (Fig. 6 and Table 1). There are some estimations that further forest protection might be needed in southern Finland. In 2002, a committee with broad membership (including representatives of various parties) proposed the so-called METSO programme for the years 2003–2007, applying new voluntary means for additional protection and biodiversity enhancement on private forest lands in southern Finland.

Finland's part of the NATURA 2000 network consists of 1,806 sites covering a total of 4.9 million hectares, with a land area of 3.59 million hectares. There are sites protected under the Habitats Directive (SCIs) covering 4.77 million hectares (14% of Finland's total area). The 453 bird sanctuaries (SPAs) cover 2.7 million hectares. SACs and SCIs overlap in some areas.

About 95% of the area of NATURA 2000 sites is already protected in Nature Reserves or Wilderness Reserves, under the adapted conservation programmes, or in other protected areas. The New NATURA 2000 sites are protected on the basis of the Nature Conservation Act, the Forest Act, the Outdoor Recreation Act, the Land Extraction Act, the Water Act, and the Environmental Protection Act.

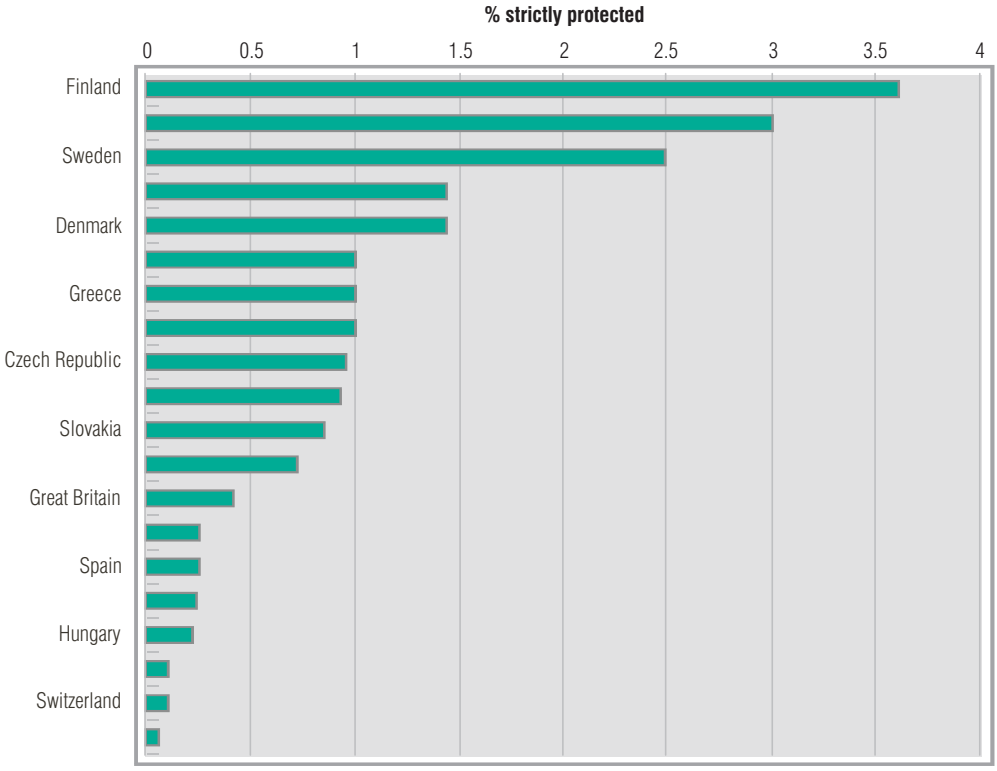


Fig. 6. The proportion of strictly protected forest areas in selected European countries in 2000 (Source: Finnish Statistical Yearbook of Forestry 2003, EU/COST Action: Forest Reserve Research Network, EUR 19550, Luxembourg)

Table 1. Protected forest areas in Finland

	Forest and low-productive forest '000s ha	% of forest and low-productive forests	Forest, low-productive forest and the land area for forestry '000s ha	% of forest, low-productive forest and the land area for forestry
Strictly protected forests	1,665	7.2	3,306	10.8
Protected forests where restricted felling is allowed	98	0.4	116	0.4
Protected forests (above areas combined)	1,762	7.6	3,422	11.2
Forests under restricted forestry use	1,038	4.5	1,308	4.3
All above areas combined	**2,800**	**12.1**	**4,730**	**15.5**

Source: Ministry of Agriculture and Forestry 2002.

Most of Finland's NATURA 2000 sites are located in the boreal biogeographical region. The European Union has approved the proposal within the boreal region in 2005. The sites in the Alpine biogeographical region (in Finnish Lapland) were approved as early as in 2004.

In addition to the natural and strictly protected forest in Finland, we also apply environmentally sound methods to forest management at landscape level. The principle of so-called landscape ecological planning is that small, ecologically-valuable natural biotopes should be left untouched inside production forests. These key biotopes account for 2%–10% of forest land, depending on the area. The Forest Act contains definitions of habitats that are especially important for forest biodiversity.

Of the roughly 34,000 species living in Finland, about half of them live in forests. The status of endangered species is monitored on a regular basis. According to the latest survey (in 2000), about 1,500 species of flora and fauna are threatened, 38% of these living in forests. Endangered species account for 4% of those studied, which is clearly below the European average. Most species that manage well in Finnish forests also do so in production forests, though certain natural habitats or special features of natural forest, such as rotten tree trunks or burnt trees, are vitally important.

Voluntary forest certification supports the maintenance of forest biodiversity. The Finnish Forest Certification System, embracing 28 certification criteria, was developed in Finland between 1996 and 1999. The standards were adopted for use in 2005. The FFCS is based on regional group certification and has adopted many of the pan-European forest sustainability indicators (MCPFE) that were developed between 1993 and 2003. The standards set up highly-demanding threshold values, e.g. for biodiversity characteristics, such as the dead wood component, which exceeds the requirements set out in forest and environmental legislation. The decision to start conducting group certifications was taken because of a large number of small, privately-owned forest estates, since implementing ecological requirements can only be realistic over wider land areas, and can only be achieved by defining areas that cross the land ownership boundaries. In 1999, the FFCS was accepted as part of the Pan European Forest Certification (PEFC) system.

No major environmental hazards have arisen through forestry operations. It is usually in winter that trees in Finland are cut. As the ground is then frozen and covered with snow, damage by machinery or logging is prevented. The prevention of water pollution is also taken very seriously in forestry. Protective belts are left alongside small bodies of water, brooks and springs, and no fertilisers are used in groundwater basins.

4. Forest utilisation

Everyone has the right to move about freely in Finnish forests. This "everyman's right" entitles anybody to move about on foot or skis, by bicycle or on horseback on somebody else's property, provided no damage is caused. However, a permit is always needed if a motor vehicle is used. If no damage is being caused, a camp can even be set up, and wild flowers that are not protected picked, along with berries and mushrooms. However, the permission of a landowner is always needed to light a fire, and everyman's right cannot be abused causing damage to a landowner or to nature.

A great deal of attention has been paid to the use and value of forest products other than timber. The principal non-wood forest products (NWFPs) obtained from forests that also have some financial value are game, berries, mushrooms, lichen, and eco-tourism. However, locally and for private individuals, profits made from NWFPs can be considerable. The greatest financial profit is made from game (see Table 2).

Yet the financial significance of goods and services derived from forests is small on a national scale, compared with the profits made from timber sales. It has been estimated that the value of NWFPs is about 2–3% of the annual timber cutting revenue. However, profits made from NWFPs go straight to households for their own use. At the same time, they offer a pleasant form of outdoor exercise, something which is more and more important to today's city dwellers.

The industrial use of forest for sawn goods and paper began in Finland in the late 19th century. A century ago, forest-industry products made up 80% of Finnish exports. Today, forestry and the forest industry account for around 8% of Finland's Gross Domestic Product, while in recent years, forest-industry products have accounted for some 30% of Finnish exports (Fig. 7). High-quality printing and writing paper make up over half the value of forest-industry output, while sawn goods and boards account for some 15% of export value.

The significance of the forestry sector is often evaluated alongside with the forest-related industry, or the forest cluster, which encompasses forestry; the forest industry; the manufac-

Table 2. Volumes and values of forest products in 2002

Product	Volume	Value (millions of euros)
Timber (commercial felling and household use)	60 M m^3	1,800
Wood chips (value on site use)	about 1.3 M.m^3	24
Wild berries*	4,800 t	5.5
Lingonberry Bilberry Cloudberry	3,300 t 1,200 t 100 t	2.8 1.6 0.9
Wild mushrooms*	220 t	0.7
Export of lichen	319 t	1.5
Christmas spruces (calculated value)*		about 7
Reindeer meat (income from slaughter)**	2,600 t	14,3
Game (calculated value)	about 13,000 t	73
Elk	11,126 t	57.1
Peat production***	19,200 m^3	about 210
Energy use	17,000 m^3	
Horticultural use	2,200 m^3	

* The wild berry and mushroom volumes brought in for sale and income from picking.
** Reindeer herding season 2001-2002.
*** The figures for peat production do not include those by small-scale producers (Suomen turvetuottajat ry)
Source: Gallup Food and Farm Facts Ltd 2002, Finnish Forest Research Institute 2002, Forestry Development Centre Tapio 2002, Ministry of Agriculture and Forestry 2002, Reindeer Herders Association 2002, Finnish Game and Fisheries Research Institute 2002, Statistics Finland 2002, National Board of Customs 2002, The Association of Finnish Peat Industries 2002.

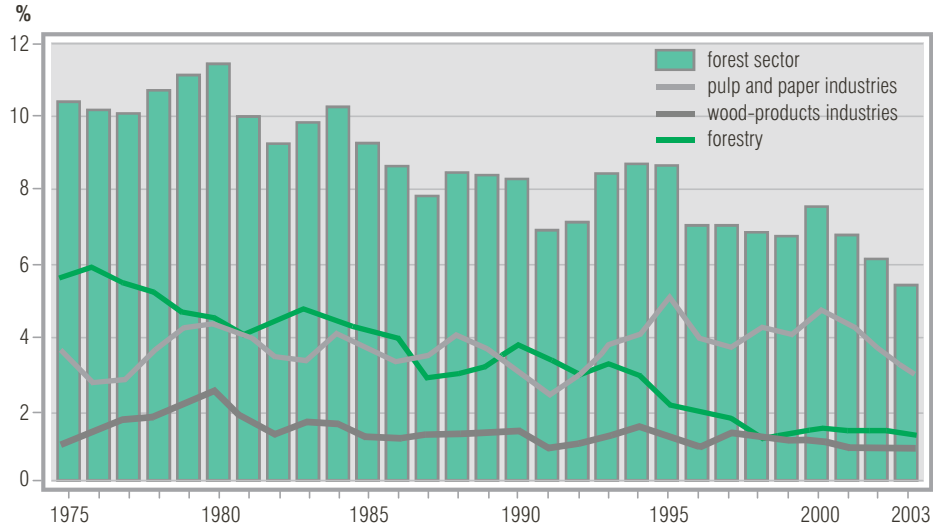


Fig. 7. Share of the forest sector as a percentage of Finland´s Gross Domestic Product (Source: Finnish Statistical Yearbook of Forestry 2003)

ture of forest machinery; part of the chemical industry; automation and packaging systems; the printing industry; energy production; the transport trade; and forestry consulting companies. With all these put together, the forest cluster accounts for some 35% of Finland's gross export revenues.

Relative to its size, Finland is on top of the list when it comes to being dependent on forests and the entire forest cluster. Turnover by the Finnish forest industry has doubled in a matter of just a few years through company acquisitions, and at the same time Finland has become a centre of excellence for the European forest industry and forestry, because the top expertise has accumulated not only in companies but also in universities, colleges and research institutes.

Finland's biggest market area for the forest industry is the European Union, to which some 70% of Finnish exports go (mainly to Germany, the UK, France and the Netherlands). Other European countries account for 9% of forest industry exports, and the rest of the world – 20%.

5. Employment

The forest cluster employs approximately 140,000 people in Finland, of which two-thirds work in the forest industry and forestry. This means that the forest cluster employs about 6% of Finland's employed workforce, though the period since the early 1990s has brought a decline in the absolute number of forest-sector jobs reflecting automation and company mergers. Nevertheless, the share of all employment accounted for by the forest cluster has been growing by a couple of per cent a year over the past 30 years.

6. Legal and organisational forms of forest holdings

Forest ownership

In the principal tree-growth areas of southern and central Finland, two-thirds of forest land is privately-owned. Indeed, there are areas in which up to 80% of all forests are in private hands. Since farms are often owned by families, the number of individual forest owners is estimated to run to 900,000, which is to say that one Finn in five owns a forest. This is why the term 'family forestry' is used in Finland, to denote the type of forestry practised by private families in their own forests. The forest ownership structure based on private, non-commercial ownership corresponds to that of most Western European countries.

Forest ownership in Finland	Per cent of forest land
Non-industrial private	61%
State	25%
Industrial private	9%
Other (church, communities)	5%

The largest protected forest areas and state-owned forests are located in the north of Finland.

While the fact that forests have remained in the ownership of families from one generation to the next, attests to the idea that Finns have strong roots in the countryside, structural changes in Finnish society has led to new features of both ownership and owners. For example, more and more owners now live in cities, while the number of such owners continues to increase as estates are divided in connection with the partition of inheritance. Some 70% of today's forest owners live in sparsely-populated areas or villages, 10% in small towns and 20% in larger cities. The proportion of female owners of forests is increasing steadily (see Fig. 8).

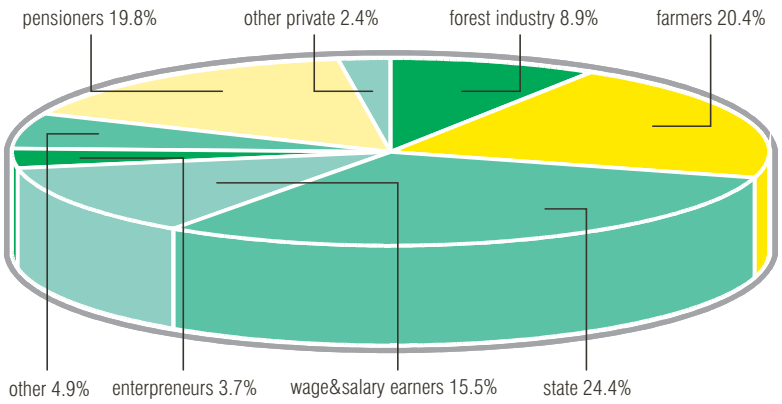


Fig. 8. Private family business (farmers, wage & salary earners, pensioners, other private) own 62% of the Finnish forests. Finnish forest owners in 1999 (Source: Karppinen, H., Hänninen, H., Ripatti, P., 2002. Suomalainen metsänomistaja. Research Report of the Finnish Forest Research Institute 852)

Cooperation between forest owners has also been working in the direction of long-term and good forest management. The first associations of forest owners were founded in Finland at the beginning of the 20th century, and their number has now reached 155. The basic task is to serve forest owners – to develop forest management, improve profitability and offer advice and training. Individual forest owners can, for example, obtain advice on the timber trade and forestry planning. If several forest owners sell timber at the same time, the timber can fetch a higher price (the sale of small, individual lots is burdened by proportionally high logging and transport costs). Members of these associations pay a small annual fee plus any expenses incurred by the expert services they use.

Forest law

The large number of owners ensures that private forest estates are relatively small, of 26 ha on average. Private forestry has a key role in Finland, because 80%–90% of Finnish wood used by the forest industry comes from stands in private hands. Forest legislation, a nationally-defined forest programme, cooperation between forest owners at many levels and advice given to forest owners are all aimed at ensuring sustainable forestry in practice.

The next hundred years of long-term and sustainable forestry have been secured in the privately-owned forests by a new Forest Act (see below), the first such legislation since 1886, which prohibits forest devastation. If reforestation is not properly arranged after cutting, use of the forest is temporarily prohibited and the replanting costs can be recovered from the forest owners by law. On the other hand, the Government gives financial aid, grants and loans to forest owners with sound forest management methods, such as those ensuring sustainable timber production through proper management of young forests, the maintenance of forest diversity and improvements in the health of forests.

This objective remains in the legislation, though the aims of forest policy have changed over time and legislation has been reformed. The most recent extensive reform of forest legislation made in the 1990s was put into effect by a Government Decision-In-Principle, made in 1994, on the sustainable management of forests, and by the Environmental Programme for Forestry ratified the same year. The need for the reform stemmed from changes in the operational environment of forestry, pressures to lower costs, and the active public debate on the sustainability of forest utilisation. Since the late 1980s, the maintenance of biodiversity, conservation, the multiple use of forests, and the preservation of forest landscapes have also grown in importance as goals underpinning the use of forests.

Finnish forest legislation underwent extensive reform in the 1990s. The Forest and Park Service Act entered into force in 1994, The Act on Forest Centres and the Tapio Forestry Development Centre – in 1996, the Forest Act, the Nature Conservation Act, and the Act on the Financing of Sustainable Forestry – in 1997, and the Forest Management Association Act – in 1999. The reforms were carried out in harmony with the forest principles of the UN Conference on Environment and Development in Rio de Janeiro, and the general principles of the Helsinki Ministerial Conference on the Protection of Forests in Europe. The reform of Finnish forest and environmental legislation is also considered especially significant in terms of the implementation of international environmental agreements signed by Finland.

Moreover, an amendment was made to the Finnish Constitution, whereby responsibility for the environment and the maintenance of biological diversity has become a matter of common concern.

The Forest Act (1094/1996), which repealed the Private Forest Act and the Act on Protection Forests, entered into force on 1 January, 1997. The Act applies to forests under all forms of ownership. It aims to promote the sustainable economic, social and ecological utilisation and management of forests in a way that provides a sustainable satisfactory yield while maintaining biological diversity. The Act regulates felling and places landowners under an obligation to secure the regeneration of forest after final felling. With a view to the maintenance of biological diversity, the Act defines habitats that are especially important for the preservation of biodiversity in forest ecosystems. If those habitats are in a natural or related state, all management work carried out in them must serve the preservation of their natural features. To achieve harmonisation of the goals of timber production and multiple use, the Act requires Forest Centres to develop regional forest programmes (regional forestry target programmes) for their territory.

As has been noted, most of the **legislation concerning forestry organisations** was reformed in the 1990s. The revised Forest and Park Service Act (1169/1993) entered into force on 1 January 1994, and established the Forest and Park Service as a State-owned corporation. In March 1996, the Act on Forest Centres and the Tapio Forestry Development Centre (1474/1995) entered into force. Its purpose was to streamline the organisation by which private forestry is promoted and monitored, and to improve the efficiency of its operational and management system. The Act on Forestry Management Associations came into force on January 1, 1999. The new law is aimed at promoting cooperation between forest owners and advisory services in forestry. (See forest and environmental organisations).

The new **Act on the Financing of Sustainable Forestry** (1094/1996), which entered into force at the beginning of 1997, replaced the earlier Forest Improvement Act. The purpose of the Act is to promote the sustainable management of forests in accordance with the Forest Act. Under the Financing Act, State subsidies and loans may be granted to private forest owners for management work that aims to secure the sustainability of timber production, maintain the biological diversity of forests, and manage forest ecosystems. Moreover, funding may be provided for the prevention and compensation of forest damage.

Forest Taxation (Income Tax Act 1535/1992, Decree on Forest Tax 1208/1991) – in conjunction with the revision of capital income taxation, regulations entered into force at the beginning of 1993, the old system of forest taxation based on site productivity being replaced by a system based on net earnings from timber sales. However, during the transition period (1993–2005), forest owners had the option of deciding which taxation system they wanted to apply. With the taxation of income from timber sales, the net difference between forest income and expenditure is taxed like any other capital income.

In addition to income tax, a value added tax is currently levied on forestry income. Like any other property, forests are subject to property tax, and in various cases of ownership transfer, inheritance and gift duties, capital transfer and sales profit taxes may also be levied.

The Forest Insect and Fungi Damage Prevention Act (263/1991), entered into force on 1 July 1991, limits the storage of coniferous timber in forests in the summer, requires that damaged trees be removed from the forest when the number thereof exceeds a specified maximum limit, and regulates measures for the prevention of damage caused by insects and fungi in conjunction with harvesting and the tending of seedling stands, for example. The Act also places forest owners under an obligation to comply with the orders and instructions which authorities issue to prevent large-scale damage by insects and fungi. The costs of such measures to forest owners are compensated from State funds.

The Act on Trade in Forest Reproductive Material (684/1979) which entered into force at the beginning of 1980, aims to ensure the creation of healthy and vigorous seedling stands through provisions regulating the production, sale, import and export of seedlings, which must be suited to a site in terms of their species and provenance, as well as being free of diseases, viable and otherwise suitable.

The Nature Conservation Act (1096/1996) was drafted in tandem with the Forest Act, and it entered into force on the same date, 1 January 1997. The Act aims at the maintenance of biological diversity, supporting the sustainable use of natural resources and natural environment, promoting public awareness of and a general interest in nature, preserving nature's beauty and scenic value, and promoting scientific research. Biological diversity is safeguarded by conservation programmes, by establishing conservation areas, protecting habitats and species, and by extending the range of conservation measures. The new Act also incorporates international agreements into national legislation.

Nature conservation legislation contains provisions on the implementation of the EU Habitats and Birds Directives, special provisions on the NATURA 2000 network related thereto, and a list of protected habitats in Finland. The new Act develops planning, establishment and use of conservation areas, creates a system by which the implementation of conservation programmes is funded, enhances the legal protection of forest owners, and diversifies tools in the implementation of conservation.

The Land Use and Building Act (132/1999), which entered into force at the beginning of 2000, places an emphasis on safeguarding public participation in land development planning. The Act aims at such an organisation of land use and building activities as will favour the creation of good living environments and promote sustainable development. The harmonisation of the various uses of forests is in practice achieved in conjunction with the preparation of general land-use and town plans under the Act.

The Environmental Protection Act (86/2000), which entered into force in March 2000, consolidates into one law provisions previously scattered across Finnish legislation, as well as improving the consistency of permit procedures. Provisions relevant to forestry in the new Act include those on the pollution of surface and ground water, water structures, drainage, and the runoff of harmful substances into aquatic systems.

The Act on Environmental Impact Assessment Procedure (468/1994) entered into force in 1994, and was amended in 1999. It aims to promote the assessment of environmental impacts and the consistent use of EIA in planning and decision-making, and to enhance the opportunities for public participation and access to information. Under the Act, environmental impact assessment must be carried out for all peat-production areas of over 150 hectares, as well as for unbroken forest, marshland or wetland areas exceeding 200

hectares where ditching or drainage would permanently alter the nature of such areas. In addition, the permanent removal of tree cover or regeneration of forests with exotic species requires that an EIA be performed.

7. Structure and tasks of forest administration

The highest forest authority in Finland is the Ministry of Agriculture and Forestry whose mandate is to create the conditions for the sustainable and diversified use of renewable natural resources and for the development of economic and leisure-time activities of the countryside. The Ministry of Agriculture and Forestry also secures the quality of the commodities obtained from renewable natural resources. The duties of the Ministry also include the drawing up of forest legislation and the supervision and monitoring of its implementation. The Finnish Forest and Park Service, the Forest Research Institute (Metla), the Tapio Forestry Development Centre and the regional Forest Centres are all under the supervision of the Ministry (see Fig. 9).

The mandate of the Ministry of the Environment is to promote sustainable development and ensure that the environmental perspective is given proper consideration in international cooperation and society, and at all levels of government. The Ministry formulates environ-

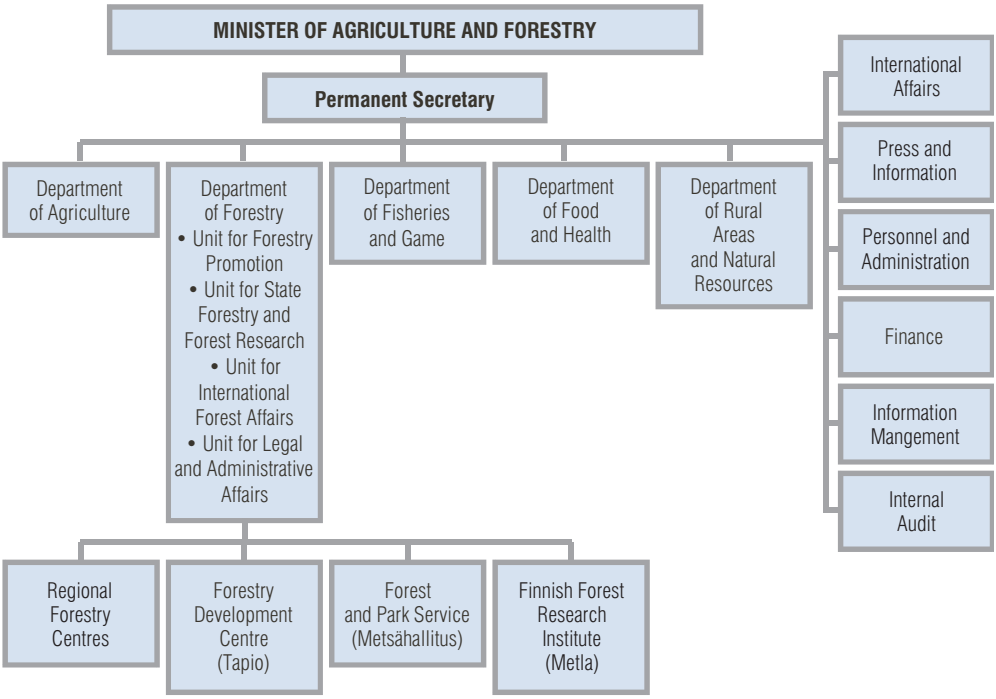


Fig. 9. State Administration of Forestry in Finland

mental policies, engaged in strategic planning and makes decisions in its own sphere of interest. It is also responsible for preparing legislation and drawing up its own budget, as well as for result management and the setting of binding standards. The Finnish Environment Institute (SYKE) and regional Environment Centres come under the jurisdiction of the Ministry of the Environment, which also oversees the Forest and Park Service and the Finnish Forest Research Institute as far as protected forest areas are concerned.

The thirteen **Forest Centres** in Finland are charged with monitoring of the compliance of forest management with forest legislation, along with other administrative duties. The mandate of the Forest Centres is to promote the sustainable utilisation and management of forests and the protection of their diversity, as well as other environmental protection activities in forestry. Within their jurisdictions, the Centres develop cooperation within forestry, develop occupations, forestry-based trade and livelihoods, and provide training, advisory and information services related to silviculture. The Forest Centres monitor the state and development of the forests within their jurisdictions, and draw up regional forest programmes (regional forestry target programmes) for their region.

The Tapio **Forestry Development Centre** is a development and expert organisation which prepares proposals and initiatives on forestry, and provides development and expert services for the forest-management sector. It also offers administrative services to the Forest Centres.

The **Finnish Environment Institute** (SYKE) is an environmental research and development organisation that promotes sustainable development, for example, by conducting research and development related to forestry issues, especially to biodiversity in forest and protected forest areas. The duties of the thirteen regional Environment Centres in Finland include environmental protection, land use, supervision of construction-related activities, nature conservation, maintenance of the cultural environment, and the management of water resources.

The Forest and Park Service (Metsähallitus) is a state enterprise charged with the management, utilisation and protection of the State lands and waters it has responsibility for (over 8.7 million ha), while securing both sustainability and profitability.

The Forest and Park Service provides a broad range of services and commodities based on the utilisation, management and protection of natural resources. Its areas of operation include the management of forests and the acquisition of timber, the production of seeds and seedlings of forest trees, ecotourism, international consulting, as well as the trade in, exchange and leasing of land. The Service comes within the jurisdiction of the Ministry of Agriculture and Forestry in all other matters except nature conservation, as regards which it is administered by the Ministry of the Environment.

Forest owners associations

There are 155 **Forest Management Associations** (FMAS) in Finland which are grouped into **13 Regional Forest Owners Unions**. Each extending over one or more municipalities, the associations are statutory service organisations funded by forest owners. The mission of the Forest Management Associations is to promote the profitability of forestry practised by forest owners and the realisation of the other goals they have set for forestry, and to

advance the economically, ecologically, and socially sustainable management and utilisation of forests. They provide professional services in matters pertaining to silviculture, the timber trade and forest planning. The membership of the Forest Management Association is made up of forest owners who pay their forest management fees and own forests within the Associations' jurisdictions.

The mission of the regional Unions of Forest Owners is to take care of private forest owners' interests in the region and to develop private forestry and the activities of the Forest Management Associations in their area. They also promote the profitability of silvicultural activities undertaken by forest owners. The Unions also act as intermediaries between the associations and the Forest Commission of the Central Union of Agricultural Producers and Forest Owners (MTK).

The Forestry Council of the Central Union of Agricultural Producers and Forest Owners (MTK) is the central organisation of private forest owners for economic policy issues. The Council looks after the interests of private forest owners and promotes the operation and profitability of private forestry by providing information on the timber market and prices.

8. Education in Forestry[1]

Forest education in Finland, available since 1862, is provided at academic level (doctorate or equivalent tertiary education and higher-degree tertiary education) in universities, at technical level (lower-degree tertiary education) in polytechnics, and at vocational level (upper secondary education) in several schools and colleges.

Academic degrees (Doctoral, Licentiate, Master's and Bachelor's) in the field of forestry can be obtained at the University of Helsinki and at the University of Joensuu. The Faculty of Agriculture and Forestry, Helsinki (established in 1862), offers three Master's degree programmes, while the Faculty of Forestry, Joensuu (established in 1982), offers four Master's degree programmes in forestry. Forest and wood-related education is furthermore provided, as a part of other disciplines, by the faculties of science at the Universities of Turku, Jyväskylä and Oulu.

In the case of Master's and Bachelor's degrees, general and basic studies can be substituted by optional studies. The students have to accomplish general and basic studies, and the required intermediate and advanced studies. Students at both Universities select a specific major in a specific degree programme themselves. The degree programmes consist of:

- general studies (incl. language studies, mathematics, statistics, etc.);
- basic, intermediate and advanced studies in the major subject;
- basic (sometimes also intermediate) studies in the minor subject;
- elective studies;
- one or two practical training periods (the average length of one being three months).

* [1] Compiled by Markus Lier: Finnish Forest Research Institute (Metla), Joensuu Research Centre.

A Master's thesis constitutes a central part of advanced studies. Students can choose their minors freely, either from other subjects in the Faculty, or from other faculties or other universities. Usually, it takes about 4.5 years to complete a Master's degree in forestry. In 2002, about 146 people started their studies, whereas about 88 completed their studies. The number of graduated Masters of Science in forestry in 2002 differed slightly from the numbers in either previous or subsequent years (77 graduates in 2003; 97 graduates in 2004, see also Fig. 10).

According to statistics, about 72% (year 2000) of those completing a degree at a University were working in the field of forestry. Estimations show that also this percentage is most likely to decline in the near future. A graduate in forestry might have difficulties finding employment in one of the traditional forestry sectors and might therefore be constrained to find a job that is not connected with the received forestry education. (Opetusministeriö 2004; Metsänhoitajaliitto 2004 and 2005; Finnish Forest Research Institute 2003; University of Helsinki 2004).

The technical degree of forest engineer can be obtained in one of the 8 Polytechnics, of which one is in Swedish (see Table 4). To complete studies for the degree of forest engineer usually takes 4 years. In 2002, about 404 people (2003 about 259) started their studies. The number of graduated students in 2002 (290) differs slightly from the number in 2003 (277) and in previous years (251 in 2001; 224 in 2000, see also Fig. 10).

In total, 1,644 people (year 2002) were studying at forestry-oriented Polytechnics across Finland. According to the statistics, there are about 7,000 (year 2000) people working in the field of forestry who earned a degree at a Polytechnic. (Opetusministeriö 2004).

A degree in basic forestry and the forest-machinery field can be taken in one of the 27 **vocational schools**, of which two are in Swedish. Usually it takes 3 years to obtain basic

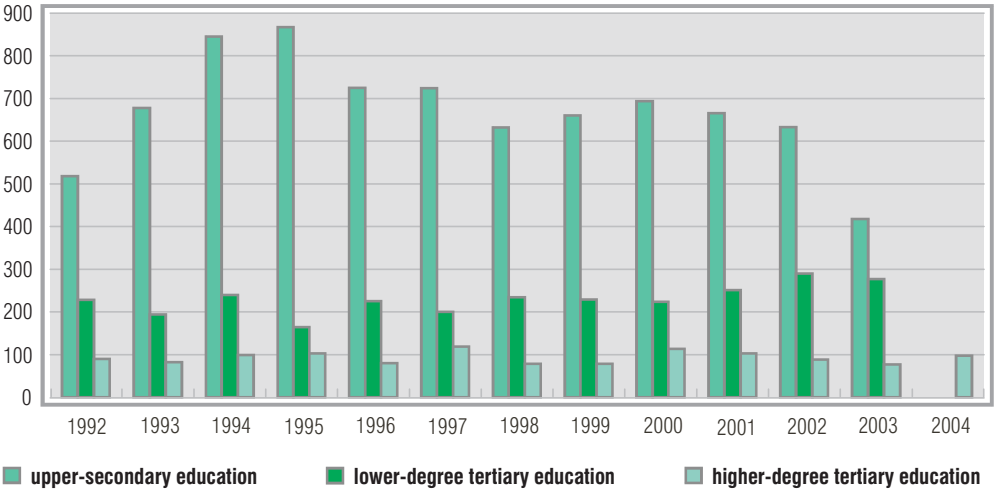


Fig. 10. Number of graduates in 1992–2004; 2004 data for upper-secondary education and lower-degree tertiary education not available (Finnish Forest Research Institute 2003; Metsänhoitajaliitto 2004 and 2005)

qualifications in forestry, depending on the student's previous education. The qualifications that can be obtained are suitable for those employed as a forestry worker, a forest-machine operator, or a forest manager. In 2003, a total number of 465 people commenced their studies at vocational schools in the field of forestry. It is interesting to note that the number of people (441 applicants) willing to commence studies differed markedly in 2003 from the number of available places (745). According to the statistics, there are about 8,200 people working in the field of forestry who completed a degree in a vocational school (Opetusministeriö 2004).

The degrees that can be obtained in colleges for further qualifications are especially meant for adults that have already been employed, or have already had another profession. It is possible to participate in examinations, and to complete a degree, without visiting a single course – if the person has enough experience or has done self-study. Courses are usually held in vocational schools. There are no exact data available on the number of students and graduates (Opetusministeriö 2004).

9. Forest Research

Forest research in Finland currently employs about 450 researchers with academic qualifications, over 300 of whom work at the Finnish Forest Research Institute (Metla). The Forest Research Institute is the principal research organisation in Finland – an independent, non-profit governmental organisation reporting since 1917 to the Ministry of Agriculture and Forestry (see Fig. 11).

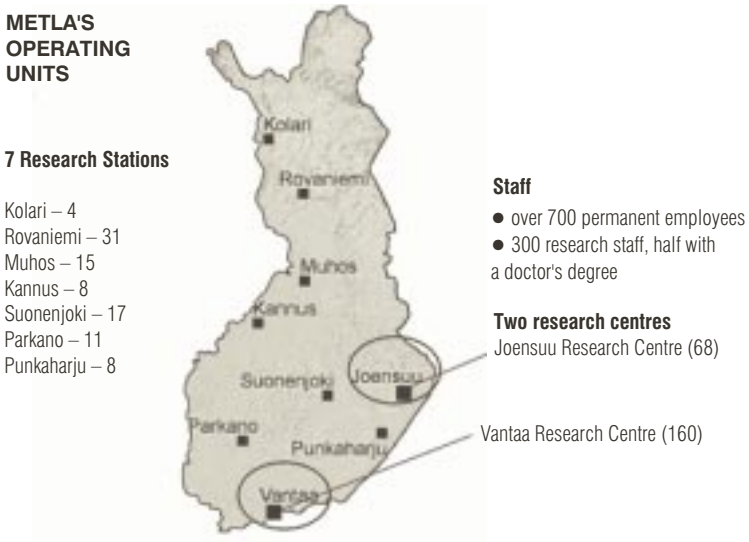


Fig. 11. Operating Units of the Finnish Forest Research Institute (Metla). Number of scientists in research centres is given in parenthesis

Its mandate is to promote – through research – the economically, ecologically and socially sustainable management and utilisation of forests. The Institute conducts scientific research, promotes the use of research results, develops national and international cooperation within forest research, and monitors the development of forest resources and forests.

The research activities of Metla are organised into problem-oriented research projects, which are partly further organised into multi-disciplinary research programmes. In 2005, about 100 research projects and 7 research programmes were ongoing at Metla. The research programmes – as the main research areas considered timely in Finland – were:

- national forest inventory,
- forest management planning,
- ecologically and economically sustainable forestry on drained peatlands,
- alternative silvicultural practices,
- pools and fluxes of carbon,
- policy instruments for safeguarding forest biodiversity,
- potential for the utilisation of roundwood and wood raw materials in relation to the wood-product markets.

The current share of funding shows that the main emphasis of research is on ecological and forest-management topics. The research strategy and research focus areas of Metla are under revision. The new organisational structure with new research focus areas was to be taken up at the beginning of 2006. It is evident that there will be a shift from ecological research towards social and economic research (see Fig. 12).

With 9 operating units of the Research Institute and two regional research stations of the Universities of Helsinki and Joensuu, there is a network of 11 stations providing nationwide coverage. In addition, the Institute has 90,000 hectares of research forests with over 23,000 experimental stands covering a wide range of research subjects.

Forest-related issues are also researched at the Universities of Helsinki, Joensuu, Turku, Oulu, Kuopio and Jyväskylä, at the European Forest Institute (EFI) in Joensuu, at Keskuslaboratorio Oy Centrallaboratorium Ab (KCL = the Institute for Pulp and Paper Research owned by the forest industry) in Espoo, Metsäteho (a private research unit owned by Finnish forest industry enterprises and the Forest and Park Service), the Finnish Environment Institute (SYKE) in Helsinki, the Technical Research Centre of Finland (VTT) in Espoo, the Finnish Game and Fisheries Research Institute, and the TTS-Institute (Work Efficiency Institute). Forest industry companies also conduct their own research and development activities.

Finland is an active participant in international research co-operation, especially with the neighbouring states, but also with other European countries. Since Finland's accession to the European Union, the share of pan-European research projects has increased. Furthermore, the establishment of the European Forest Institute in 1993 has increased the international research cooperation on forests in Finland.

Forest research is largely financed by the State. The annual budget assigned by the Ministry of Agriculture and Forestry to the Finnish Forest Research Institute is about 45 million euros. The external finance is of between 10%–30%, mainly in the form of research projects financed by governmental institutions like TEKES, and joint-research projects financed by several ministries. Part of forest research funding is channelled into the

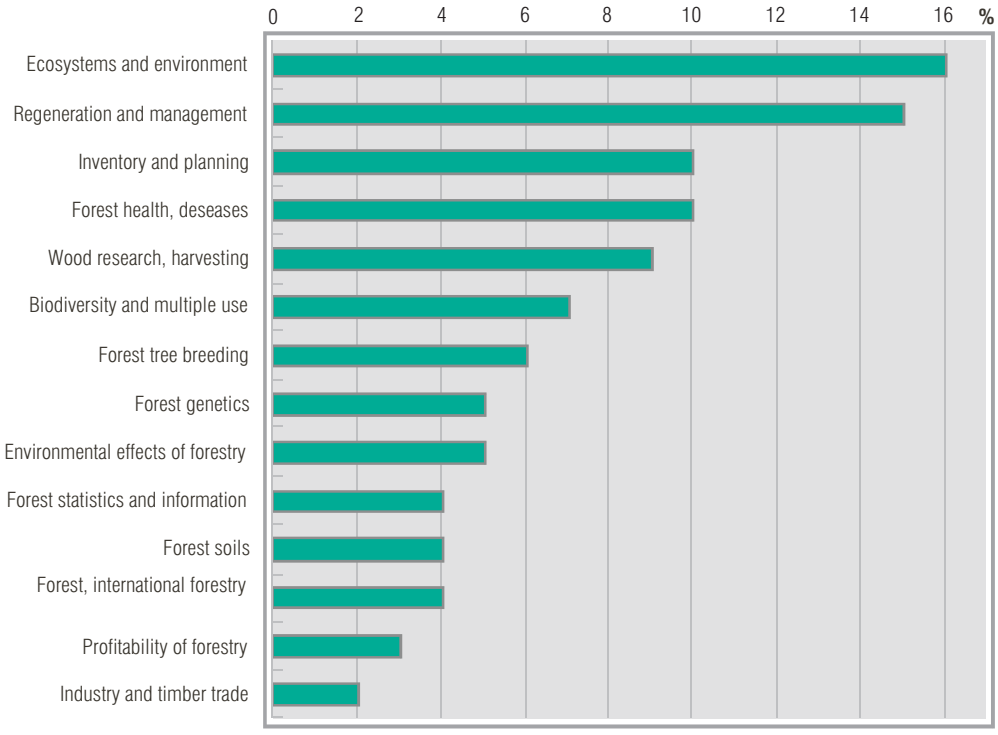


Fig. 12. Share of financing of research topics at the Finnish Forest Research Institute, 2003

research programmes of the Academy of Finland, or granted to individual researchers. The research carried out by universities is mainly financed by the Academy. Other bodies providing funding for research include various societies and funds (Metsämiesten Säätiö, Suomen luonnonvarojen Tutkimussäätiö and Suomen Kulttuurirahasto), as well as commercial enterprises, the industry, and the European Union.

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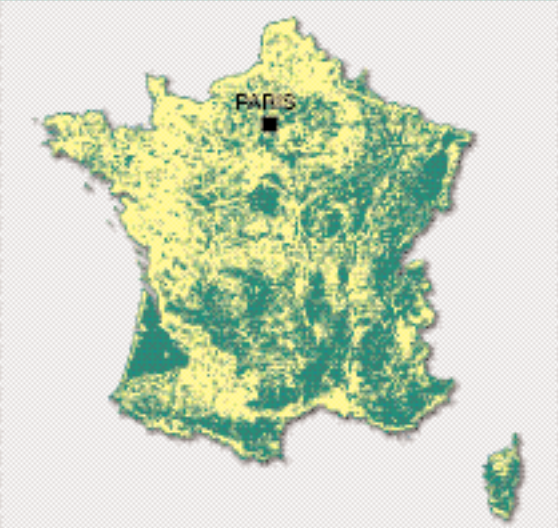
France

Jean-Marc Guehl and Anne Jambois (chapter forest law)

The French Republic (République Française), territory: 551,500 km², population: 59.5 million, capital city: Paris.



1. Forest characteristics

Forest area and species composition

The total area of Metropolitan France[1] is 54,882,760 hectares (IFN, 2005), with forests covering 15,061,650 hectares, or 27.4% of this area. The forest area in different departments fluctuates between 4% and 62%.

Table 1. The area of France by forest utilisation category (data from the inventory conducted in 1991–2001; Inventaire Forestier National 2005)

Category of utilisation	Owned by state (ha)	Owned by local-governments (ha)	Private (ha)	Total
Production forests	1,441,474	2,314,582	10,481,410	14,237,466
Other forests	68,677	138,103	617,403	824,183
Heath land	114,332	135,928	2,232,643	2,482,903
Poplar stands	1,995	5,356	205,244	212,595
Agricultural lands	31,618	25,518	30,466,637	30,523,773
Non-production	129,726	101,843	5,722,444	5,954,013
Water	2,304	3,921	641,601	647,827
Total	**1,790,126**	**2,725,251**	**50,367,382**	**54,882,760**

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[1] Metropolitan France refers to the part of France in Europe, including Corsica, as opposed to Overseas France, which includes Martinique, Guadeloupe, French Guiana, and Réunion.

Broadleaved trees predominate in the forest species structure accounting for 63.8% of all stands (2/3 of total forest area). Broadleaved forests prevail in lowlands (except for Maritime pine which occurs only in moors), while coniferous woodlands cover the mountain regions and also grow in Mediterranean latitudes. The percentage share of species in total stand volume is as follows: oak – 34%, beech – 12%, maritime pine – 10%, fir – 8% and Norway spruce – 8 %.).

Volume and increment

Total stand volume of French forests amounts to approximately 2.19 billion m^3 of merchantable timber, and it has increased by 15% during the last 10 years (in 1994 it was 1.85 billion m^3). At the same time, the total volume of growing stock has increased from 138 m^3/ha to 156 m^3/ha.

Table 2. Area, total volume of growing stock and annual production of merchantable timber by species (Data from the inventory conducted in 1992–2004; Inventaire Forestier National 2005)

Species	Area		Total volume of growing stock	Annual increment
	'000s ha	%	m^3/ha	m^3/ha
Oak*	5,101	36.4	146	5.2
Beech	1,303	9.3	203	6.5
Chestnut	508	3.6	133	6.6
Other broadleaves	2,044	14.6	101	5.0
Broadleaves in total	**8,956**	**63.8**	**144**	**5.4**
Spruce and fir	1,368	9.7	269	12.6
Maritime pine	1,368	9.7	156	9.7
Other pine spp.	1,795	12.8	126	5.4
Douglas fir	397	2.8	173	14.1
Other conifers	149	1.1	157	5.4
Conifers in total	**5,076**	**36.2**	**177**	**9.2**
Total	**14,032**	**100.0**	**156**	**6.8**

* Pedonculate, sessile and pubescent oaks.

Table 3. Area, total volume of growing stock and annual production of timber by stand structure (Data from the inventory conducted in 1992–2004; Inventaire Forestier National 2005)

Species	Area		Total volume of growing stock	Annual increment
	'000s ha	%	m^3/ha	
Broadleaved high forest	3,395	24.4	189	6.2
Coppices with standard (broadleaved)	3,315	23.9	152	5.9
Coppices	2,221	16.0	64	3.6
Total broadleaved	**8,931**	**64.3**	**144**	**5.4**
Coniferous high forest	4,209	30.3	193	10.0
Coppices with standard (coniferous)	768	5.4	115	6.0
Total coniferous	**4,977**	**35.7**	**181**	**9.4**

Forests in France are structurally differentiated. Almost a half of forest stands are coppices or coppices with standards (45.6%), where annual increment is significantly lesser.

2. Logging and wood processing

In 2003, harvesting of timber amounted to almost 32.8 million m^3, including: hardwood – 10.8 million m^3, softwood – 20.6 million m^3 and poplar – 1.4 million m^3.

Industrial timber is almost totally processed into pulp (10.2 million m^3, 96%) and designated for the production of paper, cardboard and particle boards. Large assortments (46%) are delivered to sawmills where they are processed mostly into sawn wood: spruce (3.9 million m^3), maritime pine (1.8 million m^3), Douglas fir (0.8 million m^3), oak (0.8 million m^3), and beech (0.5 million m^3).

Table 4. Timber harvesting in 2003 (in millions of cubic meters) (Memento AFOCEL 2005)

Assortment group	Total
Industrial timber	10.7
Merchantable timber	19.8
Fuelwood	2.3
Total	**32.8**

Table 5. Exports and imports of timber in 2004 (in millions of euros) (Memento AFOCEL 2005)

Product	Export	Import	Balance
Unprocessed wood	603	1,180	–577
Pulp and waste paper	370	1,056	–686
Paper and cardboards	4,536	4,699	–163
Particle boards (different types)	679	575	+104
Furniture and other wood products	976	2,499	–1,523
Other products of mechanical wood processing	697	951	–254
Other	100	340	–240
Total	**7,961**	**11,300**	**–3,339**

3. Nature protection

Currently, the Environment Code adopted by the Parliament on 28 February 2005 constitutes a basis for nature protection in France. Its first two paragraphs include statements that everybody has the right to live in a sustainable environment that respects human

health needs, and also that everybody has an obligation to participate in the protection and improvement of the environment. The leading institution responsible for nature protection is the Ministry of Ecology and Sustainable Development.

There are 14,755 areas which have been selected and included into the natural and landscape heritage of France for their ecological, as well as fauna and flora values. Their total area amounts to 16 million hectares, (23.5% of total country area). There are 285 indexed areas essential for bird protection (4.7 million hectares, 7.3% of total country area). A landscape atlas was prepared for 79 departments in co-operation with local communities, and monument trees were specified in 53 departments.

Nature protection in France is pursued on the basis of contracts or legal acts. NATURA 2000 is a form of contract-based nature protection, which embraces 174 areas of special protection of birds (1,428,000 hectares, 2.6% of the total area of Metropolitan France), and 1,219 areas of protection of wild fauna and flora habitats, with the terrestrial area of 4,200,000 hectares and 480,000 hectares of the sea area.

The contractual form of nature protection encompasses 44 regional nature parks that cover 7.1 million hectares (12.5% of the total area of France). Each regional nature park functions on the basis of an individual contract and collaborates with other parks in the framework of the Federation of Regional Parks of France. The projects for 7 other regional parks are under preparation.

Following the state regulations, the network of protected areas embraces 7 national parks (1 million hectares, 1.7% of the total area of France), 156 national nature reserves throughout the territory of France (427,400 hectares of the terrestrial area, and 18,700 hectares of the sea area; 0.8% of the total area of France), 600 biotope protection objects and 7,400 areas (totalling 2,443,000 hectares) with landscape and socio-cultural values: artistic, historical, scientific and legendary.

At the same time, a policy on the selection of new areas especially valuable as regards nature richness is conducted, particularly in the littoral zone and riverbeds. In 71 departments, this is possible because of the local tax designated for the acquisition and management of these lands. Currently, these areas embrace more than 7,000 hectares in the coastal regions and alongside 861 kilometres of the rivers.

Table 6. National Parks

Name	Year of establishment	Central zone (ha)				Protection zone (ha)
		total	State-	community	private	
Parc National des Pyrénées	1967	45,707	215	4,977	40,308	206,352
Parc National	1973	91,800	20,982	2,882	66,266	178,401
des Ecrins	1963	52,839	14	347	52,211	143,637
Parc National	1970	91,270	27,892	2,454	60,744	230,110
de la Vanoise	1979	68,494	14,040	8,165	45,405	146,270
Parc National des Cévennes	1963	675	no data	no data	no data	0
Parc National	1989	17,380	no data	no data	no data	16,200

4. Legal and organisational aspects of forest holdings

Ownership structure and accessibility of forests

Private forest ownership predominates in France. They are in hands of 4 million owners and cover 10.9 million hectares, or 73.7% of the total forest area. State-owned forests constitute 11% (1.5 million hectares) and local-government forests – 16.2% (2.4 million hectares). Public forests are generally accessible, except of protected forests. A private forest can be made accessible to society only by a decision of its owner.

Privately owned forests are much more fragmented than public forests: one forest holding measures 2.9 hectares, on average. The volume of growing stock in private forests amounts to 67% of the total growing volume, and the stand volume in these forests is greater than in public forests.

Table 7. Share of managed forests of different size by ownership

Type of ownership	Area		Number of units	Mean area	Share of holdings (%)		
	'000s ha	%		ha	area <10 ha	area 10–25 ha	area >25 ha
State-owned forests	1,422	10.3	1,533	928.0	0.0	0.0	100.0
Other public forests	2,252	16.3	15,220	148.0	0.0	1.4	98.6
Private forests	10,889	73.4	3,495,000	2.9	35.0	16.6	48.4

Forest law

Forest law has a long tradition in France. The Royal Ordinance (Act) signed in Brunoy in 1346 encouraged sustainable management of the royal forests. The famous Royal Ordinance signed by Louis XIV in 1669 consolidated most of the previous legal provisions on forests and could be considered as a Forest Code. The first official French Forest Code was voted in 1827; it took again the principal provisions of the Ordinance of 1669 and supplemented them with new ones, where gaps were noted. It is still today the basis of the French Forest Code, the main amendment has been made to the Forest Act of 2001, which comprises several chapters dealing with public forests, private forests, their general conservation and regulation, forest protection and erosion control, assessment and development of forest resources.

Forest policy takes into account the economic, environmental and social functions, and takes part in land planning directed towards sustainable development. Its aim is to ensure the sustainable management of forests and their natural resources, to increase employment, to reinforce the competitiveness of the forest sector, and to satisfy social demands in relation to forests. It is clearly influenced by the international debate on

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sustainable forest management and the so-called Helsinki process. It is related not only to international developments concerning forests but also to other policies in the fields, such as rural development, employment, consequences of climate change and its mitigation, conservation of biological diversity, soil, water, and prevention of natural hazards. It is now intended to be adapted at regional and local scales, particularly in the mountainous, Mediterranean, tropical and urban environments. It gives priority to incentives and agreements aimed at identification of the most appropriate counterparts to provide services, when the latter cause constraints or entail excessive costs.

5. The structure and tasks of the national forest administration

Organisation of management of public forests

Forest policy and management are the responsibility of the General Directorate of Forests and rural affaires (La Direction Générale des Foręts et des Affaires Rurales) at the Ministry of Agriculture and Fishery (Ministere de l'Agriculture et de la Pęche).

The National Forest Office (ONF – Office National des Foręts) is the main institution that shapes forest policy at national level, and implements the tasks of the Forest Code. This institution acts under the supervision and on behalf of the state, namely the Ministry of Agriculture, Alimentation, Fishery and Rural Affaires, and the Ministry of Environment.

The National Forest Office is administered by the decision-making board that consists of representatives of the ministries supervising the ONF, forest local governments, forest associations, as well as selected experts on technical, economic, scientific and social issues. The Office is supervised by the Director General nominated by a decree. Employees of the National Forest Office have the status of civil servants.

The Director General is assisted by: 1) general inspection that carries out internal audits in thematic or geographic arrangement, 2) scientific committee composed of 13 members with various specialisations and from different scientific centres, nominated every 4 years 3) crisis management centre that is responsible for actions in case of forest fires or wind damage. Furthermore, in the National Forest Office there are people co-operating with the forest and environment police, as well as experts working in so called thematic nets.

Financing of the ONF is indispensable for it to fulfil its mission and is specified in the Forest Code. The funds come from timber sales, fees for grazing animals and hunting, forest services and contracts with local governments, as well as from the state budget subsidies.

The National Forest Office directly administers forests and lands to be afforested that are owned or co-owned by the State. Managed forests belonging to regions, departments, communities (or parts of communities), public institutions, insurance companies, funds, associations and individual owners, are administered by the ONF on the basis of contracts. These contracts take into account the costs of forest protection and administrative expenses.

Table 8. Cost and income structure of the ONF in 2003 (Rapport du developement durable. Gestion 2003)

Cost (in millions of euros)		Income (in millions of euros)	
Salary of civil servants	293.0	Timber and game	200.5
Other salaries	117.2	Supervision and protection of community forests	137.4
Services and purchases	121.3	Trade of production and contract services	134.0
Taxes	38.8	Subventions	113.5
Other	58.4	Other	43.3
Total	**628.7**	**Total**	**628.7**

The total area of forests and other lands administered directly by the ONF amounts to more than 12 million hectares. The temperate zone forests in Metropolitan France cover 4.5 million hectares, of which 1.8 million hectares are state-owned forests and 2.7 million hectares are the local community forests[2].

Since 2001, the National Forest Office has embraced 10 territorial directorates (in the Metropolitan part), 5 regional directorates (Corsica, French Guiana, Guadeloupe, Martinique and Réunion), as well as the delegacy for the restoration of mountain regions (Delegation National Restauration des Terrains en Montagnes).

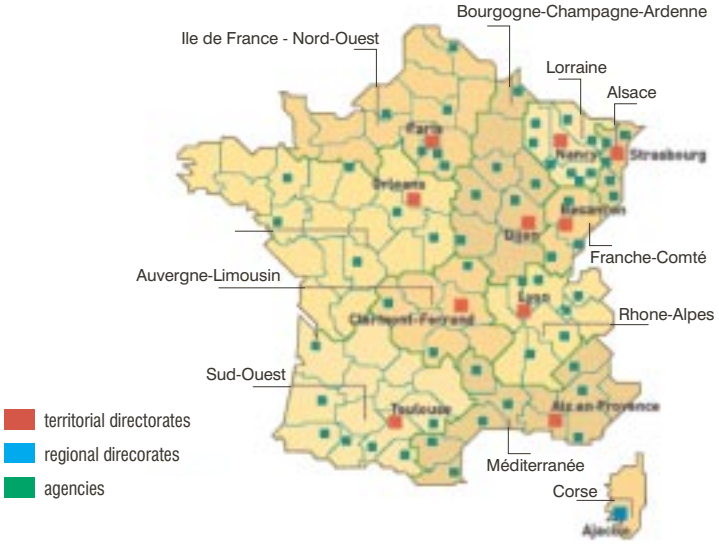

Fig. 1. Territorial division of the ONF in Metropolitan France (Inventaire Forestier National 2005)

* [2] 2.43 million hectares of these are owned by communities; 0.2 million hectares – by minor territorial communities, in general, mutually non-separated; 0.07 million hectares – by regions, departments and other institutions.

The territorial directorates are responsible for the stimulation of relevant activities, accessibility to forests, contacts with the general public, provision of advice (Arbre-conseil), arboreal activities (Atelier Bois), enhancement of local development, management of water resources, protection of wetlands, rural development, NATURA 2000, landscape, nature and biodiversity protection, trade, and geographic information systems, including GPS. Furthermore, the directorates provide free of charge expertise and services in respect of monument trees, rural parks, and roadside woods.

The territorial directorates are divided into departmental forest agencies (or inter-departmental agencies that administer forests of more than one department). The agencies consist of special units (for management of specific regions, such as maritime or mountain forests, as well as for expertise, and fire control) and operational territorial units (unités operationelles territoriales) that on average cover 1,200 hectares. The operational territorial units are composed of state-forest districts, with an average area of 1,600 hectares, local government forests under the administration of forest offices on the basis of contracts, as well as private forests under nature protection. The total number of operational territorial units is 360, including 1,185 state-forest districts.

Table 9. Forests administered by the National Forest Office – selected characteristics, from the inventory 1991–2001 (Inventaire Forestier National, 2005)

Administrative unit of the National Forest Office	Number of administrative regions	Number of departments	Total area ('000s ha)	Harvesting in '000s cubic meters (2001)	
				Total	State forests
Ile de France Nord-Ouest	5	18	310	1,389.0	1,248
Centre-Ouest	4	19	235	1,000.0	923
Sud-Ouest	2	13	497	1,200.0	508
Bourgogne-Champagne-Ardenne	2	8	606	1,676.0	749
Auvergne-Limousin	2	7	147	493.0	231
Mediterranee	2	11	1,000	560.0	301
Rhone-Alpes	2	8	466	887.0	169
Lorraine	1	4	583	2,750.0	1,380
Alsace	1	2	246	1,234.0	401
Franche-Comte	1	4	708	1,529.0	167
Total	**22**	**94**	**4,798**	**12,718.0**	**6,077**
Corse	1	2	150	50.0	35
Guadeloupe	1	1	38	0.5	0
Guyane	1	1	7,500	60.0	60
Martinique	1	1	15	3.0	0
Reunion	1	1	101	2.0	0
Total	**5**	**100**	**7,804**	**115.0**	**95**
Grand total	**27**	**100**	**12,602**	**12,833.0**	**6,172**

Since 1997, the implementation of the planned activities has been carried out on the basis of contracts. In 2001, the National Forest Office signed a contract with the Government for the period 2001–2006 (Contrat Etat-ONF 2001–2006). The National Forest Office signs annual contracts for forest management with territorial (or regional) directorates. The activities described in the contracts need to be specified precisely and in detail, and the priorities have to be further determined. Similar contracts are signed by the territorial directorates with forest agencies that include territorial units and specialised units. There is no vertical interdependency between particular agency units; they can contract each other for certain projects or services.

The National Forest Office employs 7,200 people with the status of civil servant. Among the employed are: 5,600 technicians, 1,600 administrative personnel, and 3,300 forest workers who mainly work in forest nurseries and young stands. Other forest services are provided by private companies selected through public procurement, organised by territorial directorates. Public procurements for timber trade are also organised by territorial directorates.

Table 10. Organisation of the National Forest Office (excluding Corsica and overseas departments, Inventaire Forestier National. 2005)

Administrative unit of the National Forest Office	Number of forest agencies	Number of territorial units	Number of special units	Employment	Forests				
					Total area	State-owned		Self-governmental	
					'000s ha	Number of districts	'000s ha	Number of comm-unities*	'000s ha
Ile de France Nord-Ouest	7	38	18	1,136	310	140	260	407	46
Centre-Ouest	6	26	6	650	235	112	198	473	36
Sud-Ouest	7	35	16	743	497	140	182	1,312	289
Bourgogne-Champagne-Ardenne	8	48	19	1,113	606	203	195	2,433	403
Auvergne-Limousin	4	16	7	285	147	73	46	2,379	101
Mediterranee	10	54	23	1,690	1,000	224	395	1,688	598
Rhone-Alpes	5	40	10	1,140	466	180	118	1,516	345
Lorraine	10	59	15	1,703	583	201	223	1,972	358
Alsace	5	5	5	1,200	246	56	81	655	165
Franche-Comte	5	37	15	866	708	36	39	1,891	352
Total	**67**	**358**	**134**	**10,526**	**4,798**	**1,365**	**1,737**	**14,726**	**2,693**

* Including forest owned by regions, departments and public institutions.

In 2001, the game management, hunting and game damage compensations were excluded from the National Forest Office and overtaken by the National Office of Wild Animals and Game (Office National de la Chasse et de la Faune Sauvage – ONCFS). Compensation for damage caused by wild boars and deer in agricultural cultivation is paid from a fund consisting of fees collected by regional game federations.

Organisation of management of local government forests

Local government forests may be administered directly by a local government or by forests syndicates of several territorial communities being established for more than 50 years. Local authorities can entrust the syndicate with full or partial execution of ownership rights. If a local government, forest associations, insurance companies or forest saving funds want to administer their forests jointly, then mixed syndicates are created, which are responsible for all management matters, except for taxes that are paid directly by the units within these syndicates.

Being components of national heritage, local government forests are assigned for sustainable management on a mandatory basis. This is guaranteed by a 10-year contract concluded with the National Forest Office, or forest experts, as designated by the National Forest Office. Local governments that own forests are members of the National Federation of Forest Communities (Federation Nationale des Communes Forestieres), and in 2003, they signed the Code of Community Forests (Charte de la foręt communale. 2003) with the National Forest Office. The Code constitutes a basis for the contracts for forest services related to the protection of national natural heritage signed between the National Forest Office and the communities.

The citizens are permitted to collect firewood free of charge for their household use from the community forests or those administered by the National Forest Office. Wood for own harvesting is assigned by the community authorities. Timber not harvested within the agreed time-frame is sold, and the profit therefrom is transferred to the community budget.

Organisation of management of private forests

The use of private forests is regulated by law and applies to forest areas of more than 25 hectares. In respect of forests exceeding this threshold, forest owners have to develop forest management plans for a period of 10 to 30 years (plan simple de gestion). These include a description of the ecosystem and forest type, stem distribution, management goals, an action plan and forest harvest types required. The management plan has to be approved by the Regional Centre of Private Forestry (CRPF), which is administrated by a body of elected private forest owners. Private owners manage their forests either on their own, or through associations of a different type, or else they commission forest management to the State. Subsidies are used as a tool for extorting management according to the forest policy. These are obtained only by those applicants who guarantee sustainable forest management and who implement the forest management plan in accordance with the regulations, or else, who are associated in an organisation collaborating with experts and managing their members' forests on the basis of a contract signed for at least a 10-year period. Forests included (fully or partially) in the NATURA 2000 network are considered being managed in a sustainable way.

Private forests are administered directly by landowners, or on their behalf, by the following organisations:

- forest syndicates associated in the National Federation of Forest Owners (Forestiers Privés de France – FPF);

- forest communities associated in the French Forest Union (l'Union de la coopération forestière française – UCFF);
- Regional Centre of National Forest Ownership (Centre Régional de la Propriété Forestière – CRPF) public institution established by the Ministry of Agriculture in order to stimulate sustainable forest management in private forests;
- National Centre of Professional Training for Forest Owners (Centre National Professionnel de la Propriété Forestière – CNPPF).

6. Education in forestry

The French higher education system offers two parallel ways of pursuing higher education, that is in engineering schools (grandes écoles d'ingénieurs) and universities.

A degree in forestry may be obtained mainly at the Training Centre for Forest Engineers of the State School of Agriculture, Water Management and Forestry (Formation des ingénieurs forestiers of the École nationale du génie rural, des eaux et des forêts (FIF--ENGREF). 50 students are being selected every year on the grounds of their school achievements to attend a 3-year study-programme at the FIF-ENGREF. ENGREF is a public institution that educates forest officers who after graduation can take responsible posts in the following fields: public forest management, private forest management, natural resource management, forest administration, wood processing industries, research, and teaching. Forest administration studies (1-year course) and M.Sc. studies, as well as doctoral studies (Ph.D.) are also available at ENGREF.

Others public or private education programmes in wood science are, mainly:

- The National High College of Wood Technology and Industry (École nationale supérieure des technologies et industrie du bois (ENSTIB) offers a 3-year course of study (Master's Degree) in wood processing, and is supervised by the Ministry of Education, Higher Education and Research.
- The High College of Wood (École supérieure du bois (ESB) is a private institution where students compete for a 3-year programme. The annual fee is EUR 3,300.

At the lower levels of study, students can graduate with a title of a technician (Brevet de technicien supérieur en agriculture, option gestion forestière (BTSA GF) – under the supervision of the Ministry of Agriculture and Fisheries) and with a Bachelor's Degree in forestry or wood science (Licence professionnelle).

7. Forest research

Scientific institutions

Forest research is carried out in France by the following institutions:

National Forest Inventory (IFN – Inventaire Forestier National), Nogent-sur-Vernisson, www.ifn.fr. It consists of 5 regional departments and conducts forest resource measurements and analyses across the ownership categories

National Institute of Agricultural Research (INRA – Institut National de la Recherche Agronomique), Paris, www.inra.fr. INRA reports to the Ministry of Agriculture and to the Ministry of Scientific Research. It is the leader among the European research institutes, and one of the three world-wide institutes leading in the field of agriculture, food, and the environment. It is one of two public French institutes. It employs 8,850 staff, including 1,840 scientists, 2,360 engineers, 4,640 technicians and administrative personnel. Around 6% of INRA financial resources are involved in the forest research sector, that is about 400 permanent staff (including nearly 200 researchers), plus around 100 associated researchers (professors, lecturers, scientists, engineers from other organisations) and 100 Ph.D. candidate students and post-doctoral fellows.

The structure of forest research at INRA advocates strong scientific partnership and embraces 3 scientific departments (Ecology of forests, grasslands and freshwaters, Characterisation and elaboration of processed agricultural products and Social Sciences, Agriculture & Food, and Environment & Space), 8 centres throughout France, 22 research units with 12 units co-operating with other scientific centres, also in the field of university education.

The research areas are:

- Biodiversity, functioning and dynamics of continental ecosystems at different levels of life organisation, and the role of these ecosystems in the biosphere;
- Functional and evolutionary impacts, direct or indirect, of human activities;
- Development of the methods and tools for ecosystem monitoring: environmental information system, criteria and indicators of sustainable management;
- Development and assessment of the strategies for conservation, restoration and exploitation of these ecosystems and their biological and physical resources.

Research Institute of Agriculture and Environment Engineering (CEMAGREF – Institut de recherche pour l'ingénierie de l'agriculture et de l'environment), Antony, www.cemagref.fr. The institute conducts research on the environment, particularly water and floods, soil erosion, avalanches, as well as on the mitigation of damage caused by these factors (e.g. by floral cover).

Institute of Forest Development (IDF – Institut pour le Développement Forestier), Paris, www.foretpriveefrancaise.com. The institute carries out activities relating to private forests, such as applied research on silviculture, dissemination of knowledge through publications, as well as organisation of professional training courses. IDF publishes technical books and a journal titled Forêt Entreprise. Research and Development Programme is carried out in 4 regional offices (Lyon, Orleans, Paris, and Toulouse). Main research subjects concern: silviculture of coniferous (Douglas fir, maritime pine) and broadleaved species (poplars, chestnuts, oak beech, walnut), seeds, seedlings, ecology, economics, biodiversity, ecological services (e.g. relationship between forests and water resources).

AFOCEL – (Association Forêt Cellulose), Nangis, www.afocel.fr. This private institute carries out the basic and applied research in 4 major fields:

- wood supply: harvesting, transportation, logistics, energy, wood ,trade;
- processes and products: forests – production process – final product relationship;
- forest: forest plantation, breeding and biotechnology, sustainable forest management;
- territories: strategic approach, synergies between stakeholders.

This institution co-operates in France with: INRA on genetic breeding and forest biotechnology, with the Technical Centre of Paper (CTP – Centre Technique du Papier) on research on pulp and paper through InTechFibres and the Technical Centre of Wood and Furniture (CTBA – Centre Technique du Bois et l'Ameublement) on application of wood processing phases and wood supply.

Centre of International Collaboration on Agronomic Research Development. (CIRAD – Centre de Coopération Internationale en Recherche Agronomique pour le Développement), Forest Department. Campus de Baillarguet, Montpellier, www.cirad.fr.

Research fields of the Centre include:

- elaboration of tools and methods for sustainable forest management of nature areas predisposed for forest management, including biodiversity protection;
- agro-forestry proposals, with the use of forest, urban and industrial silviculture;
- rational and economical utilisation of wood in sustainably managed coppice stands.

Research Institute for Development (Institut de Recherche pour le Développement, IRD). This institute is focused on natural and social sciences related to the economic development in the tropics. Activities linked to forest issues concern botany, taxonomy, ecology, and social sciences.

Universities, the National Centre for Scientific Research (Centre National de la Recherche Scientifique, CNRS) and the National Museum of Natural Sciences (Muséum National d'Histoire Naturelle, MNHN) do not have any specific forestry divisions. However, quite a large number of scientists work on forest issues, such as ecology and biodiversity conservation, both in Metropolitan France and abroad.

ECOFOR is a Public Interest Group concerned with forest ecosystems that co-ordinates research on functioning of forest ecosystems and increasingly on forest management and monitoring. It is a network of nine scientific and professional organisations: IFN, INRA, Cemagref, IDF-CNPPF, Cirad, IRD, CNRS, ENGREF, and ONF.

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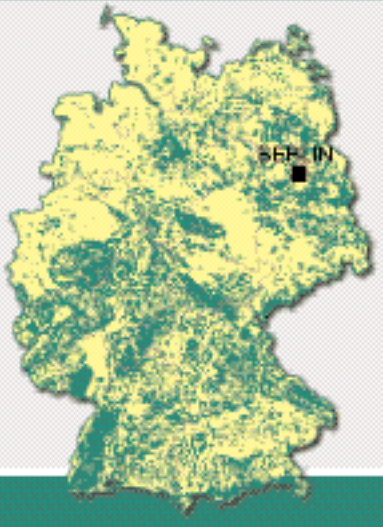
Germany

Hans Walter Roering

The Federal Republic of Germany (Bundesrepublik Deutschland), territory: 357,000 km², population: 81.9 million, capital city: Berlin.



Forestry at federal level

Introduction

The Federal Republic of Germany is a federal state. According to its Constitution, forestry is mainly the responsibility of individual States (Bundeslaender) (see point 2.3). For this reason, no comprehensive annual surveys on forestry data are issued in Germany at federal level. This study is therefore a compilation of data from various sources. The main sources for this information are the annual Agrarian Report of the Federal Ministry of Consumer Protection, Food and Agriculture (BMVEL), the results of the last Federal Forest Inventory and publications by Germany's Federal Statistics Office.

1. Forest Characteristics

Forest area and species composition

Forests cover approximately 11 million hectares, or 31% of the national territory of the Federal Republic of Germany. This means that, after agriculture, forestry is the second greatest form of land use and the most important near-natural living space throughout the country. According to the results of the most recently produced Federal Forest Inventory,

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that of 2001/2002, which was the second to be conducted in Western Germany and the first in Eastern Germany, the Federal State of Bavaria has the largest forest area, whereas the State of Rhineland-Palatinate has the highest proportion of forest cover. Table 1 provides a detailed overview of forest area and forest coverage in Germany.

In Germany, coniferous tree species still predominate. They account for 57.5% of the total forest area, while deciduous forest tree species cover 42.5%. Norway spruce (*Picea abies*) is the most important tree species in German forests. The most common deciduous tree species is the European beech (*Fagus sylvatica*) (see Fig. 1).

Table 1. Forest area and forest coverage in Germany

The German States	Forest Area	Forest Coverage (%)
Baden-Württemberg	1,362,299	38.1
Bavaria	2,558,461	36.3
Berlin	16,000	18.0
Brandenburg	1,055,733	35.2
Bremen	0	0.0
Hamburg	3,000	4.0
Hesse	880,251	41.7
Mecklenburg-Western Pomerania	534,962	23.1
Lower Saxony	1,159,522	23.5
North Rhine-Westphalia	887,550	26.0
Rhineland-Palatinate	835,558	42.1
Saarland	98,458	38.3
Saxony	511,578	27.8
Saxony-Anhalt	492,128	24.1
Schleswig-Holstein	162,466	10.3
Thuringia	517,903	32.0
Federal Republic of Germany	**11,075,869**	**31.0**

Source: Federal Forest Inventory 2, Federal Ministry of Consumer Protection, Food and Agriculture, Bonn.

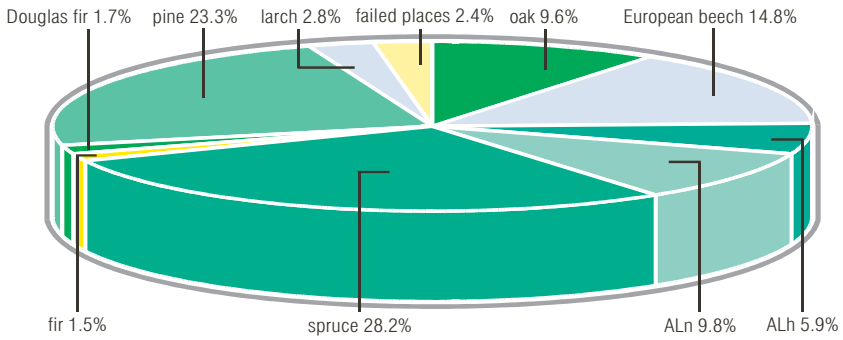


Fig. 1. Tree species composition in Germany
ALh: other deciduous wood with long rotation period (e.g. ash, maple, elm, lime tree, etc.); ALn: other deciduous wood with short rotation period (e.g. poplar, willow, birch, etc.) (Source: Federal Forest Inventory 2, Federal Ministry of Consumer Protection, Food and Agriculture, Bonn).

Volume and increment

The Federal Forest Inventory quotes the total volume of standing timber, which amounts to 3.381 billion m^3. This corresponds to a volume of 317 m^3/ha. The current annual increment of timber amounts to approximately 135 million m^3 (12 m^3/ha/year).

2. Logging, wood processing and trade

In 2002, a volume of approximately 42.4 million m^3 of timber was felled in Germany. Approximately 78% of the felling involved coniferous timber, only 22% being broadleaves (see Table 2).

Table 2. Felling in Germany in 2002

Species	Felling in '000s m^3
Oak, red oak	1,562
European beech, other broadleaves	7,641
Spruce, fir, Douglas fir	23,976
Pine, larch	9,201
Total	**42,380**

Source: Federal Statistics Office, Wiesbaden.

The sawn wood industry is the major consumer of raw timber and a very important sector of Germany's forest industry. During the last 3 years, sawmills constantly processed between 21 and 22 million m^3 of raw timber, approximately 50% of the country's raw timber harvest. Table 3 provides an overview of consumption and production in the most important sectors of the forest industry.

In 2002, forest industries in Germany employed a workforce of more than 550,000, while total volume of transactions amounted to EUR 80.9 billion.

The international timber trade shows no uniform pattern. On the one hand, Germany has a large import surplus of pulp, but on the other hand it also has a large export surplus of fibre- and chipboard. If converted into raw timber equivalents (r) and including recycled paper, Germany's external trade balance for all wood-based products in 2002 was negative (Imports: 99.3 million m^3(r), Exports: 94.1 million m^3(r). Table 4 provides an overview of the international trade in a subset of forest and wood-based products.

Table 3. Timber consumption, manufacture of forest products in Germany 2000–2002

Federal Republic of Germany	2000	2001	2002
	'000s m³		
Sawmills			
Timber consumption	21,822	21,482	21,625
Sawn wood production, including:	16,341	16,131	18,240
– coniferous timber	15,021	14,889	15,869
– deciduous timber	1,320	1,242	271
Veneer mills			
Timber consumption	350	291	217
Veneer production, including:	305*	241*	217
– coniferous timber	97	56	61
– deciduous timber	208	185	156
Plywood mills			
Timber consumption	–	213	154
Plywood production	357	321	270
Fibreboard mills			
Timber consumption, including:	2,864	4,481	9,251**
– round wood	1,784	2,315	3,638
– industrial waste wood	1,080	2,166	5,613
Fibreboard production	2,974	2,899	3,350
Chipboard mills			
Timber consumption, including:	8,940	8,798	17,114**
– round wood	2,522	2,960	4,118
– industrial waste wood	6,418	5,838	12,996
Chipboard production	10,341	9,880	9,507
Wood-pulp, pulp, paper, paperboard			
Timber consumption, including:	7,249	6,921	6,942
– round wood	4,203	4,001	3,948
– industrial waste wood	346	2,920	2,994
Production ('000s t)			
Pulp	873	874	896
Wood-pulp	1,342	1,229	1,252
Paper, paperboard	18,182	17,879	18,539

Source: Federal Statistics Office, Wiesbaden and German Pulp and Paper Association, Bonn.
* domestic timber
** 2002 in stacked cubic meters

Table 4. Import and export of forest and wood-based products in 2002

Forest and wood based products	Import	Export
	'000s m³	
Coniferous round wood	2,278	3,454
Coniferous sawn wood*	4,505	4,237
Wood for fibre	282	2,113
Deciduous round wood	345	1,453
Deciduous sawn wood	706	611
Railway sleepers	23	46
Veneer	154	120
Plywood	974	167
Fibreboards	1,239	2,983
Chipboards	1,538	2,246
	'000s tonnes	
Pulp	3,856	475
Wood-Pulp	158	15

Source: Federal Statistics Office, Wiesbaden.
* Incl. planed timber.

3. Forest protection

According to the guidelines of the Ministerial Conference on the Protection of Forests in Europe (MCPFE) more than 9 million hectares of forest in Germany are to some extent protected or have protective functions. But there is much overlapping between 3 classes though not between the classes 1.1 to 1.3. Thus, the actual area of protected or protection forest in Germany is between 75 and 80%. The list of various protection classes and the respective forest areas are shown in Table 5. The classes used by the World Conservation Union (IUCN) are included for comparison.

Table 5. Forests in protection areas in Germany according to MCPFE Guidelines (2002)

Form of Protection	MCPFE class	IUCN class	Forest area (ha)	Forest area* (%)
Conserving forest biodiversity, including:	1	I, II, IV	2,138,422	19.9
– no active intervention	1.1	I	0	0.0
– minimum intervention	1.2	II	90,831	0.9
– conservation through active management	1.3	IV	2,047,591	19.0
Protection of landscapes and special natural elements	2	III, V, VI	4,686,038	43.6
Forests with protective functions	3	–	2,980,850	27.8

Source: Federal Ministry of Consumer Protection, Food and Agriculture, Bonn 2. Legal and organisational forms of forest holdings.
* Of 10.7 million ha of the forest area of Germany before the results of the last Federal Forest Inventory.

4. Forest law

The Federal Structure of Forest Legislation and the Federal Forest Act

Since Germany is a federal state, this means that its 16 States have contracted an alliance in such a manner that particular Member States (States) have delegated some areas of their sovereignty to the Central Federation. Thus, not only the Federation, but also the 16 Member States are responsible for the overall national status, including the condition of the forests. This federal structure has consequences for the forest sector and by the same token for forest legislation in Germany.

In general, legislative power is shared between the Federation and its constituent States. The respective rules are set forth in Articles 70 to 82 of the Federal Constitution Act (Grundgesetz). Legislative power is structured as follows:

1) Exclusive legislative power of the Federation (Articles 71 and 73 of the Constitution, Ex. q.v. p. 5).
2) Concurrent legislative power (Articles 72, 74 and 74a of the Constitution); jurisdiction remains with the States as long as the Federation chooses not to take advantage of its legislative power. The general rule is that Federal Law takes precedence over that of States (Ex. q.v. p. 6).
3) 'Draft' legislation of the Federation (Article 75 of the Constitution); federal acts provide only a framework, which is to be completed by the States with their own specific legal provisions (Ex. q.v. p.7).
4) In accordance with 1)–3) above, where the Federation is not responsible, legislative power devolves to the States, (Ex. q.v. p. 8).

For Germany's forestry, this means that according to Article 75, p. 3–4 of the Constitution, the Federation has 'draft' legislative power with regard to the protective and recreational functions of forests, and concurrent legislative power for all other fields of forestry (Article 74 (1), p. 1, 17 and 18 of the Constitution).

Consequently, the most important forest Act at federal level, the 1975 Federal Forest Act, is based on these two different constitutional principles. This means it contains both draft provisions that are to be specified by the States and also directly applicable provisions by way of concurrent legislation. The constitutional basis for the most important regulations of the Federal Forest Act is very complicated. But this complex distribution of legislative power has been simplified by Article 5 of the Federal Forest Act, which provides that with regard to Articles 6–14, the Federation claims only draft legislative power.

The objectives of the Federal Forest Act, as described in Article 1 of the Federal Forest Law, are to:

1. Protect forests in view of their economic benefits (productive function) and their importance for the environment and the recreation of the general public (protective and recreational functions), expand them wherever possible and to ensure their proper management on a sustainable basis, whilst promoting the forestry sector and reconciling public interests and the concerns of forest owners,

2. Promote forestry, and
3. Provide a balance between the interests of the general public and the interests of forest owners.

The Federal Forest Act includes, among others, the following essential components:

- A general order for proper and sustainable forest management (Articles 1 and 11 of the Federal Forest Act).
- A reforestation duty (Article 11 of the Federal Forest Act); in conjunction with the forest legislation of the individual States, this regulates the minimum obligations to be fulfilled by forest owners in reforesting or completely clearing cut forest land and lightened forest stands within adequate time limits, where natural regeneration remains incomplete. In the forest legislation of the States, various time limits are laid down, normally 2–3 years. Further regulations in the forest provisions of the States with regard to forest management are aimed at environmental precautions, restrictions on clear cutting, protection of premature stands, imposition of a duty to tend forests, forest opening and appropriate and orderly forest management.
- A provision permitting the conversion of forests (Article 9 of the Federal Forest Act); in accordance with this provision, forests are only cleared and transformed into other land use forms under a permit to be granted by the responsible authority by virtue of State legislation. The rights, duties and interests of forest owners are weighed against the needs of the general public. This permit is denied where the forest's protective function constitutes the overriding public interest. The regulations of the Federal Forest Act may be further expanded by the States.
- The promotion of forestry (Article 41 of the Federal Forest Act); the promotion especially shall improve the efficiency of sustainable forest management and ensure the protection of forests.
- Overall forestry planning (Article 6 of the Federal Forest Act), whose purpose is to order and improve the structure of forests and maintain their functions.
- Protection and recreational forests (Articles 12 and 13 of the Federal Forest Act); in order to protect specific forest functions and avert relevant hazards, disadvantages or annoyances to the general public, forests may be declared protection or recreational forest under special forest management provisions.

Special areas are governed by particular acts, for example:

- The 2003 Forest Reproductive Material Act,
- The 1969 Forest Damage Compensation Act,
- The 1998 Timber Promotion Fund Act, and
- The 1969 Raw Timber Classification Act.

The Forest Reproductive Material Act regulates the concession of parental material (those trees from which forest reproductive material is harvested), the certification and marking of the reproductive material for trade and control of the companies involved.

The Forest Damage Compensation Act regulates the compensation for damages as a result of special natural phenomena in forestry. The Act provides for the opportunity:

- to restrict regular logging (Article 1),
- to restrict timber import (Article 2),
- to take various measures aimed at reducing the tax burden (Articles 3–8).

The Timber Promotion Fund Act regulates the establishment, legal form, tasks, organisation and financing of the Timber Promotion Fund.

The Raw Timber Classification Act provides the legal basis for an ordinance (the 1971 Ordinance on Raw Timber Classification Types) that regulates the generation, marking, denomination, measurement and quantity surveying of raw timber in accordance with the relevant legal provisions of the European Union.

Government assistance to forestry

The promotion of forestry, especially the promotion of non-state-owned forests, falls within the competence of the individual States. The organisational structure for advisory services to and support for non-state-owned forests is presented in section 2.7 below, entitled Structure of National Forest Administrations. In terms of financial support for non-state-owned forest enterprises, there are many differences between particular States. This applies to both supported forest management activities and the funding of subsidies. Operations enjoying the most support are jointly financed by the Federation (60%) and the States (40%). The rules governing this co-financing system are regulated in the Act on the joint task 'improvement of the agrarian structure and coastal protection'. Supported forest management activities currently fall into the following 5 areas:

- silvicultural measures, *i.e.*:
  - tending of young forest stands,
  - conversion of forests not suited to their site,
  - afforestation of farmland (including replanting and tending of plantations),
- new building and the extension of existing forest roads and tracks,
- promotion of forest management associations (Forstwirtschaftliche Zusammeschlüsse), e.g.:
  - grants to cover initial investments (e.g. office facilities, machinery, etc.),
  - grants to cover administrative and consultancy costs,
- premiums for afforestation of former farmland,
- activities due to new types of forest damage, *i.e.*:
  - soil protection and melioration fertilisation,
  - reforestation of damaged forest stands.

Some of these subventions are also co-financed with EU resources (in the "old" States: 50% by the EU, 30% by the Federation and 20% by the States; in the "new" States: 75% by the EU, 15% by the Federation and 10% by the States).

Besides these subventions, various supported management activities are financed by the States and the EU (in the "old" States: 50% by the EU and 50% by the State; in the "new" States: 75% by the EU and 25% by the State) or else by the State alone. These supported activities vary from one State to another.

4. Forest ownership structure

In Germany, the predominant forms of ownership are Treasury-owned, municipal and private forest. According to the results of the Federal Forest Inventory, just under 50% of German forest area is private forest, one third is state-owned and approximately 20% constitutes municipal forests (see Fig. 2).

In Germany, there are approximately 1.3 million forest owners, among which 17 are Governmental forest owners and approximately 10,000 municipal forest owners; the majority of remaining owners are private holders. Farmers constitute more than 90% of the private forest owners. Approximately 1 million of the private forest owners hold forests smaller than 1 hectare in area. The size of privately owned forests averages 7.7 hectares, that of municipal forests – circa 900 hectares. Table 6 provides an overview of the size structure of forest enterprises.

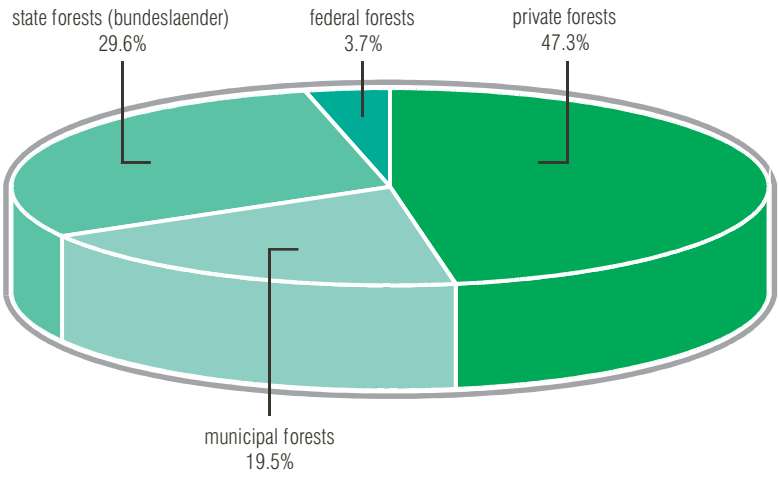


Fig. 2. Forest ownership structure in Germany (Source: Federal Forest Inventory 2, Federal Ministry of Consumer Protection, Food and Agriculture, Bonn)

Table 6. The size structure of forest ownership in Germany

Size range	Number of enterprises	Forest area in millions of ha
below 10 ha	circa 1,295,000	2.3
10–50 ha	circa 48,000	1.0
51–200 ha	circa 7,300	0.8
201–1,000 ha	circa 3,300	1.5
Over and above 1,000 ha	circa 1,400	5.5
Total	**circa 1,355,000**	**11.1**

Source: Agrarian Structure Survey 2001, modified, Federal Ministry of Consumer Protection, Food and Agriculture, Bonn.

Types of public forest

In Germany, the official types of ownership are defined in the forest legislation. There are two forms of public forest ownership: government ownership and municipal ownership. Government ownership comprises the forests owned by the States and the Federation, municipal ownership – those owned by towns, municipalities, districts, and public authorities. The remaining forest owners are private holders.

Public access to forests

Access to forests by the general public is regulated by the draft legislation of Article 14 of the Federal Forest Act (Bundeswaldgesetz). The first paragraph of that Article provides that access to forests is permitted for recreational purpose. Cycling, use of wheelchairs and horseback riding in forests are only permitted on roads and forest tracks. The second paragraph provides that the relevant details are regulated by particular States. For suitable reasons, the States may restrict public access to forests. Thus, in Schleswig-Holstein, a State with only thin forest cover, public access to forests is only allowed on roads and forest tracks and horseback riding is only permitted on specially marked bridle paths.

Forest associations

More than 400,000 forest owners are members of Germany's 5,403 forest management associations. These associations manage 3.3 million hectares, or approximately one third of all German forests (see Table 7).

Table 7. Forest management associations (Forstwirtschaftliche Zusammenschlüsse)

Number of forest management associations	5,403
Number of member enterprises	449,102
Forest area of member enterprises in ha	3.3 million
Forest area of member enterprises as % of total German forest	30%
Forest area of member enterprises as % of non-state-owned forest	46%
Forest area of member enterprises as % of total forest of "old" States	39%
Forest area of member enterprises as % of non-state forests of "old" States	56%
Forest area of member enterprises as % of total forest of "new" States	8%
Forest area of member enterprises as % of non-state forests of "new" States	15%

Source: Federal Ministry of Consumer Protection, Food and Agriculture, Bonn.

Private owners associations

In Germany, forest owners have syndicated at state level to forest owners associations, with a total of 14 such associations (in 16 States, except for 3 city-states; also Lower Saxony has two such associations: one each for the western and eastern parts of this State). Except

for Baden-Wuerttemberg, they have all established Federal level working committees called the Alliance of German Forest Owner Associations (Arbeitsgemeinschaft Deutscher Waldbesitzerverbände – AGDW). The AGDW is in turn a member of the Confederation of European Forest Owners (CEPF) being the umbrella organisation for national forest owners organisations in the European Union.

5. Structure and tasks of the national forest administration

In accordance with the Constitution of the Federal Republic of Germany (see above) forest administration is managed by particular State Governments, namely Germany's 16 different governmental forest administrations. Moreover, 2 governmental forest administrations act at Federal level, one of which manages the forests owned by the Federation and is subject to control by the Federal Ministry of Finance, whereas the other is responsible for forest policy and forest legislation at Federal level and constitutes a section of the Ministry for Consumer Protection, Food and Agriculture. In general, three types of activities are carried out by forest administrations, *i.e.*:

- management of state-owned forests,
- control of and supervision over non-state-owned forests and
- advisory services for and promotion of non-state-owned forests.

Table 8 provides an overview of the structure of the various state administrations.

Table 8. Overview of administrative structures in Germany (numbers signifying different administration levels)

Federal State (Bundesland)	Ministry	Management of state-owned forests	Forest supervision, Forest police	Forest consultancy services and promotion of non-state-owned-forests
1	2	3	4	5
Baden-Wuerttemberg (Baden-Württemberg)	Ministry for Food and Rural Areas (MELR)	State Forest Administration 1) MELR, Dept. 5 2) 2 Forest Directorates 3) 163 Forest Offices Planned from 2005-01-01 1) MELR, Dept. 5 2) 2 Regional District Offices, Dept. Forests 3) 35 District Offices and 9 Mayor's offices, Dept. Forests	State Forest Administration 1) MELR, Dept. 5 2) 2 Forest Directorates 3) 163 Forest Offices Planned from 2005-01-01 1) MELR, Dept. 5 2) 2 Regional District Offices, Dept. Forests 3) 35 District Offices and 9 Mayor's offices, Dept. Forests	State Forest Administration 1) MELR, Dept. 5 2) 2 Forest Directorates + 1 Municipal Forest Directorate 3) 163 Forest Offices Planned from 2005-01-01 1) MELR, Dept. 5 2) 2 Regional District Offices, Dept. Forests 3) 35 District Offices and 9 Mayor's offices, Dept. Forests

Table 8. continued from page 124

1	2	3	4	5
Bavaria (Bayern)	State Ministry for Agriculture and Forests (MLF)	State Forest Administration 1) MLF, Dept. 5 Forest Administration 2) 4 Forest Directorates 3) 127 Forest Offices Planned from 2005-07-01 State Enterprise Bavarian State Forests 1) Head Office 2) circa 40 regional enterprises	State Forest Administration 1) MLF, Dept. 5 Forest Administration 2) 4 Forest Directorates 3) 127 Forest Offices Planned from 2005-07-01 1) MLF, Dept. 5 2) not clarified 3) circa 50 Offices for Agriculture and Forestry	State Forest Administration 1) MLF, Dept. 5 Forest Administration 2) 4 Forest Directorates 3) 127 Forest Offices Planned from 2005-07-01 1) MLF, Dept. 5 2) not clarified 3) circa 50 Offices for Agriculture and Forestry
Berlin	Senate for Urban Development	Forest Authority of Berlin 1) State Forest Office 2) 4 Forest Offices	Forest Authority of Berlin 1) State Forest Office 2) 4 Forest Offices	Forest Authority of Berlin 1) State Forest Office 2) 4 Forest Offices
Brandenburg	Ministry for Agriculture, Environmental Protection and Land-Use Regulation (MLUR)	State Forest Administration 1) MLUR, Dept. Forestry 2) 10 Offices for Forestry 3) 72 Upper Forest Districts	State Forest Administration 1) MLUR, Dept. Forestry 2) 10 Offices for Forestry 3) 72 Upper Forest Districts	State Forest Administration 1) MLUR, Dept. Forestry 2) 10 Offices for Forestry 3) 72 Upper Forest Districts
Bremen	Senate for Construction, Environment and Traffic (SenBUV)	Municipal Enterprise Bremen Urban Green	SenBUV, Dept. 3, Environmental Protection of Areas	SenBUV, Dept. 3, Environmental Protection of Areas
Hamburg	Authority (Senate) for Economics and Labour (BWA)	BWA, Economics and Agriculture Section, Agriculture and Forests Dept., Forest Office	BWA, Economics and Agriculture Section, Agriculture and Forests Dept., Forest Office	BWA, Economics and Agriculture Section, Agriculture and Forests Dept., Forest Office
Hesse (Hessen)	Ministry for Environment, Rural Areas and Consumer Protection (MULV)	State Enterprise Hesse-Forests Head Office 40 Forest Offices (from 01.01.05)	State Forest Authority 1) MULV, Dept. 6 Forests and Nature Protection 2) 3 Regional District Offices, Rural Areas, Nature and Consumer Protection Dept. 3) 21 District Offices, Rural Areas, Nature and Consumer Protection Dept.	State Enterprise Hesse-Forests Head Office 40 Forest Offices (from 01.01.05)

Table 8. continued from page 125

1	2	3	4	5
Lower Saxony (Niedersachsen)	Ministry for Rural Areas, Food, Agriculture and Consumer Protection (MELV)	State Forest Administration 1) MELV, Dept. 4 Forests and Forest Industries, Forest Ecology 2) 45 Forest Offices	State Forest Authority 1) MLELV, Dept. 4 Forests and Forest Industries, Forest Ecology 2) 4 Regional District Offices, Dept. 510 Forests, Forestry and Hunting 3) 38 District Offices	Eastern and Southern Lower Saxony 1) Chamber of Agriculture Hannover, Dept. 5 Forestry 2) 7 Forest Consultancy Service Offices Western Lower Saxony 1) Chamber of Agriculture Weser-Ems, Dept. 4 Forestry 2) 3 Forest Consultancy Service Offices
Mecklenburg-Western Pomerania (Mecklenburg-Vorpommern)	Ministry for Food, Agriculture, Forestry and Fisheries (MELFF)	State Forest Administration 1) MELFF, Dept. 2 Forestry 2) State Office for Forestry and Greater Reserves 3) 33 Forest Offices	State Forest Administration 1) MELFF, Dept. 2 Forestry 2) State Office for Forestry and Greater Reserves 3) 33 Forest Offices	State Forest Administration 1) MELFF, Dept. 2 Forestry 2) State Office for Forestry and Greater Reserves 3) 33 Forest Offices
North Rhine-Westphalia (Nordrhein-Westfalen)	Ministry for Environment and Nature Protection, Agriculture and Consumer Protection (MUNLV)	State Forest Administration 1) MUNLV, Section III Forests, Nature Protection, Agricultural Planning 2) Supreme Forest Authority 3) 35 Forest Offices	State Forest Administration 1) MUNLV, Section III Forests, Nature Protection, Agricultural Planning 2) Supreme Forest Authority 3) 35 Forest Offices	State Forest Administration 1) MUNLV, Section III Forests, Nature Protection, Agricultural Planning 2) Supreme Forest Authority 3) 35 Forest Offices
Rhineland-Palatinate (Rheinland-Pfalz)	Ministry for Environment and Forests (MUF)	State Forest Administration 1) MUF, Forests Dept. 2) Regional District Office South, Dept. 5 Central Office of Forest Administration 3) 45 Forest Offices	State Forest Administration 1) MUF, Forests Dept. 2) Regional District Office South, Dept. 5 Central Office of Forest Administration 3) 45 Forest Offices	State Forest Administration 1) MUF, Forests Dept. 2) Regional District Office South, Dept. 5 Central Office of Forest Administration 3) 45 Forest Offices
Saarland	Ministry for Environment (MU)	State Enterprise Saarforst 1) Head Office 2) 4 Regional Enterprises	State Forest Authority 1) MU, Dept. B Rural Areas, Agriculture, Forests 2) State Enterprise Saarforst (in charge of orders)	State Enterprise Saarforst Head Office, Dept. L5 Service Centre

Table 8. continued from page 126

1	2	3	4	5
Saxony (Sachsen)	State Ministry for Environment and Agriculture (MUL)	State Forest Administration 1) MUL, Dept. 7 Forests 2) State Forest Office 3) 46 Forest Offices + 1 National Park and Forest Office Planned from 2006-01-01 State Enterprise Sachsenforst Organization not yet clarified	State Forest Administration 1) MUL, Dept. 7 Forests 2) State Forest Office 3) 46 Forest Offices + 1 National Park and Forest Office Planned from 2006-01-01 not clarified	State Forest Administration 1) MUL, Dept. 7 Forests 2) State Forest Office 3) 46 Forest Offices + 1 National Park and Forest Office Planned from 2006-01-01 not clarified
Saxony-Anhalt (Sachsen-Anhalt)	Ministry for Agriculture and Environment (MLU)	State enterprise State Forest Enterprise Saxony-Anhalt 1) Head Office 2) 24 Forest Offices	State Forest Authority 1) MLU, Dept. 4 Nature Protection and Forests 2) State Administration Office, Dept. 4 Agriculture and Forests 3) 24 Forest Offices of State Enterprise (in charge of orders)	State enterprise State Forest Enterprise Saxony-Anhalt 1) Head Office 2) 24 Forest Offices
Schleswig-Holstein	Ministry for Environment, Nature Protection and Agriculture (MUNL)	State Forest Administration 1) MUNL, Nature Protection, Forestry and Hunting Dept. 2) 7 Forest Offices	State Forest Administration 1) MUNL, Nature Protection, Forestry and Hunting Dept. 2) 7 Forest Offices	1) Chamber of Agriculture, Forestry Dept. 2) 3 Project Management Districts
Thuringia (Thüringen)	Ministry for Agriculture, Nature Protection and Environment (MLNU)	State Forest Administration 1) MLNU, Dept. 7 Forests 2) 46 Forest Offices	State Forest Administration 1) MLNU, Dept. 7 Forests 2) 46 Forest Offices	State Forest Administration 1) MLNU, Dept. 7 Forests 2) 46 Forest Offices

Table 8. continued from page 127

1	2	3	4	5
Federal Level	**Ministry**	**Management of Federal state forests**	**Forest policy and legislation**	**Forest consultancy services and promotion of non-state-owned forests**
Federal Republic of Germany Bundesrepublik Deutschland	Federal Ministry of Finance (BMF)	Federal Forest Administration 1) BMF, Federal Real Property Dept. 2) 3 Forest Inspectiorates 3) 36 Federal Forest Offices		
	Federal Ministry of Consumer Protection, Food and Agriculture (BMVEL)		BMVEL, Directorate-General 5 Rural Areas, Social Structure, Plant Production, Forestry and Forest Industries, Directorate 53 Forestry, Forest Industries and Hunting	

Source: a compilation based on the State Forest Administrations' own information.

The major responsibilities of the national forest administrative authorities in Germany are set forth in the forest legislation for the Federation and for individual States (see above).

With regard to the formulation of basic forest policy guidelines within the framework of the National Forest Programme (NFP), the Federal Government in 1999 initiated a continuous dialogue process, the two first rounds of which have already been completed (the 1st round in 1999–2000 and the 2nd round in 2001–2003). The 1st phase identified and dealt with the following issues:

- Forests and society;
- Forests and biological diversity;
- The role of forests in the global carbon cycle;
- The importance of wood as a renewable resource;
- The contribution of forestry and forest industries to the development of rural areas.

In the 2nd phase, a guide for all those involved in the NFP was developed to make the process more transparent and efficient in the future. Based on the results of the 1st phase, the following fields of activity were either tackled for the first time or dealt with in a different manner:

- Forests and international co-operation/international trade;
- Biological diversity; forest management and nature conservation;
- Selection of forest policy instruments;

- Economic importance of forestry and forest industries;
- New role(s) for forests.

This process is to be continued.

6. Education in forestry

In Germany there are 4 universities (see Table 9) educating foresters to graduate level (Höherer Dienst). The duration of studies is on average 4–6 years (Master's Degree), or 3–4 years (Bachelor's Degree).

In Germany there are 5 Universities of Applied Sciences (UAS) (see Table 10) for the education of foresters at the technical level (Gehobener Dienst). The duration of studies is on average 4 years (Diploma, FH = Fachhochschule = University of Applied Sciences).

In Germany there is only 1 forestry high school (see Table 11) to educate foresters at secondary level (Mittlerer Dienst). The duration of studies is 2 years (Forest Technician).

Table 9. Universities for forest education in Germany

Universities	Annual number of graduates
University of Freiburg, Faculty of Forest and Environmental Sciences	circa 70–90
University of Goettingen, Faculty of Forest Sciences and Forest Ecology	circa 60–80
Technical University of Munich, School of Forest Science and Resource Management	circa 60–70
Technical University of Dresden, Faculty of Forest, Geo- and Hydro-Sciences	circa 70–80
Total	**circa 260–320**

Source: Own compilation.

Table 10. Universities of Applied Sciences for forest education in Germany

Universities of Applied Sciences (UAS)	Annual number of graduates
UAS Hildesheim/Holzminden, Faculty of Resource Management	circa 70–90
UAS Eberswalde, Department of Forestry	circa 80–100
UAS Weihenstephan (Freising), Department of Forestry	circa 70–90
UAS Rottenburg, School for Forestry	circa 80–100
UAS for Forestry Schwarzburg	circa 10–20
Total	**circa 310–400**

Source: Own compilation.

Table 11. Technical high schools for forest education in Germany

Technical Forest Schools	Annual number of graduates
Bavarian Technical Forest School in Lohr	circa 20–30
Total	**circa 20–30**

Source: Bavarian Technical Forest School in Lohr.

7. Forest research

In Germany, there is a long tradition of parallel educational and research activities at universities. Hence, the universities for forest education are also centres of forest research (see above). All universities pursuing forest education and research are financed by the governments of individual States; no privately financed universities exist in this field. Apart from the forest research at the universities, there are also special forestry research centres in Germany whose primary task is to assist state governments and forest administrations. Such centres operate at federal level (1) and at the level of individual States (11). Table 12 provides an overview of the 12 most important of these research centres.

Table 12. Overview of the major Forest Research Centres (universities not included)

Research Centres		Federal/State level	Staff	Major Forestry Research Directions	Financed by
English	German				
1	2	3	4	5	6
Federal Research Centre for Forestry and Forest Products, Hamburg	Bundesforschungsanstalt für Forst- und Holwirtschaft, Hamburg (BFH)	Federation	250	World Forestry, Forest and Forest Product Economics, Forest Policy, Timber Markets, Forest Genetics, Forest Tree Reproduction	Government of the Federal Republic of Germany
Forest Research Station of Baden-Wuerttemberg, Freiburg	Forstliche Versuchs- und Forschungsanstalt Baden-Württemberg, Freiburg (FVA)	Baden-Wuerttemberg	207	All fields of practical forestry	Government of Baden-Wuerttemberg
Bavarian State Institute for Forestry	Bayerische Landesanstalt für Wald und Forstwirtschaft (LWF)	Bavaria	132	All fields of practical forestry	Government of Bavaria
State Institute for Forestry, Eberswalde	Landesanstalt für Forstwirtschaft Eberswalde (LFE)	Brandenburg	144	All fields of practical forestry	Government of Brandenburg
Service Centre for Forest Planning, Information and Research of Hesse-Forest, Gießen and Hann. Muenden	Hessen-Forst Dienstleistungszentrum für Forsteinrichtung, Information und Versuchswesen (FIV)	Hesse	80	All fields of practical forestry	State Forest Enterprise Hesse Forest
Forest Research Station of Lower Saxony, Goettingen	Niedersächsische Forstliche Versuchsanstalt, Göttingen (NFV)	Lower Saxony, Schleswig-Holstein	120	All fields of practice-oriented forestry	Governments of Lower Saxony and Schleswig-Holstein

Table 11. continued from page 130

1	2	3	4	5	6
State Centre for Ecology, Land Regulations and Forests, the Dept. of Forest Ecology, Forests and Hunting	Landesanstalt für Ökologie, Bodenordnung und Forsten, Abt. Waldökologie, Wald und Jagd (LÖBF)	North Rhine-Westphalia	26	All fields of practical forestry	Government of North Rhine-Westphalia
Forest Research Institute Rhineland-Palatinate, Trippstadt	Forschungsanstalt für Waldökologie und Forstwirtschaft Rheinland-Pfalz (FAWF)	Rhineland-Palatinate	53	All fields of practical forestry	Government of Rhineland-Palatinate

Source: Own compilation.

Forestry in the selected federal states

Baden-Württemberg

Marc Hanewinkel

1. Forest characteristics[1]

The forest area is 1,362,228 hectares, or 38.1% of total landmass of Baden-Württemberg being the richest State in the Federal Republic of Germany in terms of forest cover. This high forest cover is due to the mountainous or upland nature of the Schwarzwald landscape which limits the possibility of agricultural utilisation of the land.

Baden-Württemberg,
territory: 35,700 km^2,
population: 10.7 million,
capital city: Stuttgart.

Spruce forests predominate in Baden-Württemberg, particularly in the mountainous Schwarzwald region. The current forest policy aims at increasing the proportion of broad-leaved species in stand composition, first of all, of beech.

It is worth mentioning that hurricanes were the decisive factor, which largely affected spruce stands causing a decline in the share of spruce in stand composition.

[1] Data acquired from the second National Forest Inventory (BWI II) for Germany.

Changes in the age structure of the Baden-Württemberg stands expressed in age classes were also noticeable – a tendency towards increase in the share of area of the oldest stands.

At the same time, the area of the youngest stands has markedly increased as a result of restocking of large areas of stands damaged or destroyed by hurricanes.

The average age of stands does not exceed 70 years, which is the effect of a high share of older oak and fir stands. The relatively low average age of spruce stands is due to a high share of the youngest stands and a short rotation cycle for the stands affected by fungal diseases. The relatively high average age of fir stands, which in recent years has not changed, is the result of a high share of stands with diverse vertical structure, frequently occurring in the private forests in the mountain areas.

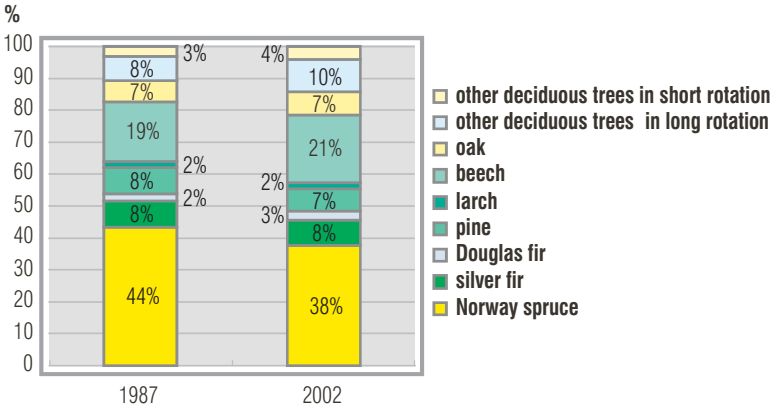


Fig. 1. Tree species composition in the Baden-Württemberg forests

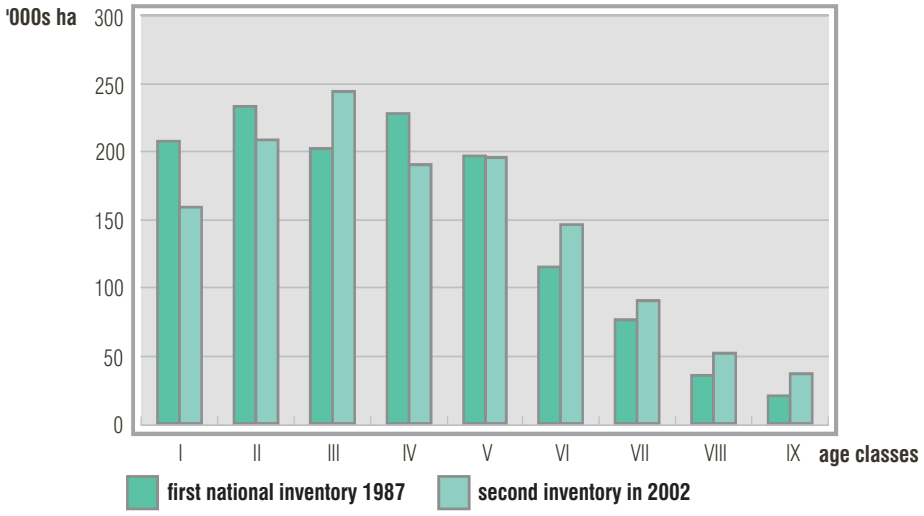


Fig. 2: Age class structure in the Baden-Württemberg forests

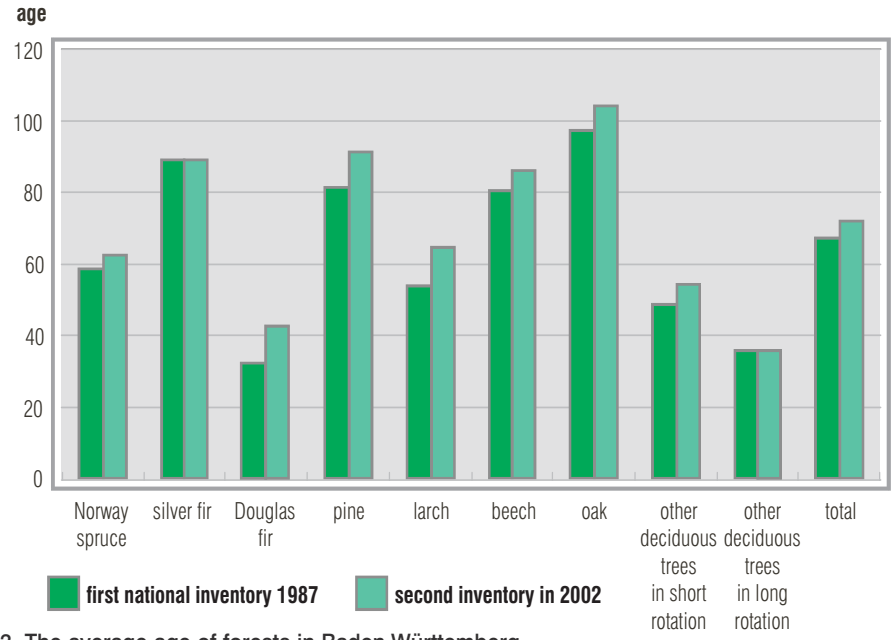


Fig. 3. The average age of forests in Baden-Württemberg

Growing stock, volume increment

The standing volume in the Baden-Württemberg is very high (Fig. 4).

In recent years, the standing volume of all Baden-Württemberg State's forests has increased only to a small degree. In the small and medium-sized private forest holdings, where small-scale management is the prevailing silvicultural method, and in so-called single tree management, an increase in the volume of growing stock is very noticable. In the State-owned forests and in the large private forest holdings with the prevailing large-scale management (partial cutting and, recently, also clearcutting), a clear decline in volume has been observed.

Large-scale forest management favoured spruce as the main species in stand composition. However, the share of spruce was changing as a result of various natural disasters. As a result of these unfavourable factors, changes in standing volume proceeded in different directions, irrespective of the form of ownership.

The structure of size classes in the Baden-Württemberg stands is characterised by high increase in the share of trees exceeding 40 cm in diameter at breast height. The share of thinner trees, particularly the thinnest ones (10–20 cm) in recent 15 years has clearly changed as a result of an increase in the share of older stands.

The volume increment of stands is very high. The average volume for all tree species is ca 14 m^3/ha.

Douglas-fir stands yield a record-high increment (ca 20 m^3/ha), which is the effect of not only the characteristic feature of the species but also of the fact that these are young-growth

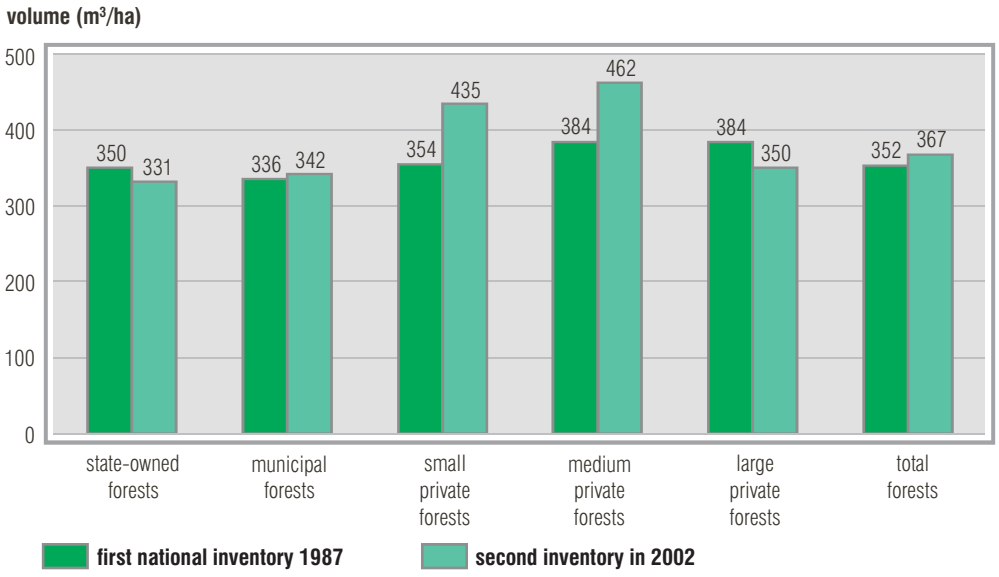


Fig. 4. The total volume of forests by ownership category in Baden-Württemberg

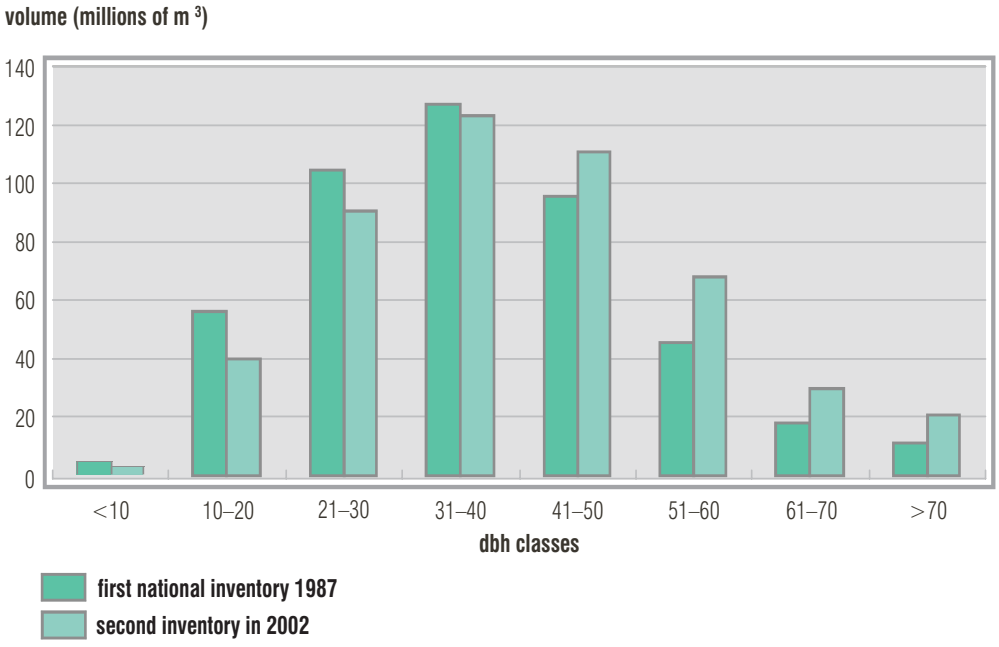


Fig. 5. Structure of the standing volume of forests in Baden-Württemberg in millions of cubic metres by dbh class

stands featuring the highest growth dynamics. Fir and spruce stands also show high increment.

At present, the level of harvest is slightly lower than that of stand increment (ca 95%). In spruce and pine stands, it exceeds increment. In the case of spruce, this process was largely impacted by losses caused by various kinds of disaster, while in the case of pine – also by a large participation of the relatively poor increment of older stands.

The ratio of harvest to increment varies in different ownership categories.

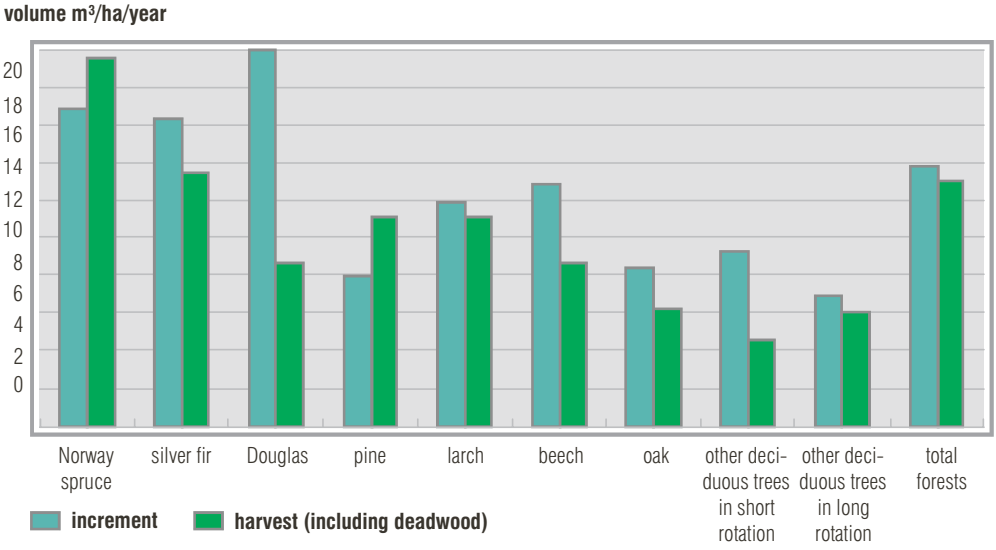


Fig. 6. Wood increment and harvest (including deadwood) in Baden-Württemberg

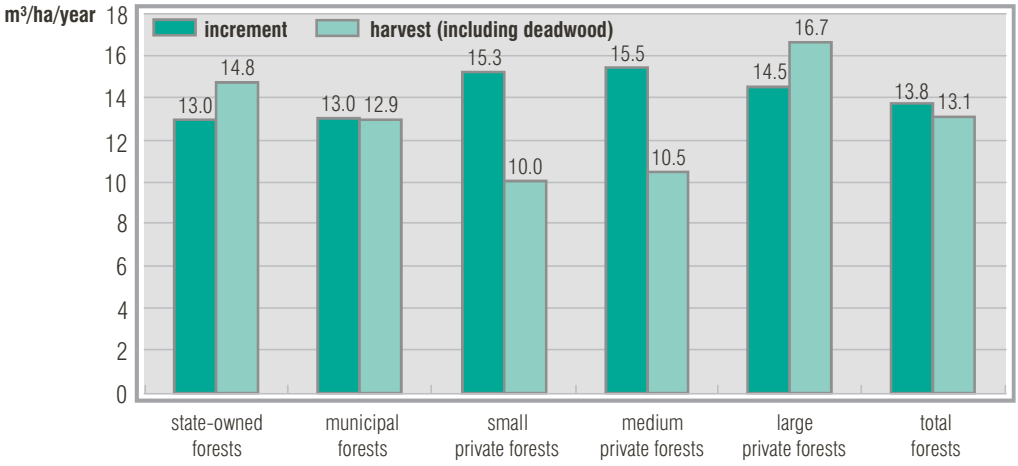


Fig. 7. Wood increment and harvest (including deadwood) in Baden-Württemberg by ownership category

2. Ownership structure

Municipal forest is the prevailing form of ownership, representing 48% of the total forest area in Baden-Württemberg. This is related to the traditional management of forests, mainly in the Schwarzwald region.

In small and medium-sized private forest holdings, the harvest was about 65% of volume increment, while in the State-owned forests and in the large private forest holdings it was about 115% of the increment. This process can be explained, to some degree, by the harvest induced by natural disasters. This may have been impacted by stand composition, specifically by spruce.

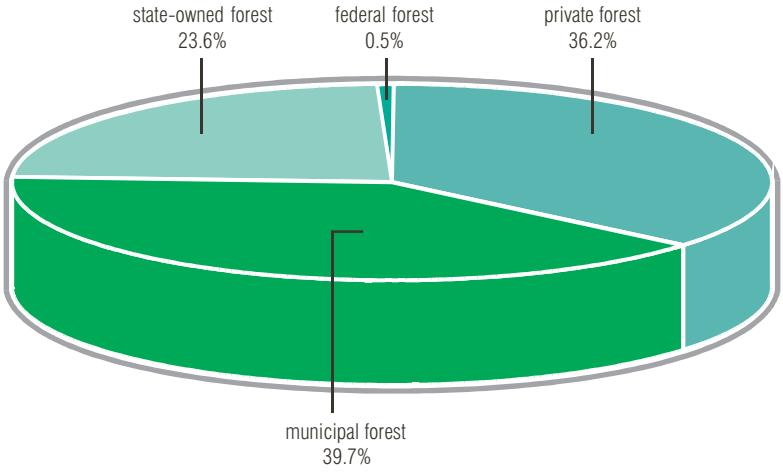


Fig. 8. Forest ownership structure in Baden-Württemberg

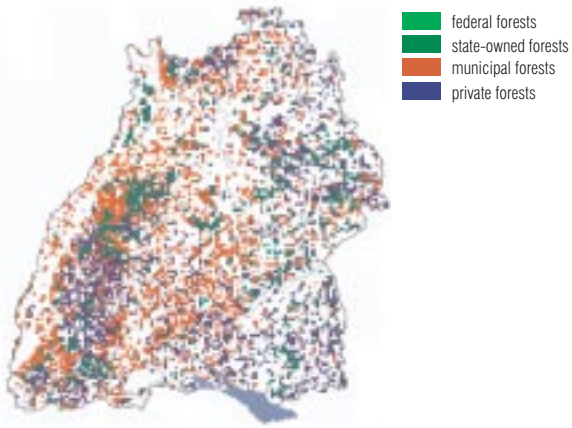


Fig. 9. Forest ownership – spatial distribution in Baden-Württemberg

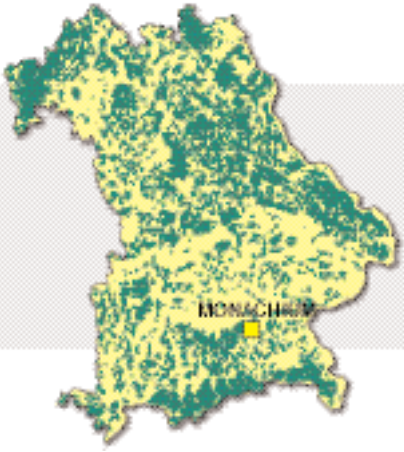
Bavaria

Christian Ammer and Olaf Schmidt

1. Forest characteristics

Forest cover

Forests cover 36.3% of Bavaria's total area. This corresponds to an area of 2,560,000 hectares, representing almost a quarter of all German forests. Despite the continual demand for land for industry, human settlements and roads, forested land has increased during the last decade, mainly due to afforestation of the abandoned former agricultural lands. However, this increase has not been very fast-paced. It amounts to only 475 hectares a year.



Bayern,
territory: 70,500 km^2,
population: 11.2 million,
capital city: Monachium.

The most recent inventory of Bavaria's forests in 2002 recorded 62 different woody species. However, their distribution is very uneven (see Fig.1). Generally speaking, conifers are the dominant species on two thirds of the area, whereas broadleaved species cover the remaining one third.

Species composition

The current tree species composition still reflects the social and economic conditions of the past. After several centuries of exploitation, plantations of conifers were the only remaining option on many sites at the end of the 18th century. Since Norway spruce (*Picea*

Christian Ammer and **Olaf Schmidt** – Bavarian Forest Institute (LWF), Am Hochanger 11, D-85354 Freising, Germany.

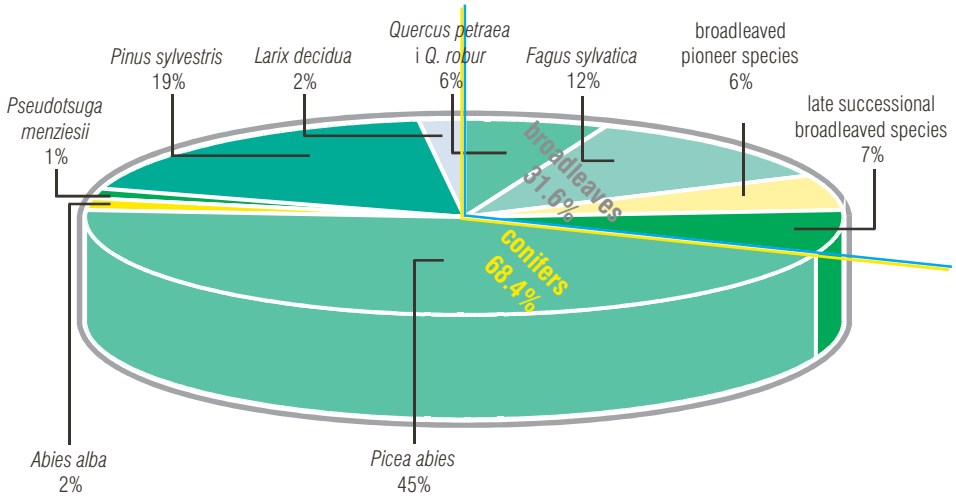


Fig. 1. Tree species composition in Bavaria in 2002 (Schnell and Bauer, 2005)

abies) provides an especially high yield, this species was also favoured throughout the 19th century, at the cost of European beech (*Fagus sylvatica*) in particular, which under natural conditions would be the dominant species in Central Europe. However, for ecological and economic reasons (von Lüpke and Spellmann 1997, von Lüpke *et al*. 2004, Knoke *et al*. 2005) considerable effort has been made to convert pure coniferous forests into mixed forests. Thus, the percentage of broadleaved species in general and the percentage of mixed forests have increased over the last 30 years (Fig. 2 and Fig. 3).

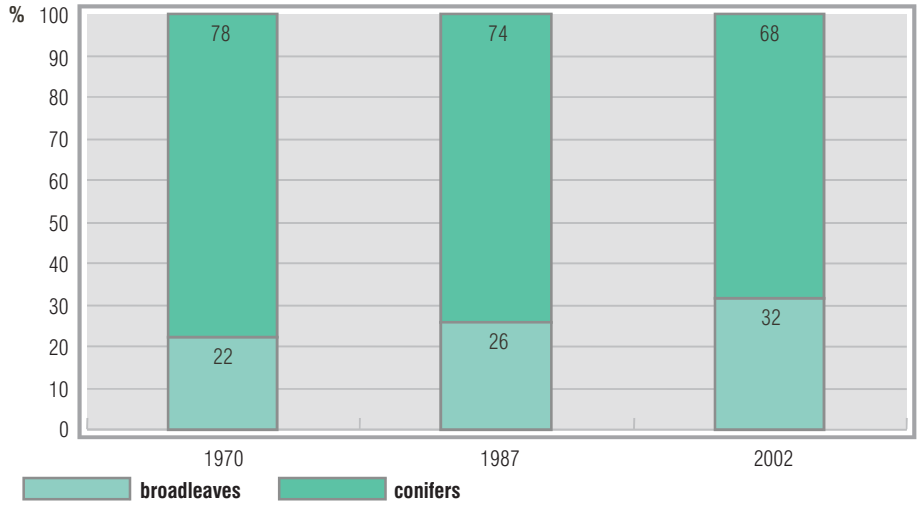


Fig. 2. Percentage of broadleaves and conifers over the last 30 years (Schnell and Bauer, 2005)

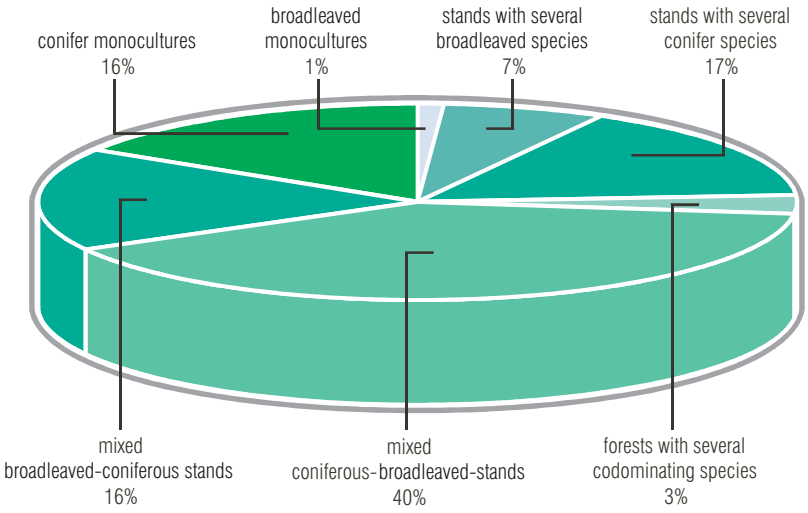


Fig. 3. Types of species mixes in 2002 (stands are classified as mixed where the percentage of other tress species is >10%), data from Schnell and Bauer (2005)

Volume and increment

Since 1970, the growing stock in Bavaria has increased considerably (Fig. 4), from 292 m³/ha in 1970 to 403 m³/ha in 2002. As Fig. 4 shows, the increase in the growing stock has been particularly high in broadleaved stands.

The annual increment in growing stock per hectare varies between tree species. It should be noted that the values given in Fig. 5 represent mean increments based on the

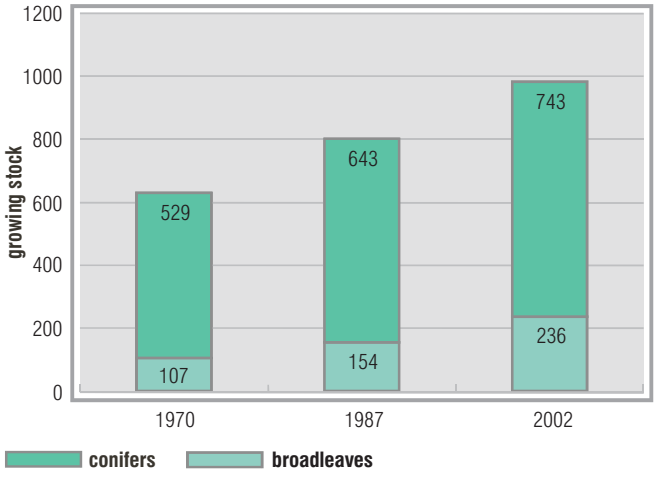


Fig. 4. Development of the growing stock (in millions of m³) between 1970 and 2002 in Bavaria (Schnell and Bauer, 2005)

current age class distribution. This means that the values are influenced by the number of stands within a specific (productive or less productive) age class. However, the current average annual increment per hectare across all tree species is 12.9 mł.

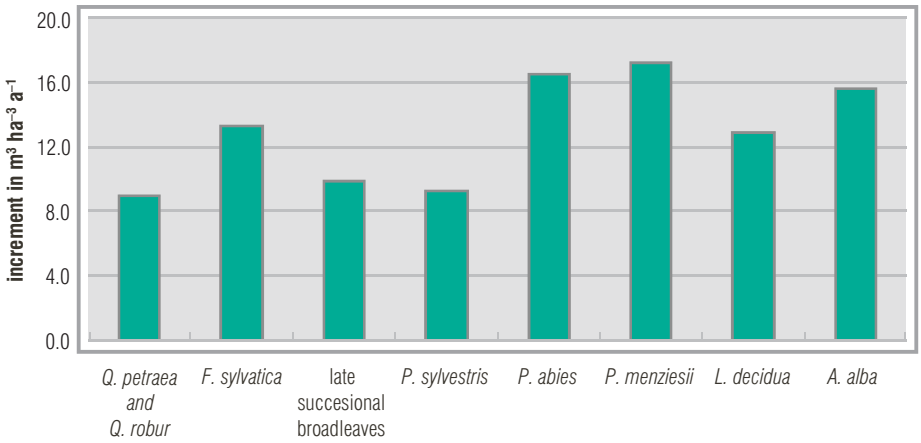


Fig. 5. Increment per tree species in 2002 (Schnell and Bauer, 2005)

2. Categories of forest protection

Approximately 64% of Bavaria's forests fall into a certain protection category (Fig. 6). However, the area of fully protected forest (no intervention permitted) represents only 1.53% of all forested land.

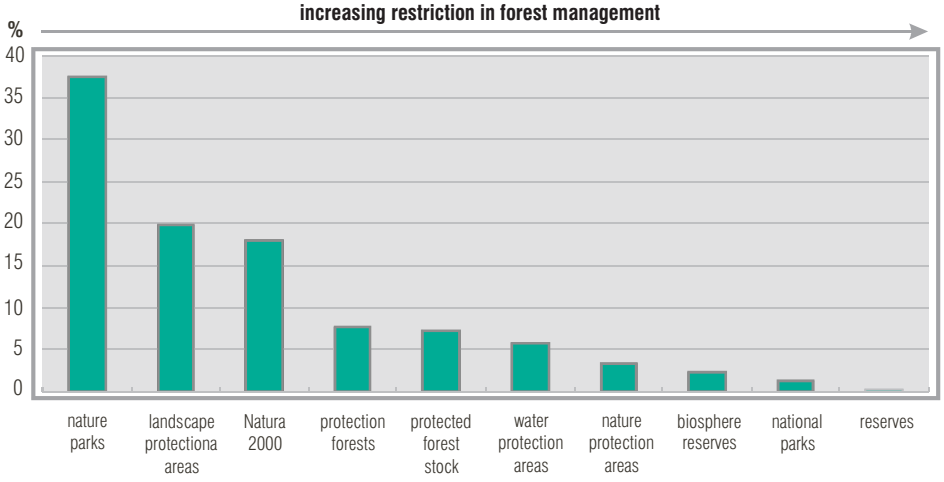


Fig. 6. Percentage of protected forest area, classified according to categories of forest protection (Bayerisches Staatsministerium für Landwirtschaft und Forsten 2004)

3. Legal and organisational aspects of forest holdings

Structure and tasks of state forest administration

Looking back over the past 250 years, it can be stated that since its foundation in 1752, the Forest Service has had to face a wide variety of challenges. As a consequence, its concept and organisation have been adjusted to meet society's changing requirements. Recently, a drastic administrative reform has abolished the concept of forest administration and state forest management. Whereas the former Forest Service was responsible for the administration and management of state-owned forests, since the 1 July 2005 two branches exist. State-owned forests are now managed by an independent and economically – oriented enterprise and the Forest Service ensures compliance with the forest law. In addition, the Forest Service provides services to 700,000 forest owners.

The legal form of the company that manages state-owned forests is a public-law institution. However, the corporate arrangement of the state forest enterprise does not alter the principles of the previous forest management, which can be summarised according to the Bavarian Forest law as follows: "The state-owned forest in particular serves the public interest. State-owned forest must therefore be managed in an exemplary fashion".

This means that management of the state-owned forest must ensure its economic, ecological and social sustainability. Its advisory board will ensure that this management is guided by the following criteria:

- Ecological sustainability:
  - State forest management takes into consideration the concerns and interests of nature conservation, landscape protection, and water management;
  - The forest's protective and recreational functions are secured or restored;
  - The previous guidelines and principles for a naturally oriented silviculture remain binding. These determine all issues relating to timber production and provide for biodiversity;
  - Ensuring natural regeneration is given priority with regard to the potentially contradicting game management interests.
- Economic sustainability:
  - The economic utilisation of state-owned forests by forest and game management represents the core activity;
  - All activities of the state forest enterprise and its organisation are profit oriented;
  - Existing profit centres are enhanced and new areas promising returns will be established.
- Social sustainability:
  - The success of the state forest enterprise depends on a qualified and motivated staff. They therefore continue to be educated by means of systematic human resource management;
  - The state-owned forest is the focus of various interests and social groups. However, the state forest management interacts in an unbiased manner with each of these groups and is open to constructive dialogue.

– The activities of the state forest enterprise should strengthen the countryside and contribute to rural development.

The State Forest Service is a lobby for all forest and forestry-related concerns and interests. It balances the demands of the general public and forest owners by information, services and the imposition of legally binding regulations. It provides full services for all types of forest owners. Like the management of the state-owned forest, the activities of the State Forest Service are governed by the following three principles:

- Ecological sustainability:
  - Professional services and supervision ensure that the demands of the general public are given consideration in the management of public and private forests;
  - Surveys on forest health and development are provided;
  - Applied forest research is conducted and its results are forwarded to forest owners and interested members of the public;
  - Monitoring systems are operated and provide a multitude of information on the current condition of the different forest types.
- Economic sustainability:
  - Forest services and training enable all forest owners to manage their forests professionally;
  - Government financial aid supports forest owners in the close-to-nature management of their forests, with consideration for the demands of the general public;
  - Information about forestry and forest products supports and creates marketing opportunities.
- Social sustainability:
  - The success of the State Forest Service depends on a qualified and motivated staff. They therefore continue to be educated by means of systematic human resource management;
  - Every effort is made to ensure the high standard of education of junior employees;
  - A broad range of environmental education activities provides the public with information about forests and their multiple functions;
  - The State Forest Service is a fair and unbiased dialogue partner to all social groups interested in forests and forestry;
  - The common interests of all Bavarian forest owners are represented in forest policy issues at national and international level, regardless of ownership type.

Private ownership associations

Over 50% of Bavarian forests belong to approximately 700,000 private forest owners (Fig. 7). More than 50% manage very small forests <1 hectare, whereas only approximately 500 forest owners manage forests of between 100 and 200 hectares, and only 400 people own forests of between 200 and 500 hectares. A comparable number of owners manage forest enterprises >500 hectares. However 18% of all forest owners, representing 74% of private forest land, are organised in forest owners associations. The State Forest Service supports these associations in various ways. In addition, subsidies are granted for specific management measures, such as the establishment of broadleaved stands or tending. As a consequence of historical forest

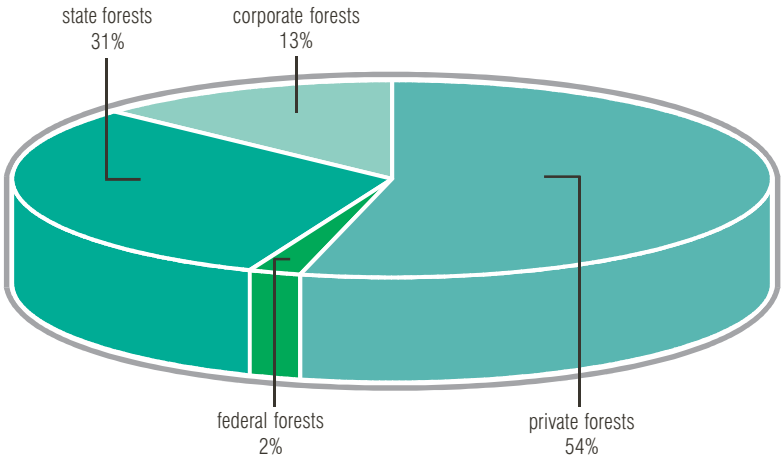


Fig. 7. Forest ownership structure in Bavaria (Data from Bayerisches Staatsministerium für Landwirtschaft und Forsten 2004)

management in northern Bavaria, corporate forests are common. Some of these are managed by members of the State Forest Service. In these cases however, the municipality owning the forest has to allocate a certain amount of money for them. In contrast to state-owned forests, which must be managed in an exemplary fashion, the restrictions imposed by Forest law on private forest owners are few. They are however required to comply with reforestation obligations within three years of final cutting. In addition, cuttings that endanger neighbouring stands must be approved by the State Forest Service.

4. Education in forestry

Forest education is offered at several levels and degrees of intensity. The Technical University of Munich (TUM) provides B.Sc. and M.Sc. programmes for Forest and Wood Science, as well as the international M.Sc. programme Natural Resource Management. The University of Applied Sciences Weihenstephan offers a B.Sc. course in forestry. Applicants for jobs in forest administration have to train for another one (in the case of foresters) or two (for forest managers) years at the Forest Service.

In cooperation with the Leadership Academy, the School of Forest Management in Lohr organises training for members of the forest administration in social skills and complementary courses in Agriculture and Forestry (FüAK). Whenever necessary, specialists from the Bavarian Forest Institute act as lecturers reporting on the latest research results and their possible application in practical forestry.

The State Forest, in cooperation with the School of Forest Management in Lohr organises theoretical and practical education for foresters.

Private forest owners take specific courses at a school for private forest owners in Goldberg.

5. Forest research

Forest research in Bavaria is carried out at Freising, near Munich. It is performed by several departments of the Life Science Centre, which was established from relevant sections of the Technical University of Munich (TUM), the Bavarian Forest Institute (LWF), and the forestry school managed by the University of Applied Sciences Weihenstephan. These three institutions cooperate in the Forest and Wood Centre (Zentrum Wald-Forst-Holz).

Fig. 8. The forest research institutions in Bavaria

Forest research at the university (TUM) currently focuses on basic issues of forest science. Although this research need not necessarily result in recommendations for practical forestry, forest research at the Bavarian Forest Institute should always provide information and guidelines for foresters and forest owners. In order to ensure transfer of knowledge from forest scientific studies to practical forestry, the Bavarian Forest Institute is equipped with a system to provide flyers, reports, presentations, posters and a special journal. In contrast to the University and the Bavarian Forest Institute, research at the school of forestry is more education oriented, which is the school's main task.

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Brandenburg

Klaus Höppner, Jörg Müller and Carsten Verch

1. Forest characteristics

Brandenburg is one of the richest states in the Federal Republic of Germany in terms of forest cover, which represents 37% of its total area. The nature of these forest areas is due solely to the effects of the ice age. That is why sites poor in nutrients predominate in this State. The landscape features a high percentage of pine forest and this is the main factor determining sustainable use of wood in the coming decades.

Brandenburg,
territory: 29,500 km^2,
population: 2.6 million,
capital city: Potsdam.

Berlin, the capital of Germany and the city with the highest population density, stands in the middle of the otherwise thinly populated State of Brandenburg. As a result, besides the useful potential of these forests, there are various other demands imposed on them, such as their protective and recreational functions.

Forest area

The entire forest area of Brandenburg was 1,086,782 ha as at 31 December 2003. That included 51,328 ha (5%) of non-wooded areas.

Forest cover parameters:

Total area of the State of Brandenburg	2,947,600 ha
Forest area	1,086,800 ha
Timberland (HB)	1,035,400 ha
Forest cover as a percentage	37%
Population	2.582 million
Forest area (ha) per capita	0.42 ha

In the Federal State of Brandenburg, Scots pine predominates on 78% of the timberland (Fig. 1). Thanks to the development over the past two centuries, these stands are often single-storied pure pine stands.

But there are also some regional areas with a higher density of broadleaved species. These are situated particularly in the North of Brandenburg, with its higher levels of precipitation and better soil conditions and where more beech stands can be found. The Spreewald Biosphere Reserve in Lower Lusatia is well known for its black alder stands.

All in all, there are more than 100 tree species covering areas from 1 hectare upwards in Brandenburg. A high percentage of the area is covered by Scots pine (*Pinus sylvestris* L.). They also include penduculate oak (*Quercus robur* L.) and sessile oak (*Quercus petraea* (MAT.) LIEBL.), European beech (*Fagus sylvatica* L.) as well as such soft wooded broadleaved species as birch (*Betula pendula* ROTH.) and black alder (*Alnus glutinosa* (L.) GAERTN.). Non-indigenous tree species, mostly Douglas fir (*Pseudotsuga menziesii* (MIRBEL) FRANCO var. *menziesii*), robinia (*Robinia pseudoacacia* L.), and red oak (*Quercus rubra* L.) grow on approximately 5% of the timberland.

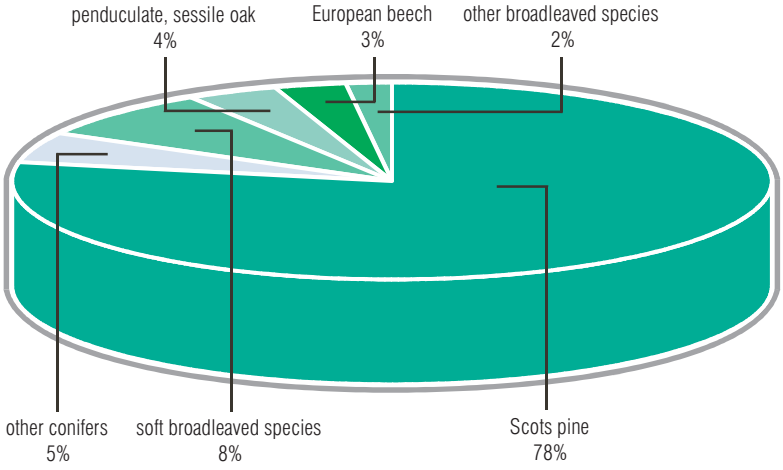


Fig. 1. Tree species mixture of the upper crop in %

The State of Brandenburg strives to continuously increase the percentage of site-adapted, broadleaved, coniferous mixed forests supporting potential natural forest communities. This may already be seen in the mixture of underwood tree species. So far, the underwood of sufficient importance for the stand structure accounts for only 9% of the upper crop area. Efforts should be redoubled towards converting these forests in the future.

The following summary of single stands within stand types (see Fig. 3) illustrates best the diversity of stand structure. This classification shows that approximately one fifth of forest stands are already covered with mixed stands. The prospects are that this percentage will be doubled. On the other hand, the percentage of pure coniferous forests will fall to less than 50%.

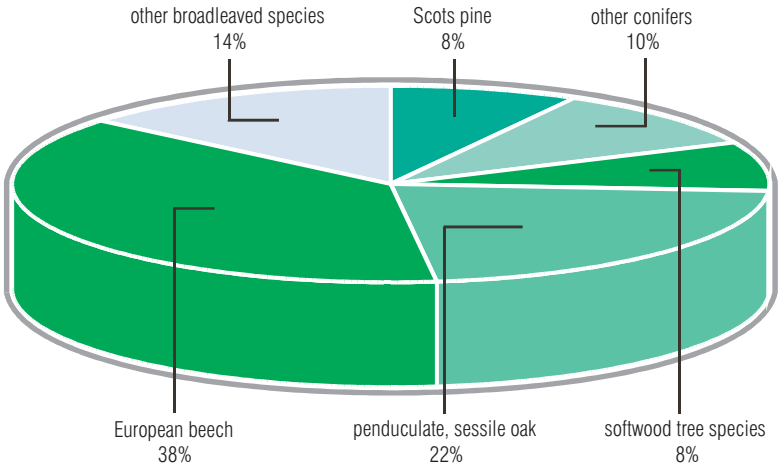


Fig. 2. Tree species mixture of underwood in %

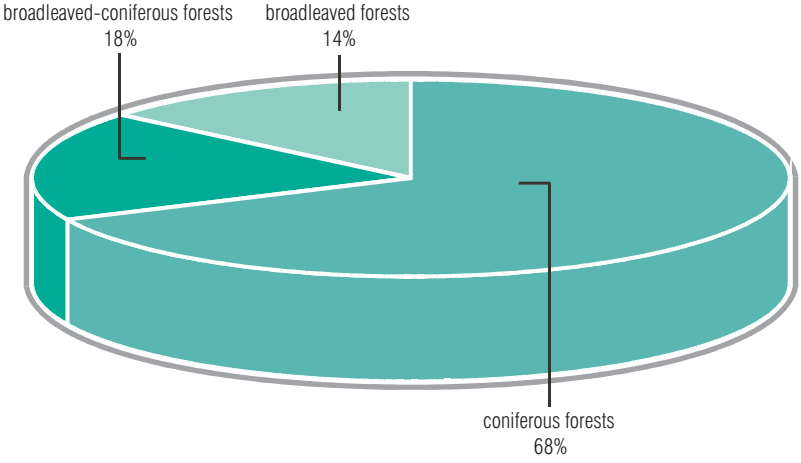


Fig. 3. Percentage of stand types in the forests of Brandenburg

Volume, increment

The State of Brandenburg features an average standing volume of 245 m^3/ha. This is the lowest average standing volume in the Federal Republic of Germany. This is mainly due to the stronger effects of its continental climate, poorer subsoil and the extensive clearing and felling carried out after World War II. The latter led to an imbalance in the age classes and their standing volumes. All statewide records concerning standing volume, increment, and forest yield feature a predominant proportion of Scots pine. Because of its presently minor importance for the development of standing volume, underwood is not included in the following figures.

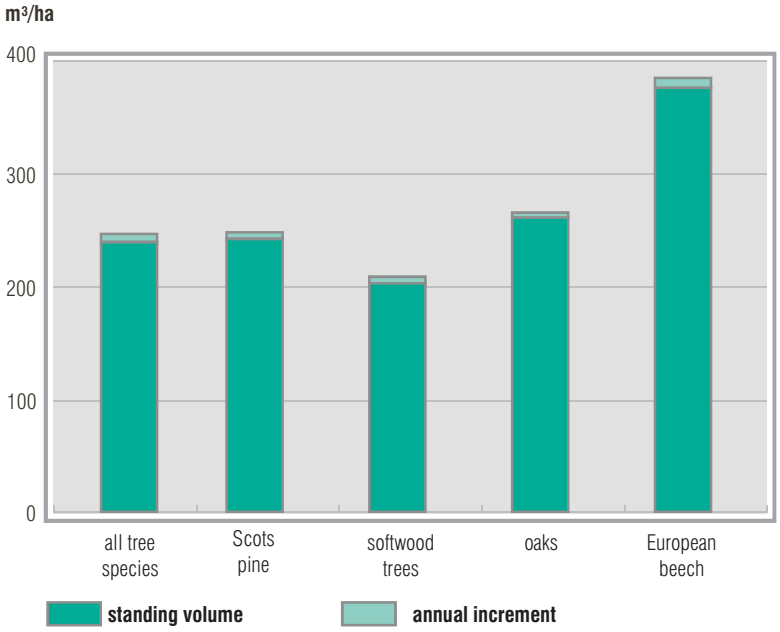


Fig. 4: Average standing volume per hectare and increment of the major tree species

The annual increment is 6.7 m³ of merchantable standing volume/ha, which constitutes approximately 3% of the standing volume per hectare. It is expected that this figure will remain constant over the next few years.

In all tree species, average standing volumes with regard to age and area show a clear predominance of young and middle-aged stands aged between 20 and 59 years. This has considerable consequences for forest yield, particularly in view of the high proportion of industrial timber products.

Reliable information on forest utilisation over the last few years is only available for forests owned by the State of Brandenburg, so no statement can be made concerning the whole of the forest lands. Since 2000, the annual felled volume in state-owned forests has been between 3.3 and 3.6 m³/ha. This corresponds to approximately 60% of the increment. As shown in the figures above, Scots pine predominates, constituting 84% of the timber assortment.

The structure of the timber sorts sold by state-owned forests reflects the consequences of the age class proportion on one hand and the structure and demands of the wood processing industry on the other. The average composition of the wood sold (as a percentage) is as follows:

- High-class timber: 0.2%,
- Stem wood: 5.5% (including: pine 4.0%),
- Log wood: 27.0% (including: pine 25.3%),
- Industrial wood – short: 63.0% (including: pine 54.0%),
- Stacked wood: 3.0%.

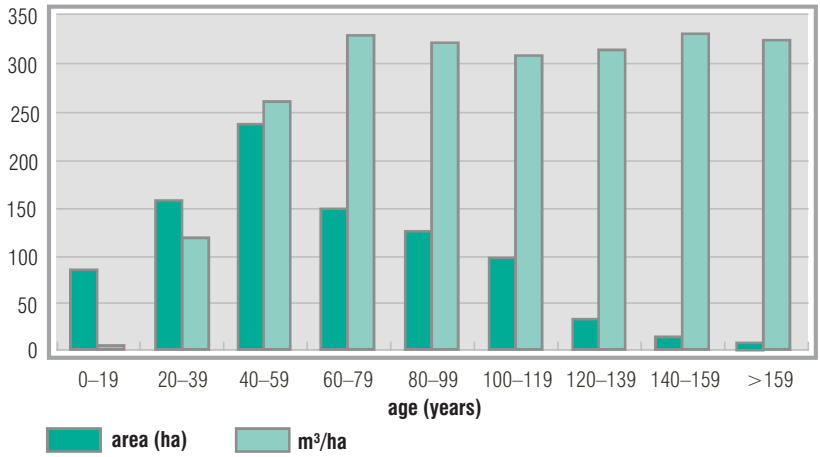


Fig. 5. Distribution of areas and average standing volumes by age classes

2. Categories of protected forest area

The selection and establishment of special protected sites in forest areas takes place in accordance with Basic Planning. In line with the Federal and State Forest Law, this planning involves all areas and all types of forest property. Not only their protective function, but also the recreational function and the commercial/productive functions of forests are taken into consideration. At some sites, these three functions may be combined, a fact that must be taken into account in the treatment of forests. There are particularly high requirements with regard to the protective and recreational functions of these forests, due to the location of Berlin, the Federal capital, with its 3.4 million inhabitants, in the centre of Brandenburg.

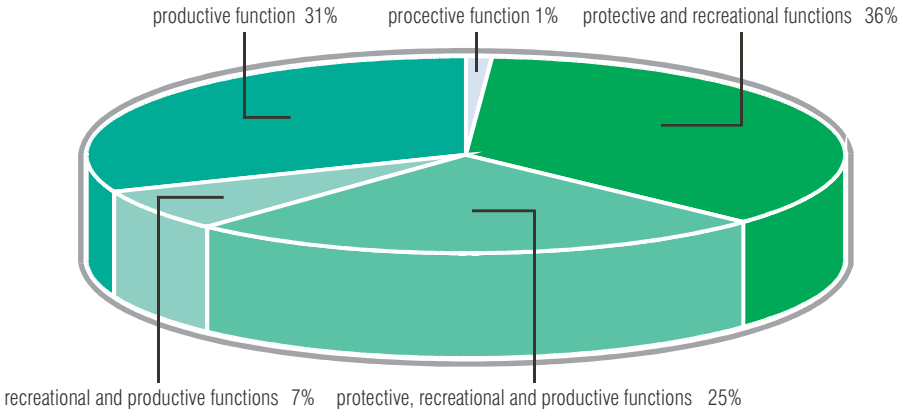


Fig. 6. Combination of protective, recreational, and productive functions

This fact becomes apparent when one examines the high proportion of combined forest functions. On 25% of total forest area, all three of these functions are combined.

The protection forests are subdivided into the following categories:

- water protecting forests 14%
- soil protecting forests 2%
- climate protection forests 4%
- culture protection forests 8%
- other protection forests 7%
- nature conservation forests 65%

Nature conservation forests mostly constitute protected landscapes, nature reserves and nature reserves under strict protection. These are mainly situated in the State of Brandenburg's several large-scale protected areas. These are the Unteres Odertal National Park, three biosphere reserves (Spreewald, Schorfheide-Chorin and the river Elbe landscape) and 11 nature parks, occupying a total area of 271,571 hectares.

3. Legal and organisational forms of forest holdings

Forest ownership

The ownership structure of the forest areas in Brandenburg includes various forms of property ownership. On the one hand, 27% (290,720 ha) constitutes state-owned forest, while on the other, 6% (70,683 ha) is corporately owned forest and 8% (88,300 ha) constitutes Federal government forests. However, privately-owned forests are the major ownership class, constituting 50% (535,590 ha), and this percentage is expected to increase due to future privatisation of the forest now owned by the German privatisation agency (another 9%, *i.e.* 103,277 ha).

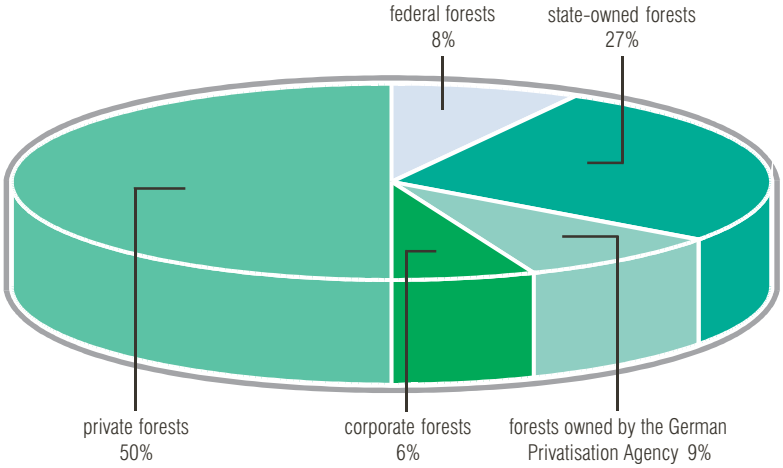


Fig. 7. Forest ownership structure (as of 31.12.2002)

In 2002, the Brandenburg State Forest Administration managed 254,600 hectares of state forest (timberland). This area is not evenly distributed over the entire territory of the State.

Corporate forests are almost exclusively Brandenburg's municipal forests. Under the new regulation of property relations that followed the political changes of the time, municipal property that had already existed before 1945 was renewed – where appropriate – in the municipalities, in line with specific legal provisions. By 31 December 2002, 439 forest-owning municipalities had been registered. Of these, 42 forest enterprises own over and above 200 hectares, and 21 – over and above 1,000 hectares of managed forest. The largest municipal forest enterprise in Brandenburg operates over an area of 4,677 hectares. The average size of enterprises is 133 hectares.

Management of municipal forest enterprises is carried out either by their own forestry staff or, within the scope of agreements, by state forestry offices. Some of the municipalities that own smaller forest areas are members of forest associations and organise their forest management through these. As a rule, only municipalities with larger forest properties employ their own forestry staff, including foresters. At the beginning of 2004, in those municipal forest enterprises larger than 200 hectares and with a total area of approximately 50,000 hectares, altogether some 17 university graduates, including those from universities of applied sciences, 66 foresters, and 5 apprentices were employed.

In order to complete the necessary forestry work, local authorities often contract private forest enterprises.

Private forests in the State of Brandenburg constitute private forest ownership, which has existed since 1945, and the forest property that was established as a result of the 1945–1946 land reform. On the other hand, it may also be traced back to the privatisation or re-privatisation that in 1990 followed the political changes in the former German Democratic Republic (GDR).

In the GDR, private forest property was mostly managed by the State Forest Enterprises. That is why the true owners of those areas have only been able to fully exercise their ownership rights and duties as landholders since 1990. Approximately 300,000 hectares of forest area had to be privatised or re-privatised in the course of implementing new regulations on economic relations in Brandenburg. Most of this had belonged to the large-scale land property that had been expropriated in 1945 and 1946 as a result of land reform.

Primarily, the so-called Treuhandgesetz and the Entschädigungs und Ausgleichsgesetz, which are special laws, form the basis for land privatisation or restitution. Such an assignment was entrusted to a Federal, state-owned Limited Liability Co. for land utilisation and administration. In the course of their activities, larger private forest enterprises were developed in Brandenburg. Some of these are now in the possession of their former owners' families, but now there are also new forest proprietors.

In 2003, there were altogether approximately 100,000 forest owners in Brandenburg, who on average each owned just over 5 hectares of forestland.

Though most forest owners (73%) administer their forests on an individual basis, some 27% of them are organised into forest associations.

Most of the newly established private forest enterprises do not have the material and technical resources to manage the forestry work themselves. In most cases, due to the size

and natural conditions of the forests, they do not employ any staff of their own. A total of approximately 160 employees work for private forests in Brandenburg. In order to address these circumstances, associations have been established to provide such services as forest planning and operational management, while payroll companies are also used for carrying out actual forestry work.

In the State of Brandenburg, there are currently approximately 100 forest service companies, with an average of four to ten employees working in the field of timber harvesting, wood hauling, forest tending, and reforestation. In addition, forest experts perform managerial and practical project work in both private and municipal forests.

The Forest Law of the State of Brandenburg guarantees free access to all types of forest property for all citizens. This ensures full advantage may be taken of the highly recreational value of forests. The State forest administration and the private forest owners control the volume of visitors by means of forest education proposals.

Private owners associations

Voluntary associations of private forest owners (associations of forest enterprises, forest societies and communities), whose main task is to cope with such structural disadvantages as small area size, property fragmentation and/or scattered forest holdings, are a desirable element in view of the State of Brandenburg's circumstances. More and more forest owners are joining the existing and actively operating associations of forest enterprises. This trend is most welcome, because in this way the development of efficient working entities can be achieved more rapidly than by establishing new associations.

As of 1 January 2004, 404 approved associations of forest enterprises with 21,300 members and a total area of 152,000 hectares had been registered in Brandenburg. The largest of these associations is operating on an area of 3,995 hectares. But the average size of forest enterprises is still between 200 and 600 hectares. The changes noted in this respect are rather slow.

Forestry societies provide another opportunity to improve the efficiency of forest management. These are federations of associations of forest enterprises registered under private law. Their major task is to work towards adapting forestry production and the sale of forest products to meet market requirements. Here, coordination of timber sales is of particular importance. At the present time, two forestry societies operate in the State of Brandenburg.

Private forest holdings are publicly encouraged because of the various possibilities they represent for collective wealth. For this purpose, financial assistance for forestry measures in private forests is provided on an annual basis. Suitable subsidies are available within the framework of a major project for agricultural structure improvements and coastal protection as well as state subsidies that are co-financed by the EU. Assistance in the management of forestry societies is another important form of this encouragement.

In order to support private forest owners, the State Forest Administration offers its paid services to private and corporate forests, as well as free advisory services within the framework of its active assistance. By means of regulating payments for active assistance from the State Forest Administration, support for private and municipal forest owners in managing their properties is provided through the various forms of service.

4. Structure and tasks of the national forest administration

The Brandenburg State Forest Administration is structured into two managerial levels. The Ministry of Agriculture, Environmental Protection and Regional Planning is the supreme forest authority. It oversees ten subordinate forestry offices as lower forestry authorities. These offices are composed of expert teams and divided into forest districts and intensively managed forest ranges. With their 72 forest districts and 504 intensively managed forest ranges, they are responsible for carrying out all local forest administration tasks.

As at the end of 2003, a staff of 2,782 was employed by the Brandenburg State Forest Administration. This number is expected to undergo a continuous reduction. By the end of 2005, only 1,052 permanent employees and officials and 1,134 foresters will be managing the state-owned forest, providing services to other forms of forest property and the general public and fulfilling sovereign and other administrative duties.

Landesforstanstalt Eberswalde is an independent institution forming an integral part of the State Forest Administration.

Structure and tasks of the Brandenburg State Forest Administration

The State Forest Administration is responsible for carrying out the following tasks:

- providing advice and guidance to private and corporate forests,
- encouraging development of private and corporate forests,
- managing basic planning and other specific planning for forests, involving authorities, public interest institutions and forest-owner representatives,
- ensuring forest control, particularly supervision over compliance with the formal requirements and bans imposed on forest owners by the regulations in order to protect and cultivate forests and to avert forest destruction,
- providing forest conservation,
- monitoring the conservation status in all types of forest property.

In addition, the forest authorities must ensure the performance of the following tasks:

- cultivation of the state-owned forest,
- monitoring the development of forest ecosystems,
- forest-related educational work (forest education and science).

Since 2002, the State Forest Administration has been working with a net budget. This means that income and expenses are charged against each other and reproduced within the financial planning in the budget.

The budget identifies the business areas of the State Forest Administration. It is structured into six production fields (PB):

PB 1: management of the state-owned forest,
PB 2: protective functions,
PB 3: recreational functions,
PB 4: advising and supervision of private forests, performance of services for third parties,
PB 5: other forms of supervision,
PB 6: real estate.

Controls are implemented by means of cost and productivity accounting. Management of State-owned forests plays the most important role in incomes and expenditures. Approximately one third of the net budget comes from products not included under the management of State-owned forests.

5. Education and research in forestry

The Federal State of Brandenburg has a long historical tradition in the field of forest science and research. In 1838, the so-called Höhere Forstlehranstalt (an institution of higher forest education), under the presidency of Wilhelm Pfeil, began operations in Eberswalde. Institutional forest research was established in Eberswalde in 1871, when the Hauptstation für das forstliche Versuchswesen in Preußen (main station for forest research in Prussia), with its headquarters in Eberswalde, was founded.

After decades of interruption to academic forestry education, the University of Applied Sciences was founded in 1992 in Eberswalde. It is subordinated to the State of Brandenburg's Ministry of Sciences Research and Culture. The university manages four faculties. These are Forestry, Landscape Management and Nature Protection, Wood Science and Technology, and Business Administration, with a total of approximately 1,500 students.

The forestry faculty conducts the following courses:

- A four-year diploma course in forestry. After passing the final examinations, students obtain a forest engineer (FH) diploma and can be employed at, amongst others, the State Forest Administrations, as well as at larger municipal or private forest enterprises (for example as District Rangers). The number of places available to applicants for this course is up to 50 a year. Beginning in the winter term 2005/2006, it is planned to reorganise this diploma course into a B.Sc. course.
- A B.Sc. course entitled IFEM, with a standard duration of three years and up to 50 places available a year. This International Forest Ecosystem Management course, which was launched in 1998, includes one semester abroad, besides a practical semester. 70% of the course is taught in English. This course concentrates on imparting scientific knowledge and practical skills, with particular regard to developing nations.
- An M.Sc. course entitled IFEIT. This course in International Forest Ecosystem Information Technology was begun in 2002 and is conducted in English. Up to 35 applicants enroll every year. The standard duration is two years. On successfully completing the course, graduates may apply for positions in many fields in, among others, developing nations.

Newly recruited candidates for practical forestry work are educated at the Kunsterspring Forestry Workers School managed by the Brandenburg State Forest Administration. Their training is organised in a unified dual system involving both, industrial and school experience.

70 apprentices are recruited annually, including 55 by the State Forest Administration and 15 by local authorities, private forest enterprises and companies. In 2004, ten forestry offices, five local authorities, and three private forest enterprises, as well as three forest companies were licensed as institutions to provide practical vocational training.

Standard training lasts three years. In exceptional cases, for example for those who have already completed vocational training, this may be reduced to two years.

The curriculum for the vocational education of qualified foresters is aimed at enhancing knowledge and providing practical skills in the fields of afforestation, forest tending, timber harvesting, nature conservation and landscape protection, as well as timber construction.

For apprentices with technical talents and interests, there are opportunities during the third year to complete additional training as a certified forest machinery operator. The labour market opportunities for qualified foresters are comparatively good. Surveys conducted during the last ten years have shown a placement rate of approximately 90%.

Forest research in the State of Brandenburg is performed by several institutions:

- The Forest Institute at Eberswalde (Landesforstanstalt Eberswalde), an institution reporting to the Ministry of Agriculture Environmental Protection and Regional Planning provides research results and services for the entire forestry field. Further responsibilities of this state institution include scientific advisory services for the Ministry and forestry offices. As a result of forest reform, Landesforstanstalt has become an efficient institution that manages a customer and product-oriented service facility, using modern business management, controlling and financial instruments, such as net budget, operating according to a product plan and implementation of the cost and productivity calculations. This institution is mainly financed from the budget resources of the State of Brandenburg. It is also entitled to external funds and, in recent years, approximately 8% of its budget has come from other financial sources. In 2004, a total staff of 121 were fully employed at Landesforstanstalt, of whom 34 had completed university education, 54 were scientific-technical graduates (from universities of applied sciences), 27 were technical employees and 6 were administrative staff. The structure of Landesforstanstalt Eberswalde is shown in Fig. 8.
- The Institute of Forest Ecology and Forest Regulation in Eberswalde. This institute is part of the Federal Research Institute for Forestry and Timber Industries in Hamburg, which reports to the Federal Ministry of Consumer Protection, Food, and Agriculture. The institute includes the following specialist areas: ecology, forest surveys, game ecology and hunting. The full-time staff of 30 includes 8 scientists and 3 forest engineers.
- The Institute of Forest Genetics and Forest Tree Reproduction, located in Waldsieversdorf: This institute also reports to the Federal Research Institute for Forestry and Timber Industries and employs 25 graduates (six of whom are scientists) at its location in Brandenburg.

Forestry projects are also conducted at the University of Applied Sciences in Eberswalde, the Technical University of Brandenburg in Cottbus, the Leibniz-Centre for Agricultural and Land-Use Research in Müncheberg, the Potsdam Institute for Climate Impact Research and the Research Institute for Former Mining Landscapes in Finsterwalde. Landesforstanstalt Eberswalde cooperates closely with these institutions in the performance of contracts.

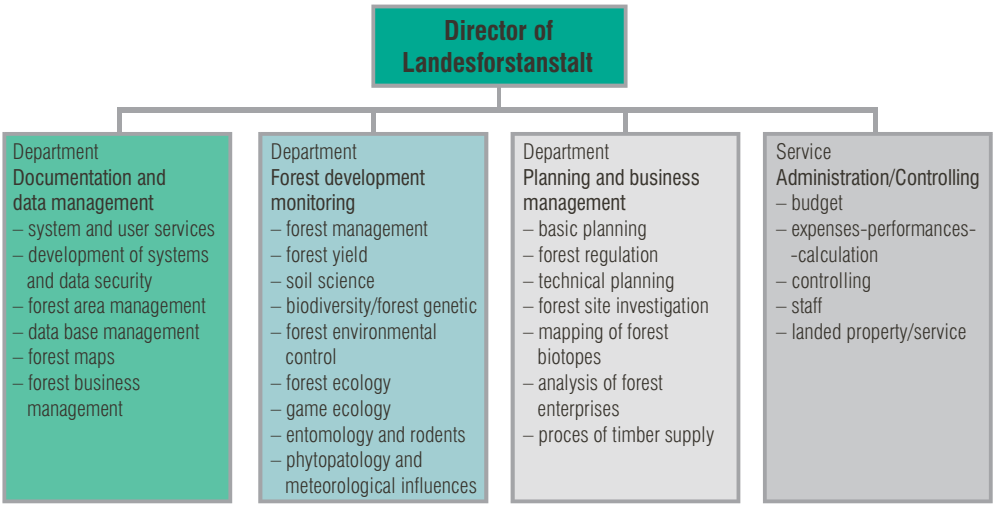


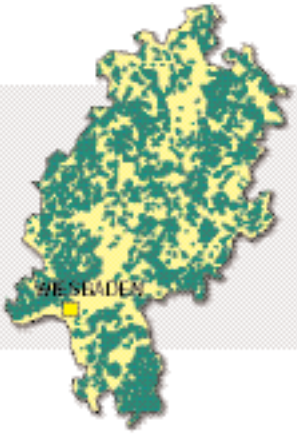
Fig. 8. Structure of Landesforstanstalt Eberswalde

Hesse

Volker Grundmann and Stefan Nowack

1. Forest characteristics

The German Federal State of Hesse was established in the post-war period and is generally referred to as the Forest State. The East Hessia region is called Waldhessen



Hessen,
territory: 21,100 km^2,
population: 5.8 million,
capital city: Wiesbaden.

Volker Grundmann – Dr., Director of the service unit Forest Planning, Information, Research (FIV) in the State Forest Enterprise Hesse-Forst in Gießen and Hanover-Münden. **Stefan Nowack** – by 2004, the Branch Manager for forest growth at the FIV responsible for the second national forest inventory in Hesse, since 2005 he has been in charge of silviculture and forest planning in the State Forest Management in Kassel.

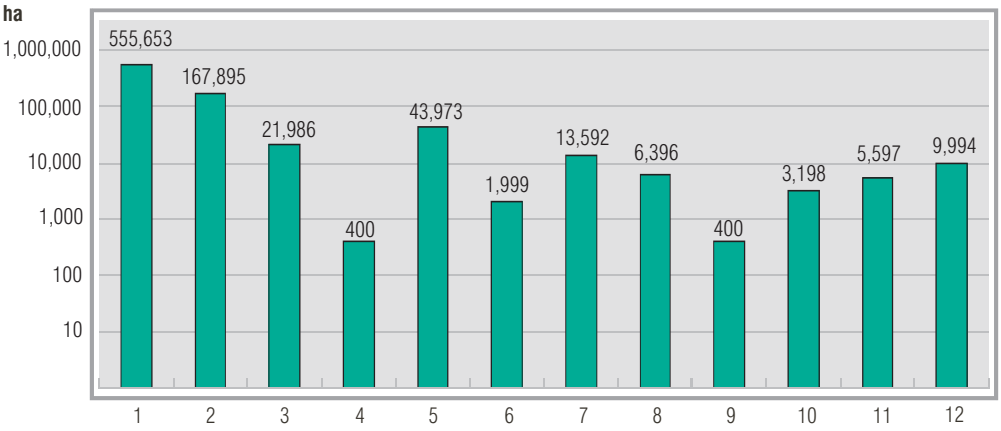


Fig. 1. The present natural forest associations in Hesse (net forest area excluding non-wooded areas). 1 – *Luzula*-beech forest, 2 – *Asperula*-beech forest, 3 – *Elymus*-beech forest, 4 – *Carex*-beech forest, 5 – beech-sessile oak forest, 6 – birch-common oak forest, 6 – oak-hornbeam forest, 7 – *Stellaria*-oak-hornbeam forest, 8 – *Stellaria*-alder carr, 9 – *Prunus*-alder-ash forest, 10 – ash-riverine forest, 11 – alder swamp forest, 12 – broadleaved forest on scree

(Hessian Forest) and is traditionally named Buchonia – a name originating from the Roman period and meaning beech, the region's major tree species. Approximately 90% of all forest sites in Hesse have the potential to form beech forest associations. Still today the Federal State has the greatest proportion of beech trees (Fig 1.).

Stand structure

In order to improve species composition classification, tree species are organised into groups. The oak group includes all oak species; the beech group includes all other broadleaved species; Weymouth pine and Douglas fir belong to the spruce group, and the pine group also includes larch.

By 1990, the proportions of the tree species groups diverged by only ±1% from the following values: oak 11%, beech 35%, Norway spruce 31% and Scots pine 23%. The ratio of broadleaves to conifers was then 46:54. Today, the proportions of tree species groups are oak 13%, beech 43%, Norway spruce 28% and Scots pine 16%. This gives a broadleaves to conifers ratio of 56:44.

In terms of forest dynamics, this represents a significant change in a short period of time and may be explained by three major causes:

- changes in silvicultural aims, which now favour native tree species, especially beech,
- the severe storms since 1984, with wind damage over large areas of coniferous forests on unstable sites, with subsequent reforestation focusing on broadleaved species,
- beginning from 1989, an increase in beech production, with an almost 2-year full mast cycle.

The above graph shows relative proportions of oak, beech, spruce, Douglas fir, pine and larch species, as well as the tree species groups 'broadleaves with long life expectancy' (ALn) and 'broadleaves with short life expectancy' (ALh) (BWI 2).

Fig. 3 shows the distribution of age classes in four tree species groups. Noteworthy here is the reversal of the beech-spruce ratio in the first two age classes, and a comparatively large proportion of beech in the higher age classes.

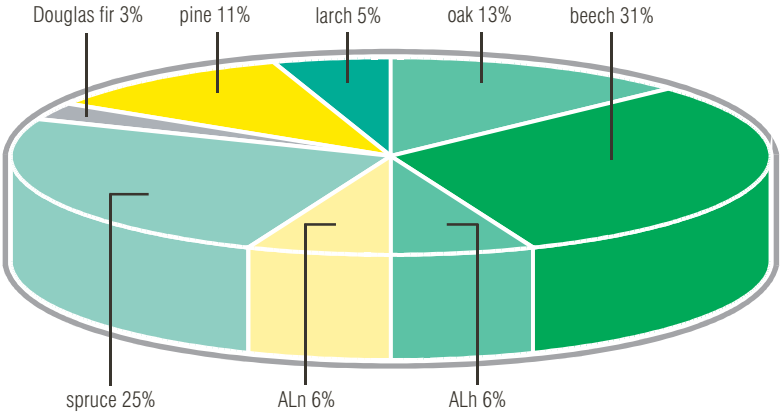


Fig. 2. Proportion of tree species groups in the Federal State of Hesse according to the National Forest Inventory

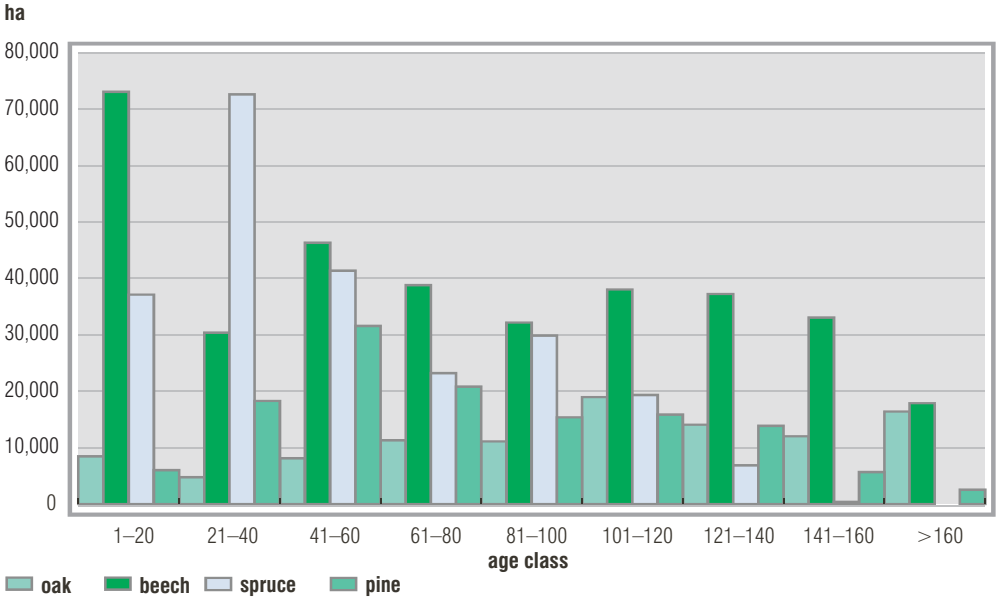


Fig. 3. Area proportion of the tree species groups oak, beech, spruce and pine by age class (BWI 2)

Age structure

The average age of the main stands of the four major tree species groups has continually increased over the last few decades, and almost certainly over the last three centuries. The average age in the oak group is now 100 years, for beech around 90, spruce approximately 50, and around 80 years for pine. In terms of economy and harvesting, these ages pose an increased risk in terms of possibilities for utilising the older age classes, especially in the case of beech (discolouration of heartwood) and spruce (*Fomes annosus* butt and root rot). However, this development is extremely positive in terms of nature conservation.

In terms of their ownership structure, compared with the national average, the statistics for forests in Hesse show only small differences of less than 10% in the categories: State-owned, municipal and privately-owned.

Volume and increment

Together with Rheinlandpfalz, Hesse is the Federal State with the greatest proportion of forest cover (approximately 42%) far exceeding the average forest cover figure of approximately 31% claimed for the German Federal Republic as a whole. State-owned forest accounts for 40% of the forested area, while municipal forests represent 35% and privately owned forests 25%. A third of privately owned forests are referred to as 'small' privately owned forests, occupying on average areas of less than 50 hectares. The other two thirds are privately owned forests larger than 50 hectares. The total forest area including associated non-wooded areas (7%) amounts to approximately 895,000 hectares.

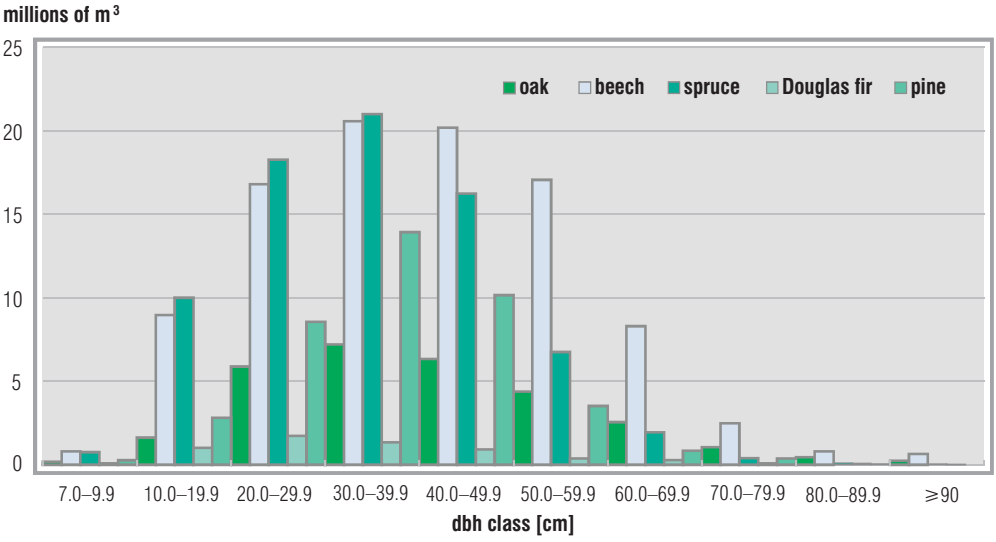


Fig. 4. Timber volumes of the four tree species groups and Douglas fir in dbh classes. These figures come from the analysis of the second national forest inventory for Hesse in 2002 (BWI 2)

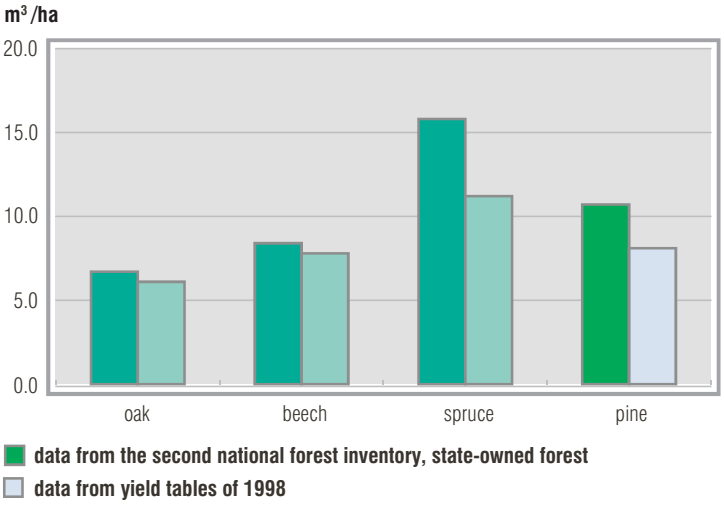


Fig. 5. Comparison of increments as per the National Forest Inventory and as per yield tables

In the period 1960–2005, standing volumes per hectare increased in State-owned forests from 215 to more than 300 m³/ha. Using sample plot methods, the national forest inventory figure arrived at was a volume of 315 m³/ha, which is slightly higher than the volume in the forest management data (Fig. 4).

On average, there is 10 m³ of annual increment per hectare. During the last 15 years, 85% of this increment has been utilised. The increment in the tree species groups (Fig. 5) is on average greater than that found in the yield tables. For example the volumes of oak (7 m³) and beach (8.5 m³) are greater by 0.5 m³, spruce (16 m³) by nearly 5 m³ and pine (11 m³) by 2.5 m³.

2. Forest functions

Besides economic functions, forests are also required to fulfil numerous other social functions. The most important of these functions include protection of natural resources (water and soil), nature conservation (e.g. Natura 2000, nature reserves, biosphere reserves and National Parks), cultural functions (e.g. experimental scientific sites, natural scientific and historic features) and recreational functions (e.g. tourism, recreation, National Parks).

Approximately 70% of the Hessian forest area fulfils these functions, which on average overlap each other by a factor of 1.9. This overlap does not include landscape conservation areas and nature parks, since these only minimally affect forest management. The highest degree of overlap is found in the capital area of Rhine/Main in Southern Hesse.

Table 1. Overview of the forest functions in Hesse

Forest function	ha	% of the forest area
National Park	5,724	0.6
Biosphere reserve	23,356	2.6
Nature conservation area	23,846	2.7
Fauna-Flora-Habitat area	208,962	23.3
Area for the protection of birds	310,899	34.7
Landscape conservation area	493,495	55.1
Wildlife conservation area	11,075	1.2
Natural forest reserve	1,240	0.1
Forest biotope	33,523	3.7
Forest of special landscape importance	24,910	2.8
Geologically interesting natural formations	1,241	0.1
Site with special soil characteristics	3,447	0.4
Experimental forestry sites	2,398	0.3
Water protection area (Zone I + II)	21,484	2.4
Water protection area (Zone III)	247,917	27.7
Water protection area (currently in designation process)	32,505	3.6
Mineral water spring protection area (qualitative protection zone)	38,446	4.3
Flood plains	2,494	0.3
Protection and preservation forest (§ 22 HFG)	23,415	2.6
Strictly protected forest reserve (§ 22 HFG)	18,691	2.1
Forest with climate protection function (local)	45,837	5.1
Forest with climate protection function (regional)	231,104	25.8
Forest with noise reduction function	26,745	3.0
Forest with concealment function	14,555	1.6
Forest with emission control function (local)	10,809	1.2
Forest with soil protection function	186,546	20.8
Nature park	345,809	38.6
Recreational forest (§ 23 HFG)	22,408	2.5
Forest with recreational function (class I)	95,291	10.6
Forest with recreational function (class II)	220,275	24.6

The National Parks and nature conservation areas generally preclude forest utilisation and therefore contribute towards selective nature protection. Dead wood has an important role to play within the framework of integrative forest-nature conservation, depending upon the amount and type of dead wood. Following centuries of forest exploitation and removal of practically all dead wood to improve the dire conditions of the human population, the past few decades have seen more and more dead wood being left where it has fallen in forests.

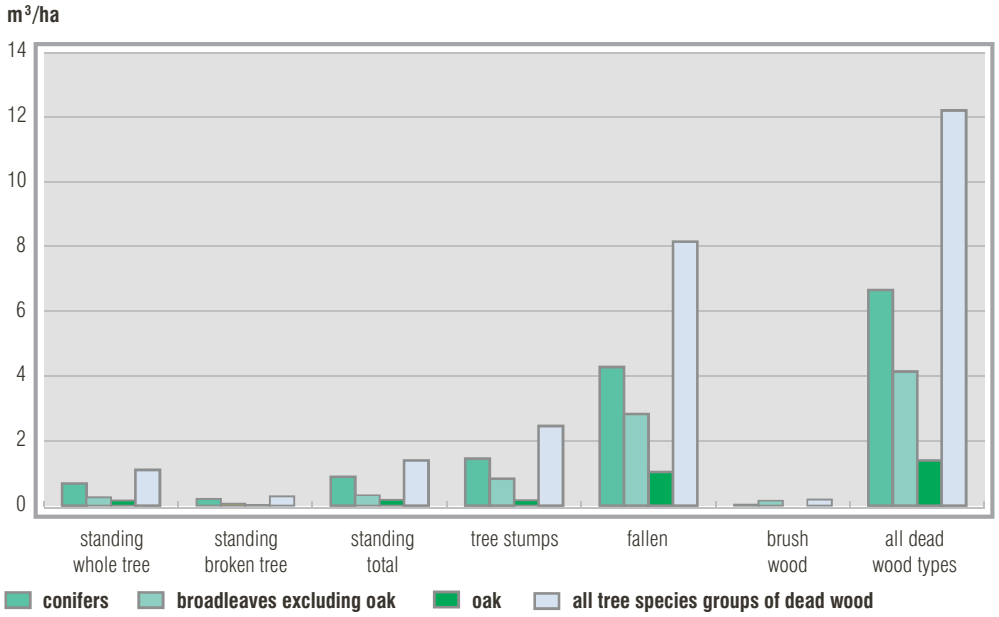


Fig. 6. Average dead wood volumes per hectare by species

Two years ago, the forest management process in Hesse began to include estimates of dead wood volumes in forest stands. The second National Forest Inventory also measured the amount of dead wood and determined its average volume in Hesse at 12 m^3 per hectare, of which 1.5 m^3 was standing and 8 m^3 was fallen dead wood, as well as 2.5 m^3 of dead stump wood. Twelve percent of dead wood was smaller than 20 cm dbh in diameter; 45% of this dead wood was between 20 and 39 cm dbh. The larger diameter size classes, which are of special nature conservation value, made up 18% (size class 40–59 cm), 15% (size class 60–79 cm) and 10% (size class >79 cm) of dead wood (Fig. 6).

3. Legal and organisational forms of forest holdings

Forest law

According to the Constitution of the Federal Republic of Germany, the individual Federal States are held responsible for forestry management. The Federal Government has exhausted all its available legal opportunities in establishing the Federal Forest Act.

The Hessian Forest Act includes, amongst others, the following regulations:

- State-owned forests are managed by a governmental budgetary enterprise, which also offers forest services to forest owners in exchange for regularly adjusted fees. In fact, this State forest enterprise manages the majority of municipal and syndicate forests (*i.e.* private forests in joint ownership) and a proportion of privately owned forests.

- The establishment of forest enterprise cooperatives and the opportunity to join forest enterprise syndicates are regulated by the Federal Forest Act.
- State-owned forests must be managed with public welfare in mind.
- The State forest enterprise is, among other things, responsible for promotion of municipal and privately owned forests, medium-term forest planning for all enterprises under its jurisdiction, applied forest research, education, training and further education outside the universities and colleges, publicity operations and participation in forest policy regulation.
- The basic obligations of forest owners regarding common welfare, as well as proper forest management, are also laid down.
- Access to forests, riding, and use of (non-motorised) transport for recreational purposes is a principal citizen's right on a free of charge basis, which is or may be limited under certain circumstances.

Financial support for forest owners is provided according to the relevant capacity of the EU, the Federal Republic, and the Federal State. In the last two years, annual subsidies have varied by two million euros and are noticeably lower than in the 1990s.

The Hessen-Forst State Forest Enterprise

This State Forest Enterprise was established on 1 January 2001 and further restructured on 1 January 2005. Since then, the Enterprise has consisted of:

- an administration office,
- 41 forest district offices and 440 forest sub-districts,
- a service unit for forest planning, information technology, research and nature conservation data handling,
- a service unit for timber harvesting and civil engineering,
- seedbeds and a tree nursery,
- three forestry education centres (after 2006 there will be only one centre),
- three mobile silvicultural schools,
- a National Park office along with its two administrative district offices.

One third of the existing 3,000 jobs will be reduced by 2007/2008 through natural fluctuations, early retirement, transfer of personnel to other job areas, and by other means; however this will not involve any redundancies. New steps in restructuring are planned or expected.

The annual harvest volume in State-owned forests amounts to two million cubic metres; the volume harvested in forests supervised by the State Forest Enterprise is approximately the same. In total, taking all forest ownership types into consideration, the Federal State of Hesse represents 10% of the total timber harvest in Germany. This volume ranks Hesse in third place behind the States of Baden-Württemberg and Bavaria. Hesse is, however, the largest supplier of beech and oak species.

Hesse is a timber-exporting State. This means, the volume of timber harvested is greater than the State's processing capacity. Around three quarters of the State Forest Enterprise's income is generated through timber sales, the remaining quarter coming from other uses, hunting leases, property management, provision of commercial services, and other sources.

4. Forest research

Applied research for the Hessian forests was, until recently, carried out by a service unit. The main research areas include forest growth, natural forest research, forest genetic resources, forest protection, and environmental control. The oldest beech trial site is approximately 160 years old and has been under observation for the last 120 years.

An interesting feature of the State's biodiversity research is its Hessian natural forest reserve programme. Thirty-one reserves with a total area of 1,240 hectares, along with 26 managed forests that serve as control areas, are under continuous intensive observation, with stand inventories being recorded. For these natural forest reserves, Hesse has focused on beech forests on sites that are representative for Hesse. The results of the fauna studies in particular exceed all expectations. The Senckenberg research institute in Frankfurt surveys fauna in the 74-hectare Niddahänge Reserve in the Vogelsberg area. It has estimated the occurrence of up to 6,000 species, of which approximately one half have already been previously identified. Of these species, around 500 are 'notable' species, *i.e*. species either on the Red List or of under similar protection. The inventory of further reserves shows a similar richness of species, although with different species spectrums adapted to the differing site conditions.

In another reserve, a unique study has been conducted of fungal succession on the beech wood of a windthrow site.

Other major research areas include the 'focussed forest' topics and forest hydrology. The oldest German forest hydrological research areas are situated in Hesse and have been observed and studied quantitatively and qualitatively, as well as in terms of silviculture.

Genetic diversity, an often-ignored element of biodiversity, will be surveyed more intensively in the future. Previous studies in Hesse's beech forests have shown a remarkably rich diversity within forest stands and only a very small difference between beech stands. In natural forest reserves and their control areas, more detailed surveys are intended to show the influence of forest management and utilisation on genetic diversity.

The response to global warming by forest pests, which require or prosper under warmer conditions, is another future-orientated research field. This research area also involves development of pest control strategies and tree tending recommendations for forest regeneration. Older provenance trials will also be reinvestigated to determine whether new findings relating to global warming can be extrapolated. The broad variety of site conditions contained within these trials offers an opportunity for new analyses in this respect.

Forestry research has also been affected by an overall reduction in employment within the public sector. It therefore seems appropriate to combine the forest research of several Federal States and to enter more intensively into collectives and other specialisations wherever appropriate. The research of the Federal States of Hesse, Lower Saxony, and Saxony-Anhalt is being combined in 2006, which will result in the maintaining of a broad range of professional competence despite a 25% reduction in personnel. Synergy may however prove to be less than expected; while the three former institutions have up till now certainly researched similar aspects in many areas, they have not been concerned with studies on exactly the same aspects.

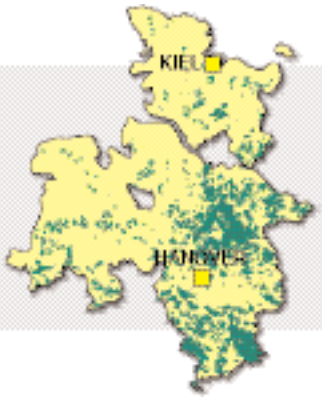
The new Northwest German Forest Research Institute (NW-FVA) will have a total of 125 employees, of which one third will be scientists. It will be financed using a proportional funding system in accordance with the logistics and human resources provided by the individual Federal States. The non-personnel costs have been calculated at approximately one-third of the personnel costs. Third-party funding is also available to the Institute, which will develop its future orientation in cooperation with the Ministries and State Forest Enterprises of the three States.

Lower Saxony and Schleswig-Holstein Regina Petersen

1. Forest characteristics

Forests in Lower Saxony cover 1.16 million ha, constituting 24% of the total State territory. More than a half of this represents private forests. Small farm forests are common. 18% of private forests are between one and five ha in size and 46% are from 1 to 20 ha. Forest cover in Schleswig-Holstein is thin (approximately 10% of the state's total territory).

Conifers are the dominant species. Large post-war deforestations, wind-damaged and devastated areas have been reforested with spruce and Scots pine. Broadleaved mixed forests are typical for most of the mountain areas. Norway spruce predominates in the Harz and Solling Mountains.



Niedersachsen,
territory: 47,400 km², population: 8 million, capital city: Hanover

Schleswig-Holstein,
territory: 15,800 km², population: 2.8 million, capital city: Kiel

Table 1. Forest structure

Type of forest	Lower Saxony	Schleswig-Holstein
	%	%
Pure coniferous forest	30	17
Coniferous forest mixed with deciduous trees	28	24
Pure deciduous forest	24	40
Deciduous forest mixed with conifers	18	20

Table 2. Tree species distribution

Species	Lower Saxony	Schleswig-Holstein
	%	%
Oak	11	15
Beech	14	19
Maple, ash, etc.	3	8
Birch, alder etc.	15	19
Spruce	20	19
Douglas fir	2	1
Pine	30	2
Larch	5	9
White fir		8

Table 3. Age-class distribution

Age	Lower Saxony			Schleswig-Holstein
	%	conifers (%)	deciduous trees (%)	%
1–20	9	33	67	13
21–40	25	68	32	19
41–60	28	79	21	29
61–80	14	63	37	11
81–100	10	54	46	7
101–120	6	43	57	8
121–140	4	40	60	6
141–160	3	33	67	3
>160	1	27	73	4

Volume and increment

In Lower Saxony, total timber volume is on average 267 m^3/ha and estimated current increment amounts to 10.6 m^3/ha. The same figures for Schleswig-Holstein are 297 m^3/ha, and 11.3 m^3/ha, respectively.

Table 4. Timber increment by species

Species	Lower Saxony (m^3/ha/year)	Schleswig-Holstein (m^3/ha/year)
Oak	8.7	8.2
Beech	11.3	13.0
Birch, etc.	6.7	7.3
Ash, etc.	10.4	10.4
Spruce	14.7	16.0
Pine	9.8	10.2
Douglas fir	15.7	16.5
Larch	13.1	12.4
Fir	–	14.3

2. Logging and wood processing

Logging in Lower Saxony totals 4.5 million m³ of timber harvested per year, the equivalent of an annual volume of 4.3 m³ of timber harvested per ha. The same figures for Schleswig-Holstein are 0.762 million m³ of timber harvested per year, an annual volume of 5.1 m³ of timber harvested per ha.

Table 5. The major wood processing operations in Lower Saxony

	Softwood timber (m³)	Hardwood timber (m³)	%
Sawmills	1,485,000	167,000	54
Veneer and plywood	68,000	8,000	2
Chipboard industry	352,000	173,000	17
Fibre-board industry	800,000	18,000	26
Pulp	31,000		1

Table 6. The major wood processing operations in Schleswig-Holstein

	Timber	
	(m³)	%
Sawmills	108,000	20
Veneer, plywood, chip- and fibre-board industry	104,400	26
Pulp	91,800	17
Carpentry	97,200	18
Export	102,600	19

3. Forest protection

Table 7. Categories of forest protection

Category	Lower Saxony		Schleswig-Holstein	
	ha	%	ha	%
Natural forest reserves	18,700	6.0	8,600	19.0
Near-nature managed forest	61,300	18.0		
Habitat protection forest	5,700	2.0		
Historical-cultural forest	500	0.2		
Special biotopes	9,100	3.0	1,425	3.0
Non-forested land			2,600	5.0
Total	**95,300**	**29.2**	**12,625**	**27.0**

Public access to forests

By law, all forest areas may be entered by the public for recreational purposes. The Federal law and the Forest Act of Lower Saxony impose the relevant exceptions and priorities. They set forth the objectives of forest management, and prescribe forest tending and management for all forest owners. Federal forests are a special category: these are forests growing on military training grounds.

In Schleswig-Holstein, pedestrian access to forests is generally permitted to all types of forest roads. Unlimited access is permitted to all areas, especially in forests declared as recreational (5,360 ha = 3.5%).

The 1991 Lower Saxony Governmental LÖWE-Programme, setting forth 13 principles, prescribes close-to-nature forestry with mainly broadleaved and mixed stands. In line with this Programme, the proportion of broadleaved trees will increase to 65%, whereas the proportion of conifers will decrease to 35%. These principles are as follows:

- soil protection and species selection appropriate to the site conditions,
- expansion of broadleaved and mixed forest,
- ecological tolerance,
- preference to natural regeneration,
- improvement in the stand structure,
- target diameter harvesting,
- conservation of old trees and protection of rare and threatened plant and animal species,
- establishment of protected forest networks,
- guarantee of special forest functions,
- tending of forest edges,
- ecological forest protection,
- ecosystem-appropriate game management,
- ecosystem-appropriate forest technology applications.

4. Legal and organisational forms of forest holdings

Forest ownership

Forest ownership structure in Lower Saxony and Schleswig-Holstein is illustrated in Table 8 and Table 9.

Table 8. Forest ownership

Category of ownership	Lower Saxony		Schleswig-Holstein (2002)*	
	%	ha	%	ha
Private forests	44	508,640	50	81,000
Forests of corporate entities, cooperatives	15	173,400	15	24,300
Federal forests	4	46,240	4	6,480
State forests	34	393,040	31	50,220
Church-owned forests	3	34,680		
Total		**1,156,000**		**162,000**

* The proportion of forests is 10.3% of the State's total area.

Table 9. The size of private forests

ha	Lower Saxony	Schleswig-Holstein
	%	%
1–20	46	46
21–50	14	4
51–100	10	5
101–200	10	9
201–500	10	8
501–1000	4	12
>1000	6	16

Private forests and forestry promotion

The Federal Government and the Government of the State of Lower Saxony provide subsidies to enable private forest owners to fulfil their legal and private targets. These subsidies help to improve their economic situation, so that forest owners can maintain or even expand their forests. However, the main aim behind these subsidies is conversion of pure coniferous stands to mixed stands and thinning.

In 2003, financial support in Lower Saxony amounted to EUR 15.53 million. In 2002, financial support in Schleswig-Holstein amounted to EUR 3.85 million.

Table 10. Financial support provided in Lower Saxony in 2003 (millions of euros)

Federation and the State of Lower Saxony (unified grants)		
Silviculture measures	6.61	Total 15.53
Pollution control	1.40	
Regrouping of properties	0.71	
Road construction	1.79	
Afforestation	1.86	
Subtotal	**12.37**	
Grants from the Lower Saxony State budget		
Forest services support	1.70	
Forest protection	0.07	
Fire insurance	0.61	
Contribution to water works	0.76	
Contracts for forestry	0.02	
Subtotal	**3.16**	

Table 11. Annual financial support in Schleswig-Holstein (1998–2002) (millions of euros)

Promotion of afforestation	1.28
Promotion of silviculture measures	2.10
Measures to counteract new forms of damage	0.30
Promotion of forest associations	0.17
Total	**3.85**

5. The structure and tasks of the forest administration in Lower Saxony

Private owners associations

The organisation of private forestry in Lower Saxony has historical origins. There are only a few large properties. Small and subdivided private woodlands are administrated and sustained by two Chambers of Agriculture. Many forest owners have become members of these associations in order to improve their economic and market situation.

Table 12. Organisation of the Chambers of Agriculture in Lower Saxony

	Chamber of Agriculture	
	Hanover	Weser-Ems
Centrally administered areas of forest management	375,000 ha	122,000 ha
Number of forest divisions	12	3
Number of forest districts	107	42

Forests owned by corporate entities and cooperatives

Corporate entities, for instance municipalities, counties, etc., and forest cooperatives, may choose whether they wish to employ their own staff or be supervised and advised by others.

Church-owned forests

In Lower Saxony, church-owned forests are owned by two ecclesiastical foundations, the Hanover convent and educational fund and the closely linked Braunschweig convent and educational fund.

Administration of Federal forests

The Federal Ministry of Finance is responsible for administering German Federal Forests. It has its own staff and is composed of four forest divisions with 34 districts in Lower Saxony.

The Lower Saxony State Forest Administration

Lower Saxony's State forestry is organised on different levels. Under public law, this institution is supervised by the Ministry of Rural Areas, Food, Agriculture and Consumer Protection, and controlled by the Administration Council. Its management is divided among several Departments:

- Area Manager North,
- Area Manager South,
- Production and Marketing Assistant Manager,
- Forest and Environment,
- Financial Management,
- Employees and the Law.

The following three Service Centres are still associated in a public law institution:

- Research Station,
- Planning Office,
- Information and Education Centre.

This public law institution manages 26 forest divisions and 274 districts.

Structure and tasks of forest administration in Schleswig-Holstein

- Private forests are administered by the Chamber of Agriculture's Department of Forestry, which is responsible for consultation, supervision and transactions for the financial advancement of forestry. It manages 14 forest districts (total 47,000 ha).
- Corporate entities and private forests under self-contained management (total 49,800 ha).
- Administration of Federal forest (total 6,200 ha).
- The Schleswig-Holstein State Forest Administration includes: the Ministry of the Environment, Nature Protection and Agriculture, which manages: 7 forest divisions, and 47 forest districts, covering a total area of 52,000 hectares.

6. Education in Forestry

Forests offer employment either directly or in related industries. Most forestry employees are engaged in work in the forest or its administration. The state of the economy requires the number of staff be reduced and so the total number of employees has fallen: in 1960 there were nine times more foresters than today. There has been a recent decrease in the number of foresters and state officials.

Forest professions

- **Master of Science – Forester.** At least 4½ years of university studies (Master of Science) are followed by periods of practical training in state forests. This involves two years of education in state forests and results in a state examination (Forstassessor),

which qualifies staff for managerial functions in a forest division or even higher advancement. State forests have only limited employment opportunities.

- **Forestry Engineer Diploma.** This diploma is the end result of professional education in a technical college. For any employment in the public sector, an additional one-year practical training period is required. Typical employment opportunities for these graduate foresters (Forstinspektor) include responsibility for a forest district (ranger) or special functions. Other enterprises and institutions are also potential employers.
- **Foresters – men and women.** Foresters are provided with vocational training: practical in-forest training and education at the Service Information and Education Centre that concludes with a state examination. Additional professional education may qualify foresters for the grade of 'master forester'. All these employees remain in close contact with nature, and work independently.

Table 13. State forest employees in 2003

	Lower Saxony	Schleswig-Holstein
Foresters	717	181
Officials and clerks	932	149
Trainee foresters	135	33
'Forstassessor' trainees	19	–
'Forstinspektor' trainees	29	2
Total	**1,832**	**365**

7. Forest research

Table 14. The Lower Saxony Forest Research Station (Departmental personnel)

	Officials and clerks	Employees
Administration	8	1.75
Department A	18	
Department B	15	
Department C	15.5	7
Department D	15.5	1
Total	**72**	**9.75**

In 2003, the Forest Research Station's expenditures (in millions of euros) were as follows:

- personnel: 4,427,
- other administrative expenditures: 0.964,
- investments: 0.149,
- external funds: 0.831.

The Forest Research Station supports the forestry of all ownership types in Lower Saxony and Schleswig-Holstein, taking special practical requirements into consideration. Research and consultancy services are provided in the fields of forest growth and yield, forest protection, forest genetics and environmental monitoring.

Negotiations are under way concerning a merger between the Forest Research Stations of Lower Saxony, Hesse, and Saxony-Anhalt, aimed at establishing a common administration office. Such a merger would lead to various synergetic effects, such as:

- improving the efficiency of research work,
- tightening of administration,
- economising on resources,
- maintaining a sufficient and competent staff.

In many projects, such as those supported by external resources, indicators and strategies are provided in order to maintain sustainable multifunctional forestry.

As a common research project conducted by all departments of the Research Station and the Faculty of Forest Science in Göttingen, two large trials have begun in the Solling Mountains in order to test the effects of different types of felling (clear-cut, strip-felling, target diameter harvesting) in the use and regeneration of even-aged spruce stands. These trials will constitute decisive support to practical forestry and provide the basis for further research applications.

Due to the extreme summer of 2003, outbreaks of bark beetle damage have proved a particular challenge for the Forest Protection Department.

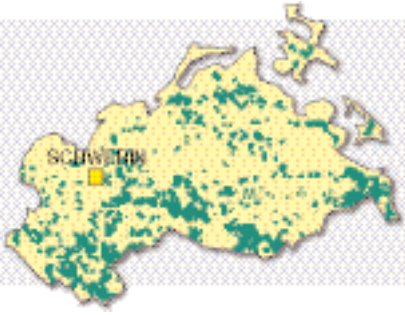
Mecklenburg-Western Pomerania

Herbert Rolf Schäfer

1. Forest characteristics

Forest area

The total forest area in Federal State of Mecklenburg-Western Pomerania (MV) is 503,280 hectares that accounts for a little more than one fifth (22%) of the total national territory. In spite of considerable losses of forest areas in the past, the percentage of forest



Mecklenburg-Vorpommern,
territory: 23,600 km^2,
population 1.7 million,
capital city: Schwerin.

area could be successively expanded to a great extent by afforestation. Thus, 3,465 hectares of new forest were developed from 1997 to 2001 alone. By this increase in forest area, Mecklenburg-Western Pomerania holds a leading position in Germany.

Table 1. Development of the total forest area (ha)

1997	1998	1999	2000	2001
500,261	501,140	501,810	502,543	503,280

Species composition

Historically, coniferous trees have predominated in Mecklenburg-Western Pomerania forests, approximately 59% being Scots pine, while the proportion throughout all the regions is 44%. Other coniferous tree species occurring here are spruce, its proportion being 9%, and also larch and Douglas fir, each with a 3.5% share. As for deciduous trees, beech predominates with its share of approximately 12%, while oak contributes approximately 7% to this variety of tree species. Red alder, a tree growing on lowlands with a good nutrient supply, represents 7%. Birch and other softwood species, such as willow, aspen and poplar, complete the forest diversity, accounting for approximately 8% of the total. In the long term, an increase in the share of deciduous trees from the current approximately 37% to approximately 56% is planned in state-owned forests over the next 100 years. The objective in this case is to increase forest stability.

Age structure

The age structure of the Scots pine and spruce species in Mecklenburg-Western Pomerania is characterised by a scarcity of older specimens. On the other hand, the age structure of beech and oak appears relatively balanced. Particularly in the case of beech, a high proportion of old stands is accompanied by a low share of young ones.

Forests in Mecklenburg-Western Pomerania are characterised by their relative close-to--nature stand structure. 42% of the forests include stands where one or more tree species have been added to accompany the primary species. However, there is still an overly high proportion of mixed stands in which one deciduous tree species predominates. 18% of

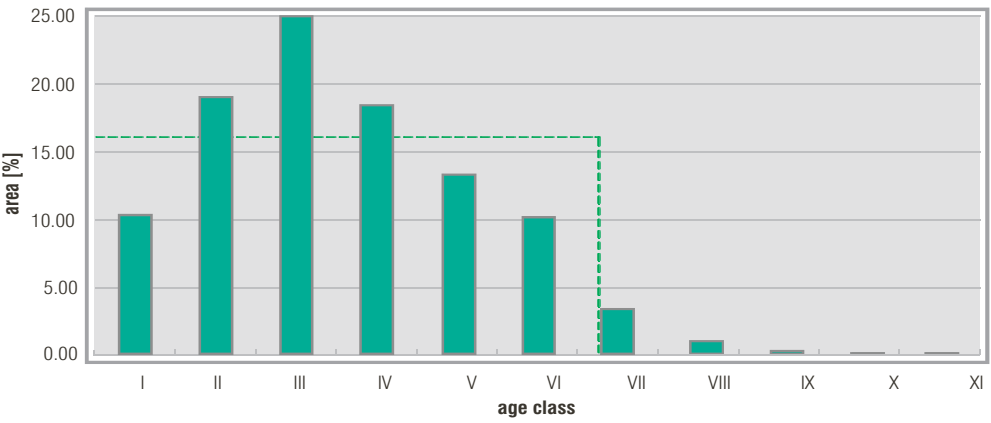


Fig. 1. Age class structure of pine stands

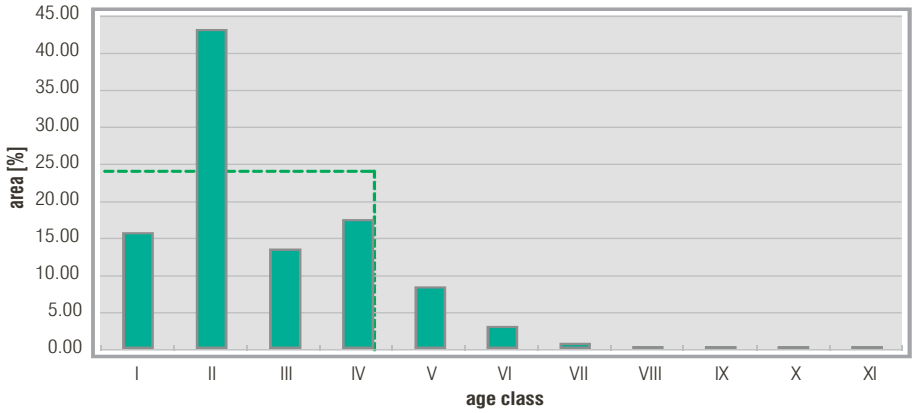


Fig. 2. Age class structure of spruce stands

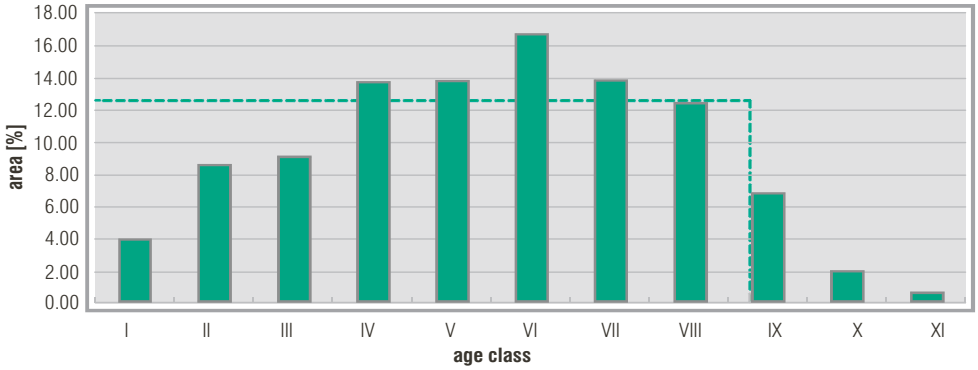


Fig. 3. Age class structure of beech stands

Table 2. Ideal shares of age classes according to tree species groups in the overstorey and their production periods

Tree species group	Ideal share of the age class	Assessment
Pine	15.4%	– The share of stands aged 20 to 59 years (age classes II and III), is too large. – Too low a share of stands older than 100 years, from age class VI on.
Spruce	25.0%	– Particularly large share of stands aged 20 to 39 years (age class II) – Area has insufficient old stands (age class III to IV)
Oak	11.1%	– Relatively well-balanced area portions of age classes I to VIII versus the absence of oak stands aged 160 years and older.
Beech	12.5%	– The absence of areas with a growing stock younger than 39 years, combined with too large an area share of old stands, is a typical feature of the beech species group, characterized by natural regeneration through rejuvenation under the cover of old stands.

forest areas have a second tree layer present, partly as a result of natural regeneration and partly from planting. These trees in a 'waiting position' – as long as they are site-adapted and of good quality – can form future stands after careful harvesting of the overstorey. In the beech forests, mostly uneven in structure, several tree generations are to be found, the result of natural regeneration.

Volume and increment

The average growing stock of all tree species amounts to 282 m³/ha. Beech stands are particularly rich in growing stock, with 397 m³/ha. For all tree species, current annual increment amounts to approximately 7.8 m³/ha.

Table 3. Average volume and current annual increment of tree species

Tree species/species groups	Average volume (m³/ha)	Current annual increment (m3/ha*a)
Pine	278	8.4
Larch	220	7.1
Spruce	295	8.9
Other conifers	237	9.3
Oak	268	6.0
Beech	397	10.2
Other broadleaved hardwood	299	6.3
Common alder	238	6.2
Poplar	205	5.2
Other broadleaved softwood	213	5.3

2. Forest economy

The potential and supply of raw timber

For all tree species, the potential round timber supply amounts to approximately 2.4 million m³/year. Of this, the economically justified harvest volume presently amounts to approximately 1.7 million m³. Comparing the share of individual tree species in the harvest structure in Mecklenburg-Western Pomerania with the Federal average, the following regularities can be found:

- a high share of hard broadleved timber (42%),
- a high share of timber of 'other broadleaves' (22%),
- the clear predominance of the 'pine' species group (39%),
- a high share of industrial wood (49%), particularly hard broadleves.

Potential raw timber supply by ownership category is as follows:

- government-owned forest (*i.e.* state-owned forests and Federal forest): 49%,

- private forest (including trust forest): 44%,
- corporate forest: 7%.

Between 1997 and 2001, approximately 13 million m^3, or circa 76% of the economically usable potential was harvested in Mecklenburg-Western Pomerania.

Basic conditions governing sales of forest products

Due to the comparatively high proportion of low-yield tree species, the basic conditions for forestry in MV, in terms of timber assortments, are less favourable than average Federal conditions. Nevertheless, timber sales are the crucial source (approximately 90%) of the forest holdings' income. The domestic timber industry's capacities have been radically increased, while in some assortment sectors, e.g. industrial round wood, they are already higher than the potential round timber supply.

Table 4. Price trends for the main timber assortments [EUR/m^3]

Assortment designation	1997	1998	1999	2000	2001
Stem long wood, oak	90	87	82	85	83
Stem long wood, beech	69	69	74	78	71
Stem long wood, spruce	53	59	62	55	51
Stem long wood, pine	38	42	45	45	42
Industrial short wood, oak	13	13	15	16	15
Industrial short wood, beech	21	22	23	25	25
Industrial short wood, spruce	13	19	21	19	18
Industrial short wood, pine	14	17	18	18	20
All assortments, oak	55	55	55	59	58
All assortments, beech	40	42	47	50	46
All assortments, spruce	37	42	44	39	37
All assortments, pine	24	28	30	30	29
Assortments together	30	34	37	36	35

The unsatisfactory earnings achieved by all categories of forest ownership are the result of various economic conditions, which are particularly dependent on the size of forest enterprises and their natural production capacities, but also on the surrounding infrastructure and the social demands on forest. For this reason, the Federal and the state governments sponsor forest-economy measures by non-governmental forest owners. Finally, proceeds from timber sales, with a more than 90% share, are the most important source of income for forest enterprises.

Development of the timber industry

The extensive capacity growth of the domestic timber industry means that the supply of round timber must be partly complemented by imports. Due to a constantly progressing

concentration in the sawmill industry, the situation of the State's small and medium-sized sawmills has become more and more critical.

Except for a predominant group of small-scale local customers, timber sales for energy use still plays a subordinate role in the state. The Government's forest service will continue to support projects for timber use as an energy source in the context of its capacity.

Table 5. Development of the timber industry

Branch	Number of enterprises 1998	Capacity in thousands of m³ 1998	Number of enterprises by 2001	Capacity in thousands of m³ by 2001
Round wood processing (sawmills)				
Coniferous wood	16	300	16	1,635
Predominantly broadleaved	5	50	8	288
Total	**21**	**350**	**24**	**1,923**
Secondary round wood processing (wood board industry)				
MDF	0	0	1	500
OSB	0	0	1	600
Total	**0**	**0**	**2**	**1,100**

Table 6. Sawmill industry structure (according to annual round wood output)

Category	Number of sawmills	Total annual output in thousand m³	% Share
More than 100,000 m³	4	1,740	90
30,000–100,000 m³	1	40	2
10,000–30,000 m³	7	87	5
Below 10,000 m³	12	56	3
Total	**24**	**1,923**	**100**

Forest seed production

Tree seeds are important forest by-products. They are collected in an economically useful manner for the sustainable satisfying of all forest owners' needs. Seeds of those tree species that are subject to the Act on Forest Seeds and Planting Stock may only be collected and distributed where the parental material has been approved.

In accordance with the appropriate regulations, the Administrative Office for Forests and Large Protected Areas of Mecklenburg-Western Pomerania is the authority responsible for permitting and controlling the harvesting of seeds for forest propagation in MV. Once stands have been approved, they are entered in a harvest admission register.

The certification of forests in MV, particularly in accordance with PEFC, but also FSC, is a common goal of the MV Federal State's government and the Forest Owners Association.

Table 7. Forest seed collection

Collection year * / Tree species	Quantity**	1996/1997	1997/1998	1998/1999	1999/2000	2000/2001
Sycamore	S	5	221	143		145
Common alder	C	346		754		284
European beech	S			4,766		17,551
Ash	S	64	184	34	173	166
Red oak	S	127	229	1,049	1,682	2,656
Common oak	S	370		11,373		3,918
Sessile oak	S	514	83	15,218		14,275
Small-leaved lime	S	23		5		7
Grand fir	C					
Common larch	C	700		209	40	388
Japanese larch	C					61
Spruce	C			4,751		
Sitka spruce	C			410		180
Pine	C	262	838	6,443	11,232	624
Douglas fir	C	10		2,860		1,295

* Year of forest seed collection = 1st July of the current year till 30th June of the following year.
** S = seed crop in kg; C = cone crop in kg.

Forest service enterprises

The trend towards a further mechanisation of forest operations still remains unbroken, above all with regard to cutting and hauling. As for silviculture, the main emphasis is placed on implementation of and technical support for forest operations, such as planting, tending of stands and forest protection.

The public forest administrations and private forest enterprises are increasingly outsourcing their tasks to the service branch. This also applies to various types of forest operations. Forest service enterprises in particular have substantially developed the state's forest technology. Thus some 80% of the timber cut in state-owned forests is hauled by private entrepreneurs and these perform as much as 100% of mechanical wood harvesting, particularly thinning. The technical development of forest service enterprises is promoted by the European Union and the MV State.

Table 8. Support for forestry service enterprises (in '000s DM)

	1998	1999
Disbursed EU subsidy	431.7	517.1
Disbursed State subsidy	123.4	147.8
Total amount financed investments	1,233.6	1,477.6

3. Forest protection

Nature conservation in forests

More than half the forests in Mecklenburg-Western Pomerania fulfil proven conservation functions. Thus 35% of forests are situated in landscape protection areas. A further 7% are proven nature reserve areas and another 7% are specially protected biotopes. The National Parks account for 6% of the State's total forest area and 11% of state-owned forest area. Additionally, a Natural Forest programme envisages 2,000 hectares (approximately 1%) of the state-owned forest area being made natural forest reserves. These forests are to be left completely to natural development. By the end of 2004, there had been already 32 areas, amounting to 1,200 hectares, proven as natural forest reserves. This area selection could not be completed by 2004. However, the state forest administration has taken measures within the framework of its SEBASTRA programme to preserve rare tree and shrub species. Furthermore, over 40,000 heavy, standing dead trees were registered. Finally, the safeguarding of 580 proven bird protection zones is also particularly important.

The area of forest in the State's National Parks is approximately 31,357 hectares. This represents 6% of total forest area and 11% of state-owned forest. Thus, Mecklenburg-Western Pomerania is one of the leading states in Germany in this respect (with the Federal average amounting to 1%).

Table 9. Forest areas in National Parks

National Park	Total area (ha)	Forest share (ha)
Müritz	32,200	23,180
Vorpommersche BoddenStateschaft	80,500	6,054
Jasmund	3,003	2,123
Total	**115,703**	**31,357**

Hazards to and burdens on forests

The demand to expand forest areas inevitably increases in line with the State's general economic and infrastructural development. But these affect forests as well. Full compensa-

Table 10. Loss of forest areas, according to kinds of land use (in ha)

Land use type	1997	1998	1999	2000	2001	2002
Road construction	0.23	17.69	5.18	2.17	2.79	20.06
Construction of cycle tracks	2.17	0.71	2.09	26.96	1.45	33.38
Motorway construction	2.60	5.51	10.13		22.17	40.41
Location lines	4.33	1.13			0.01	5.47
Gravel winning	3.97	3.26		2.73		9.96
Building projects	15.23	7.76	9.32	14.91	100.77	147.99
Other	7.61	4.63	6.72	33.57	4.04	56.57
Total	**36.14**	**40.69**	**33.44**	**80.34**	**131.23**	**313.84**

tion for ecological losses solely through intervention in forests is not possible. However, to a large extent those involved in forest protection endeavour to limit any negative consequences.

The concept of close-to-nature forestry

The basic principles underlying a close-to-nature forestry model represent a holistic view of the forest as a dynamic ecological system. It should serve as the basis for long-term forest development in the State. The goals and principles of close-to-nature forestry are mandatory for State forest administration. Emphasis is thereby placed on the following objectives:

- a substantial increase in the share of site adapted deciduous tree species and the share of mixed and multi-storied stands,
- utilisation of natural regeneration,
- forest-compatible game stock level,
- an increase in the share of old stands and the safeguarding of dead tree proportions,
- the protection of plant and animal species living in the forests,
- safeguarding the protective and recreational functions of forest.

The long-term transformation of the growing stock into mixed deciduous stands and into mixed deciduous-coniferous stands is another of the objectives being strived for.

Public access to forests

The State Forest Act of 8 February 1993 sets out the importance of forests and the role state forestry plays in policy and the economy. Forests have a considerable influence on the shape of the landscape in Mecklenburg-Western Pomerania. They must not only to be preserved and expanded due to their utility function but, above all, because of their protective and recreational functions. Thus, the coastal protective forest on the Baltic Sea coast, approximately 340 kilometres in length, presently encompasses an area of approximately 4,000 hectares. An additional area of approximately 88 hectares is forest protected against air pollution.

Recreation, environmental education and tourism in forests

Approximately 24,000 hectares of forests in the State are of prime importance in view of their recreational function. In state-owned forests alone, 885 kilometres of hiking paths and 760 kilometres of cycle tracks have been approved and marked out. The State Forest Law regulates riding and driving in the forest. Consequently, riding and driving are only permitted on approved forest paths and areas. At the end of 2001, there were a total of 4,732 kilometres of approved riding paths and roadways in all forest areas. A real concern of Mecklemburg-Western Pomerania is to expand relations with neighbouring Poland in the field of tourism and forestry (Interreg III A Programme).

Forest-related educational work within the State Forest Administration could be improved still more. Particularly intensive educational work is being carried out at forest

youth homes, thanks to which more than 16,500 children and youngsters have been brought closer to the forest and its uses in such homes.

4. Legal and organisational forms of forest holdings

Forest law

With the specific circumstances of Mecklenburg-Western Pomerania taken into consideration, the State Forest Law within the framework of the Federal Forest Law lays down the necessary guidelines for compliance with sustainable forestry. These substantial guiding rules include setting out the objectives and principles for close-to-nature forestry, as well as the objectives regarding types of growing-stock, silvicultural treatment guidelines for particular tree species (also for the National Parks), forest development planning, the forest conception of the State forest administration, and last but not least, the forest working plans and the code regulating the implementation of the law on forest reproductive materials.

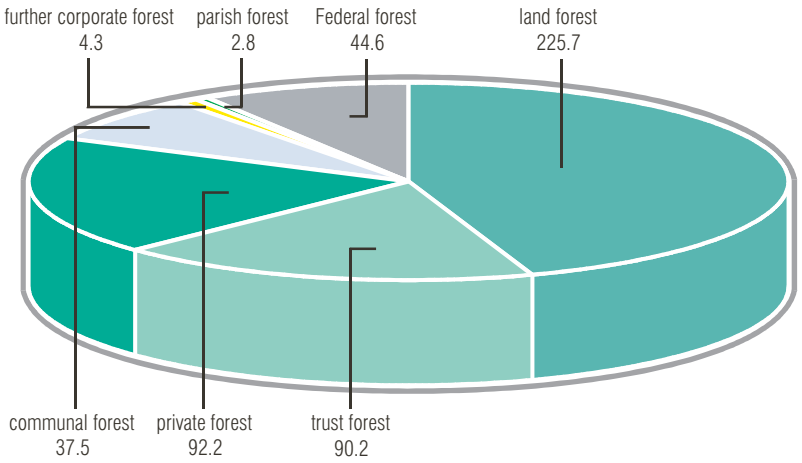


Fig. 4. Forest area by ownership category (in '000s ha)

Forest ownership

The following survey illustrates an overview of the forest ownership structure in Mecklenburg-Western Pomerania:

- **State-owned forests.** Totally state-owned forests are exclusively situated in the Mecklenburgian region.
- **The former 'Prussian forests'.** The forests (45,710 ha) and agricultural areas (17,453 ha) of the former Prussian property are located in the Western Pomeranian region. These so-called 'Prussian forests' in Western Pomerania have been taken over and have became a part of MV State.

- **Federal forests.** Besides state ownership, the Federal Government is the largest forest owner in MV. The Federal Government maintains a forest administration with six Federal forest offices for managing and administrating its forest areas in the State. A major part of federal forests is set aside for special functions, e.g. for military purposes. In view of this special military function, the forestry technical administration maintains a close-to--nature form of management and protection of the forest ecosystems in the Federal forest.
- **Corporate forests.** Like the state-owned forest, corporate forests serve the public welfare to a high degree. Thus the recreational function plays an important role with the municipalities. Many towns with forest property maintain their own forest technical personnel in order to safeguard forest tending. The Hanseatic City of Rostock is one of the richest towns in Germany in terms of woodland and the only municipality in the State that manages its own municipal forest office.
- **Private forests.** Currently, small and very small enterprises with an average size of 2 hectares are predominant among private forest holdings. The establishment of forestry unions was successfully supported by the State. By the end of 2001, a total of 64 forestry partnerships with 3,288 members managed 19,475 hectares of forest in this way. Besides free consultation, state forest administrations also offer extensive contractual technical support to all forest owners.

Table 11. Development of private forest areas

Year	1998	1999	2000	2001
Forest area (ha)	77,941	93,145	95,966	98,138

- **Trust forests.** Trust forests are a specific peculiarity of the so-called 'new States' incorporated into the Federal Republic of Germany. These originated in the expropriation of forest holdings in the course of the land reform introduced when the State was part of the former German Democratic Republic. The Federal Government is the present owner of these trust forests. Nowadays, the federal legal authority is transferring these forests to private ownership through the BVVG. Until they were denationalised, they had to be managed and administrated by the state forest administration. However, by 2001, their management had gradually been reduced and finally phased out.

5. Structure and tasks of the state forest administration

The organisational structure of State administration is presented in Fig. 5.

The Ministry of Food, Agriculture, Forestry and Fisheries in the city of Schwerin is the supreme forest authority, while the Administrative Office for Forests and Large Protected Areas of Mecklenburg-Western Pomerania represents the superior forest authority at Malchin. In charge of forestry since 1 July 2001, it has had 33 newly established forestry field offices, managed as minor forest authorities, with 235 newly formed forest districts. The table below provides a comprehensive overview of forestry employment figures.

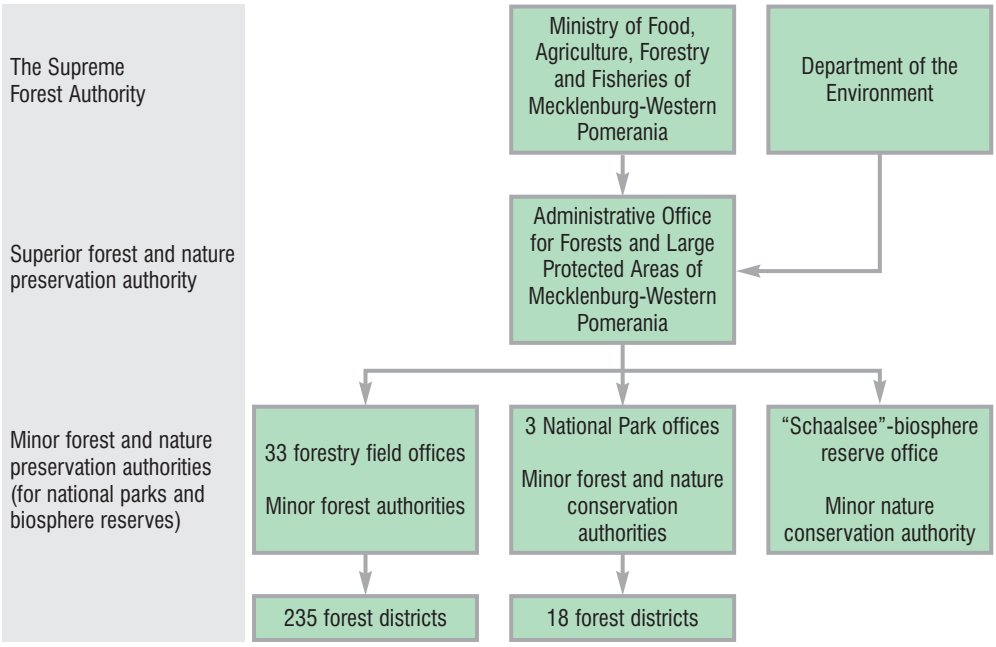


Fig. 5. Organisational structure of State administration for management of forests and large protected areas

Table 12. Personnel development in the State forest administration

Posts	1997	1998	1999	2000	2001
Senior forest service	120	124	131	131	123
Higher forest service	585	570	561	551	507
Medium-grade civil service	172	171	174	174	149
Lower forest service	3	3	4	4	4
Candidates for senior forest service	12	11	11	11	11
Candidates for higher forest service	18	18	18	18	18
Qualified foresters (state-owned forest)	925	925	925	925	925
Qualified foresters (trust forest)	485	462	419	355	303
Total number of foresters	**1,410**	**1,387**	**1,344**	**1,280**	**1,228**
Other employees	14	14	9	9	8
Trainees	60	60	60	60	60
Total number of posts	**2,394**	**2,358**	**2,312**	**2,238**	**2,108**

The demand for subsidies

In the last few years, forest enterprises and thus the forest field offices were entrepreneurially challenged to reduce the demand for subsidies, although the revenues from trust forest management inevitably decreased, due to the advanced denationalisation of forest areas.

As a result of the developments described above, the amount of subsidies in 1997–1999 initially decreased, despite the decline of trust forest areas that had to be managed. However, this trend could not be continued, due to the recessive developments on the timber market, the advancing privatisation of trust forest areas and, additionally, the job market-political situation since 2000.

Table 13. Subsidies granted to promote forestry measures

Subsidised measure	Monetary supply in '000s EUR				
	1997	1998	1999	2000	2001
Silvicultural measures	4,444	3,645	2,576	3,374	1,848
Forest road construction	258	0	0	0	0
Promotion of forestry groupings	271	245	215	216	32
Afforestation premium	483	619	732	855	879
Measures conditioned by new type of forest damage	0	27	0	0	0
Total subsidized measures	**5,456**	**4,536**	**3,523**	**4,445**	**2,759**

Achievements of the State Forest Administration in rural areas

The responsibility of a forest authority is to support preservation of forests and to guarantee their functions, irrespective of the kind of forest ownership. To this end, legal provisions are laid down for the preservation, management, protection and regeneration of forests in collaboration with various other public interest bodies. The forest authority also issues forestry statements in the case of authorization procedures.

In the period 1998–2000, a total of 10,600 hectares of forest area was regulated under forest management planning. This included an assessment of the past planning period, the taking of further inventories of forest stands and updating the ten-year plan. In 2000, an extensive 2000–2009 programme for forest development planning (WEP) was begun in state-owned forest areas (excluding nature reserve areas) and this was successfully completed in 2001. Thus the State Forest Administration has now a simplified plan for naturally sustained yield, covering the whole of its forest area. All plans are based on the principles of close-to-nature forestry, including nature preservation and technical considerations.

Advisory and technical support for forest owners

In Mecklenburg-Western Pomerania, forestry field offices are centralised, *i.e.* besides their forest-related official tasks, they provide advice and support for all forest owners. State forestry offices carry out substantial forest promotion of both private and corporate forest. The aim of this promotion is to create opportunities for utilizing, preserving and reproducing forests under economically sound conditions. Such promotion is aimed at balancing the disadvantages of small area size, unfavourable area shape, fragmentation of estates and stands, insufficient opening-up of forest areas and other structural deficiencies.

Agricultural and forest-economy enterprises, private forest owners, forestry groupings and other entrepreneurs may be promoted on the basis of the Guiding Rule for Promotion of Forestry Measures in the State of Mecklenburg-Western Pomerania dated 12 December 2000. In the period 1991–2001, subsidies granted to promote forestry measures in MV amounted to EUR 33,502,000.

The structures of small private forests complicate their independent management. Forestry groupings in the form of forestry partnerships within the forestry unions make it possible for individual forest owners to manage their forests effectively. The major tasks of these forestry groupings are to overcome the above-mentioned unfavourable structures and to mobilise timber resources in private forests, along with their association for the purpose of improved marketing.

6. Forest management

Presented below are the figures for the range of silvicultural measures taken in state-owned forests in 1997–2000, the gradually decreasing role of trust forests, Federal forests and forests given technical assistance, as provided by the State Forest Administration. However, complete data is not yet available on other types of forest ownership.

Table 14. Scale of silvicultural measures (ha)

Silvicultural measures	1997	1998	1999	2000
Forestation, including:	2,725	2,395	2,332	2,128
– afforestation	844	589	636	680
– reforestation	981	786	743	711
– under planting	581	663	612	419
– replanting	66	66	70	55
– admixture species planting	253	291	271	263
Planting under canopy cover	412	423	246	141
Young-growth cleaning	2,432	2,451	1,951	1,755
Young growth tending in total, including:	7,696	5,992	5,547	5,368
– early thinning	3,136	2,354	2,371	2,354
– late thinning	4,560	3,638	3,176	3,014
Pruning	2,214	2,090	1,857	1,811

Timber marketing

The State Forest Administration is at present the largest supplier on the domestic timber market. The results of timber marketing, as presented in the tables below, may serve as an indication of the situation in Mecklenburg-Western Pomerania.

Table 15. Sales volumes by State and trust forests (in '000s m³)

Tree species group	1997	1998	1999	2000	2001
Oak	41	43	44	48	47
Beech	178	191	193	200	200
Other deciduous hardwood	38	26	25	27	26
Other deciduous softwood	32	28	36	31	46
Deciduous wood in total	**289**	**288**	**298**	**306**	**319**
Pine	467	435	424	437	355
Larch	50	57	43	37	32
Spruce	194	165	138	88	105
Other coniferous wood	19	14	12	11	9
Coniferous wood in total	**730**	**671**	**617**	**572**	**501**
Total	**1,019**	**959**	**915**	**878**	**820**

Forest services

By 2009, state-owned forest technology will be successively reduced by approximately 25%, as a result of the growth in employment. At the same time, the degree of use of machinery will be optimised. Apart from its own operational and sovereign tasks, state-owned technology is mostly used in services supplied to, for example, other forest owners. This depends on their varied requirements and so the use of machinery is also often organised in an agreed-upon rotation in stands managed by several forest offices.

Activation of small-sized forest ownerships is essential from the point of view of growth in employment and wood production. It is therefore of great economic importance and takes priority in forest policy. The offer of forest-operational services to forest owners and third parties is of public interest and provides a substantial contribution to structural improvements in rural regions.

7. Education in forestry

Most vocational and advanced training programmes are available free of charge to all State Forest Administration employees, as well as to forest owners and other interested parties. The training comprises 14 subjects, *i.e.* from silvicultural methods, forest protection,

through timber marketing, forest technology and forest legislation, concluding with public relations. The following forms of education and training are carried out by the State Forest Administration under specific legal provisions:

- **Career training for senior forest services.** Every year, graduate foresters are appointed to civil service status as public servants, until revoked. Such training for junior foresters lasts two years and is based on the training and examination regulations for a career in the senior forest service of the MV State. Possession of a university degree is a precondition for this training.
- **Career training for higher forest services.** Appointments to civil service status, until revoked, also take place on an annual basis for career training in the higher forest services. A degree from a forest technical college is a prerequisite in order to become a graduated forester. However, such training lasts only one year and is based on the training and examination regulations for a career in the higher forest service in the MV State.
- **Vocational training for qualified foresters.** Over the last ten years, an annual average of 25 trainees have been trained to become qualified foresters. In the last five years, an annual average of 5 employees from private forest enterprises were accepted into the State forest service following training.
- **Advanced training for nature conservators and environmentalists.** In the course of the last 3 years, about 20 employees of the State forest and large protected areas administration have been successfully trained in advance as qualified nature conservators and environmentalists. All of these have found employment with the State administration.
- **Advanced training for master forester.** At present no advanced vocational training for master forester is offered in Mecklenburg-Western Pomerania, because in the last few years a disproportionately large number of foresters were trained as master foresters.
- **Supplemental school-leaving examinations for unskilled foresters.** Many foresters with no vocational forester training take courses in an endeavour to make up for their lack of a vocational school-leaving examination. The forest administration is also keen to have its foresters attain this additional school-leaving examination.

Table 16. Number of the higher and senior forest service career training graduates

Vocationally trained	1997	1998	1999	2000	2001
Candidates for higher forest service	–	8	9	4	3
Candidates for senior forest service	5	6	4	5	6

Table 17. Number of qualified foresters completing vocational training courses

	1997	1998	1999	2000	2001
Qualified foresters (state forest)	20	39	22	16	38
Qualified foresters (other forest owners/forestry service enterprises)	–	–	–	1	3

8. Forest research

Article 38 of the State Forest Act provides that the State must ensure establishment of experimental forestry research at domestic stations and, where necessary for sustainable forestry, the allocation of research commissions to foreign institutes on a contractual basis. To this end, a Department for Forest Planning and Research has been established in the Administrative Office for Forests and Large Protected Areas. However, due to financial and personnel constraints and the very stringent requirements regarding equipment and facilities, the relevant capacity of this department is very restricted.

Forest environmental monitoring

For the purpose of intensive and continuous surveillance of forest conditions in Mecklenburg-Western Pomerania, the Forest Research Department maintains variously scaled grids of monitoring plots, where a variety of environmental parameters are tested to identify the cause-effect relationships at ecosystem level. These surveys are carried out partly within the scope of the State and partly at Federal or European level. First and foremost, 340 plots are laid out on a 4×4 kilometre grid for Level I crown condition assessment, with an additional 57 plots for ecological forest condition control, 80 plots on a 8×8 kilometre grid for the European Forest Soil Condition Survey, and finally 2 plots for long-term, Level II intensive monitoring activities.

Registration system for forest protection

Surveillance and assessment of the occurrence of biotic and abiotic damage throughout the total forest area of the State is carried out by means of a control logbook recording the forest protection situation. Governmental and non-governmental forest districts maintain this logbook. The coordination and evaluation of the surveillance results is the responsibility of the Administrative Office for Forests and Large Protected Areas, *i.e.* the forest protection registration office in its research department. Forest authorities are also instructed concerning damage assessments and control measures by this office. Furthermore, monthly forest practices are based on the current forest protection situation by means of an information brochure warning against possible damage occurrences.

Silvicultural, forest genetic and natural forest research, yield and landscape studies and game management

The studies, measurements, assessments and monitoring in these fields are mainly oriented towards forest practices due to restricted laboratory facilities and a shortage of personnel. On the other hand, considerable progress is being made in natural forest research. So far, ten reserves have been fully established. In all of these, enthomological and floristic assessments, as well as inventories of fallen or still standing dead trees have been carried out.

North Rhine-Westphalia

Lutz Falkenried

1. Forest characteristics

According to the State forest inventory (LWI), forests in North Rhine-Westphalia (NRW) cover approximately 915,800 hectares, constituting approximately 27% of the State's territory.

Nordrhein-Westfalen,
territory: 34,100 km^2,
population: 18 million,
capital city: Düsseldorf.

Table 1. Forest area in NRW in ha (as of 15 December 1999)

Total Forest Area	878,400
Bare Lands	5,300
Wooded Areas	883,700
Non-wooded Areas	32,100
Forest Area	915,800

Source: LWI.

The above figures show that in densely populated NRW, there are just over 500 m^2 of forest area per capita (the average for Germany being 1,300 m^2). The lowest level of forestation is found in the Lower Rhine Bay and in Neuss County, with forest area amounting to less than 7%. Siegen-Wittgenstein is the most densely wooded county (approximately 65%) in NRW.

Forest area and species composition

In North Rhine-Westphalia, the total forest area is made up of 52.7% broadleaved species and 47.3% coniferous species (the national average by comparison is 34% and 66%, respectively). Broadleaved species have further increased in proportion. Spruce has again lost ground, while the two broadleaved groups 'Other Broadleaves with Long Rotation Period' (ALH, e.g. ash, maple) and 'Other Broadleaves with Short Rotation Period' (ALN,

e.g. birch, willow) have increased. In recent years, some spruce areas have been converted into broadleaved forests. Afforestation and reforestation projects are now mainly planted with broadleaved species.

The continuing goal of the State Government is to increase the total area of forests in the State to 30% and the proportion of broadleaved species should achieve 55%.

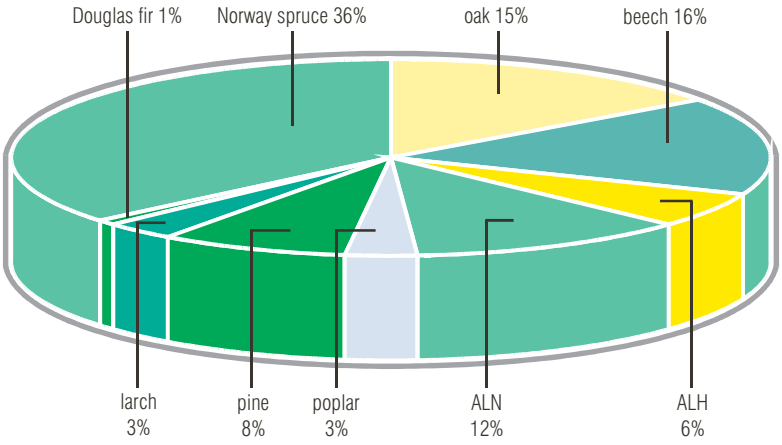


Fig. 1. Distribution of tree species in all forests of North Rhine-Westphalia (Source: LWI)

Age classes

The direct effects of World War II, as well as the resultant deforestation caused by shortages of wood fuel and mining timber and the reparation demands of the Allies led to large clear-felled areas and thereafter to extensive reforestation. This is clearly reflected in the high figures for the 20 to 60 year age classes. Spruce, which at that time was the most widely used species for reforestation, shows a particularly unbalanced age class structure.

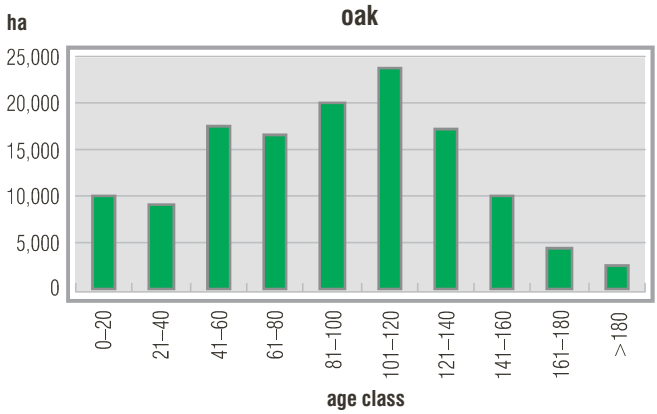


Fig. 2a. Forest species distribution by age classes (Source: LWI, LÖBF 1999)

Fig. 2b. Forest species distribution by age class (Source: LWI, LÖBF 1999)

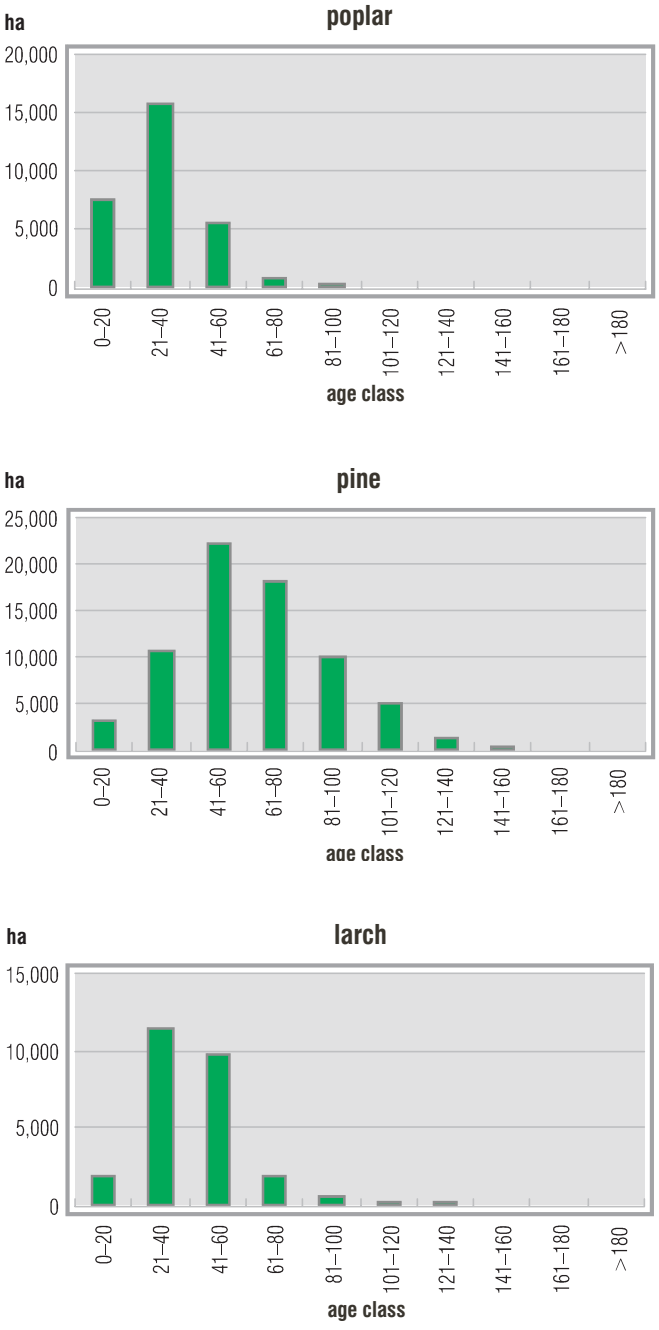


Fig. 2c. Forest species distribution by age class (Source: LWI, LÖBF 1999)

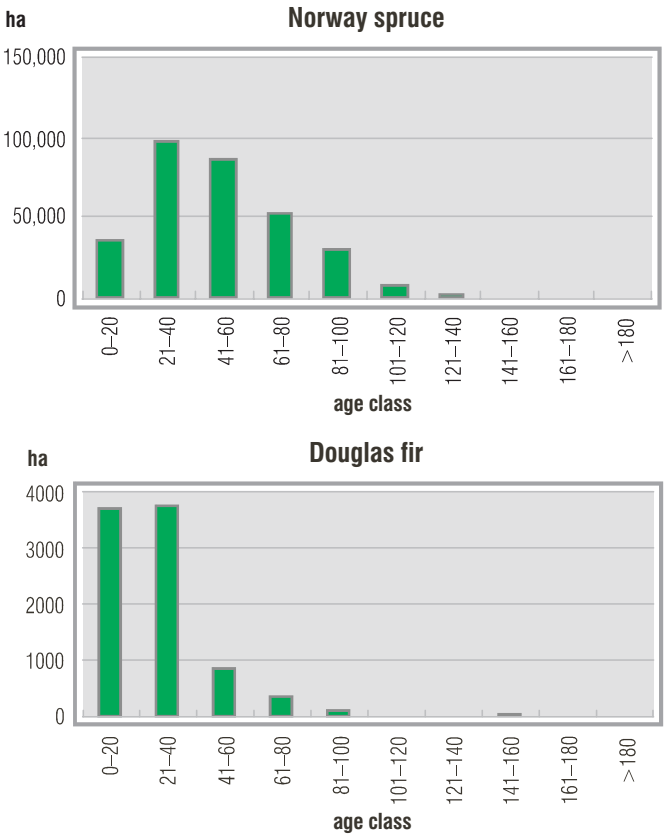


Fig. 2d. Forest species distribution by age class (Source: LWI, LÖBF 1999)

The age structure of a forest has considerable effects on its biodiversity, utilisation of the sustainable raw material wood, as well as on the maintenance requirements and stability.

The consequences of World War II may be perceived in particular by the small share of areas covered with old-growth coniferous forests.

The higher percentage of broadleaved trees in the youngest age class illustrates the change in the current reforestation practice towards increased emphasis on broadleaved trees.

Volume and increment

The economically utilisable standing volume of wood in all North Rhine-Westphalia forests amounts to 194,435,000 m^3, as traditionally expressed in units of a harvestable cubic metre under bark (H m^3)[1].

* [1] Only wood with a diameter of more than 7 cm with bark is included. The data on growing stock refer to the year 1999 and are based on the data of the State Forest Inventory.

The average utilisable wood volume per hectare of forest is thus 221 H m³ under bark. In comparison to the Federal average value for 1986, as shown by the Federal Forest Inventory, the total estimated value over 11 years amounted to an average of 26 m³/ha, which despite timber utilisation, represents an annual increase of approximately 2,4 m³/ha (SPELSBERG 2000). The theoretical amounts of wood that can be harvested in NRW are increasing by an annual 1.9 million m³.

The distribution of wood volume by species shows a considerable emphasis on spruce (Fig. 3). 67% of total cuttings take place in private forests. The State forests account for an average share of 18%, whereas municipal forests participate with 14% of total cuttings.

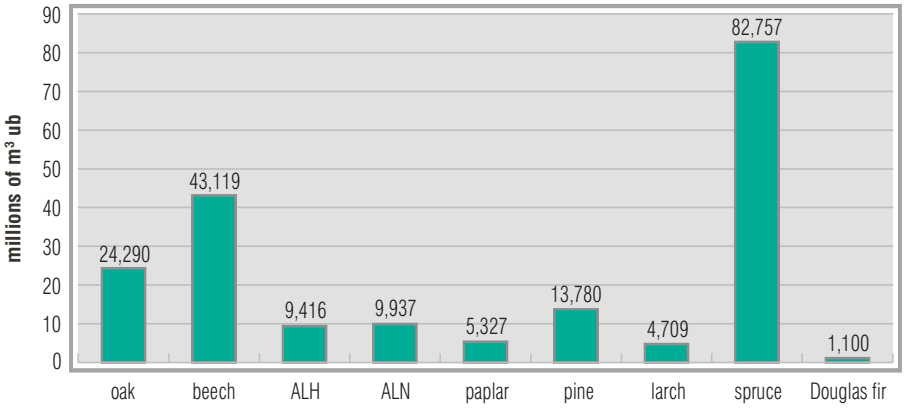


Fig. 3. Distribution of wood volume by species for all forests in NRW in 1999 (Source: LWI)

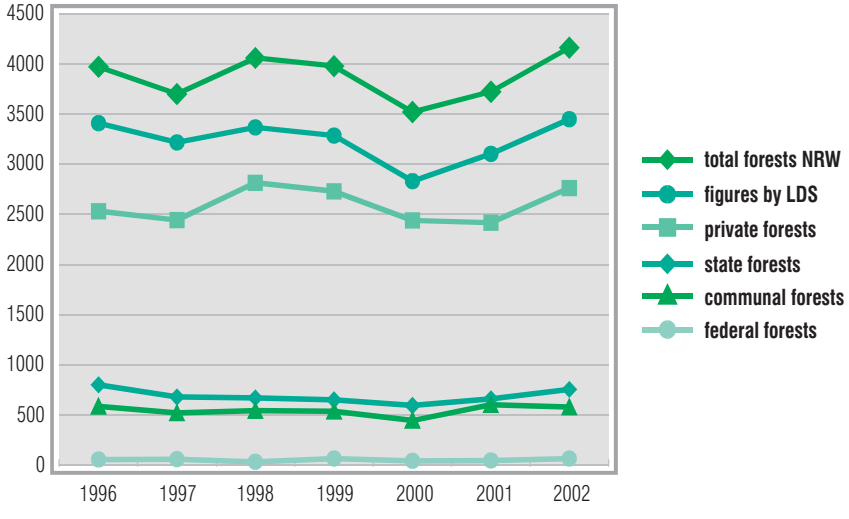


Fig. 4. Total cuttings in NRW in 1996–2002 according to forest ownership ('000s m³ ub) (Source: Results of the Forest Inventories, LDS/DIM)

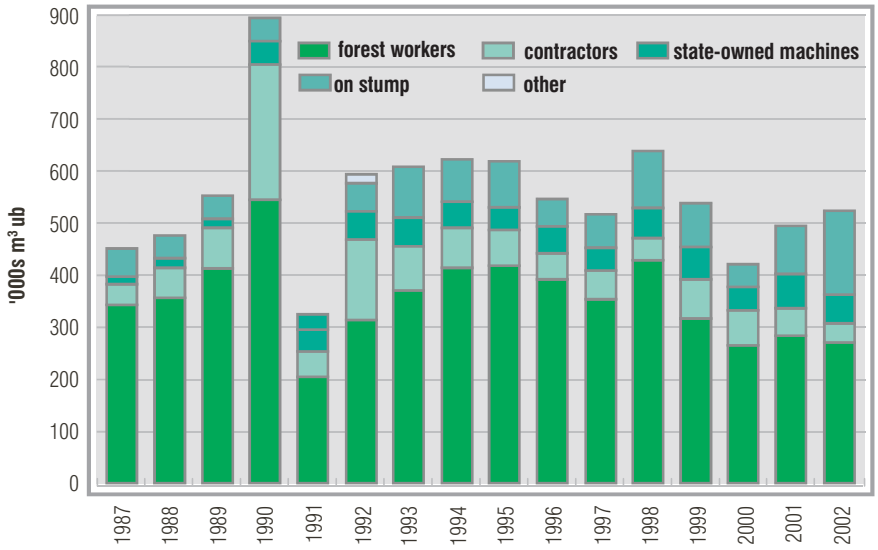


Fig. 5. Annual felling in NRW's state-owned forests by volume and method (MUNLV) (Source: MUNLV)

Due to the effect of a hurricane in 2000, there was a massive decrease in annual felling. The following two years showed a constant increase to the average level of annual cuttings for the total time period of the report. The visible trend is that the amounts of cuttings by private companies as contractors to the forest offices decreased while sales of round wood on stump increased.

2. Forest ownership structure and forest enterprises

The 915,800 hectares of forest areas in NRW are distributed among many owners (LWI 1999). The high proportion of private forests, 64% is exceptional in the Federal Republic (Fig. 6).

The total area of private forests is 592,900 hectares, whose management is structured between more than 150,000 owners. Agricultural forests play a special role, by complementing incomes from agriculture and offering the opportunity to liquidate investment reserves by timber harvests (the 'Savings Bank' function of forests). Approximately 18,400 mainly agricultural enterprises each manage an average 8.6 hectares of forest area.

The corporate forest area of North Rhine-Westphalia comprises 178,900 hectares. This includes forests of municipalities, churches, foundations and institutions. State-owned forests occupy 114,700 hectares. In addition, there are forest areas owned by foundations under public law, which are subordinated to the Ministry of Finance (a total of 4,150 hectares managed by the Büren foundation bureau and the BLB; in addition, there are 1,469 hectares of non-differentiated agricultural and forest areas, which the BLB plans to sell). A further 24,900 hectares of forest areas are owned by the Federal authorities.

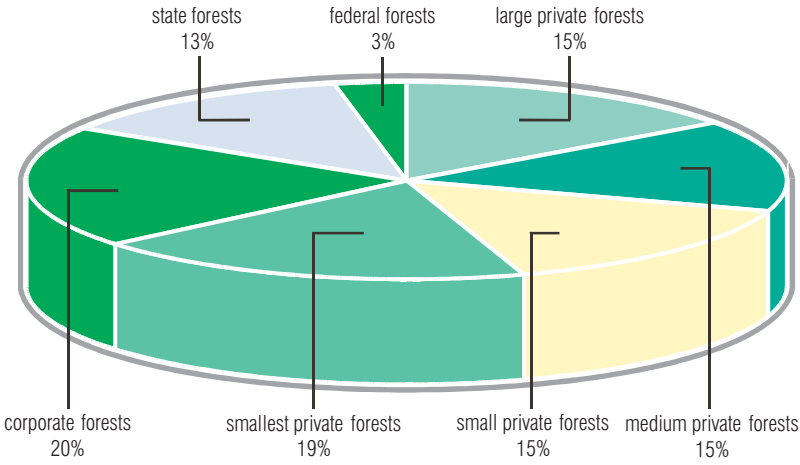


Fig. 6. Forms of forest ownership in NRW in 1999. (Description: Large Private Forests = Properties of more than 500 ha, Medium Private Forests = Properties between 50 and 500 ha, Small Private Forests = Properties between 5 and 50 ha, Smallest Private Forests = Properties less than 5 ha) (Source: LWI 1999)

Table 2. Enterprises in NRW with forestry as their main economic activity* in 2001

Size range of the forest area (ha)	Enterprises	Forest area (ha)
10–50	1,666	32,824
51–200	555	56,083
201 and more	367	444,600
Total	**2,588**	**533,507**

* Private and corporate enterprises with a forest area of more than 10 ha, and an agricultural area below 10%. A comparison with past years is not possible, because before 1999, areas of over 1 ha were included (Source: LDS).

3. Education in forestry

The LÖBF (Landesanstalt für Ökologie, Bodenordnung und Forsten) Forest Education Centre is responsible for several areas of forest education in North Rhine-Westphalia.

Many different types of pathways may be pursued within the basic structure of the German education system. Following the four-year primary school period, completed by all pupils, the educational pathways diverge within Germany's 'divided school system', which consists of modern secondary schools, secondary schools, grammar schools and, in nearly all regions, comprehensive schools. These different pathways often re-converge within the dual system.

This system is far and away the largest educational area within the secondary sector. Most graduates of the dual system training work as skilled employees, such as foresters.

Later on, many of them take advantage of the opportunities for further vocational training to become, for example, forest master-craftsmen. Under certain circumstances, the gradu-

ates of such training can also acquire a university entrance certificate after a year of full time schooling and then go on to undertake university studies. In the dual system, a combination of learning and working provides the basis for teaching vocational skills. The system seeks to teach theory and practice and to impart structured knowledge and active competence within their proper context. The various learning sites involved, the company and the vocational school, interact in keeping with their different emphases, but their tasks are not rigidly divided: school is not reserved solely for teaching theory and in-company training involves more than simply practice. Under the dual system, the vocational schools and companies are jointly responsible for educational results. Trainees spend one or two days in vocational school and three or four days in their companies. In the case of forestry in North Rhine-Westphalia, they do so on a supra-regional basis. In NRW, approximately 80 apprentices a year become foresters.

The Forest Education Centre is an institution aimed mainly at assisting forest enterprises in the teaching and training of their apprentices, who wish to become professional foresters. Within the framework of this typical German dual system of vocational education, Forest Education Centres assist the schools in practical lessons in professional forestry.

Apart from the educational tasks, there are many duties to provide further training even for older employees. This means, for example:

- manifold further training offers, such as wood construction, forest machine operations, pre-hauling by horses, tree surgery, skidding tractor and winch technology,
- preparation of professional foresters for their master examination,
- preparation for conservation tasks,
- on-job training of private forest owners in safety and hygiene at work,
- organisation of seminars and excursions for the forest state administration,
- organising and carrying out all examinations under the 'forest work' occupational category.

Number of pupils prepared for work in forestry (2003)

Federal country	Number
Baden-Württemberg	425
Brandenburg	217
Nordrhein-Westfalen	212
Sachsen-Anhalt	179
Niedersachsen	172
Bayern	158
Hessen	121
Germany – the whole country	**1,484**

The Forest Education Centre of NRW is one of 4 schools in Germany that are able to prepare people for the job of forest machine driver. During the last 10 years, special computer simulators have been developed at the centre with cooperation partners especially for

these purposes. In addition, thanks to the above, contacts with forestry entrepreneurs are excellent. The Forest Education Centre has a boarding capacity of 72 beds. The average daily number of students amounts to 60. Annually, the centre accommodates approximately 12,000 overnight stays and provides full catering for 14,000 students.

Work protection and ergonomics are important subjects of forest education. But time and money to teach these subjects are limited. To increase the efficiency of education, the Forest Education Centre of North-Rhine-Westphalia in 2003 developed a web-based training programme (WBT) entitled Work Protection and Ergonomics. This new e-learning tool can be visited at the www.waldarbeitsschule.de WBT link.

Those who are qualified and opting for higher education in forestry, can enter studies at one of the four state universities or one of the five Fachhochschulen – higher trade schools in Germany, which offer academic education in forestry. Graduate courses culminate in a diploma (Master' degree). Further qualification is possible up to the doctorate level. The Fachhochschule offers highly practice-related study courses leading to a diploma, which is the equivalent of a Bachelor's degree.

Forest owners and the staff of private, municipal and state forestry administration can take advantage of a free seminar programme offered by the LÖBF Forest Education Centre. Every year, about 1,000 students take part in one or more of approximately 60 seminars for further education in various fields of forest work, ecology or forestry public relations.

4. Forest Research

The tasks of the Forest Ecology, Forests and Hunting faculty at the LÖBF Forest Education Centre in North-Rhine-Westphalia are very complex. The scientific support based on the forestry operations carried out in NRW provides high level practical advantages.

The main tasks are:

- Carrying out forest resource inventories and forest ecological surveys.
- Working out an ecological silviculture basis and the development of concepts for natural silviculture.
- Forestry gene conservation and preservation of forest reproductive material.
- Developing concepts for forest engineering, logistics, labour protection and ergonomics, as well as the development and testing of practical techniques for forest and soil protection.

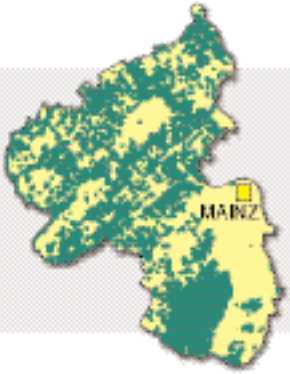
In addition to the above, the scope of the Department's responsibilities include the provision of expert opinions and scientific statements as well as the carrying out of research projects in game protection and game damage prevention. To handle these numerous tasks, the Department has approximately 100 employees at its disposal. 25% of these have an academic background in forestry or biology.

Rhineland-Palatinate

Michael Bücking and Axel Roeder

Introduction

Forest management in the German Federal State of Rhineland-Palatinate is based on the principle of sustainability. This means that forestry must be multifunctional through its production of timber and yet, at the same time, protect nature and the landscape, as well as support the recreational capacity of forests for society.



Rheinland-Pfalz,
territory: 19,800 km^2,
population: 4 million,
capital city: Mainz.

The objective of sustainable forest management is laid down in the State Forest Act amended recently, in 2000. It is defined as a forest managing mode that provides for economic benefits by, at the same time, maintaining nature and natural resources, in particular biodiversity, on a continuous and stable basis.

This goal may be achieved by means of a close-to-nature form of forest management that strives for stable and flexible forest ecosystems as a precondition for maintaining and fostering forest productivity.[1]

1. Forest characteristics

Forest cover

The forest area in Rhineland-Palatinate is approximately 835,558 hectares. The importance of forests may be seen by the fact that forestland represents 42% of the State's total territory.

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[1] Comprehensive information on forestry in Rhineland-Palatinate may be found on the web:www.wald-rlp.d & www.uni-kl.de/FVA/de

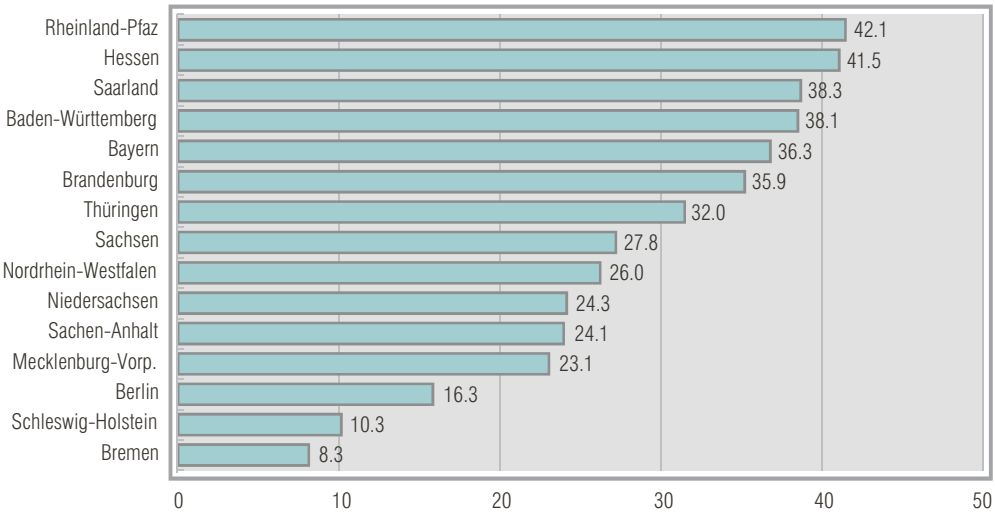

Fig. 1. The percentage of forest area in Rhineland-Palatinate, as compared with other German States (Landeswaldinventur Rhineland-Palatinate 2002)

Species composition

Approximately 56% of the forest area is covered with broadleaved species. This high percentage of broadleaves will continue to increase in the future, following a strategy of close-to-nature silviculture, by enriching pure coniferous stands by means of targeted planting of broadleaves. 79% of the forest area is covered by mixed and unevenly aged stands, respectively (Fig. 2).

The forests are characterised by an increasing diversity of tree species. The most important among the total of approximately 40 tree species in the forests are shown in Fig. 3.

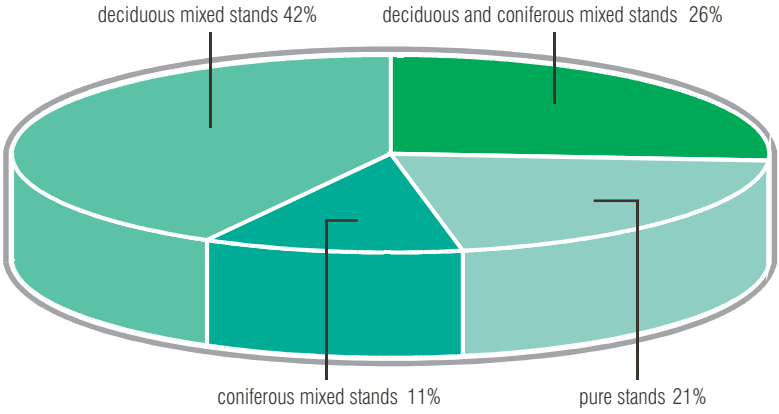

Fig. 2. Proportion of pure and mixed stands (Landeswaldinventur Rheinland-Pfalz 2002)

Norway spruce *(Picea abies)* (approximately 24%) and beech *(Fagus sylvatica)* (22%) represent typical tree species in the mountain regions. Scots pine *(Pinus sylvestris)* (11%) and sessile oak *(Quercus petraea)* (18%) are especially predominant in the southern part of the State.

Close-to-nature silviculture aims at increasing the proportion of old trees, which are considered valuable for both economic and ecological reasons. Targeted silviculture has already resulted in an increased proportion of higher-age classes of trees (Fig. 4).

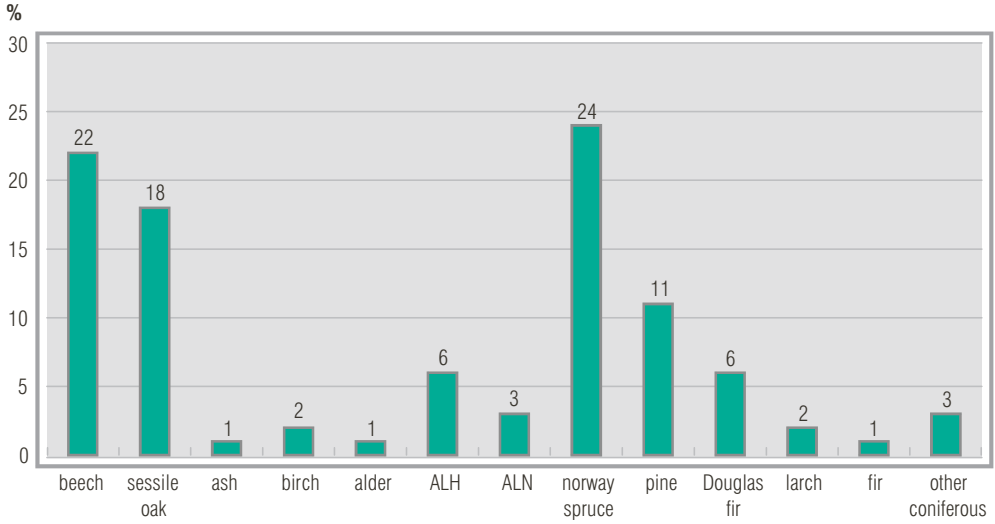

Fig. 3. Distribution of tree species in the total forest area - the proportion of broadleaves is increasing (ALH = other deciduous tree species with longer lifetimes, ALN = other deciduous tree species with shorter lifetimes) (Landeswaldinventur Rheinland-Pfalz 2002)

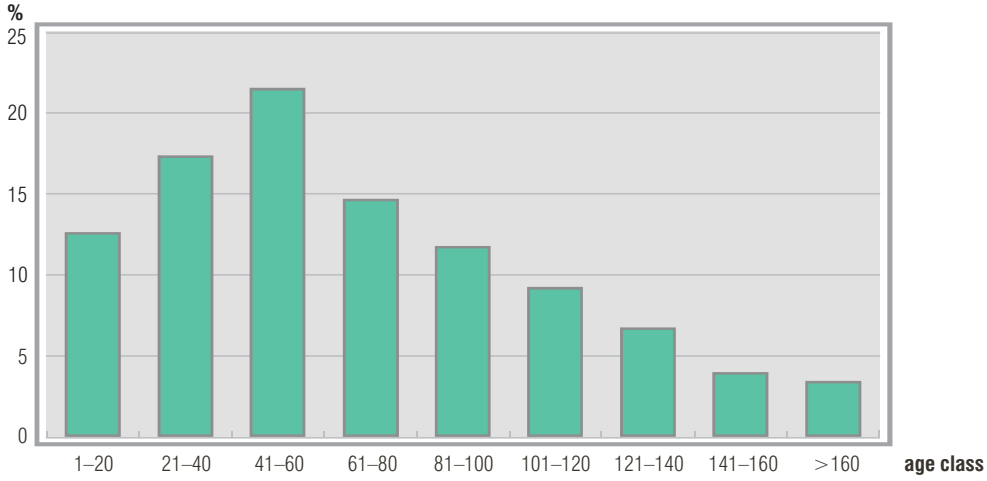

Fig. 4. Distribution of age classes throughout the total forest area (Landeswaldinventur Rheinland--Pfalz 2002)

Volume and increment

The total volume of growing stock in managed forests is an average of approximately 293 m³/ha for all tree species and forms of forest ownership (Landeswaldinventur Rheinland-Pfalz 2002). This means a total growing stock of approximately 240 million m³ for the entire forest area in Rhineland-Palatinate. Despite such catastrophic events as the heavy storms of 1990, which caused significant damage to growing stock, the volume per hectare has increased for the last 15 years by 22% to reach the current level. The state forest service intends to increase the growing stock continuously in combination with its target of mixed stands and large dimension timber. Fig. 5 shows the volume of groups of tree species and age classes.

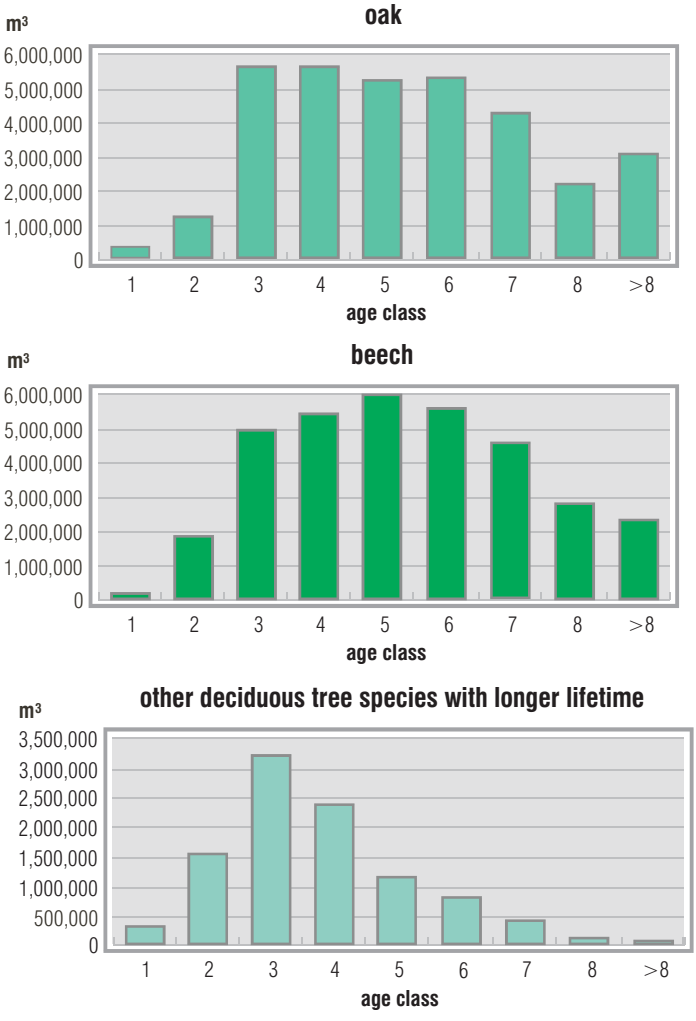

Fig. 5a. Total volume (in m³), as presented for particular tree species groups and age classes in the total forest area (age class: 20 years) (Landeswaldinventur 2002)

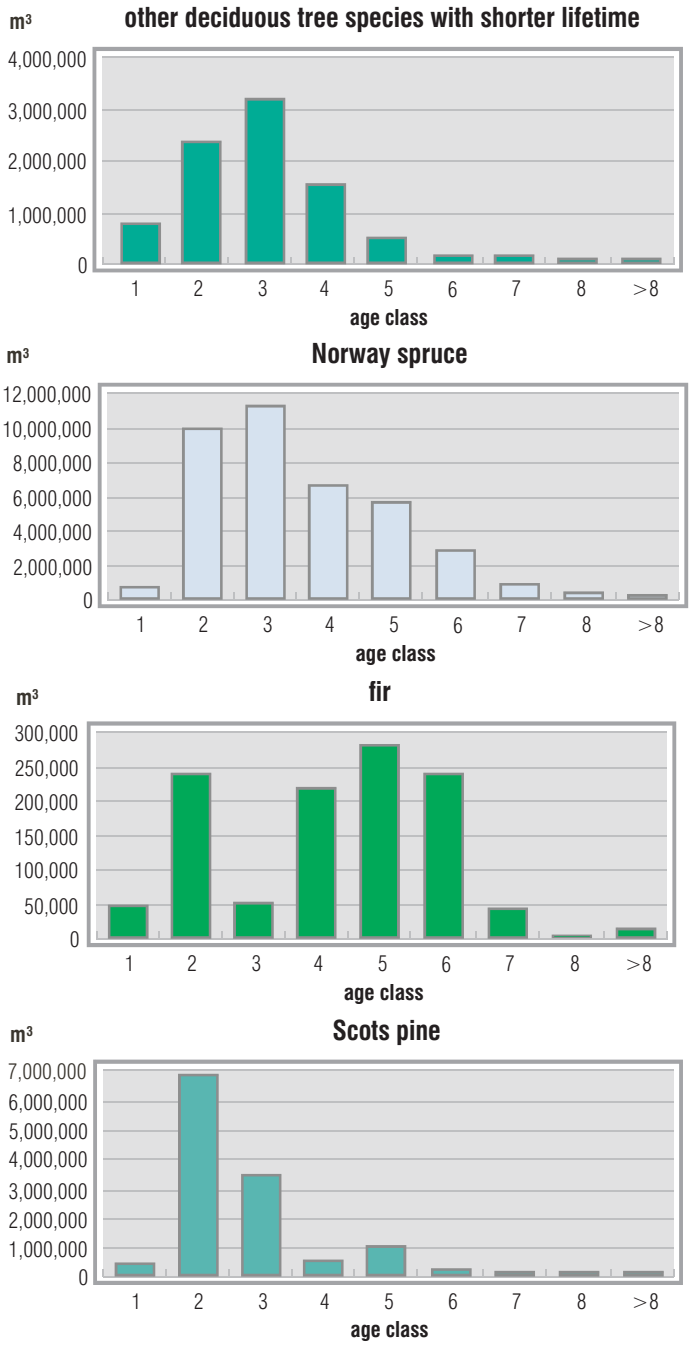

Fig. 5b. Total volume (in m³), as presented for particular tree species groups and age classes in the total forest area (age class: 20 years) (Landeswaldinventur 2002)

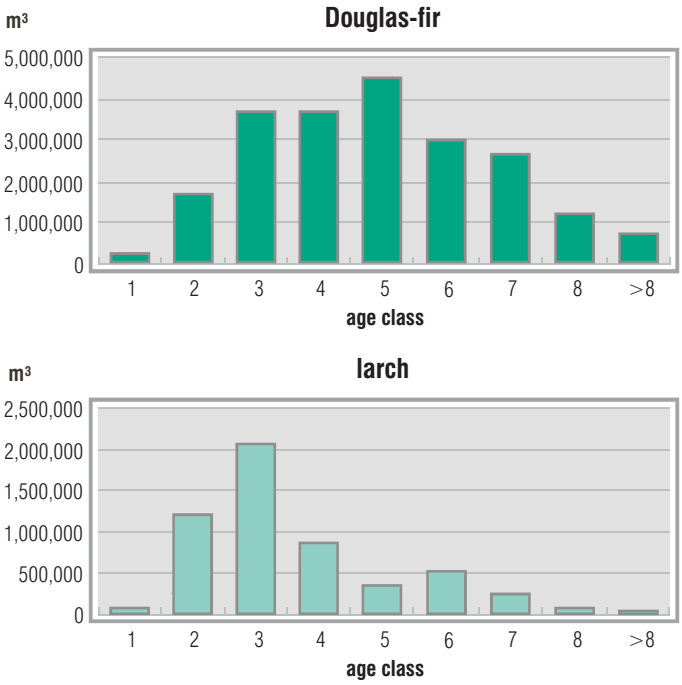

Fig. 5c. Total volume (in m³), as presented for particular tree species groups and age classes in the total forest area (age class: 20 years) (Landeswaldinventur 2002)

The percentage of allowable cuts, defined as the relation between planned harvest and current increment, has ranged over recent years between 65% and 70% at the statewide level. The real harvests in the state-owned and municipal forests in relation to the average annual increment of 6.7 m³/ha range between 70% and 75%, a figure slightly higher than the percentage of allowable cuts (Bücking *et al*., 2000). Appropriate statements concerning private forests are not available due to the lack of relevant data.

2. Logging and wood processing

Based on the data collected in the nineties, the annual quantity of marketed timber varied significantly, mainly due to calamities, ranging between 2.3 million m³ in 1997 to 4.46 million m³ in 1991 (Lucked 1999). This data primarily reflects the quantities marketed in state-owned, municipal and small private forests. Conifers represented 70% of the total wood marketed in 2003 (Fig. 6).

This is the result of harvesting the medium age classes with high increment that predominate in Rhineland-Palatinate. The supply of softwood is concentrated in the lower and middle dimensions. According to the sales data for 1996–1999, an annual average of 2.4 million m³ of solid wood was harvested, this timber going mainly to the sawmill industry.

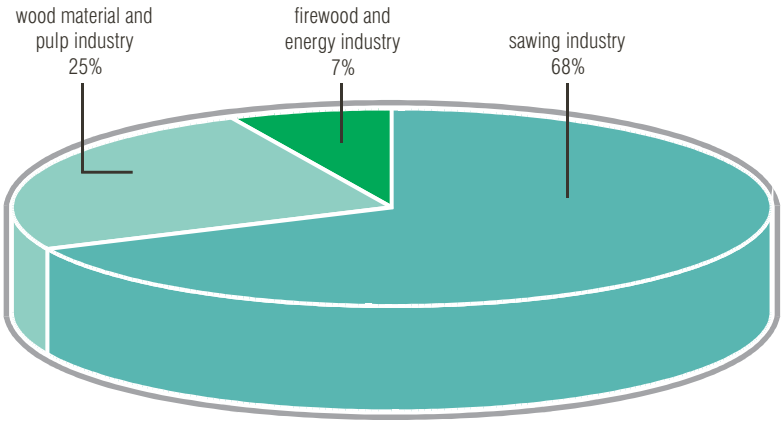

Fig. 6. The supply of timber (m³ solid wood) in 2003 (Landesforsten 2004)

Table 1. Distribution of timber sales per industry branch (Lückge 1999)

Industry branch	Millions of m³
Sawmill industry	1.6
Wood material and pulp industry	0.6
Firewood and power industry	0.2

The wood industry, equipped with its chipper-canter machinery with a sawing capacity of more than 1 million m³, is the most important customer for public forest enterprises. Their share in timber purchases from public forest enterprises averages 42% (Lehmann 1999). Other sawmill industries are characterised by a large number of small firms. Timber traders and sales by professional harvesting companies represent more than 20% of all sales from public forest enterprises. The latter group of customers presently sells 50% of all wood for industrial use. There are no enterprises from the veneer industries and only a few pulp and paper firms present in Rhineland-Palatinate (Lehmann 1999).

3. Categories of forest protection

Protection of landscape and species, as well as the rules for forestry standards to meet the concern of biodiversity are secured by law, regulations and guidelines. Planning and managerial procedures have to consider the protection of nature, species and landscape. Rare and endangered forest ecosystems are protected under nature conservation law. Thus specific forest features, such as marshes, ravines and peat bogs are protected by law. The proportion of forests in protected areas is significant, and even predominant in the Pfälzerwald biosphere reserves.

Forest areas representing predominant forest ecosystems in the State are designated as nature forest reserves, and are protected under the State Forest Act. These areas are

Table 2. Protected areas and their specific status (Ministerium für Umwelt und Forsten Rhineland-Palatinate 1999)

Type of protected status	Total area in ha	Percentage of the State territory	Forest area in ha	Percentage of protected areas
Nature reserves	26,141	1	6,578	26
Landscape reserves	477,232	24	142,123	30
National parks	0			
Nature parks	458,900	23	131,060	29
Biosphere reserves	179,800	9	134,000	75

excluded from almost all human activity and are subject to only natural processes ('virgin forests of tomorrow'). Besides the areas mentioned above, covered by their formal protection status, there are significant forest areas that play protective functions but are not subject to any special legal requirements. The idea and purpose behind multi-functional forests is that forest management should fulfil these functions on a permanent basis and in a well-balanced manner. The following forest protection categories are provided for in Rhineland-Palatinate:

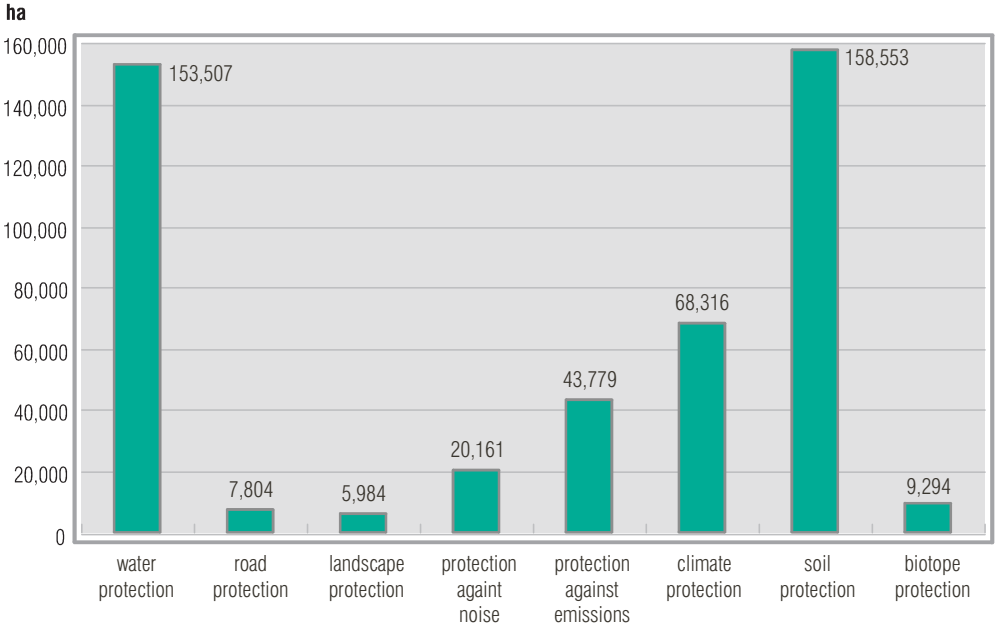

Fig. 7. Forest areas and their protective functions in Rhineland-Palatinate (in ha) (Ministerium für Umwelt und Forsten Rheinland-Pfalz 1999) Since these functions often overlap, these areas should not be summed up

- Soil protection,
- Water protection,
- Climate protection,
- Protection against noise,
- Protection against emissions,
- Site protection,
- Road protection.

The importance of these forest protection functions varies regionally and locally. For example, the climate protective forests are of high significance in wine and fruit growing regions because they often prevent the damage caused by cold air flowing into valleys. However, the prevailing protective forests focus on water and soil protection. Since the establishment of forest functions is required by law, forest plans must take into consideration and specifically document their protective functions (Fig. 7).

4. Legal and organisational forms of forest holdings

Forest ownership

Municipal forest is the prevailing form of ownership, representing 48% of the total forest area in Rhineland-Palatinate. Other ownership categories are far smaller (Fig. 8).

The structure of private and municipal forest ownership is characterised by small and medium sized enterprises; very small enterprises predominate in private forest ownership (Fig. 9 and 10).

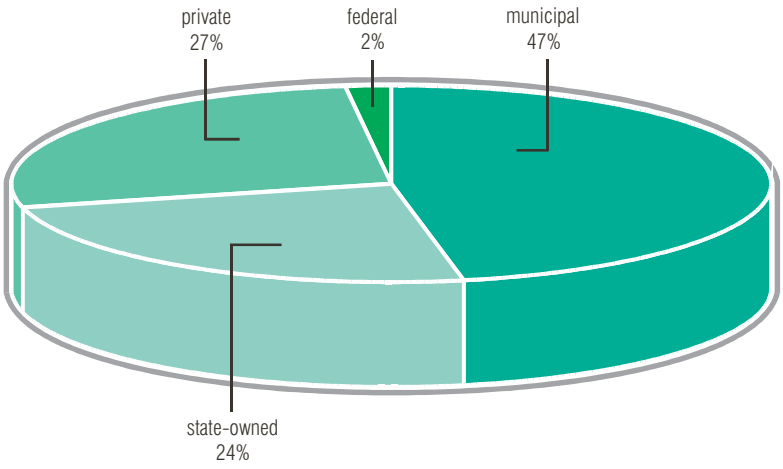

Fig. 8. Proportion of forest ownership categories in Rhineland-Palatinate (Landeswaldinventur Rheinland-Pfalz 2002)

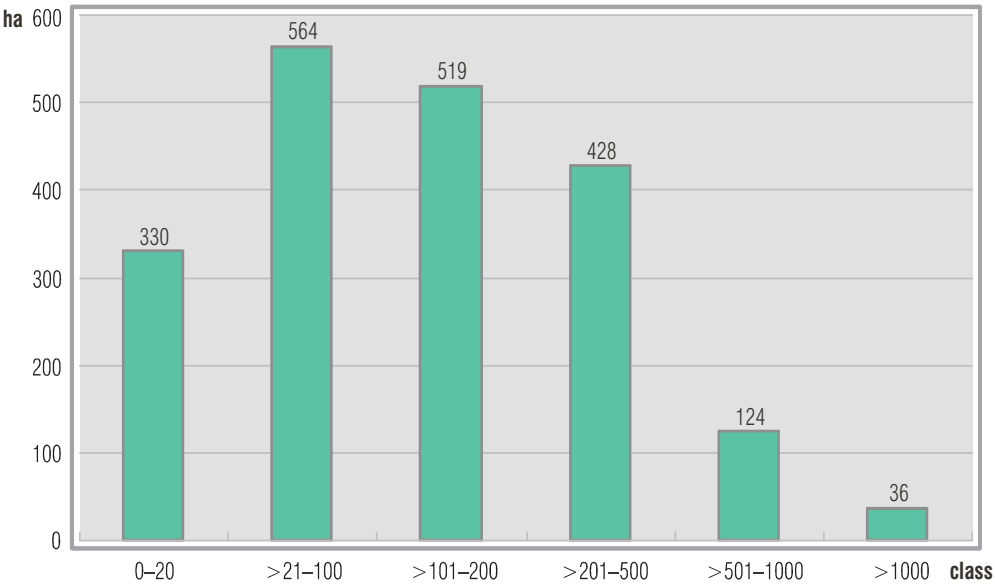

Fig. 9. Number of municipal forest enterprises, classified by size class (Ministerium für Umwelt und Forsten Rheinland-Pfalz 2004)

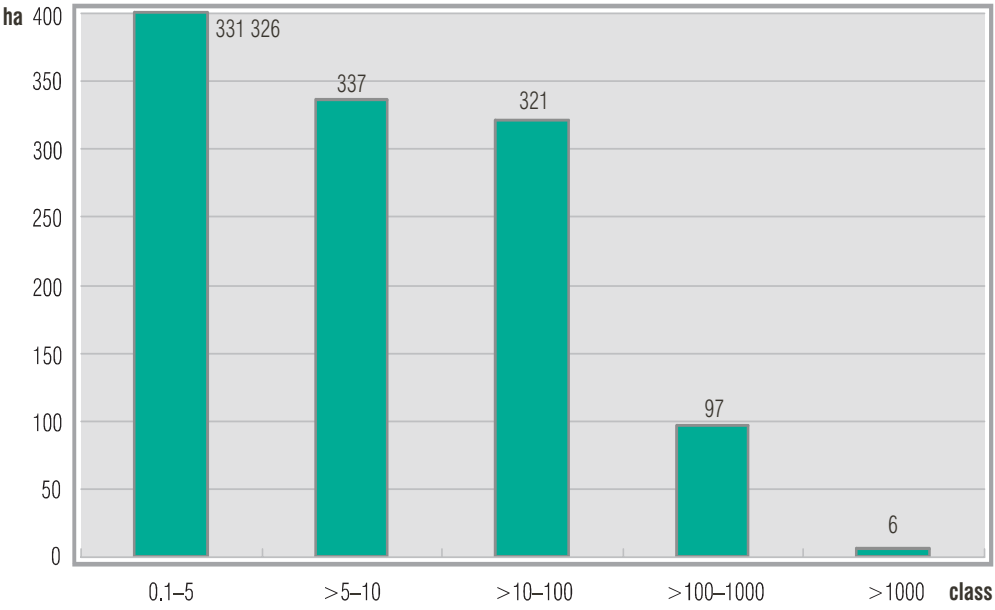

Fig. 10. Number of private forest enterprises, classified by size class (Ministerium für Umwelt and Forsten Rheinland-Pfalz 2004)

Forest law

Forestry legislation in Rhineland-Palatinate is embedded in the framework of Federal and State legislation. Federal law provides a framework for forest management and forest instruments, whereas state law more specifically regulates relations between forest owners, society and forests.

At the state level, the Rhineland-Palatinate State Forest Act, in its revised version of 30 November 2000, is the sole technical law to regulate all forest-related issues, including forestry and its relations with society and the environment. The primary objective of this law is outlined in paragraph 1 below:

(1) The objective of the State Forest Act is to:
   1. maintain in a sustainable manner, protect, and where necessary improve the forests and all of their balanced functions, including their economic benefits (utility function), their contribution to the environment, especially for the sustainable capacity of nature, climate, water balance, clean air, soil fertility, preservation of genetic resources and landscape (protective function), and their contribution to recreation (recreational function); close-to-nature forest management is the governing principle,
   2. support forest owners, forestry and forest research in order to put into effect the requirements of the objectives referred to in point 1 above, and
   3. balance the interests of the general public and forest owners.

(2) All authorities and officials are required to support implementation of the State Forest Act's objectives in their respective capacities.

The law requires from forest owners to treat the forest in compliance with the rules, in a sustainable manner, according to set plans, and in a skilful manner. The law also provides definitions of these requirements. Examples of these are the ban on clear-cuts larger than 0.5 ha, the selection of site-adapted tree species, the fostering of natural regeneration, and the striving for tolerable game densities.

5. Structure and tasks of the forest administration

Forest authorities in Rhineland-Palatinate are organised on three hierarchical levels under the overall organisational management of the authority named Landesforsten. This authority is responsible for overall forest management, support to and advice for forest owners with various approaches depending on the type of ownership. The Landesforsten has jurisdiction over both public and private forest owners and is structured into forest offices and ranger districts (Fig. 11).

The main scope of its responsibility is the following, as illustrated in Fig. 12:

- Providing services and advice for municipal and private forest owners, while of major importance is its support for the management of municipal forests and assistance for private forests and forest aid programmes.
- Managing state-owned forests in its capacity as the largest forest enterprise.
- Acting as both the public authority and a public service – this means fulfilling tasks including the monitoring of legal regulations and participating in public planning (e.g.

contributing as the forest authority in all public environmental and development planning processes relating to forests). Other tasks are forest education and expansion, landscaping and forest research.

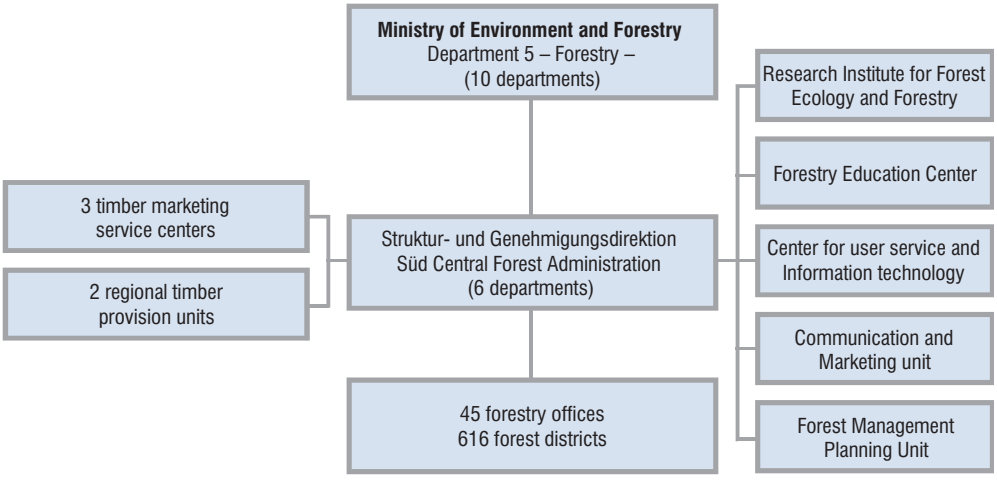

Fig. 11. Organisational structure of the Landesforsten forest authority

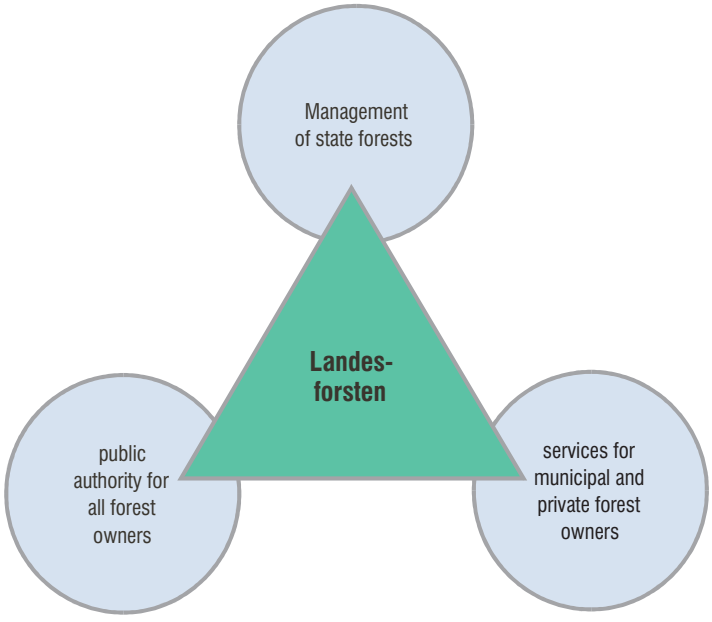

Fig. 12. The main scope of responsibility of the Landesforsten forest authority

The Ministry of Environment and Forestry (Ministerium für Umwelt und Forsten), located in the City of Mainz, heads this organisational hierarchy. Its Forestry Department is the supreme administrative authority for forestry and game affairs. Providing general guidance and management, the Forestry Department is in charge of the overall performance of forestry services. The Ministry provides an interface between the State Government, the State Parliament, Federal authorities, shareholders and various consultancy service committees, and it proposes political guidelines and implementation solutions in the field of forestry and game for further discussion. The Zentralstelle der Forstwirtschaft (Central Forest Office), which acts at the mid level, is part of the major public authority Struktur und Genehmigungsdirektion Süd, which is located in Neustadt an der Weinstraße. It exercises overall State jurisdiction over management of the State forest enterprise and public supervision of forestry and game affairs. The Zentralstelle der Forstwirtschaft is also responsible for long-term forest management planning, as well as public environmental and development planning for the entire State.

The forest district offices carry out all the above-mentioned tasks in all types of forest ownership, putting them into practice at the lower level.

Private owner associations

Private forest ownership is highly fragmented, as may be seen in Fig. 8. Most private forest estates are smaller than 2 hectares, with only a very few larger ones (above 1,000 ha). This specific ownership structure underlines the importance of State support and assistance, as well as its establishment of local and regional forest owner associations (Forstbetriebsgemeinschaft) under Federal law, for the further purpose of creating forest societies (Waldbauvereine). Both these institutions contribute significantly to sustainable management of small and very small private forests and foster the interests of forest owners and the identification of forest properties.

The forest ownership association for Rhineland-Palatinate is a registered society providing support and assistance to private and municipal forest owners in accordance with its statutes, specifically through communication of relevant information and improvement in forest knowledge. Its most important objectives include representation of forest owners and forest policy issues at state level. Its membership includes municipal forest owners, private forestry owners and forest societies as corporate members.

Besides this forest ownership association, the association of municipalities and towns (Gemeinde-und-Städtebund) also represents the interests of municipal forest ownership. It represents and provides advice to most of the approximately 2,000 municipalities owning forests with an average acreage of 200 hectares.

6. Education in Forestry

In accordance with paragraph 8(1) of the State Forest Act, forests are to be managed in an appropriate manner. This means that forestry expertise must be based on training, practical courses and continued education.

The education for technical and academic careers in forestry follows normal education and examination regulations.

A technical career (gehobener Dienst) begins with a successful study course of 8 semesters in forestry at a technical college (Fachhochschule). This is followed by the candidate having to complete a one-year apprenticeship and pass a final examination.

The academic career (höherer Dienst) is based on successful university studies in forestry lasting a minimum 8 semesters. In order to enter state forest service, a graduate is required to carry out a 2-year apprenticeship ending in a final examination.

The education and training of qualified foresters (Forstwirt) follows a dual system with the alternative of being taught at a technical school or trained in a forest enterprise, with additional special courses provided by the State Forestry Education Centre. Training for forest foreman (Forstwirtschaftsmeister) qualifications is also offered.

Continued education and lifelong learning form an important basis for efficient forest management. In order to satisfy the need for flexible and professional training, a wide range of educational activities are offered, as laid down in an annual training programme and provided at the State Forestry Education Centre in Hachenburg.

7. Forest research

Forest research contributes to solving the current and future issues in forestry on a scientific basis. Science-based knowledge forms part of the professional training and education of forestry personnel. In order to manage forests in a sustainable manner, it is essential to understand the complex interrelationships in forest ecosystems. Therefore support for forest research is one of the main objectives as formulated in paragraph 1 of the State Forest Act. In particular, paragraph 25(4) states that state forests are dedicated to serving forestry research purposes. On that legal basis, the applied forest research of the State forest authority is concentrated at the Research Institute for Forest Ecology and Forestry in Trippstadt, which covers a wide range of research topics.

At present, the 5 departments of this Institute handle such issues as:

- concepts of close-to-nature silviculture, the environmental effects of soil compaction and flood prevention measures for forests;
- environmental and management impacts on genetic diversity, preservation and re-establishment of genetic diversity;
- the impact of air pollutant deposits on forest ecosystems, nutrient balance studies, pest control;
- operational and economic optimisation of forest activities, innovative forest products, marketing of forest products (e.g. forest biomass); and
- monitoring of forest nature reserves, forest landscape ecology, wildlife studies and game management research.

The research capacity of the Institute is strengthened by close national and international co-operation with universities, research institutes and other partners on the basis of joint ventures or research contracts. The Research Institute is mainly financed by the State forestry authority, but an increasing portion of total funding comes from other sources.

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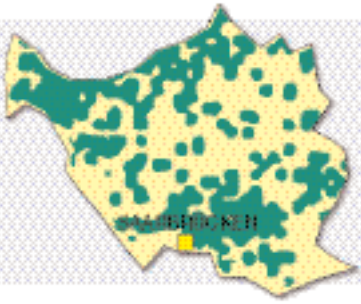
Saarland

Stefan Panka

1. Forest characteristics

Saarland's forests cover 85,363 hectares, which represents 33.24% of Saarland's total territory. The share of broadleaved species in Saarland forests is higher than the average for the rest of Germany:



Saarland,
territory: 2,600 km^2,
population: 1.1 million,
capital city: Saarbrücken.

Table 1. Share of broadleaved species in Saarland forests

Tree species	Area (ha)	%
Oak	18,397	19.1
Beech	16,722	17.4
Other broadleaves	30,775	30.5
Spruce	13,992	14.6
Fir	30	0.0
Douglas fir	3,547	3.7
Pine	5,631	5.9
Larch	3,037	3.2
Total conifers	**26,237**	**27.3**
Total broadleaves	**65,894**	**68.6**
Bare lands	2,768	2.9
Not afforested	1,186	1.2

Stefan Panka – Fachhochschule, Eberswalde.

Growing stock and increment

As the most recent forest inventory shows, the mean annual increment in net merchantable timber is 6.5 m³/ha. The annual allowable cut is 4 m³ per hectare, while average standing timber resources are estimated at 215 m³ of net merchantable timber per hectare of forest area.

Considerable changes in species composition have taken place since the previous forest inventory. The area of spruce stands decreased in favour of broadleaved species, specifically oak and beech.

Changes in age structure of stands were also noticeable. The timber volume of stands of age class IV and VI decreased while this was increased in stands of age class VII and VIII.

Table 2. Growing stock by species

Species	m³	m³/ha
Oak	5,618,073.42	58.47
Beech	5,745,073.50	59.79
Other broadleaves	4,625,525.98	48.14
Spruce	5,378,932.57	55.98
Pine	2,074,429.39	21.59
Douglas fir	1,005,123.10	10.46
Larch	984,710.53	10.25
Conifers	**9,443,195.59**	**98.28**
Broadleaves	**15,988,672.90**	**166.40**
All species	**25,431,868.49**	**264.68**

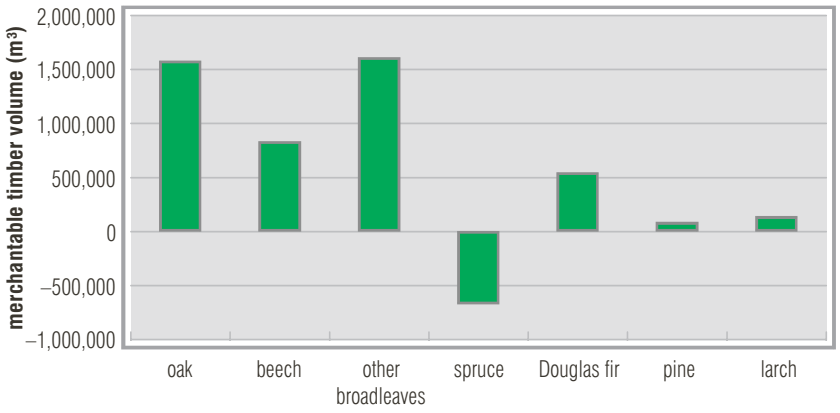


Fig. 1. Changes in merchantable timber volume by species

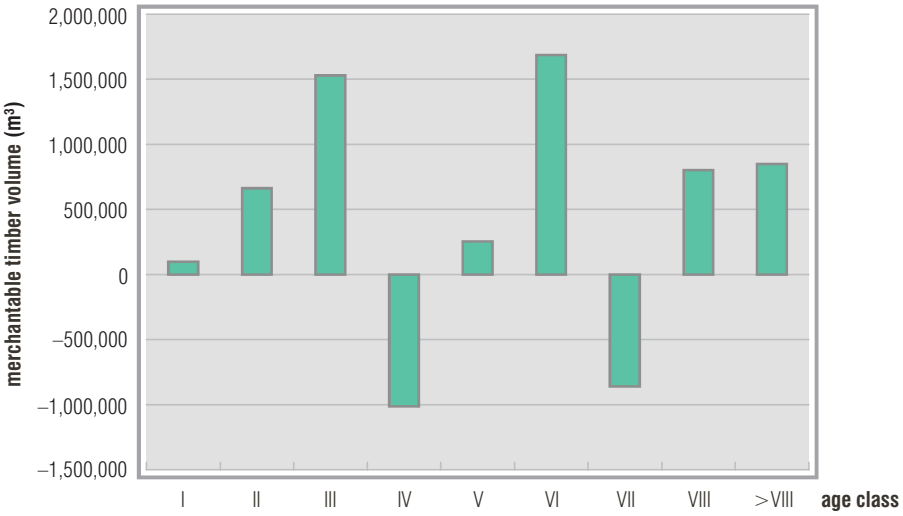


Fig. 2. Changes in timber resource by age class

2. Forest utilisation

In all forests in Saarland, it is required that increments and harvests should be maintained at the same level, irrespective of the form of ownership. These requirements are taken into consideration while planning the amount of cut, this being of particular importance for the successful implementation of economic and ecological objectives.

At present, the level of harvest differs from the level of stand increment. The new forest management strategy provides for an increase in allowable timber harvests, thanks to the considerable proportion of increment in the structure of standing timber resources.

As of 1999, the average stand resource was around 200 m^3/ha and this increased by more than 1/4 following the windstorm, reaching a level of 260 m^3/ha.

The amount of timber to be harvested annually on the basis of silvicultural needs was established in the course of the 1994 forest inventory at a level of 4.1 m^3/ha. Since 1993, the actual annual harvest, an average 3.9 m^3/ha, has been markedly below the annual increment of standing volume, set at a level of 7.4 m^3/ha. Assuming that annual harvest is at a level of approximately 5 m^3/ha, a 10% increase in forest resources can be anticipated for a 10-year period.

During the last three years, the harvest of timber from improvement felling has exceeded the planned volume by approximately 10%, due to the fact that individual trees attained a desirable diameter.

It can thus be concluded that standing volume will continue to increase because the annual cut is 20% lower than the annual increment.

The level of utilisation by diameter class is higher than was originally planned, but only to a small degree.

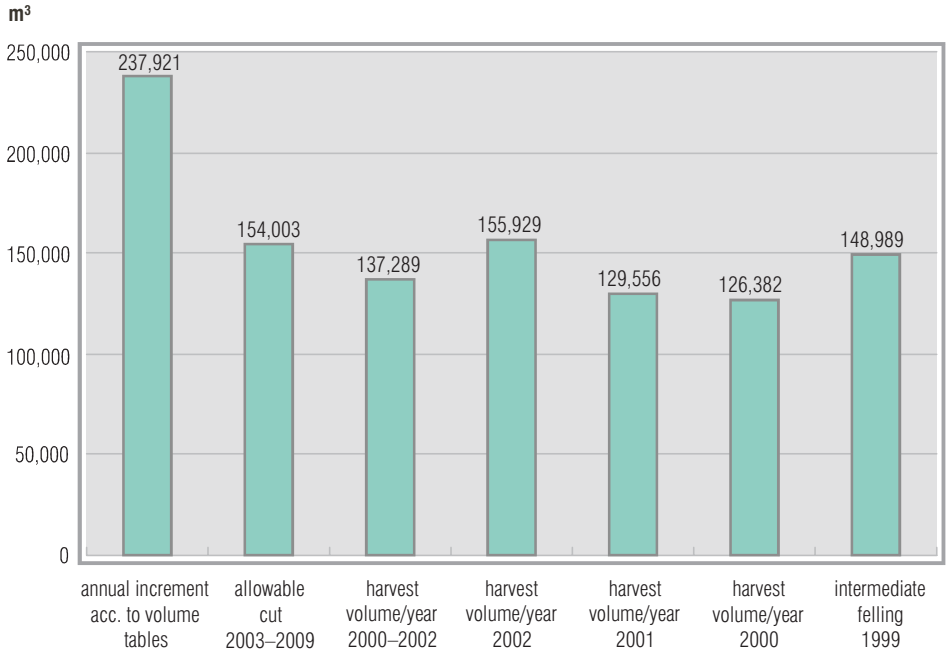


Fig. 3. Allowable cut. Total harvest in the Saarland forests in m³ in 2000–2002

Forest management priorities

As a result of the 1988 reforms, the following priorities have been identified:

- rebuilding of coniferous forests by way of a further gradual increase in the share of broadleaved species in stand composition, resulting in a greater area of mixed forests and more effective utilisation of the production potential;
- consideration of current and future possibilities for utilising certain tree species, taking into account the regional structures of timber customers;
- restocking with naturally regenerated species in small areas instead of artificial planting or seeding.

3. Forest protection

The environmental protection policy pursued is carried out through, among other things, the implementation of ecological aspects in forest utilisation and various forms of forest protection. The legal protection encompasses areas of high biological diversity containing rare species and those threatened by extinction.

As of November 2005, there are 116 protected areas in the Saarland covering a total area of 9,600 hectares (3.67% of the country's area). By 2010, the number of protected areas should increase by another 20 sites.

4. Legal and organisational forms of forest holdings

Forest law

The more important legal acts in force in Saarland relating to environment protection and methods of forest management include:

- Nature and Landscape Protection Act No. 1097 (Saarländisches Naturschutzgesetz – SNG);
- Act No. 1069 – Act on Saarland forests (Landeswaldgesetz – LWaldG) of 26 September 1977 amended by the Act of 9 July 2003 (Amtsbl. S. 2130);
- Act on the preservation of wildlife species and wildlife management No. 1407 (Saarländisches Jagdgesetz – SJG);
- Act on fisheries (Saarländisches Fischereigesetz – SFischG) announced on 16 July 1999;
- Act on Saarland water management (Saarländisches Wassergesetz – SWG) of 30 July 2004.

5. Structure and tasks of state forest administration[1]

The present system of forest administration is the result of a number of changes, which since 1988 have drastically affected the structure of Saarland's administration. These reforms were implemented due to a more ecological approach to forests, which is reflected in, among other things, strict limitations to clear cutting and enhanced development of a multi-aged and multi-species structure of forest stands. Since that time, forestry has become involved in the pursuit of sustainable forest management through, among other things, the promotion of natural mixed forests cultivated under appropriate site conditions and focussing on the production of one assortment.

Six years later, in 1994, further changes took place. This time, these were due to economic reasons, as a result of the growing demands of the State Budget. As a result of combining local forest administration and forest sub-districts, as well as by rationalising the raw timber harvesting process and introducing the requirement that private forest owners conduct ecological forest management, the demand for staff has been reduced to the equivalent of 600 full-time forestry personnel. The result has been a significant cost reduction in forestry.

The intended aim of the most recent reform, introduced in 1999–2000, was to separate the management function from other functions in administering forest holdings. This innovative trend, never applied before in Germany, called for abandoning the incumbent administration structure in forestry. As a result, the Saarland National Forest Holding was created to handle both ownership-related tasks and management in forestry.

* [1] By Yannik Alles, SaarForst Landesbetrieb, 66115 Saarbrücken.

At the same time, the Ministry of Environment performed the functions that had previously been assigned to state-owned forests. The distinct separation of management from other administrative functions allowed the state enterprise to become competitive in comparison with other traditional enterprises. It could also function in accordance with the principle that no decisions should be taken without prior evaluation of the economic consequences of the actions they precipitate.

Such a strategy has enabled gradual reduction of the Saarland National Forest Holding's annual deficit, thus reducing the amount of state subsidies. Concurrently, the target adopted was to achieve a balanced financial budget without recourse to state subsidies.

The current manner of conducting business in forestry, which sees market supply of raw material timber as the only source of revenue is being gradually modified in terms of its proportion of an enterprise's total turnover. Additionally, new business areas enabling revenue generation are being created. The forest services sector, which has recently begun to play an increasing role in forestry, can serve as an example. To support such development, a service centre was established in 2000 with its directorate located in Eppelborn. The centre is responsible for this type of activity alone.

Because of the difficult situation of the State Budget, since 1 January 2006 the Saarland National Forest Holding has ceased to take advantage of state subsidies. Moreover, owing to the continuously changing market, the incumbent system for division of jurisdiction in forests has been rejected. This means that in future, foresters will be responsible for all the activities carried out in forest areas. A specialist function that will keep in permanent touch with customers and will carry out all activities in the market will shortly be created. A forest officer position, responsible for professional performance of forest services for all interested parties will be established. This will apply particularly to services not connected with biological and technical production (forestry/silviculture and harvesting of forest raw materials). Currently, owing to the unfavourable raw material prices on international markets, only 50% of revenue from forests is generated by timber sales. The other 50% comes from sources such as: forest services, hunting and fisheries, as well as real estate administration.

Public forests account for more than 70% of forestland. They consist of federal land and municipal forests.

Table 3. Ownership structure of forests in Saarland

Form of ownership	Area		Volume
	ha	%	'000s m³
Federal forests	791	0.8	340,442
Land forests	47,450	48.2	13,083,166
Municipal forests	21,748	22.1	5,566,204
Private forests	28,470	28.9	6,442,055
All forms of ownership	**98,459**	**100.0**	**25,431,867**

Since 3 February 1999, the reorganisation has begun of forest administration, based on Act No. 1424 (Amtsbl. S. 838). The former seven forest administrations, the Forest Vocational Education Centre and the Forest Management Office have been liquidated and the **Saarland National Forest Holding** (SaarForst Landesbetrieb) has been created in their place. The Forest Holding supervises forest management in Saarland irrespective of the form of ownership. It is responsible for the management of state forests, the incorporation of social aspects into forest management plans and the carrying out of management activities in private and municipal forests. In addition, the Forest Holding is required to prepare draft plans for the functioning of private and municipal forests and is responsible for forest supervision as defined in the forest law (Act on Saarland forests no. 1069 – Landeswaldgesetz – LWaldG) of 26 September 1977. The Saarland National Forest Holding is obliged to support activities undertaken by private forest owners within the framework of the programme Improvement of Agricultural Structure (GAK) of 3 October 1969 (BGBl. I S. 1573).

The main tasks of the Saarland National Forest Holding are:

- Management of state forests in accordance with the principles of sustainable forest management;
- Providing consultancy services in the area of forest management for municipal forests;
- Execution of tasks in connection with care of the environment ensuing from the State's obligations as laid down in the Federal Act on forests and in other federal acts (e.g. § 28);
- Drawing up directives and proposals aimed at optimisation of recreational management of forests.

The authority of the former forest administrations in the area of state supervision has been delegated to the Ministry of the Environment.

Saarland's **individual forest holdings** (Landesbetriebe) report to forest administration and while, in the legal sense, these are not independent entities, as a rule they focus on the generation of revenues, though this is not obligatory. The activity of forest holdings in the territory of the German Federation is governed by budgetary regulations. Saarland is governed by Legal Regulation 26 LHO.

At present, there are 4 **regional forest holdings** in Saarland. The administration in these holdings has been decentralised. The various areas of operations have been divided into separate management activity sections: wildlife management, real estate administration, timber production and forest services.

On average, the area of forest districts has expanded to 5,000 hectares. Two foresters head each forest district. One of them is responsible for coordination of timber production, the other for the services provided to forest owners. The forest inspector, in collaboration with 6 forest owners, is responsible for activities carried out in the entire district.

The Saarland National Forest Holding employs 118 manual forest workers, 49 nominated clerical staff and 22 other staff assigned to the respective activity sections: real estate administration (6), wildlife management (10), forest services (73), timber production (78) and administration (22).

The Saarland National Forest Holding is composed of two Divisions. Division L1 is designed to coordinate tasks related to forest management, as well as represent forest holdings in their dealings with other institutions and release information for the press and

public opinion. The scope of operations of Division L2 includes issues related to the budget, accounting, costs and revenues, as well as supervision of the Saarland National Forest Holding's IT network. The timber management section functions within the framework of this Division. It deals with the organisation of timber harvesting and sales.

The state forests in Saarland are divided into 16 forest districts, in which management is carried out in compliance with FSC and PEFC principles and criteria. Competent advisory and management support services, as offered to municipal and private forest owners, as well as issues related to the forest service sector are important elements of their operation. The forest service section within Division L2 encompasses 9 forest districts across the entire Land. Its headquarters are located in Eppelborn. Foresters together with co-operating parties are required to provide advisory services related to forest management. It is also possible to consult specialists in timber harvesting and tree tending, as well as wooden house construction. The Saarland National Forest Holding encourages foresters to improve their skills in its Vocational School for Foresters in Eppelborn with its own forestry faculty.

The wildlife management and fisheries section has its headquarters in Karlsbrunn. It focuses on issues related to wildlife management, including leasing of forest areas set aside for hunting (stalking) and the organisation of individual hunts. The rivers and ponds within the Saarland forest holding are leased by local hunting associations.

The section with its facilities located in Merzig coordinates activities connected with real estate property administration. These properties are the responsibility of the Saarland forest management. This section deals with the development of principles for land lease, renting of houses, etc.

Private owners associations

There are various forms of forest ownership in Saarland. The varied activities of forest landowners stimulate economic growth. A Forest Owners Community operates here, representing the interests of private forest owners. It takes the form of a private association devoid of economic aspects. Membership in this Community is obligatory for all forest owners.

Together with the development of the Forest Owners Community, the integration of private and municipal forest management is proceeding. This creates the basis for the joint solution of common problems. Meetings with forest owners concerning economic integration are organised on a regular basis. The Community members participating in these meetings frequently belong to other associations in the Saarland, thus becoming acquainted with a range of issues at local level.

6. Education in forestry

The Saarland has no forest university. The nearest university where education in forestry is offered is in Freiburg (Baden-Württemberg). Vocational-level education is provided in the Vocational School for Foresters in Eppelborn, established in 1955. The educational staff of the Institute consists of 12 persons subordinated to the head of the unit. The school

provides education in many fields of forestry, including work safety, ergonomics and health protection, forest operations, forest technique, administration, forest management and work-place management.

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Saxony

Jana Gutzer and Andrea Eden

1. Forest characteristics

The forest area of the State of Saxony is 510,763 hectares, or 27.7% of the total national territory. In comparison with the rest of the Federal Republic of Germany, Saxony has a below average 30.1% proportion of forestland.

Sachsen,
territory: 18,300 km^2,
population: 4.3 million,
capital city: Dresden.

Table 1. Forest coverage of the Saxon administrative district (31 December 2003)

Administrative district	Forest area (ha)	Forest proportion (%)	Forest area per capita (ha)
Dresden	247,950	31.1	0.14
Chemnitz	191,697	31.4	0.12
Leipzig	71,116	16.1	0.07
Total	**510,763**	**27.7**	**0.11**

Due to the heritage of the last few centuries, deciduous and mixed forests, which were originally predominant in Saxony, have been strongly repressed. At present, most forests feature small proportions of beech and oak.

Under natural conditions, beech and mixed beech forests, with their almost 60% proportion were decisive for the appearance of Saxon forests. Presently, they only cover 3% of the total forest area. Silver fir, which in the 16th century was still a dominant tree species in mixed mountain forests, has today almost vanished.

In the State of Saxony, medium-aged forest stands (41 to 80 years) occupy the first position, constituting approximately 40% of the total. In the years following World War II, Germany was obliged to make extensive compensation in the form of reparation cuttings. By means of further afforestation, forests of a unified age were established on large areas. In future, the proportion of relatively old trees will increase still further in Saxony.

Table 2. Tree species distribution in the Saxon forests

Tree species	Proportion (%)
Oak	7.6
Beech	3.4
Other long-living tree species (maple, ash, hornbeam, elm)	3.1
Other short-living tree species (birch, aspen, poplar, willow)	16.4
Total deciduous tree species	**30.5**
Spruce	35.3
Silver fir	<0.1
Douglas fir	0.2
Pine	30.6
Larch	3.4
Total coniferous trees species	**69.5**

Table 3. Age-class distribution of the Saxon forests

Age class	Proportion (%)
I (up to 20 years)	15
II (21 to 40 years)	17
III (41 to 60 years)	23
IV (61 to 80 years)	16
V (81 to 100 years)	14
VI (101 to 120 years)	10
VII (121 to 140 years)	3
>VII (141 years and above)	2

Volume and increment

The timber stock (over bark) in Saxon forests amounts to approximately 126,000,000 m^3. In relation to the total forest area (*i.e.* excluding roads, storage sites, etc.) this means an average 262 m^3/ha (data from the Federal Forest Inventory II/2004). The timber increment reaches an annual average of 9.8 m^3/ha, an annual total of approximately 5 million m^3.

2. Logging and wood processing

Reliable figures on felling are available only for the state-owned forest of the State of Saxony. The reason behind the strikingly low values for 2000 was the restrictions on felling following the Lothar storm.

The majority of timber cut in the State of Saxony is processed in sawmills, whereas cellulose and sheet-materials industries are located in Thuringia and Brandenburg. The State's highly modern sawmills are capable of cutting several hundred thousand cubic metres of timber a year. Frequently, sawn wood is further processed by drying or production

Table 4. Felling quantities in the state forest (1999 to 2003)

Year	State forest area (ha)	Felling volume (m^3 under bark)	(m^3 under bark per ha)
1999	187,644	923,500	4.92
2000	189,007	739,479	3.91
2001	190,118	942,458	4.96
2002	193,331	941,203	4.87
2003	192,979	1,001,426	5.19

of plank cordwood. In Saxony, there are approximately 30 sawmills, processing mainly high-quality stem wood (both soft and hard). Additionally, a large sheet-materials plant processes low-quality wood into laminates and wall cladding.

3. Forest protection

Forest areas that are under special protection or prone to significant stress are defined as special status forests. The specific category of protection is derived directly from the appropriate regulations of the Saxon Forest Act and various special laws; otherwise it is formally imposed according to legal regulations or statutes.

Table 5. Forests under legal protection

The grounds	Forest area (%)	Forest area (ha)
Forest protected under § 29, section 1 of the Saxon Forest Act	4.7	24,208
Biotope specially protected under § 26 of the Saxon Nature Conservation Act	3.3	17,230
Cultural monument protected under § 2 of the Saxon Act for Protection of Historical Monuments	0.6	3,049

The Saxon Forest Act: Natural forest cells (305 ha).
The Saxon Nature Conservation Act – entire areas, forest areas, and proportions of forest areas within protected areas, including temporarily secured protected areas (data as at 31 December 2002).

Table 6. Forests protected under legal regulations and statutes

Category of protected area	Total area	Wooded proportion*		Proportion of the total forest area
	ha	ha	%	%
Nature reserve	48,619	32,137	66.2	6.2
National park	9,292	8,535	91.9	1.7
Biosphere reserve	30,102	14,326	47.6	2.8
Landscape protection area	532,334	225,080	42.3	43.7
Nature park	185,500	109,876	59.2	21.4
Nature monument	4,390	3,060	69.7	0.6
Protected landscape component	n/a	997	–	0.2

* Figures for forest areas are minimal values since they were partly gathered from forest function mapping (Status: 1998).

Table 7. NATURA 2000 (EU)

Category of protected area	Total area	Wooded proportion		Proportion of the total forest area
	ha	ha	%	%
Flora-fauna-habitat areas (Directive 92/43/EEC)	168,667	96,267	57	18.8
Bird protection areas (Directive 79/409/EEC)	78,281	43,718	56	8.6

Table 8. Water Regime Act/Saxon Water Act – entire areas, forest areas, and proportions of forest areas in protected areas according to the Saxon Water Act, including temporarily ordered protected areas (status as at 1 June 2002)

Category of protected area	Total area	Wooded proportion		Proportion of the total forest area
	ha	ha	%	%
Water protection area, including:	165,704	77,052	46.5	15.0
– protected area of healing springs	6,222	3,448	55.4	0.7
Inundation area	n/a	2,156	–	0.4
Margin of waters	n/a			

4. Legal and organisational forms of forest holdings

Forest ownership

In Saxony there are approximately 73,000 forest owners. All forest areas are open to the public for recreation. Forest owners bear responsibility for their forests and manage them independently.

Private forest owners contribute in an essential way to protecting the basis of all life by their forest management. The average size of private forestry enterprises in Saxony amounts to only 2.8 hectares and for this reason, their independent management is a difficult task. Many forest owners also possess agricultural areas, which are in most cases managed by leaseholders. Nearly all forest owners are in employment or living as pension-

Table 9. Distribution of forest property

Ownership type	Area (ha)	Area proportion (%)
State-owned forests of the State of Saxony	192,979	37.8
Forest owned by the Federal government	29,802	5.8
Corporate forests	38,856	7.6
Church-owned forests	10,415	2.0
Private forests	201,993	39.6
Special status forests	36,718	7.2
Total	**510,763**	**100.0**

ers, with forestry being a secondary occupation. Only very few forest owners derive their main income from management of their forests.

In the State of Saxony, almost all **corporate forests** are owned by municipalities as so--called local community forests (Kommunalwald). Some of these forests are managed by a municipal forest ranger. However, most of them are under the care of the Saxon State Forest Administration on a contractual basis.

Objectives are differentiated, depending on the size of the forest property, for example with regard to nature conservation, or maintaining and enhancing recreational functions. The larger the forest property, the more important the economic aspect. In this respect, municipalities pass resolutions and bear the responsibility for and costs of forest management. In principle, all municipalities aim to cover at least their expenses, mainly through sales of timber.

A forest owned by a church or other religious community is named a **church forest** (Kirchenwald). In this case, forest management is performed either by the church's own staff or by the Saxon State Forest Administration on a contractual basis.

State-owned forest is either Federal property (Bundeswald) or the property of the State of Saxony (Landeswald). The latter is managed by the Saxon State Forest Administration, serving first and foremost the public interest.

Under the land reform of 1945, forest areas owned by large landowners were expropriated and handed over to rural communities. Some of these expropriated areas became state-owned property. Since 1990, these have undergone restitution as so-called **trust forests** (Treuhandwald). Once this privatisation is complete, the distribution of forest property in Saxony will be approximately the same as in 1945, as it had developed since the middle of the 19th century.

The **'special status forest'** category includes the Forests of the Lusation and Central--German Mining and Administration Company (LMBV mbh). These forests mainly originated through the re-cultivation of former opencast lignite mines.

The different types of forest ownership show considerable regional differences in their spatial distribution. Large coherent areas of the Saxon state-owned forests are found in Erzgebirge (Ore Mountains), Vogtland and Sächsische Schweiz. On the other hand, Eastern Saxony is characterised by private, municipal, and church-owned forests. Forests in the military training areas of the German Army (Bundeswehr) in Northern Saxony are owned by the Federal government (Bundeswald), with its own forest administration.

Forest law

- Federal Forest Act (BWaldG) of 2 May 1975, amended 26 August 1998,
- Forest Act of the State of Saxony (SächsWaldG) of 10 April 1992, amended 1 January 2003,
- Saxon Regulation on Private and Corporate Forests (SächsPKWaldVO) of 16 April 2003,
- Forest Closing Regulation (WaldSpVO) of 16 November 1992,
- Bridle Path Regulation (ReitwegeVO) of 14 December 1994,
- Guidelines of the Saxon State Ministry of the Environment and Agriculture on the promotion of close-to-nature forest management and forestry (RL 52/00),

- Guidelines of the Saxon State Ministry of the Environment and Agriculture on the promotion of ecological forests in the State of Saxony (RL 93/2003),

Apart from the above, forests and forestry in Saxony are strictly governed by legal regulations on nature conservation and hunting.

5. Structure and tasks of the Saxon State's Forest Administration (LFV)

The LFV is a three-tier unitary forest administration divided into the following organisational units:

- Department of Forestry at the Saxon State Ministry of the Environment and Agriculture (SMUL),
- State Forest Administration Centre (LFP),
- Saxon forest offices.

At the beginning of 2003, two regional forest administrations in Chemnitz and Bautzen were integrated into the Saxon State Department of Forestry to form the State Forest Administration Centre (LFP) with its headquarters in Graupa and local offices in Bautzen and Chemnitz. In addition, the forest training centres in Grillenburg and Morgenröthe, the machinery bases in Crottendorf and Königstein, and the pilot tree-nursery in Graupa were all associated with the LFP.

The forty-six state forest offices (average size: 10,782 ha of forest) supervise 329 subordinate forest ranger stations (average size: 1,508 ha of forest, depending on region and function). 148 of these stations are responsible for state-owned forests, 147 for the management of other forms of forest holdings and 34 for those with mixed ownership. Three forest school hostels are associated with these forest offices. At the beginning of 2003, the National Park and the Sächsische Schweiz Forest District were combined (11,290 ha of forest) and divided into 9 new forest ranger stations. Independent municipal forest offices are located in Leipzig and Chemnitz.

The Saxon State Forest Administration (LFV) stresses the importance of preserving and developing complex 'ecosystem forests', whose various functions form the basic components of our lives. In addition, the use of forests by future generations, *i.e.* all forest functions, must be secured in a sustainable manner. To achieve this task, LFV cooperates with all forest owners and the political authorities responsible, but also seeks a dialogue with the public.

The LFV is seen as an efficient and competent economic and service enterprise as well as a source of consultation for all questions relating to forests and forestry in Saxony. In contrast to a private enterprise, the LFV is not primarily guided by commercial principles, but first and foremost by the public interest.

The scope of the LFV's operations is defined in the Saxon Forest Act, § 37. These can be summarised as follows:

- management of state-owned forests in the State of Saxony and administration of state forest property,

Table 10. Employees of the Saxon State Forest Administration (figures for 31 December 2003)

Employees		SMUL	LFP	Forest offices, machinery bases	Σ
Higher service	Civil servants	18	43	76	137
	Employees	2	32	23	57
Upper service	Civil servants	5	38	269	312
	Employees	3	41	134	178
Middle service	Civil servants	–	–	–	–
	Employees	6	56	148	210
Graduated forest-service trainees		–	–	18	18
Forest-section candidates		–	–	37	37
Forest-service trainees		–	–	12	12
Foresters		–	20	791	811
Administrative employees		–	19	22	41
Qualified forest-worker apprentices		–	–	178	178
Other apprentices		–	3	–	3
Employees within job pool B (limited)		–	8	5	13
Employees on the basis of third-party funding (limited)		–	12	–	12
Total		**34**	**272**	**1,713**	**2,019**

- provision of services to society and forest owners,
- fulfilment of sovereign obligations.

As at 31 December 2003, the Saxon State Forest Administration employed a staff of 2,019 including permanent employees, part-time employees and trainees. 85% of these worked in the forest offices and machinery bases. Another 13% worked at the State Forest Administration Centre (Landesforstpräsidium; LFP), and 2% were employed at the Saxon State Ministry of the Environment and Agriculture (SMUL). In addition, a staff of 248 (12%) was employed on the basis of various training schemes.

From 1 January 2006, the LFV is expected to become a government enterprise named Sachsenforst. This enterprise is to operate independently, like a private enterprise. This will enable state subsidies to be gradually reduced. The Sachsenforst Enterprise will take over all the former tasks of the forest administration.

Private owners associations

Considerable structural problems exist with regard to the tending and management of small private forests, but also the relatively small municipal and church-owned forest properties in Saxony:

- more than a half of all Saxon forest owners own forest plots of less than one hectare. In consequence, independent and efficient forest management is often reduced, partly also due to the unfavourable configuration of these areas,

- in many cases, a further problem involves insufficient or totally non-existent timber transportation methods,
- due to their personal living conditions and lack of technical facilities, many forest owners are not in a position to carry out practical tasks themselves. The majority of Saxon forest owners are pensioners and individuals on early retirement and only a small proportion still work in agriculture. Many forest owners are no longer local residents.

In accordance with the Federal Forest Act, forest cooperatives are economic entities. The establishment of these associations of forest owners is aimed at reducing the structural disadvantages of small forest enterprises and improving their economic situation. Objectives include common management of their forest holdings and the marketing of forest products. Thanks to these associations, forest owners become or remain able to withstand competition.

At present, there are 29 forest cooperatives in Saxony, covering 20,500 hectares of forest. Besides private owners, these associations also accept church and municipal forest owners.

Depending on their organisational structure, cooperatives are assigned various tasks by their members:

- sometimes only limited activities, e.g. timber sales, whereas every forests is managed individually (single-item services),
- additionally, (partial or complete) provision of forest management and, at the same time, planning and financial statements for all individual members (total services) are provided,
- delegation of all usufruct rights, *i.e.* the forest areas of all members are managed as a unified enterprise. The revenue is divided between members in proportion to the size of the area contributed (common management).

6. Education in forestry

The Saxon Forest Administration offers training for the position of qualified forester and the higher and senior forestry service.

Training as a forester

The profession of qualified forester is the acknowledged trade for all biological-technical tasks in the forest. Their activities include thinning, plantation tending, young-growth tending, biotope tending, planting, chain-saw logging operations and the operation of special machinery (harvesters and forwarders).

Training for a qualified forester is undertaken in a dual system. Vocational school education and external training are both located in the Forestry Training Centre in Morgenröthe. 13 Saxon forest districts are responsible for internal training. In 2003, 178 trainees for the trade of qualified forester (from one to three years of training) were employed by the Saxon State Forest Administration.

Training for the higher forestry service

The higher forestry service of the Saxon State Forest Administration consists mainly of the responsibilities of a forest ranger. Beyond this, there are interesting task areas, like manager of forest office, tree-nursery head, chief of a forest school hostel, officer in charge of an object in the State Forest Administration, or in the Department of Forestry of the Saxon State Ministry of the Environment and Agriculture.

Training for the career in the higher forestry service is carried out on the basis of an internal educational path together with the Thuringia State Forest Administration at the Vocational College (Fachhochschule), in Schwarzburg, at the Forestry Training Centre, in Grillenburg, and in 57 Saxon Forest Ranger Stations eligible for training. 15 training sites are available every year.

Training for the senior forestry service

The senior forestry service offers the opportunity to work as a senior official in public administration (district forest officer or deputy district forest officer, consultant, subject area head or departmental manager in the State Forest Administration or in the Department of Forestry of the Saxon State Ministry of the Environment and Agriculture), or as an independent forest expert. The Saxon State Forest Administration accepts candidates for the senior forestry service career to continue their training with a two-year practical course. The sole precondition is a university degree in forestry science.

The training for a senior forestry service career and the final legal examination are organised and carried out by the Saxon State Forest Administration itself. 10 training places are available every year.

Table 11. Enrolment, final qualifications and subsequent employment (figures on the internal forestry education of the Saxon State Forest Administration in 2003)

Training target	Duration of training	Training places	Final examination		
			candidates	successful	subsequent employment
The senior forestry service	2 years	10	8	8	1 + 3*
The higher forestry service	4 years	14	13	12	3 + 4*
Qualified forester	3 years**	63	67	58	5*

* Limited; ** 2 years if A levels (Abitur) are given.

7. Forest research

Applied research is carried out by the LFP aimed at the preservation and sustainable utilisation of forest ecosystems. This research includes extensive work on environmental monitoring and the economic and social aspects of forests and forestry in Saxony.

The most important fields of research, for which temporary and permanent experimental plots have been established, include ecological forest conversion, gene preservation, forest

protection and soil protection. In 2003, six more experimental plots were added to those already existing, bringing their total number to over 400. Emphasis was also laid on investigations into the natural inherent dynamics of natural forest sites given free rein, and comparison of these with neighbouring sites under management. The research and development targets of forest policy include further stocktaking and mapping of forest-area development in Saxony up to 1900, as well as a pilot study on forest extension in the high--water area of the Müglitz River for flood prevention purposes.

Cooperation with domestic and international partners, essential for research and development, was successfully continued in 2003 through participation in or management of several national or international associated projects.

Table 12. Selected examples of LFP participation in or management of projects

Project title	Project specification
Associated project of the BMBF (Federal Ministry of Education and Research) Future-oriented silviculture	Participation in 4 sub-projects on Procedures meeting sustainability and ecological processes of conversion of pure spruce and pine stands to ecologically adapted forests for the project region Ore Mountains and Saxon Lowlands. These sub-projects were: – Stabilisation of pine stands against biotic pathogens by forest conversion – stand disposition and developmental parameters, – Genetic characteristics of natural beech regeneration under pure spruce canopies in the middle Ore Mountains, – Integration of gap dynamics in the forest conversion of spruce stands – artificially created gaps, – Conversion of pine stands on sites of deciduous forest communities including stand succession.
Associated project of the BMVEL (Federal Ministry of Consumer Protection, Food and Agriculture), sub-project Poplar planting for paper production	Examination of the suitability of abandoned agricultural areas for planting fast-growing poplars to produce paper wood with a rotation period of 10 years.
DBU project Partial restoration of acidified soil by the LoBo procedure	Search for possibilities to incorporate bio-compost into degraded forest soils of low base saturation and its consequences for plant growth and the elements cycle.
DBU project Consideration of genetic aspects in silviculture – recommendations for practical thinning	Recording of the consequences of several thinning methods for the genetic structures of beech stands.
EU project Virtual authority – a contribution to the development of rural areas and cross-border cooperation between Saxony and the Czech Republic	Preparation and provision of Internet-based service offers of regional forest authorities for forest owners and citizens, promotion of cross-border dialogue between the state forest administrations and various forest-related institutions, mediation in cross-border exchange of information on forests and their management.

Saxony-Anhalt

Henning Kurth

1. Forest characteristics

Forest area

Saxony-Anhalt with a 23.2% forest cover, ranks among those States of the Federal Republic of Germany with the lowest share in forestlands. According to the inventory conducted by the Regional Forestry Administration, on 1 January 2004 total forest area amounted to 475,617 hectares. The percentage of forest cover varies considerably between the Harz region's 63%, and areas with intensive agriculture, for instance the Magdeburg Börde region, with approximately 6%.

Sachsen-Anhalt
territory: 20,400 km², population 2.5 million, capital city: Magdeburg.

The State of Saxony-Anhalt is subdivided into three large natural landscapes, which can be clearly differentiated according to their geo-morphological, as well as climatic conditions. These large landscapes, which themselves consist of very varied landscape units, are the Northern German Lowlands, the Hilly Land and the Low Mountain Range.

Table 1. Structure of natural landscape areas in Saxony-Anhalt

Natural landscape area – regional sites	Total area (%)	Forest area (%)	Forest cover (%)
Lowlands	53	70	30
Hilly Land	40	11	6
Low Mountain Range (Harz)	7	19	63
	100	100	23

Species composition

The present distribution of tree species is both a reflection of the natural growth conditions in the specific areas and the result of decades of forest management.

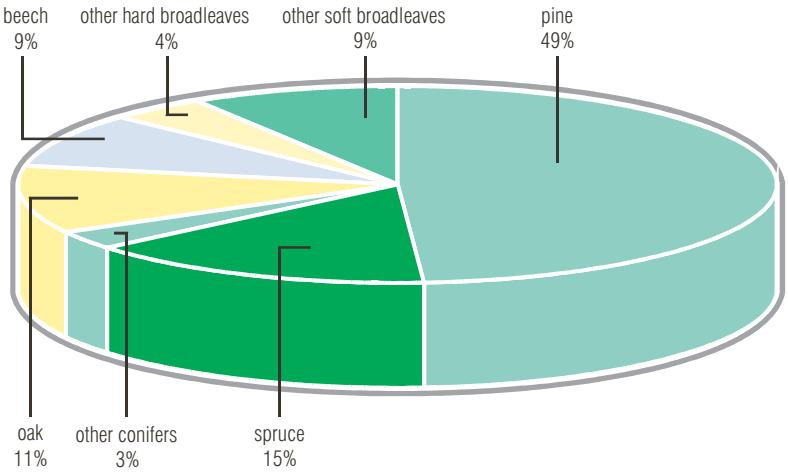

Fig.1. Distribution of forest areas in Saxony-Anhalt by tree species

In Saxony-Anhalt, the mix of stand resources is essentially dominated by pine, which grows naturally on poorer sites of the Lowlands, though today occupying a slightly smaller area than in the past.

Spruce has a 15% share in the forests of Saxony-Anhalt. The main area in which spruces are found is the Harz region, where naturally growing spruces are indigenous only to the higher parts of the montane zone, especially in the Brocken massif.

Oak is the most important broadleaved species in the state of Saxony-Anhalt. It amounts to 11% of the total forest area. It mainly occurs in areas with lower precipitation in the Eastern Harz region, in the climatically dry parts of the Hilly Land, in the pasture forests along the rivers Elbe, Saale and Mulde, and also in fertile and medium fertile Lowlands sites.

Beech presently comprises a 9% share of the forest area in Saxony-Anhalt, mainly in the Harz region and in some parts of the Hilly Land. Without human influence, beech would cover a far larger area. The other broadleaved species, such as alder, birch, mountain ash, poplar, lime, maple, ash, hornbeam, etc. altogether comprise approximately 13% of the forest area.

Great efforts have been made to increase beech and oak stocks by natural regeneration, using natural forces to the farthest extent possible. Essential efforts have been made to transfer pure stands of coniferous forest into mixed broadleaved and coniferous stands by means of artificial regeneration. In the long run, the share of broadleaves will increase.

Age structure

The age structure is an essential characteristic feature of commercial forests. From this structure one may conclude which are the primary tasks of forest management and what will be the economic results. Age structure has considerable influence on the growing stock and increment. The coniferous forests are characterised by a large share of young stands. For this reason, utilisation focuses on improvements in felling techniques, *i.e.* harvesting of

weak timber assortments. Stands aging more than 80 years are extremely scarce and so there are few opportunities to utilise such valuable and strong timber.

The age structure of the oak and beech forests is more promising thanks to their well--balanced age gradation up to stands aged more than 160.

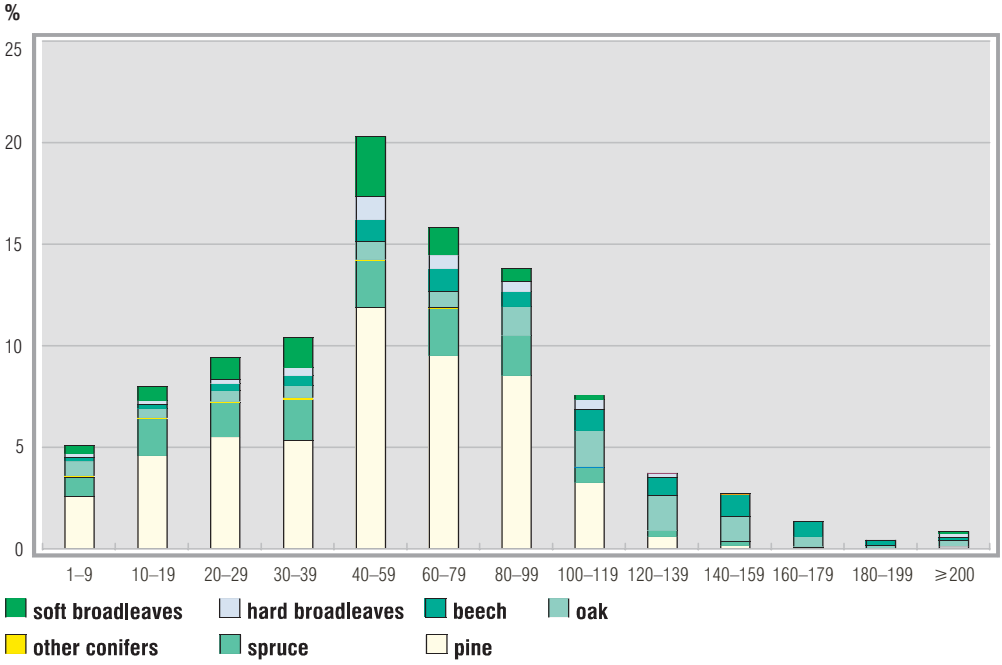

Fig. 2. Overview of the age structure of tree species in Saxony-Anhalt

Volume and increment

Data on the growing stock and increment will be available for the entire forests only following completion of the 2004 Federal Forest Inventory.

On the 130,000 ha of the State forestland utilised, the growing stock amounts to 202 m^3 u.b./ha (cubic metres under bark per hectare). The prescribed yield amounts to 4.3 m^3 u.b./ha and the increment is to 6.5 m^3 u.b./ha.

The forests in the State of Saxony-Anhalt are still growing, combined with an economic and ecological increment of the growing stock. At present, actual stock amounts to approximately 80% of the target figure.

Forest area balance

The Forest Act of Saxony-Anhalt, passed on 13 April 1994, stipulates that the forest should be managed according to approved forest principles and particularly in a sustain-

able, careful and competent manner. Because of the special importance of forests for the public welfare, their area is to be increased.

Each year the forest area is expanded by approximately 205 hectares, 159 hectares of which are the result of afforestation of meadows, and approximately 47 hectares through afforestation of former farmlands.

In Saxony-Anhalt, loss of forest lands amounts to an average 59 hectares per year. This loss is caused by mining (approximately 17 ha), other construction operations (approximately 25 ha), and other types of disturbance (approximately 16 ha).

In absolute terms, the forest area in Saxony-Anhalt has expanded by approximately 1,300 hectares during the past 9 years, which corresponds to an annual increase of approximately 146 hectares.

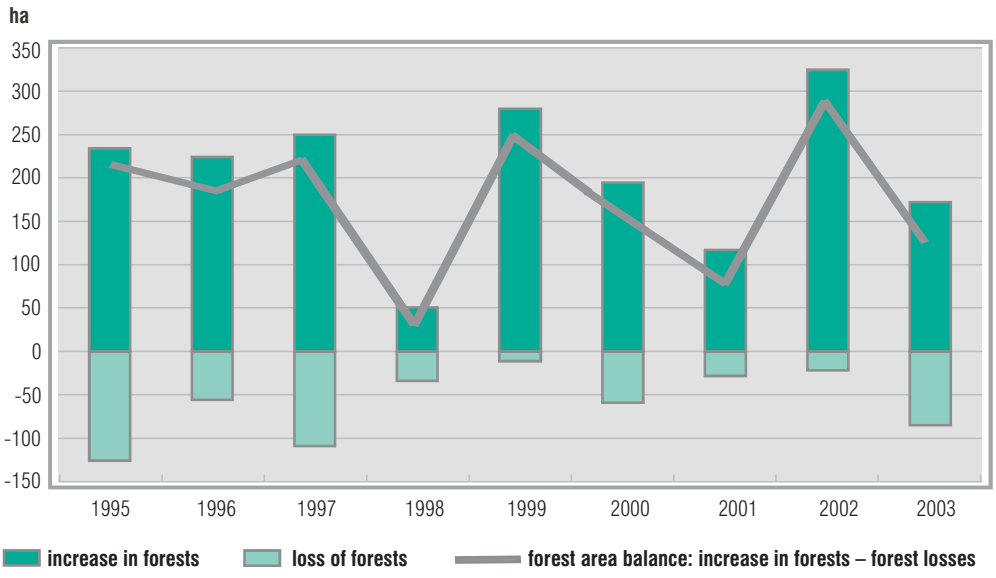

Fig. 3. Forest area balance in Saxony-Anhalt

2. Logging and wood processing

According to the 6 Helsinki criteria, sustainable management of state forests forms the central principle for action at all management levels of the Regional Forest Enterprise. At the same time, utilisation of timber is an essential factor of sustainable forest management.

The Regional Forest Enterprise manages an operational area of 140,000 hectares, of which approximately 130,000 hectares is forestland. The actual growing stock amounts to 202 m^3 u.b./ha and the prescribed yield is 4.3 m^3 u.b./ha.

The distribution of tree species over state-owned forests is quite different to that in the State's forests as a whole (see Fig. 4).

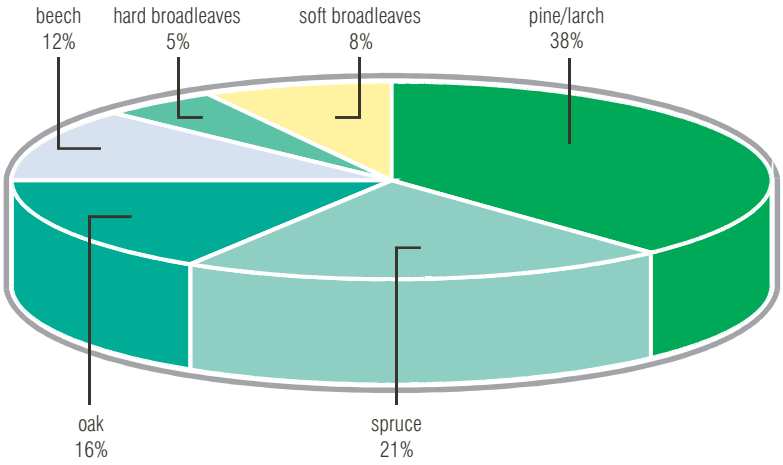

Fig. 4. The Saxony-Anhalt forest area by tree species

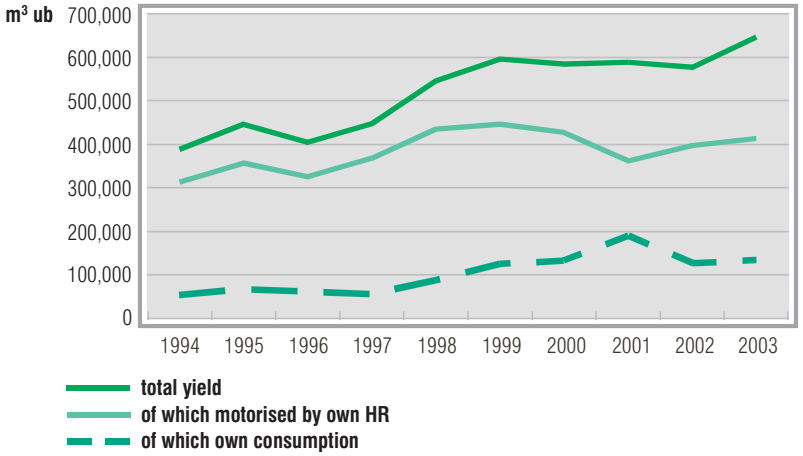

Fig. 5. Volume of timber harvested in state forests

Figure 5 illustrates development of the harvest volume in the Saxony-Anhalt forests between 1994 and 2003.

The ratio of the current increment to yield prescribed by the forest authorities is an essential feature of forest preservation. While prescribed yields have increased in the past few years in line with development of forest management, they are still clearly below the level of the current increment.

Due to the age structure, with its very high share of medium-aged stands, the forests in the State of Saxony-Anhalt are still growing and developing. Because of this, the current growing stock is still clearly below the target level, the optimum figure for which should be 280–300 m³ u.b./ha.

During the 2003 business year, approximately 568,000 m³ u.b./ha was sold by the forest districts of the Regional Forest Enterprise. The major emphasis is on pine wood, with a share of 42% in the total sales volume, followed by spruce wood – 27%. This means almost 75% of the timber yield is in the form of conifers.

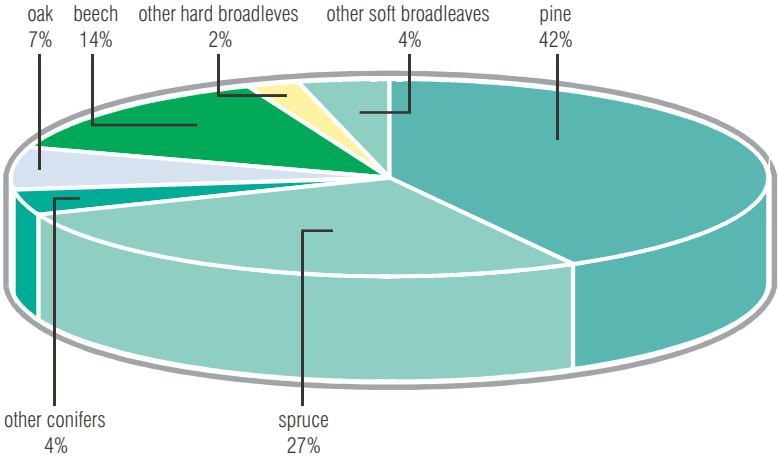

Fig. 6. Timber sales in state forests by wood species in 2003

3. Legal and organisational aspects of forest holdings

Forest ownership

The State of Saxony-Anhalt owns 31% of the forests. At present, 41% of the forests are privately owned. This share will increase to more than 50% by sales of 11% that are currently under the trusteeship of the BWG (the Company for Land Administration and Use). The remaining forest acreage forms Federal property (12%) and corporate property (5%).

The Regional Forest Enterprise carries out forest management tasks on 280,000 hectares of the total forest area (state-owned forests, forests under trusteeship, those tended privately and corporate forests).

On another area of some 120,000 hectares, the Regional Forest Enterprise provides advisory and consultancy services, and on approximately 50,000 ha (mainly forests owned by the Federation) it carries out only consultancy services.

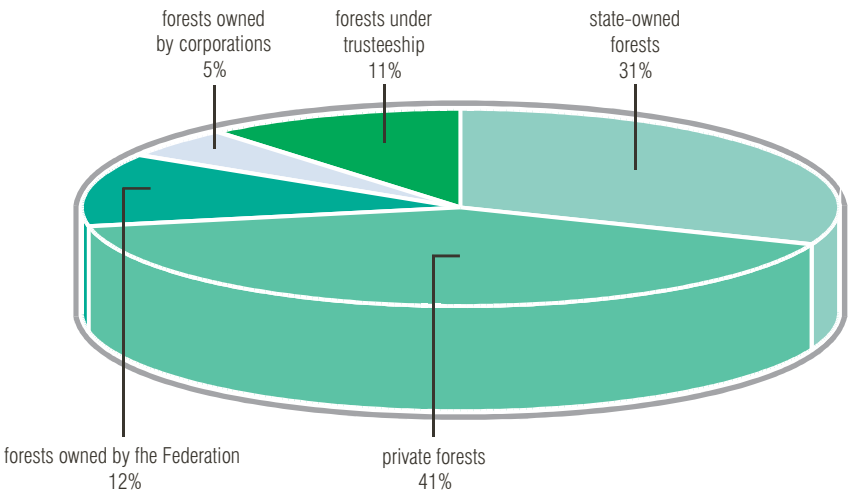

Fig. 7: Forest areas in Saxony-Anhalt by ownership type

Forest law

On 13 April 1994, the Forest Act of the country of Saxony-Anhalt was passed.

In view of the special importance of forests for the general public, the specific purpose of this Act is to:

- preserve forests, due to their economic benefits and significance for the environment, especially for the long-term ecological balance, climate, water balance, air purity, soil fertility, landscape, agrarian structure and infrastructure, and the recreational benefits for the general public (protection and recreation); also to expand forests where necessary and ensure their lasting and appropriate utilisation;
- support forestry; and
- balance the interests of the general public against those of forest owners.

On 16 April 1997, the State Parliament passed the Act on Field and Forest Regulations. This governs access to and utilisation of fields and forests.

The amendment to the Nature Conservation Act, in force since 23 July 2004, provides for nature and landscape conservation in the State of Saxony-Anhalt.

4. Structure and tasks of the Regional Forest Administration

The Ministry for Agriculture and Environment with its headquarters in Magdeburg – the capital city of the State – is the supreme forestry authority. Forest administration is the responsibility of its Department 4, which is in charge of nature conservation and forestry. The organisational structure of forestry in Saxony-Anhalt is strongly influenced by the Regional Forest Administration. Being a uniform forest administration authority, it is responsible

for supervision over all types of forest ownership. This is at the same time an economic enterprise, a service company and a sovereign administrative authority.

In accordance with the country's Forest Act dated 13 April 1994, the Forest Administration fullfils the following tasks:

- co-operation as an authority responsible for issues of public interest,
- administration and management of state-owned forests,
- advisory and related services for private and corporate forest holdings,
- implementation of the Government's development programmes for forestry,

Fig. 8. Forest structure in Saxony-Anhalt

- forest land-use planning and other special plans for forests, as well as identification of and care for protected forest areas,
- wxecution of forest inspections and forest protection,
- decision-making concerning the granting of permits to the extent forest authorities are entitled to do so under the Act or any relevant regulations issued under the same,
- forestry public relations to communicate its concern for maintaining and protecting forests, as well as the concerns of forest owners to the public.

Moreover, on the basis of their expert knowledge, forest authorities also provide advice and support to local authorities and their associations, nature conservation authorities, the authorities responsible for reallocation of agricultural land and other boards and authorities responsible for the upkeep and tending of landscapes, concerning the issues of landscape gardening and rural conservation.

The Regional Forest Enterprise

On 1 January 2002, substantial parts of the Regional Forestry Administration were restructured to establish the Regional Forest Enterprise.

Of a total forest area of approximately 476,000 hectares, this Enterprise exercises its forest management tasks on 280,000 hectares. In addition to the 140,000 hectares of state-owned forests, this comprises the parts of forests managed by trusteeship, as well as those tended privately and corporate-owned forests. On another area of 120,000 hectares of private and corporate-owned forest not subject to supervision, the Regional Forest Enterprise carries out advisory and consultancy services, and on another 50,000 hectares (mainly federally owned), it is responsible for consultancy issues.

The average size of forest districts is approximately 20,000 hectares. The actual operational area of state-owned forests, forest under trusteeship, forest tended privately and corporate-owned forests amounts to an average of 13,000 hectares.

The average size of forest ranges is approximately 2,450 hectares. The actual operational area of the average forest range amounts to approximately 1,600 hectares.

Governmental support for forestry

Due to the special significance of forests for the general public and their protective and recreational functions, development funds can be made available to the owners of private or corporate forests for implementation of appropriate measures for their proper and lasting use and for compensatory planting (Regulation on the Allocation of Funds for Supporting Forestry Measures and Compensatory Planting).

Since 1991, considerable financial resources have been allocated in Saxony-Anhalt for silvicultural measures (afforestation, transformation, replanting, tending during the establishment phase and thinning), as well as for measures to combat new types of forest damage (advance planting and undergrowth management, afforestation and tending during the establishment phase), construction of forest roads, forest protection and forest fire insurance, forestry associations and for the processing and marketing of forestry products (see Fig. 9).

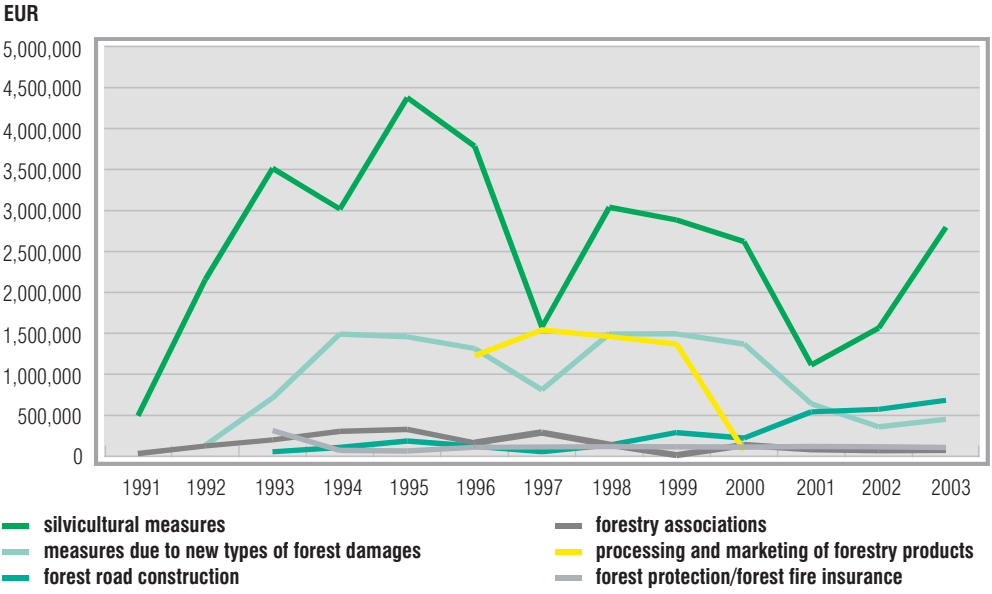

Fig. 9: Allocation of forest funds in Saxony-Anhalt

Private owners associations

At present, the area of privately or corporate-owned forests in Saxony-Anhalt is 233,000 hectares. Following privatisation of the forests now under the trusteeship of the BVVG, this will amount to approximately 275,000 hectares, *i.e.* 57% of the total forest area in Saxony--Anhalt.

The average operational forest size is 3.7 hectares. Small-sized privately owned forests are organised into forest enterprise communities with an area of between 25 and 5,000 hectares. The current level of their organisation amounts to 47%. At present, the Regional Forest Enterprise of Saxony-Anhalt is responsible for approximately 110,000 hectares of forests that are under private or community ownership.

The estimated prescribed annual yield of the attended areas is approximately 2.0 m^3 u.b./ha.

A cost-covering rate of 32 €/ha is collected from owners for membership and full services. These charges apply without deductions for enterprises with areas of more than 500 hectares. For smaller enterprises, this charge is reduced in line with forest policy (Regulation on Privately Owned Forests).

The Regional Forest Enterprise renders advisory services free of charge on approximately 233,000 hectares (in accordance with paragraph 24/2 of the State Forest Act).

At present, 139 forestry associations are active in Saxony-Anhalt, the total membership of which includes 17,189 forest owners, and a total area of 88,297 hectares. Since 1991, these forestry associations benefit from state financial support (see Fig. 9).

5. Education in forestry

Training as a forester

Forestry training is managed under a collective agreement for forestry workers (MTW). Within the framework of dual vocational training, vocational schools and companies employing trainees fulfil a joint educational task. This education lasts 3 years and is divided into in-house training as an apprentice at forest districts and interplant training at the Regional Institute for Agriculture, Gardening and Domestic Science (LLG) and Forestry Faculty, in Magdeburgerforth, where education is also provided at the vocational school. The subjects taught fall within the general framework for the profession of forester. In addition, the Forestry Faculty of the LLG fulfils the following tasks:

- practically oriented courses, training and instruction in the fields of forest work / forest management, nature conservation / landscape protection, tree cultivation and industrial safety / accident prevention,
- mobile training courses for forest owners,
- further training of master foresters,
- further training for the teachers and tutors of the Regional Forestry Administration,
- special tasks for the Regional Forestry Administration,
- development, testing and inspection of forestry machinery and work processes in co-operation with other institutions (*e.g.* KWF, the Board of Trustees for Forestry Work and Equipment).

Higher sections of the forestry service

The professional tasks of the higher sections of forestry service are based on the economic use of forests and their environmental importance. The main responsibilities assigned to the higher sections of forestry service are forestry management in state forests, provision of advice for forests under trusteeship and those under private or corporate ownership, as well as nature conservation and landscape protection.

Saxony-Anhalt itself does not provide any advance training in the field of forestry at technical colleges, but employs graduates of the external technical colleges in Eberswalde, Göttingen and Weihenstephan, who undergo a term of preparatory service that constitutes the qualifying precondition for beginning a career in the higher sections of forestry service. The preparatory service and career examinations last 12 months.

Senior sections of the forestry service

The professional tasks for which the senior sections of the forestry service are responsible ensue from the considerable economic benefits of forests and their environmental importance, whereas the main emphasis is placed on ensuring the sustainable and balanced functions of forests with regard to their utilisation and protection, as well as their recreational advantages.

For this reason, the senior sections of the forestry service are mainly assigned management planning tasks at various operational and administrative levels.

The preparatory service (probationary period) lasts 24 months. For the preparatory service performed by senior sections of the forestry service, Saxony-Anhalt employs graduates from the universities of Dresden, Freiburg, Göttingen and Munich with degrees in forestry.

6. Forest research

Forest research in its strict sense is not performed in Saxony-Anhalt. However, Department 5 of the Regional Forest Enterprise, responsible for services and research, carries out research into the future existence of forestry, conducts environmental monitoring and forest protection, and develops practical solutions for the Regional Forestry Enterprise. Moreover, with their expert knowledge, they ensure and support implementation of the forestry policy decisions taken by the Ministry for Agriculture and Environment, and also support the sovereign tasks of the Ministry.

Department 5 of the Regional Forest Enterprise has a staff of ten. In 2003, approximately EUR 116,000 was spent on implementing tasks in forest research and protection.

Among others, the following issues have been studied during the past few years:

- Environmental monitoring of forests,
- Concepts for the thinning and improvement in felling of pines,
- Volume change of the steel-blue jewel beetle,
- Long-term studies concerning dying oaks.

Thuringia

Susanne Schwerhoff

Forest characteristics

Forest cover and species composition

Forestlands in Thuringia cover 542,728 hectares and mainly comprise the crop trees – spruce, beech and pine.

Türingen,
territory: 16,200 km^2,
population: 2.4 million,
capital city: Erfurt.

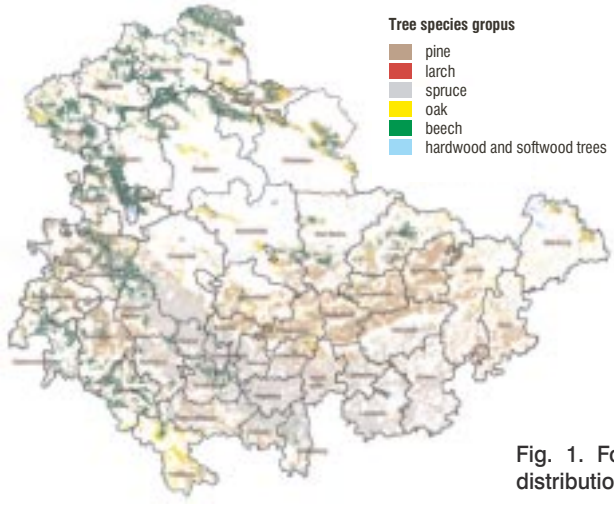

Fig. 1. Forestry Office data on structure and distribution of tree species, as at 1 January 2004

The distribution of tree species in Thuringia mainly depends upon three factors: location, climatic conditions and historical development, and is as follows:

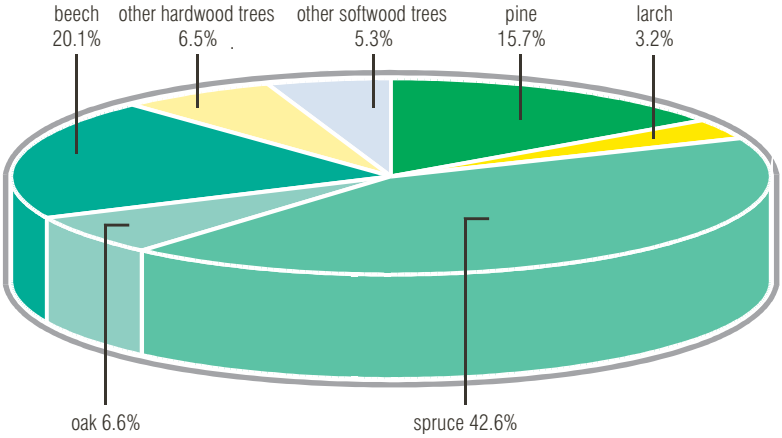

Fig. 2. Distribution of tree species on forest lands in Thuringia

In many areas, the original deciduous and mixed forests were augmented in the past centuries by conifers. The current continuing increase in the percentage of deciduous trees testifies to the success of the switch to semi-natural forest management. Spruce is the most common tree species in Thuringia (43%) and is mainly concentrated in the area of the Thuringian Forest. Beech is chiefly found in northern and western Thuringia, while oak usually grows on dry areas on the edge of the Thuringian basin and in eastern Thuringia.

Volume and increment

Taking all tree species and types of ownership into account, the forest lands in Thuringia provide a mean wood supply of approximately 301 m^3/ha according to the latest findings of the Federal Forest Inventory, thus more or less meeting the target average of 300–330 m^3/ha. Annual increment amounts to approximately 10 m^3/ha. Logging considerably lags behind current increment, especially in small private forestland, meaning that wood supplies are actually on the increase. This is partly a result of accelerated forest growth attributable to improvements in local conditions. In the interests of developing stable, structured, mixed forests where priority is given to providing trees with enough space and concentrating growth on selected individual trees, this trend is countered by increased logging.

Owing to the disastrous storm damage followed by a bark beetle infestation in the mid-20th century and the subsequent reforestation of the resulting defoliated areas, there is a considerable surplus of young and medium-aged stands of coniferous trees. These age and diameter structures exhibit the highest growth, which is the main factor behind the increase in wood supply.

By contrast, as far as beech is concerned, there are surplus mature stands. Taking into account the development of wood quality, natural regeneration and the continuity of the habitat and biotope structures, these mature stands are used whenever possible for transition to the structures reminiscent of ‘Dauerwald’ (permanent forest).

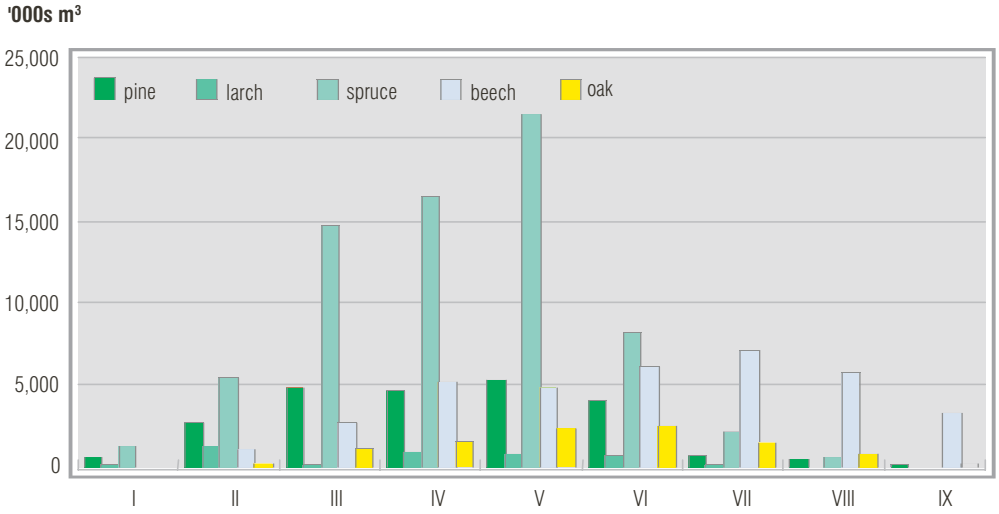

Fig. 3. Wood supplies classified by tree species and age class distribution, in thousands of m³

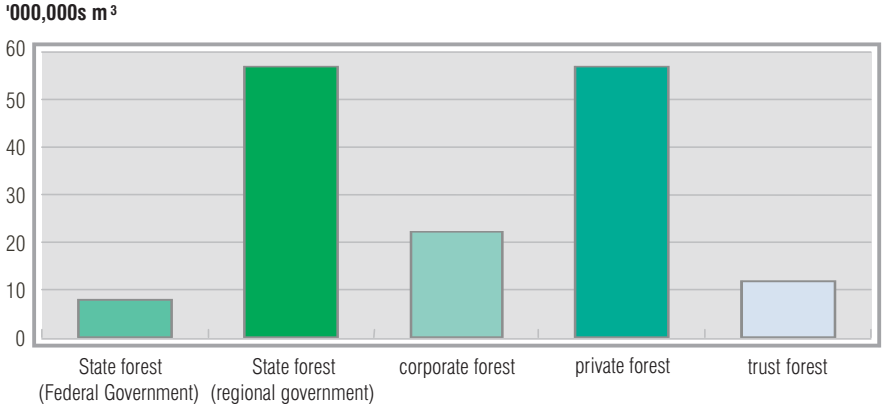

Fig. 4. Wood supplies classified by ownership type in Thuringia

2. Logging and wood processing

In 2003, logging in all forest ownership types in Thuringia totalled 2,190,853 m³ harvested. This figure was 19% higher than in the previous year, largely explained by a 35% increase in the prescribed annual yield for private forestland compared to 2002. Spruce represents more than 60% of logging and almost 70% of revenue from sales of wood, making it the main type of wood sold. Despite initially negative indications, in 2003 the average price for all types of wood remained at the relatively low price of EUR 40 prevailing in 2002.

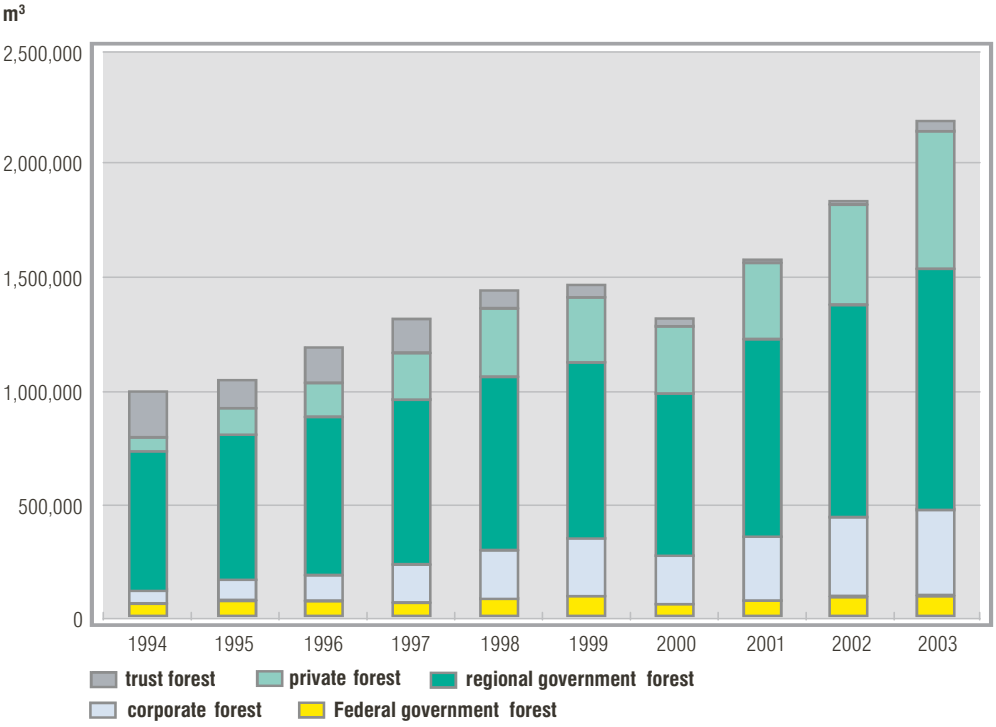

Fig. 5. Logging in 1994-2003 for all ownership types

Table 1. Logging in 2003 for all ownership types

Tree species group	State forest	Corporate forest	Private forest	Trust forest	Federal forest	Total (cmh)*
Spruce including:	671,827	203,587	356,033	47,556	38,418	1,317,421
– round timber	556,294	154,612	271,112	30,924	27,525	1,040,467
– industrial timber	115,533	48,975	84,921	16,632	10,893	276,954
Pine including:	133,544	75,373	104,946	1,718	20,920	336,501
– round timber	95,743	46,738	70,128	492	13,636	226,737
– industrial timber	37,801	28,635	34,818	1,226	7,284	109,764
Beech including:	230,733	89,880	135,797	656	26,722	483,788
– round timber	83,447	36,446	63,784	46	3,198	186,921
– industrial timber	147,286	53,434	72,013	610	23,524	296,867
Oak including:	24,153	10,884	10,793	107	7,206	53,143
– round timber	9,043	4,277	4,722	3	2,976	21,021
– industrial timber	15,110	6,607	6,071	104	4,230	32,122
Total	**1,060,257**	**379,724**	**607,569**	**50,037**	**93,266**	**2,190,853**

* cmh = cubic metres harvested.

Acquisition of wood from all types of forest ownership and jointly marketed by the Thuringian Forestry Commission has proved profitable and will be increased further. The market for wood in Thuringia can be described as difficult but receptive. For example, with the exception of beech, the volume of wood is still not sufficient to keep up with regional industrial demand. The prospects for expanding logging and wood sales in Thuringia are good, because demand among the Thuringian wood-processing businesses outstrips supply.

The increasing sales by means of central marketing through framework contracts is mainly due to the structure of timber stocks and their buyers in Thuringia. The adoption of framework contracts enables customers to buy the larger quantities they require in a single transaction. In particular, larger customers appreciate the fact that the sale of large quantities of timber is managed by the Thuringian Forestry Commission's central timber marketing department. Thanks to intensive marketing, such framework contracts have now been signed with new customers.

Alongside this central marketing, the Thuringian Forest Offices also take pains to provide small regional wood users with the quantities they need and thus help to keep production levels stable. The economic situation of small and medium-sized wood processors is uncertain and joint solutions by both the forestry and timber sector are urgently needed to help these businesses thrive. In addition, auctions are also a regular form of wood marketing among all types of forest ownership.

Fig. 6. Operating income, operating costs and operating performance in EUR/ha (including additional wage costs) in state-owned forests

Given the sufficient regional take-up capacities, little round wood is exported, although mention should be made of industrial timber deliveries to Sweden and parquet wood to Denmark. These and other activities have been stepped up in order to make the market more flexible and as a form of risk hedging. Consequently, Thuringian wood is now also exported to France, Austria, China, and the Benelux countries. The market for wood as fuel is expanding and will soon form a sizeable supplement to its use as a raw material. Investors seeking to take advantage of the new legal opportunities obtain advice and support from the Thuringian Forestry Commission. For example, joint contractual concepts have been developed to safeguard wood as a raw material in the long term while simultaneously providing incentives for forest owners to provide wood for use as fuel.

In 2003, timber sales were as usual the main source of income. While wood prices remained stable at the same low level, the previous year's results were exceeded owing to greater wood usage. However, an operating loss was again incurred in 2003 and subsidies for state-owned forests amounted to EUR 81.76 per hectare.

3. Forest protection

Forest reserves

The multifunctional form of forestry practised in Thuringia includes simultaneously safeguarding usage and environmental and recreational functions through semi-natural forest management. Over 70% of Thuringia's nature reserves are located on forestland, underlining just how important the forest is for the protection of biotopes and species. Landscape protection areas comprise approximately 60% of all forests. The biosphere reserves contain approximately 46% forests. Meanwhile, 3.9% of the total forestland in Thuringia is located in nature reserves. Almost half the forests in Thuringia (45%) are situated in landscape protection areas, while another 6% lies within biosphere reserves.

Almost 40% of the total forestland is located in water protection areas. Although these figures cannot be simply added together (since some types of protective areas overlap), they emphasise the high significance of forestland when it comes to the protection of biotopes, species and natural resources.

Environment and nature protection projects in forestlands:

- **Forest biotope mapping.** Forest biotope mapping is a joint project that was launched by the forestry and nature conservation administration in 1993. Forest biotope data is now available for approximately 94% of the forestland in Thuringia.
- **Protection, cultivation and usage of forestland in NATURA 2000 areas.** 49% (58,360 ha) of the forestland in fauna and flora habitat areas is classified as forest habitat types in accordance with Annex I to the Habitats Directive.
- **Forest conversion programme** – The active forest conversion measures involve amending the distribution of tree species (including combinations of different species) in those areas where the local site conditions are unsuitable for the existing species. In

the case of stands with trees of unsuitable provenance, the trees are replaced, while the vertical and horizontal structures of stands with poor structure are improved. Often these measures overlap.

- **Specific species and biotope protection measures** (e.g. orchid growth, moors, and forest streams).

4. Forest ownership

Table 2. Forest ownership in Thuringia in hectares (status as at 31 December 2003)

Ownership type		Wooded land	Non-wooded land	Total	Percent
1.	State Government	206,619	17,029	223,648	41.21%
1.1	Forest administration (TMLNU)	189,317	10,615	199,932	36.84%
1.2	WGT Special Fund (TMWAI)	6,112	2,623	8,735	1.61%
1.3	Federal Government (BFM)	10,817	3,752	14,569	2.68%
1.4	Other German Federal States	373	39	412	0.08%
2.	Corporations	84,234	3,693	87,927	16.20%
2.1	Local authorities	80,268	3,573	83,841	15.45%
2.2	Foundations	3,966	120	4,086	0.75%
3.	Private owners	202,455	4,592	207,047	38.15%
3.1	Small and medium private owners	196,594	4,484	201,078	37.05%
3.2	Church	5,861	108	5,969	1.10%
4.	Trust	21,496	2,610	24,106	4.44%
Total forest area		**514,804**	**27,924**	**542,728**	**100.00%**

TMLNU = Thuringian Ministry of Agriculture, Conservation and the Environment,
WGT = Western Group of the Soviet Army Troops,
TMWAI = Thuringian Ministry of Trade, Industry, Labour and Infrastructure,
BFM = Federal Ministry of Finance.

As at 31 December 2003, the total forest area in Thuringia (including state-owned forests, corporate forests, private forests and trust forests) was 542,728 hectares.

State forests account for approximately 37% of the total forest area in Thuringia. The area occupied by **corporate forests** (more than 16%) is rather unevenly divided, with four-fifths being managed by just a fifth of the corporations with sizeable forest holdings. In fact, the sixteen largest corporations, each owning over 1,000 hectares of forestland, possess as much as 29% of total corporate forestland.

Private forests include a number of medium-sized and large private forestry operations, as well as small private plots, which in total account for 48% of areas up to 5 hectares in size.

Subsidies for corporate and private forest owners

Owing to structural deficits, subsidies also have to be provided for private and corporate forests. The provision of forestry subsidies in Thuringia is designed to meet the following goals:

- to develop a sustainable (including environmentally sustainable), efficient, competitive, market-based forestry sector,
- to promote regional and local development,
- to protect the natural bases for life.

Between 1991 and 2003, the subsidies paid out totalled EUR 153.1 million. This equates to an average of EUR 55 per hectare of private forest and EUR 41 per hectare of corporate-owned forest. The total amount paid out each year was distributed through individual support programmes as follows:

Forestry policy continues to grant priority to the afforestation of land not previously used for forestry. Between 1992 and 2003, a total EUR 20.1 million was paid out in structural aid for 2,884 hectares of newly planted forestland. In addition, another € 43.6 million was made available in the same period for structural aid. The primary aim of this programme is to compensate small forest owners for the disadvantages and income losses suffered as a result of management by the former State Forestry Operations, by helping them to help themselves. Every year the volume of subsidies applied for by forest owners far exceeds the funding available.

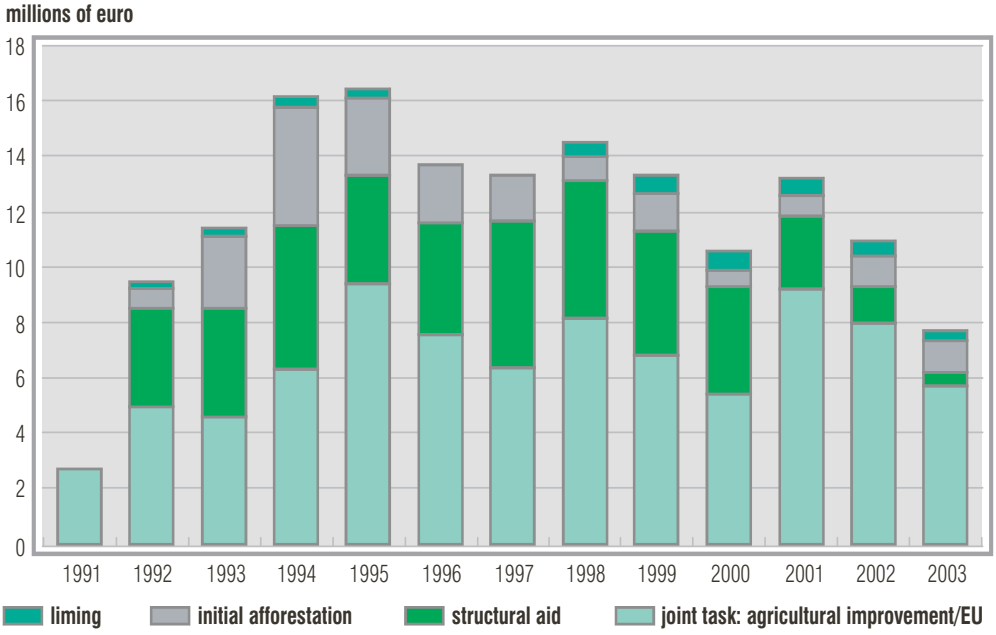

Fig. 7. Subsidies for major forestry programmes

Table 3. Operations on private and local authority forestland funded in 2003

Operations	No.	Local authority forest €'000	Private forest €'000	Total €'000
Subsidies under the Joint Task: Agricultural Improvement and EU (Operational Programme, Development Plans for Rural Areas) in 2003				
Measures necessitated by new types of forest damage	21	21	53	74
Initial afforestation bonus	2,253		457	457
Silviculture and other forestry measures	620	529	860	1,389
Forestry mergers	218		235	235
Forestry path construction	179	1,366	2,665	4,031
Initial afforestation	283	96	619	715
Total	**3,574**	**2,012**	**4,889**	**6,901**
Subsidies under regional programmes in 2003				
Structural aid	129	19	445	464
Lime treatment programme	22	194	84	278
Total	**151**	**213**	**529**	**742**

5. Structure and tasks of the Thuringian Forestry Commission

The objectives and tasks of the Thuringian Forestry Commission are laid down in the Thuringian Forestry Act as amended on 25 August 1999 under the German Federal Forestry Act dated 2 May 1975. These comprise preserving, increasing and protecting forestland in Thuringia, sustainable production of timber as a natural resource, safeguarding and improving forestry landscape protection functions, providing woodland recreation for the general public, supporting and subsidising forest owners, and (in view of the complexity stemming from this large number of responsibilities) ensuring a balance between legitimate public concerns and the justified interests of forest owners.

These tasks are carried out in accordance with the principle of sustainability, whose basic premise has set the tone for the work of foresters for more than 200 years. Sustainability is not an element restricted to forestry but a philosophy concerning man's responsible treatment of the environment. As far as forestry is concerned, this means consuming only as much as can grow back again. All forest functions are subject to this principle of sustainability.

The Thuringian Forestry Commission discharges its responsibilities within the organisational form of a municipal forestry office. Its compact, efficient structure consists of administration and the field operations. Field operations are under the responsibility of the decentralised Forestry Offices of the Free State of Thuringia, managing approximately 200,000 hectares of state-owned forest. As far as administration is concerned, the Forestry Offices

also discharge all the public tasks and services laid down in the forestry legislation. They operate as planning authorities and monitor public interests in approximately 543,000 hectares of forestland, regardless of their ownership structure. The Thuringian Forestry Commission also performs various other tasks under the Thuringian Hunting Act and the Thuringian Fishing Act.

In 2002, the Thuringian Forestry Commission was transformed from a three-tier to a two-tier administrative structure. The tasks previously handled by the Regional Forestry Department in Oberhof were transferred to the Forestry Offices, the Thuringian Institute of Forest and Forestry, district authorities and the Thuringian Ministry of Agriculture, Conservation and the Environment. The Ministry is in direct control of the Thuringian Institute of Forestry, Hunting and Fishing in Gotha, the Thuringian College of Forestry in Schwarzburg, the Hainich National Park administration in Bad Langensalza, and 46 Forestry Offices (including the Regional School of Forestry Work in Gehren).

When the Regional Forestry Department was closed down at the end of 2002, its surveying system was also reorganised and restructured, and a Survey Task Force was set up at the Thuringian Institute of Forest and Forestry.

Since 1996, the total number of employees has been reduced by 582.

At the end of the period under review, the Thuringian Forestry Commission had a staff of 1,837 employees.

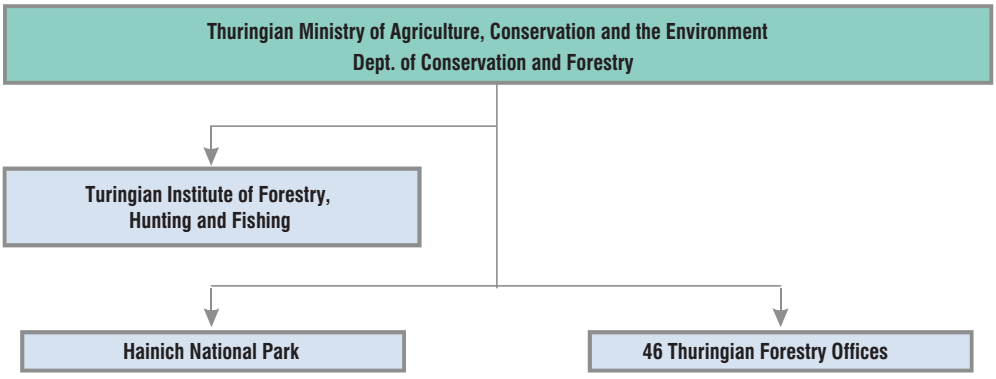

Fig. 8. Administrative structure of the Thuringian Forestry Commission

Table 4. Number of employees in the Thuringian Forestry Commission

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Senior Forestry Service	203	202	197	196	192	190	188	188	187	179
White-collar workers	253	254	248	241	234	235	234	234	234	226
Trust forest personnel	228	222	198	119	44	35	20	17	0	0
State forest personnel	1,182	1,154	1,088	991	1,005	975	964	950	940	916

Table 5. Number of personnel by section and employee group

As at 31 December 2002	Senior Service	Higher Service	White-collar workers	Forestry workers	Total
Thuringian Ministry of Agriculture, Conservation and the Environment - Forest Department	24	18	5		47
Thuringian Institute of Forests and Forestry	33	36	29		98
Forestry Offices, Base Forestry Offices and Regional School of Forestry Work	111	457	182	916	1,666
Hainich National Park administration	4	4	1		9
College of Forestry	7	2	8		17
Total	**179**	**517**	**225**	**916**	**1,837**

6. Education in forestry

Regular forester training – The three-year apprenticeship, which accepts forty new trainees a year, is divided into practical training at the State Forestry Offices and theoretical studies at the Regional School of Forestry Work in Gehren.

Higher Forestry Service – The three-year course at the internal Forestry College is divided into two years of theoretical studies and a year of practical training at a forestry office in Thuringia. The course's staff also supervise the practical working experience of students from other forestry colleges.

Senior Forestry Service – The two-year preparatory service for the Senior Forestry Service enables participants to augment their theoretical college training with practical activities in the Thuringian Forestry Commission's administration. The main areas covered are forestry operations, forestry planning, landscape management and land conservation, as well as administrative activities in the lower and higher forestry authorities.

★ Greece

Danny Panagiotopoulou

The Hellenic Republic (Elláda, officially Elliniki Dhimokratia), territory: 132,000 km², population: 11.2 million, capital city: Athens.

1. Forest characteristics

In Greek forest statistics, definitions are according to the 2nd Ministerial Conference 1995 (Starr et al. 1995, ISCLa 1996, UN-ECE/FAO 1992, Galanos 1996). **Forest** is defined as land with tree crown cover (stand density) of more than about 20% of the area, and with trees which usually grow to more than about 7 m in height and are able to produce wood. This includes both, closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground, and open forest formations with a continuous grass layer in which tree synusia cover at least 10% of the ground. **Other wooded land** is defined as land which has some forestry characteristics but is not forest, as defined above. It includes: open woodland and scrub, shrub and brushland, whether or not used for pasture or range (except for trees outside the forest).

Table 1. Forms of forest land use in Greece

Land use	Area	
	'000s ha	%
Forest	3,359	25.5
Other wooded land	3,154	23.9
Forest & other wooded land	**6,513**	**49.4**
Other land uses	6,683	50.6
Total area	**13,196**	**100.0**

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Table.2. Forest area and species composition

Species	Area	
	'000s ha	%
A. Conifers		
Fir	543.3	16.17
Aleppo pine, Calabrian pine	567.7	16.90
Black pine	281.7	8.39
Scots pine	21.0	0.62
Bosnian pine *Pinus leucodermis*	8.3	0.25
Stone pine	0.1	0.003
Spruce	2.8	0.08
Other conifers	5.2	0.15
B. Broadleaves		
Beech	336.6	10.02
Chestnut	33.1	0.99
Oak	1,471.8	43.82
Plane tree	86.6	2.58
Other broadleaves	0.8	0.02
Total forest area	**3,359**	**100.00**

Table 3. Total volume (m^3/ha)

Forest species	Growing stock (overbark)	Area	Growing stock (overbark)
	'000s m^3	'000s ha	m^3/ha
A. Conifers			
Fir	47,406	543.3	87.25
Aleppo pine, Calabrian pine	14,986	567.7	26.40
Black pine	15,269	281.7	54.20
Scots pine	2,574	21.0	122.83
Bosnian pine *Pinus leucodermis*	2,230	8.3	268.67
Spruce	941	2.8	341.77
B. Broadleaves			
Beech	30,437	336.6	90.41
Chestnut	1,862	33.1	56.29
Oak	26,537	1,471.8	18.03
Plane tree	2,116	86.6	24.44

Table 4. Annual increment of standing volume (m^3/ha/year)

Species	Net annual increment (overbark)	Growing stock increment	Net annual increment
	'000s m^3	%	m^3/ha
A. Conifers			
Fir	798	1.68	1.47
Spruce	29	3.08	10.35
Pine	1,090	3.10	1.24
B. Broadleaves			
Beech	931	3.06	2.77
Oak	695	2.62	0.47

Table 5. Logging, main directions of wood processing ('000s m^3)

Type of timber	State Forests	Non-State forests	Total
1. Industrial roundwood	**559**	**150**	**709**
Conifers	328	97	425
Broadleaves	231	53	284
2. Commercial fuelwood	**490**	**220**	**710**
Conifers	30	93	123
Broadleaves	460	127	587
3. Fuelwood collected free of charge	**349**	**253**	**602**
Conifers	59	28	87
Broadleaves	290	225	515
Total	**1,398**	**623**	**2,021**
Conifers	**417**	**218**	**635**
Broadleaves	**981**	**405**	**1,386**

2. Forest protection

Greece with its rugged mountainous relief (42 summits over 2,000 m a.s.l.), its complex geology and the numerous islands and convoluted coastline (longer than the perimeter of France) presents a great diversity of natural scenery. In addition, the remoteness of some biotopes has led to the evolution of many endemic and rare animal and plant species. Equally interesting is the great variety of meteorological conditions that vary from the dry, semi-arid, semi-desert of SE Crete to the cold, humid continental climate of the Rhodope Mountain range bordering the northern shores of the Aegean Sea.

The variety of meteorological conditions, combined with the geomorphological features, is reflected in the rich flora and fauna. The diversity of the vegetation is evidenced by the large number of different habitats from the unique palm forest at Vai, on the eastern tip of

Crete, to the boreal woods of birch, pines and spruce in the Rhodope Mountains. This diversity is limited to a very confined area; a journey of just 150 km from the town of Kavala to central Rhodope takes the traveller through the Mediterranean, Central European and Northern (Scandinavian) vegetation zones.

National Parks represent the main category of protected area. They are designated and managed in accordance with the forest legislation (Law 996/1971) that forms part of the Forest Code (Law 86/1969). They include areas mostly of a forested nature of special scientific and ecological significance, which enjoy strict protection. They consist of a core area of at least 1,500 hectares, which is strictly protected, and a peripheral zone with a size at least equivalent to the core area. In the core area of National Parks, activities such as the excavation and exploitation of minerals, digging, the placing of advertising billboards, industrial activities, housing and other construction, and agricultural and forestry activities, pasturing, hunting and fishing, are all prohibited. In the peripheral zone, all activities are controlled by the Forest Service, with a view to any negative effects on the core areas being avoided.

Aesthetic Forests is a category of protected area in which landscapes of particular aesthetic and ecological significance are usually included. The aim, besides protecting nature, is to give the public the opportunity to meet and enjoy nature through various recreational activities.

Table 6 Area of strictly-protected forest reserves

Category	Number	Total area	Area of forest and other wooded land	
		('000s ha)	('000s ha)	(%)
National Parks	10	110	93.5	65.75
Aesthetic Forest	19	33	24.7	17.37
Wetlands	10	96	24.0	16.88
Total	**39**	**239**	**142.2**	**100.00**

Protected Natural Monuments include areas that are of special palaeontological, geomorphological, or historical significance; and trees, clumps of trees or rare species of plants of special botanical, phytogeographical, aesthetic or historical significance.

Table 7. Area of forest and other forest land that is protected by a special management regime

Category	Number	Total area ('000s ha)	Area of forest and other wooded land	
			'000s ha	%
Protected Natural Monuments	14	16.5	14.0	1.47
Controlled shooting areas	10	150.0	127.0	13.34
Game breeding stations	20	3.2	3.2	0.34
Game refuges	700	950.0	807.5	84.85
Total	**744**	**1119.7**	**951.7**	**100.00**

The ecotopes of Natura 2000 in Greece

In 1992, the Rio Convention and the EU Directive 92/43 were designed to confront the threat of extinction of many species and the deterioration of the world's habitats. The EU Habitats Directive 92/43 was incorporated into Greece's national legislation by the Joint Ministerial Decision 33318/3028/1998. The main aim of the Directive is to promote the maintenance or restoration of biodiversity, taking account of economic, social, cultural and regional requirements. The natural habitat types and species are listed in Appendices I and II of the Directive. The backbone to the conservation and protection of the natural environment is the creation of a European ecological network of protected sites named NATURA 2000. The network will be under the management of a special committee consisting of representatives of the EU Member States. At present, the ecotopes of the Natura 2000 network in Greece cover 2,360,000 hectares (18% of total area of the country).

To achieve the goal of the identification and evaluation of biodiversity, the Directive was implemented in Greece in 1994 by virtue of a national project titled Inventory, Identification, Evaluation and Mapping of the Habitat Types and Flora and Fauna Species in Greece. The creation of the NATURA 2000 network, to which Greece is committed, will assist in the protection of endangered species and their habitats, by ensuring their restoration and maintenance at a favourable conservation status.

Greece has proposed 268 sites forming the country's National List and has included 52 Special Protected Areas (SPAs) under Directive 79/409/EEC. The boundary of every site has been defined and a Standard Data Form completed with data on natural habitats and wild fauna and flora of Community interest within the site. The restoration, conservation and protection on a favourable level of all priority habitats and species at sites must be ensured in all future actions until the NATURA 2000 network is established.

The Directive imposes on the State the responsibility for making an appropriate assessment of any plan and/or programme likely to exert a significant impact on the conservation objectives of the site, which has been designated, or will be designated in future. To accomplish this goal, the State is empowered to implement all necessary protection and management measures in regard to the conservation objectives pursued.

3. Legal and organisational forms of forest holdings

Forest law

The 1975 Constitution, plus Laws 86/69, 998/1979 and 1650/1986 constitute the basic legal framework of the country, pertaining to the protection and management of forest and other wooded land.

For the first time in the history of the country, forest and other wooded land gained protection under Articles 24 and 117 of the Constitution.

Law 86/1969 codified almost all the laws that have been issued since 1928 and has been amended and completed by Law 4173/1929. This Law constitutes the Forest Code of the country and regulates matters concerning protection, management, real property rights

on forest land, taxation, exploitation of State-owned and privately-owned forests, forest improvement works, etc. To this day, the Code continues to constitute the basic body of forestry legislation, though many of its provisions have been amended and substituted by other laws, such as Laws 886/1971, 996/1971, 248/1976 and 998/1979.

Law 998/1979 on the protection of the country's forest and wooded land determines the specific protection measures for maintaining, developing and improving the forest and other forest land of the country. This in turn aims at maintaining and improving the whole natural environment by direct reference to the legal status governing ownership and use.

Law 1650/1986 on the protection of the environment includes a specific chapter On the Protection of Nature and Landscape which proposes new categories of protected areas and introduces changes to the administration and management of protected areas.

The above-mentioned laws for protecting and managing forests have been supplemented by presidential decrees and ministerial decisions.

The Presidential Decree of 19 November 1928 on forest management, felling regulations, forest taxation and rent, disposal of products, resin collection and resin cultivation, etc. regulates legislatively sustainable forest management. With this decree, incorporated into the Forest Code, the principle of sustainability is adopted in its simple form, *i.e.* as regards sustained yield. However, the management of Greek forests based on sustained yield started after The Ministry of Agriculture had issued Circular No. 120094/499/1937. The broadened concept of sustainability, *i.e.* that which, besides timber yield, includes all kinds of forest functions and services, was applied to management practice, once the Ministry of Agriculture had issued Circular No. 958/1953. The Circular concerns instructions for drawing up management plans. Finally, extensive reference to sustainable forest management in its broadened sense is made in the new specifications for the drawing-up of forest management plans.

At least theoretically, the regulations of the law on forests ensure the protection of forests from excessive interventions of owners and third persons, as well as from natural factors. In the case of actions which can considerably affect forest protection, such as land-use changes and the expropriation of forest or other wooded land, respective provisions were introduced to the 1975 Constitution and to the laws mentioned above. Article 24 of the Constitution prohibits forest land-use changes, unless the public interest requires otherwise. The State and private forests and other wooded lands destroyed by fires, or other causes, are obligatorily subject to reforestation; their disposal for other purposes being prohibited (Article 117, paragraph 3 of the Constitution). Expropriation of forests and other wooded lands that belong to natural or legal persons governed by public law is permitted only in favour of the State, but without a change in their forest character (paragraph 4 of the said article). Law 998/17979 designates – per case or per category of case – the terms under which forests or fragments thereof may change their use or serve other uses for reasons required by the public interest (indicative Articles 46, 47 and 51–57).

Forest ownership

The distribution of Greek forests by ownership structure is the result of historical, social, economic and political conditions. The high percentage of State-owned forests (65.6%) is

considered favourable, because it better ensures the serving of forests' social role. The more mountainous country, the higher the percentage of forests under State management, since the State – with its funds, personnel and framework – proves to be a better manager than private forest owners. Thus, in mountainous countries, the protective and social role of forests is better promoted. In Greece, management and exploitation of State forests usually encounters difficulties due to the customary and traditional rights, as regards grazing and fuelwood felling on forest land.

Table 8. Ownership structure

Ownership	Forest		Other wooded land		Total forest land	
	'000s ha	%	'000s ha	%	'000s ha	%
State	2,200	65.5	2,626	83.3	4,826	74.1
Community	403	12.0	183	5.8	587	9.0
Private	269	8.0	154	4.9	423	6.5
Other	487	14.5	190	6.0	677	10.4
Total	**3,359**	**100.0**	**3,153**	**100.0**	**6,513**	**100.0**

As far as community forests are concerned, the personal needs of community inhabitants are satisfied first, with trading taking place if there is a surplus. Within the category of other forests are forests belonging to monasteries and joint forest property. The latter are forests belonging to several natural and/or legal persons governed by public law. They are included in the following two categories:

a) Joint forest property of the State and other natural or legal persons,
b) Joint forest property of natural or legal persons. All non-State forests are subject to State forest policy and the work carried out within them is under the control and supervision of the State.

Forest holdings and public forests

The size of a forest holding is of decisive importance, because the exploitation of a small forest holding cannot be carried out on a competitive basis. The prohibition of fragmentation of forest land under the forest law has contributed to the maintenance of relatively large forest holdings. Thus, there are few small-sized State and private forests in the country. In Greece, private forest holdings of 2–50 hectares constitute just 3.2% of total forest land – one of the smallest percentage figures in Europe.

The structure and tasks of the national forest administration

The main body protecting and managing the country's State forests, as well as supervising and exercising control over private forests, is the Forest Service. This body operates under the name of General Secretariat of Development and Protection of Forests and Natural Environment (GSDPF&NE) and constitutes an integral part of the Ministry of Rural Development and Food (the former Ministry of Agriculture). GSDPF&NE consists of the

Central Service and the Regional Services. The Central Service, which exercises control over the whole administration of the GSDPF&NE, comprises 6 Directorates. These are responsible for formulating forest policy, drawing up long-term programmes of forest development, monitoring scientific and technological development in forests management, working out fire protection programmes, supervising and strengthening research programmes, and finally promoting the country's co-operation with the EU, third countries and International Organisations (Presidential Decree 352/7-8-91).

The Regional Services are instruments for executing the instructions and forest policy formulated, in general, by the Central Service, but also for implementing local programmes and studies. They are divided into Intraprefectural and Prefectural Services. The Intraprefectural Services comprise 7 Specific Regional Forest Inspectorates and 13 Forest Inspectorates for each of the 13 administrative regions of the country. The Prefectural Services consist of 31 Forest Directorates with 80 Forest District Offices and 24 Directorates without Forest District Offices. Two Directorates in Attici and Thessaloniki Prefectures are responsible for reforestation (Presidential Decree 1213/14-10-81). Collective bodies such as the Revisional Commission for the Property of Forests, the Forest Technical Council and the Regional Councils and Committees also operate within the framework of GSF&NE (under Law 300/1981).

Besides the GSDPF&NE, other bodies contributing to forest protection and development are:

- the Panhellenic Confederation of Agricultural Co-Operation (PASEGES),
- the Forest Owners Association of Greece (FOA.),
- the Geotechnical Chamber of Greece (GEOCG),
- the Hellenic Forestry Society (HFS),
- Non-Governmental Organisations (NGOs) in environmental protection, such as the Hellenic Society for the Protection of Nature, The Hellenic Ornithology Society, the World Wide Fund for Nature Hellas, The Greek Biotope/Wetland Centre and the Arctouros Society.

Forest owners associations

The only private forest owners association in Greece is the Forest Owners Association of Greece (F.O.A.). It was founded in 1926, with a view to private forest ownership being safeguarded, production oriented to the market, and domestic tree species and traditional forest cultivation methods being promoted in line with the principle of sustainability. The FOA has 100 members, with only 20 being employed exclusively in forestry.

4. Education in forestry

Education in forestry in Greece is divided into:

a) Post-compulsory secondary education, pursued at the Technical Vocational Schools (TEE), consisting of two or three years of study.

Table 9. Technical vocational schools

Name	Place	Graduates/year
TEE of Wood Curving and Furniture Decoration	Kalambaka	14
TEE of Agriculture, Food and Environment	Athens	20

b) Public higher education pursued at Universities and Technological Educational Institutes:

- **University education.** The length of study is 5 years and the graduates obtain a Master's degree. In the framework of their education programme, students are obliged to work as trainees for two months in forest institutes or other forestry-related institutions (internships).

Table 10. Forestry departments at universities

Name	Place	Graduates/year
Aristotelian University of Thessaloniki. Department of Forestry and Natural Environment	Thessaloniki	47
Democritus University Department of Forestry and Management of the Environment and Natural Resources	Orestiada	45

- **Technical Education.** The length of study is 4 years and the graduates obtain a Bachelor's degree. In the framework of their education programme, students are obliged to work as trainees for six months in forest institutes or other forestry-related institutions (internships).

Table 11. Forestry departments at technical universities

Name	Place	Graduates/year
T.E.I. Larissa. School of Agricultural Technology. Department of Forestry	Karditsa	39
T.E.I. Larissa. School of Agricultural Technology. Department of Wood Technology and Furniture Construction	Karditsa	16
T.E.I. Kavalas. Department of Forestry	Drama	83
T.E.I. Lamias. Forestry Department of Karpenisi	Karpenisi	96

5. Forest Research

Research programmes are implemented either by the staff of the Forest Research Institute (FRI) in Athens itself (http://www.fria.gr), or in co-operation with other research bodies, universities, enterprises, etc. The total expenses for the year 2004 amounted to EUR 1,530,097. The funding sources for implementing the research programmes and projects are as follows:

- The General Secretariat for the Development and Protection of Forests and the Natural Environment (GSDPFNE.),

- The General Secretariat for the Development and Protection of Forests and Natural Environment and the European Union (GSDPFNE + EU),
- The General Secretariat for Research and Technology (GSRT),
- The Ministry of Rural Development and Food (Former Ministry of Agriculture),
- The European Union (EU),
- The National Agricultural Research Foundation (NAGREF), and
- The Ministry of Environmental Physical Planning and Public Works,
- other sources.

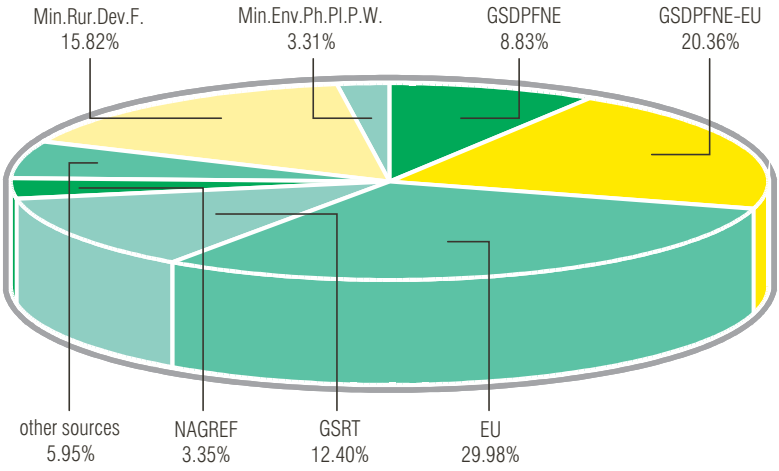


Fig. 1. Percentage distribution of expenditure for research programmes according to funding sources

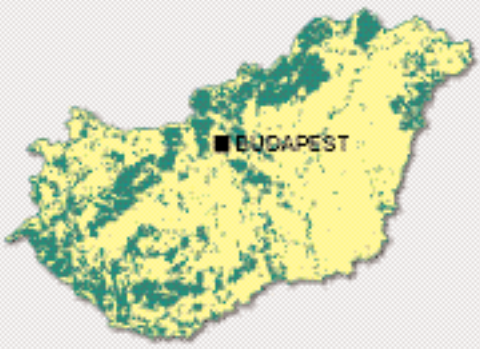
The Forest Research Institute (FRI) was established in Athens, Greece, in 1929, as the research arm of the Greek Forest Service. During its more than 70 years of operation, the Institute has achieved excellent research results, always focusing on the needs of foresters – practitioners of the Forest Service. In 1989, the Institute was integrated into the National Agricultural Research Foundation (NAGREF) and its official title became the Institute of Mediterranean Forest Ecosystems and Forest Products Technology. Both, the historical name and the official title are currently in use.

The Institute comprises eight research sectors, each covering an area of forestry research, *i.e.* Forest Management and Forest Economics; Silviculture and Forest Genetics; Forest Ecology; Forest Soils; Forest Protection; Landscape Architecture, Recreation and Land Reclamation; Forest Hydrology and Wood Technology.

Hungary

Erno Fuhrer and Karoly Redei

The Republic of Hungary
(Magyarország),
territory: 93 thousand km^2,
population: 10 million,
capital city: Budapest.



1. Forest characteristics

Hungary's natural vegetation is composed of the extensive forest-steppe areas in the lowlands covering two-thirds of the country and the beech forest communities in the Northern-Hungarian and Danube Middle-Mountain Ranges.

Floodplain forests are present in the valleys of big rivers. Today, Hungary's forest cover reaches 20%. Broadleaves are prevailing (86%) in stand composition with the greatest proportion of oak (34%) and robinia (22%).

Poplar is also an important species (10%) growing in floodplain forests and plantations.

The age structure of the Hungarian forests are characterised by a low share of older stands (nearly 4% of stands older than 100 year).

The species and age composition clearly influences stand volume which in 2003 was on the level of 180 m^3/ha (or 170 m^3/ha o forested land).

The Hungarian forests play first of all the productive function (ca 65% of land) and protection function (ca 34% of land).

State-owned forests predominate (ca 60% of land), while private forests account for 34% of the forest land of the country and are highly fragmented. The process of privatisation of forests has yet not been completed.

Table 1. National forestland and other lands directly serving forestry

Lands (under forest management plan) as of 01.01.2003.	Area (ha)
Forestland	1,823,377
Other land	131,803
Total	**1,955,180**

Table 2. Distribution by tree species

Tree species – status as of 01.01.2003	Share (%)
Oaks	20.6
Turkey oak	11.5
Beech	6.2
Hornbeam	5.7
Robinia	21.7
Other hard broadleaves	4.7
Poplars	10.3
Other soft broadleaves	5.6
Conifers	13.7
Total	**100.0**

Table 3. Distribution by age class

Age classes (years) – as of 10.01.2003	Share (%)
–20	30.3
21–40	27.7
41–60	17.2
61–80	13.1
81–100	8.0
>100	3.7
Total	**100.0**

Table 4. Changes in growing stock

Changes in growing stock – status as of:	Growing stock ('000,000s m^3)
1.01.1999	323.1
1.01.2000	325.2
1.01.2001	326.4
1.01.2002	328.8
1.01.2003	330.9

Source: State Forest Service, Budapest.

Table 5.Primary functions of forests

Forestland – status as of 01.01.2003	Share (%)
Protection forest	33.6
Production forest	64.8
Health-care, social, tourism + other	1.6
Total	**100.0**

Table 6. Distribution by ownership cathegory

Forests under land-use management plan as of 01.01.2003.	Share (%)
State-owned	58.7
Common	0.9
Private	30.7
Unsettled status	9.7
Total	**100.0**

2. The organisational structure of forest administration in Hungary

To assure the required degree of maintenance and protection of common interests in forestry, as well as to ensure controlled forest management, a specific organisational system has been in use for more than a hundred years.

The administration of forestry, as a form of land use, is assigned to the Ministry of Agriculture. Professional regulation, as well as administrative and control functions are exercised by the Department of Forestry of the Ministry of Agriculture and Rural Development. It administers and enforces sustainable and skilful forest management under long-term forest management plans provided for in the Forestry Act and supervised by the State Forest Service (SFS). The Department of Forestry is responsible for:

- organising and supervising the protection of forests; operating the forestry subsidy system (Agricultural and Forestry Fund, afforestation investments, etc.);
- evaluating and developing the guidelines for forest stand management;
- elaborating forest policy and legal regulations relating to forestry;
- acting as the last instance forestry authority;
- performing tasks resulting from the opening up of forests and wood reserves, as well as supervising the activities of the State Forest Service and the regional Forest Inspectorates;
- performing tasks resulting from Hungary's international commitments in forestry, and collecting and publishing information and statistics, including international data.

The Forest Management Plan, as prepared by the State Forest Service, is the basis for sustainable and skilful forest management and the most important tool in forest administration. The plan covers a 10-year period and includes a description of forest areas and stands (identification data, size, age, stock, composition, etc.), as well as figures representing the planned silvicultural treatments and logging operations, if any, in individual stands. Moreover, it includes detailed instructions for forest holdings, relevant land records and a detailed forest map. Restrictions on land use and projected obligatory treatments are also listed there.

The State Forest Service is a national office, with its seat in Budapest. There are eleven local offices performing fieldwork and preparing forest management plans. In order to assist

the national forest administration in decision-making, the SFS also performs certain informational and statistical tasks, as well as some limited management analysis. In accordance with the obligations resulting from the International Co-operative Programme, the SFS runs a forest health monitoring system, carrying out observations on sample plots in the framework of an international forest state monitoring programme.

Administration is performed in the first instance by ten Regional Offices of the SFS. These act on the basis of legal regulations and the prescriptions of the management plan. Within their regions, the Inspectorates operate under the state budget as independent legal entities and report directly to the Ministry. Any major changes affecting a forest stand, such as a new owner, other land use, etc., as well as any silvicultural treatments and logging operations in a forest stand need specific approval of the forest service concerned. Forest owners (users) can obtain state subsidies by applying to the relevant, first instance authority. Forest Inspectorates are entitled to impose a fine on forest owners for neglecting their obligations. Currently, the state forest administration employs 550 people.

Ownership structure

The two large groups which dominate the ownership structure of Hungarian forestry are the State (approx. 60%) and private owners (40%).

There are 22 state forest companies engaged in silvicultural, logging and other related tasks in most of the state-owned forests. At present, control over these companies is characterised by the conditions prevailing as a result of the transformation of the national economy. State-owned forests are assets of the Hungarian Treasury, a part of the Ministry of Finance. The Minister of Finance consistently exercises control over them. Nineteen of the companies are run, as if were owned by the State Holding Company for Handling and Privatising State Assets. Three of the companies belong to the Ministry of Defence.

A long-term forest stand management plan is the basis of practical forestry. It is prepared by the State Forest Service and covers a ten-year period. The management plan contains data concerning requirements and detailed, obligatory prescriptions.

In order to ensure effective and rational forest management for the scattered forests owned by private individuals and groups, the State encourages participation in common management, e.g. by way of joint tenures, forest co-operatives, etc. Forest owners and users have established their organisations to voice and represent their interests.

3. Education in Forestry

The forest industry, as a whole, can achieve high standards only when it is served by a body of trained professionals, with a solid academic background, who have access to all the latest information and research data.

Independent, state education for forest engineers in Hungary started at the beginning of the 19th century in Selmecbánya (now Banska Stavnica, Slovakia). The first independent department of forestry was founded in 1808, after being combined with a school of mining,

established in 1735, and raised to the rank of an academic institution in 1770. The Academy of Mining and Forestry, which was renamed into a College in 1904, moved to Sopron in 1918–1919 and is still in operation there. In 1962, it became the University of Forestry and Wood Industry. Today, after being extended to include a number of new faculties, it functions as the University of Western Hungary.

Currently, students can specialise in 16 fields at the School of Forestry of Sopron, and at the School of the Wood Industry of Sopron, as well as at the College of Survey situated in Székesfehérvár. In spite of certain limitations, there are regular, private and supplementary forms of education. These are optionally chosen during the first enrolment by 1,600 students, whose number is tending to increase. The average annual number of graduates is: 150 forest engineers, 40 wood-industry engineers, 30 plant engineers of the wood industry, 5–10 paper-industry engineers, 5–10 engineers of other light industries, 50–60 qualified surveyors and 20–30 engineer-teachers.

In Hungary, the secondary technical school level of state education in forestry dates back to 1883 (some experimental forms of training of foresters can be traced back to the end of the 18th century). At present, there are secondary schools for the training of foresters and forest technicians in Szeged, Sopron Mátrafüred and Barcs. Every year, 200 foresters graduate from these schools.

Skilled forest workers have been trained in large numbers since the 1950s. Currently, the state schools of Ásotthalom, Szõcsénypuszta and Piliscsaba train forest workers in line with the National Labour Classification System (in silviculture and logging, as forest machine operators).

4. Forest Research

The relevant state institute of research in Hungary now operates under the name of the Hungarian Forest Research Institute. It was established in 1898, having its headquarters at Selmecbánya. Organisationally, it was linked to the Academy of Mining and Forestry, but had a separate budget and independent statute. The Institute operated four experimental stations based on the technical and human resources of four different, regional forestry schools.

In 1919, the Institute was transferred to Sopron. The Institute has expanded after the Second World War to include the headquarters in Budapest. Its experimental stations operated in Sopron, Sárvár, Gödöllõ, Püspökladány, and Mátrafüred. There are more than 1,500 experimental plots, three arboreta, etc. run by the Institute in various regions of the country. Its main areas of scientific work are: forest economy, forest ecology, forest protection, forest pathology, silviculture and yield study, plantation forestry, and genetic improvement of plants. There are 102 personnel in total, including 26 researchers.

Research work in forestry and the wood industry is also carried out by the Faculties of Forestry and Wood Sciences of the University of Western Hungary in Sopron.

The research activity is financed partly by the budget of the organisations concerned, and partly under State contracts and various State agencies' tenders.

The Forestry Committee of The Hungarian Scientific Academy supervises the conditions of research under sectoral, scientific programmes, verifies report results, highlights research problems and seeks solutions. It devises and implements research strategies, focusing on the long-term aims of the Hungarian forestry. It also encourages young researchers to actively partake in the research.

Based on:

Barátossy, G.-Csóka, P.-Dauner, M., et al.: Hungarian Forestry, Földmûvelésügyi Minisztérium Erdészeti Hivatala, Budapest, 1996, 36 pp

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Földmûvelésügyi és vidékfejlesztési értesítõ. Magyar Hivatalos Közlönykiadó, Budapest, HU ISSN 14190303, vol LIV 2003 no. 23 p 3366.

★ Ireland

Marta Topczewska

Éire,
territory: 70,300 km²,
population: 4 million,
capital city: Dublin.

1. Forest characteristics

Forest area and species composition

Covering 680,000 hectares (forest area per capita is 0.17 ha) at the end of 2004, forests occupy less than one-tenth of Ireland's national territory, making it one of the least forested countries in Europe. Plantations make up most of the area of forests, with some remnants of forests being undisturbed by humans; none is classified as semi-natural. Virtually all forests are available for wood supply. The plantations are mostly young, with the principal species being introduced, mainly Sitka spruce and lodgepole pine. In Ireland, 79% of forestland constitutes coniferous and 21% broadleaved forest tree species.

The area of forest has been increasing rapidly (3% per year in the 1990s), as a result of afforestation programmes, with the share of broadleaved species gradually increasing. Net annual increment is above the European average, especially in the plantations, because of intense management and favourable growing conditions. Net annual increment is considerably higher than annual felling because of the age-class structure of stands. Ireland's forests are relatively free from pests and diseases and the effects of air pollution.

Within the past 15 years or so, the structure and scale of Irish forestry have changed dramatically. Annual afforestation increased from some 7,000 hectares in 1986 to an average of 17,000 hectares in the 1990s (24,000 ha in 1996).

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Total volume and current increment of stands

Standing volume is 50,859,000 m^3 over bark. Average annual increment is 3,353,000 m^3 over bark, and annual felling is 2,738,000 m^3 over bark (2002).

2. Logging and wood processing

Ireland has small, but growing roundwood production commensurate with its expanding forest cover. Most of the roundwood produced in Ireland (approximately 94 %) is harvested from the plantation forests owned and managed by Coillte Teoranta. The incremental volume of total forestland, excluding plantations under ten years of age, amounts to 3.3 million cubic meters annually, of which about 80% is harvested, depending on market demand.

The majority of wood production consists of softwood logs for the domestic sawnwood and board industry. The sawmill industry has increased its capacity over the past few years and therefore the demand for log imports is growing. Ireland has a relatively large oriented strand board (OSB), particle board, fibre board and medium-density fibreboard (MDF) industry, and part of the production is exported. Ireland imports all of its paper and nearly half of its sawnwood. The Irish market for construction timber has grown substantially in recent years. Consumption of forest products per capita is around the European average level.

Roundwood production in 2002 amounted to 2.71 million cubic meters (over bark), an increase of 6% over the previous year's production.

The overall consumption level for timber in 2002 was estimated at over 1.4 million cubic meters, up on the 2001 demand of 1.2 million cubic meters. Exports increased, especially the export of construction materials to the GB market.

Primary processing of timber output from Irish forests comprises two complementary sectors: sawmills and boardmills. There are currently 6 large sawmilling firms, 10 medium--sized mills and over 30 small mills in Ireland. The 10 largest of these employ some 1,100 people. Some 16,000 people are employed directly and indirectly in Irish forestry throughout the country. The development of Irish forestry should allow the country to eventually become self-sufficient in wood products.

Among non-wood forest products and services, Christmas tree production and tourism are most important.

Wood, as an energy source has not been developed beyond a local scale.

3. Forest protection

Protected forests of Ireland are divided into two classes according to the MCPFE Assessment Guidelines which pave the way for collecting comparable data and presenting comprehensive information on protected forests:

- MCPFE class 1.2 means protected forests designated for the conservation of forest biological diversity and managed allowing a minimum of human intervention. These charac-

teristics often apply to the core zones of national parks. In Ireland, this class covers 2,854 hectares.

- MCPFE class 1.3 means forest areas which are actively managed to conserve biological diversity. In Ireland, they cover 4,850 hectares.

Generally, protected forests in Ireland account for 1.2% of total forests. Much of Ireland's remaining indigenous forest is protected in National Parks, Nature Reserves and SACs (under the Habitats Directive).

Ireland boasts a rich archaeological heritage. Sites and monuments are widespread throughout the country and occur in many forest areas, frequently on sites where planting is being considered. The national forest policy is to conserve this rich heritage within the existing and potential forest areas.

4. Legal and organisational aspects of forestry

Forest law

Forestry is a regulated and controlled sector in Ireland. In addition to the Forestry Acts, other national laws covering environmental protection, wildlife (including fisheries), planning and development, health and safety, water pollution, roads, etc. govern forestry development in Ireland.

The current forest legislation comprises the Forestry Acts of 1946, 1956 and 1988. The Forest Service is currently in the process of revising, extending and consolidating the Forestry Acts in order to provide a workable legislative framework to safeguard and assist in the expansion of the forest sector in Ireland within the context of sustainable forest management.

The new Forestry Acts will consolidate all previous forest legislations into one. While many of the existing provisions remain unchanged, it is proposed that the new act contain a number of significant changes and initiatives, which will:

- incorporate the principles of sustainable forest management;
- address the Minister's powers in relation to the framing of regulations controlling the management of forests and forestry-related activities;
- regulate the annual harvest;
- address deforestation and illegal felling;
- consolidate, on a statutory basis, the forestry permit system, environmental impact assessment (EIA) and appeals procedure;
- facilitate the provision of information on the Irish forestry sector; and
- consolidate Coillte corporate governance.

Current forest legislation in Ireland:

- The Forestry Act 1946 contains provisions, *inter alia*, for the promotion of forestry, the development of afforestation, and the production and supply of timber. Its provisions also cover the compulsory acquisition of land, the creation of rights-of-way and the

introduction of restrictions on cutting down and injuring trees. The Act also covers the licensing of tree felling and reforestation obligations.
- The Forestry Act 1956 facilitates the acquisition of land for the purposes of the Forestry Act 1946.
- The Forestry Act 1988 makes further provision for the development of forestry through the establishment, for that purpose, of a private limited company (Coillte Teoranta) and for the assignment to the company of the functions heretofore exercised by the Minister. Coillte's shareholders include the Minister for Finance and the Minister for Communications, Marine and Natural Resources.
- Statutory Instrument No. 538 of 2001 introduced a statutory consent system with regard to initial afforestation.

A wide range of consultation processes is undertaken within Irish forestry with a view to integrating local communities in sustainable forest management programmes.

Ownership structure, access of forests to society

58% of forests in Ireland are owned by the State, but this share is declining, as private owners have come to account for a much greater share (almost three-quarters) of new forest planting. Eventually, farm forestry is emerging as a major new component of the sector. The number of public forest holdings is 152, and of private forest holdings is 21,386 (2001).

Ireland's forests represent a significant recreational resource, particularly for Ireland's growing urban population. The number of visits per year has been estimated at 8.5 million. Coillte operates a general 'open forest' policy in its forest estate, which accounts for 6.5% of the national land area. Considerable areas of woodland are also contained within Ireland's network of designated National Parks, managed by the National Parks and Wildlife Service.

5. The structure and tasks of national forest administration

The national forest authority in Ireland is the Forest Service of the Department of Agriculture and Food. Its remit is to develop forestry in Ireland in a manner and on a scale that maximise its social, economic and environmental contribution to the national well-being on a sustainable basis.

Its strategic objectives are:
- to foster the efficient and sustainable development of forestry;
- to increase quality planting;
- to promote the planting of diverse species;
- to improve the level of farmers' participation in forestry;
- to promote research and training in the sector;
- to encourage increased employment in the sector.

The main strategy of the Forest Service is to develop the forestry sector via a range of financial incentives by:

- intensifying planting and increasing the range of species planted;
- facilitating the development of the forest processing sector; and
- training farmers and others in forest management techniques.

The objectives of the Forest Service and of the Irish government in relation to forestry are set out in the Irish National Forest Strategy: Growing for the Future – A Strategic Plan for the Development of the Forestry Sector in Ireland – 1996.

Further to the initiatives outlined above, the Forest Service has supported a wide range of relevant organisations and initiatives aimed at promoting various cultural aspects of Irish forestry:

- **The Tree Council of Ireland** (TCI) is an umbrella body comprising almost 50 organisations – from statutory to voluntary – with an interest in trees and forests in Ireland. TCI is involved in a range of activities and initiatives aimed at promoting the cultural role of trees and woodlands in Ireland.
- **The People's Millennium Forests Project** is a project aimed at restoring 16 native woodland sites throughout the island of Ireland.
- **The Woodlands of Ireland** is a partnership involving those with an interest in native woodland conservation, from statutory bodies to environmental NGOs and individuals. Its aim is to promote the enhancement and expansion of Ireland's native woodlands and to increase public awareness of their value.
- **Sculpture in Woodland** was founded in 1994 to promote wood culture in Ireland by creating a greater awareness of wood as an artistic and functional medium.
- **The Tree Register of Ireland** (TROI) is a project set up in 1999 to identify and collect information on remarkable trees in Ireland by virtue of their age, rarity, height, girth, historical or cultural associations, etc.
- **Networks for Nature** is an organisation aimed at raising awareness among landowners, practitioners and general public of the natural and cultural values of Ireland's hedgerows and of the need for appropriate management.
- **Conservation Volunteers Ireland** (CVI) is an organisation aimed at providing practical opportunities for groups and individuals to protect and enhance Ireland's natural and cultural heritage, through practical projects, training courses and educational programmes.
- **Muintir na Coille – The Coppice Association of Ireland** was initiated in 1995 with a view to maintaining or enhancing species and structural diversity through small-dimension timber production. The association members provide demonstrations and workshops on crafts, carry out rustic projects, supply raw material and provide advice on traditional forms of woodland management.

The State forestry company Coillte Teoranta (the Irish Forestry Board) was established in 1989 and has since brought a clearer commercial focus to public forestry, placing an emphasis on cost effectiveness and efficiency, and generating substantial profits in recent years. Coillte Teoranta is the largest landowner in Ireland, with a forest estate of 442,000

hectares, of which almost 384,000 hectares are forested. Coillte is committed to the concept of sustainable forest management and in mid-2001 was awarded Forest Stewardship Council (FSC) certification.

Coillte is divided into 36 Forest Management Units (FMUs). The management of each FMU follows a 5-year plan that is based on a public consultation process.

Its principal objectives are:

- to operate in forestry and related activities on a commercial basis and in accordance with efficient silvicultural practices;
- to establish and carry on woodland industries;
- to participate with others in forestry and related activities; and
- to utilise and manage the company's resources in a manner consistent with the above objectives.

Forms of forest owners associations

The Irish Timber Growers Association (ITGA) was formed in 1977 to support the development and expansion of private sector forestry in Ireland and to represent and inform woodland owners.

It is now the recognised national representative body of private woodland owners in Ireland. The Association is particularly concerned that private plantations achieve their maximum potential through the implementation of good forest management practices.

To ensure good returns from forestry, plantations must be properly established and actively managed throughout their life. To this end, the ITGA provides valuable support to its members. This support includes: delivery of Newsletters, Annual Forestry & Timber Yearbook, practical forestry research information, organisation of Fielddays, Seminars and meetings, provision of advisory services, and representation.

The ITGA receives funding from the Forest Service of the Department of Agriculture and Food under the National Development Plan 2000–2006.

In 1985, the Western Forestry Co-operative was set up, with the seven main co-operatives in western and north-eastern counties being its only members. The objectives of this new association were:

- to increase farm income by bringing marginal areas into productivity;
- to create employment in remote rural areas;
- to provide a planned and co-ordinated approach to farm forestry, to maximise its commercial, environmental and social impact on farmers and rural communities. In the association's attempts to attain these objectives, the support of the Forest Service through a number of EU initiatives has always been a critical element.

Whether the programme has been a success can best be judged from the fact that the number of farm forestry co-operatives has increased to almost 2,400.

The association is forming closer links with the Irish Timber Growers Association. This is nothing new, as the two organisations worked closely in the past.

6. Forestry educational systems

Forestry education opportunities in Ireland:

- University College Dublin's (UCD) forestry degree programme has a long tradition and since 1927 many foresters have been educated. Students can acquire Bachelor's and Master's degrees in forestry.
- In Galway-Mayo Institute of Technology there is an engineering course available where it is possible to earn a degree of Bachelor of Science in forest management. This is a three-year full-time course.
- The Irish Agriculture and Food Development Authority (Teagasc) is organising vocational certificate courses in forestry. This two-year course provides training for people who wish to take jobs in forestry as forest workers and supervisors.
- The Waterford Institute of Technology, School of Science holds a three-year course in forestry. The graduates receive degrees in forest science.
- University of Limerick carries out a four-year course in wood science and technology, after which a Bachelor of Science degree is given.

Two demonstration forests have been developed to illustrate to forest practitioners and others various silvicultural approaches used in Irish forestry, including traditional systems. The first, Brackloon Wood in Co Mayo, illustrates the methods used to restore the native Atlantic oakwood. The second, Balrath Woodland in Co Meath, is aimed specifically at the general public and is an educational base for young people.

7. Forest research

The promotion of research on forestry and forest products is, *inter alia*, dealt with by Coillte Teoranta. To this end, it provides financial support to the Council for Forest Research and Development (COFORD) which co-ordinates forestry research in Ireland.

Through COFORD, research is being carried out into the potential of continuous cover forestry (CCF) in Ireland in the Department of Crop Science, Horticulture and Forestry, University College Dublin. The Forest Service supports the Irish branch of ProSilva in its efforts to promote the application of CCF principles in Ireland.

COFORD was established in 1992 and its objectives are:

- to co-ordinate all forest and forest product research in Ireland and be a link between industrial need and research competence;
- to advise the Minister on research programmes for the sustainable development of the Irish forest sector, including costing and funding issues;
- to co-ordinate the implementation of approved research programmes funded by the Exchequer and the EC;
- to recommend to the industry all programmes and projects to be funded or part funded by them;
- to encourage industrial funding of forest and forest product research;

- to encourage Irish participation in EU forest research programmes, including those in developing countries;
- to ensure proper dissemination of forest research findings.

The COFORD programme is funded mainly by the government, but public/private partnerships are encouraged where the results of the research will directly benefit a particular sector of the industry.

The Society of Irish Foresters is an important vehicle in the dissemination of scientific forest-related knowledge. Founded in 1942, the Society is a representative body for the forestry profession in Ireland. It publishes a scientific journal Irish Forestry and organises field days and seminars where scientific findings are presented and discussed.

The current annual expenditure (by the State, the EC (Framework Programme) and private institutions) on forest and forest product R&D (excluding furniture) is running at close on EUR 5 million, or about 1% of the annual gross product value of the forest industry.

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★ Italy

Susanna Nocentini

The Italian Republic
(La República Italiana),
territory: 301,300 km²,
population: 58 million,
capital city: Rome.

1. Forest characteristics

Forest area

Italy occupies a long peninsula stretching from the Alps into the central Mediterranean Sea with a mountainous 'backbone'. Forest and other wooded land account for almost two fifths of the national territory, half of it being high forests, and coppices the rest. Because of its long North-South extension and the wide range of altitudes, a large variety of forest types, flora and fauna can be found there.

As shown in Table 1, the main part of forestland is situated in the mountainous and hilly areas (about 60% in the mountains, 35% on the hills, and only 5% on the plains). Soil and water conservation is, at the same time, the main objective of and constraint to forest management in these areas. Strict regulations (*i.e.* only light, selective fellings and silvicultural regimes based on natural regeneration are allowed, clear-felling in high forests is prohibited, road construction in forest is restricted) are imposed on 92.4% of forestland.

The National Forest Inventory carried out in 1985–1986 is the most important source of forest data. Another source of forest data is the second NFI carried out by the National Forest Service. This new inventory has been designed to collect new information, in particular on the role of forests as carbon sinks. The first inventory phase has already been completed.

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Table 1. Forest area by zone

Forest area	Mountain		Hill		Plain		Total	
	59.84%	%	35.19%	%	4.97%	%	100.00%	%
Coniferous forests	1,171,277	28.88	217,662	9.13	50,811	15.10	1,439,750	21.25
Broadleaved forests	674,721	16.64	353,614	14.83	129,570	38.51	1,157,905	17.09
Mixed forests	220,893	5.45	114,819	4.81	15,328	4.56	351,040	5.18
Coppices	1,585,352	39.10	1,154,624	48.41	81,147	24.12	2,821,123	41.63
Coppices with standard	386,188	9.52	361,653	15.16	32,900	9.78	780,741	11.52
Maquis	16,563	0.41	182,543	7.65	26,704	7.94	225,810	3.33
Total	**4,054,994**	**100.00**	**2,384,915**	**100.00**	**336,460**	**100.00**	**6,776,369**	**100.00**

Source: ISTAT, 1995 – Forest Statistics.

Table 2. Categories and area of forest land

Category	Are		Type	Are	
	(ha)	%		(ha)	%
High forests	2,178,900	25.1	even-aged	1,176,300	54.0
			uneven-aged	554,500	25.4
			irregular	377,100	17.3
			transitional (in conversion)	71,100	3.3
Coppice forests	3,673,800	42.3	simple	2,751,300	74.9
			with standards	922,500	25.1
Specialised production forests	288,900	3.3	timber	134,100	46.4
			non-timber products	154,800	53.6
Other forests	2,160,900	24.9	rocky	575,100	26.6
			riparian	110,700	5.1
			Shrubs	1,475,100	68.3
Non-wooded inclusions	372,600	4.4			
Total	**8,675,100**	**100.0**			

Source: ISAFA, 1985.

The 1985 NFI adopted a broad definition of forestland, including land covered by shrubs and scattered trees. According to this inventory, forests in Italy cover more than 8,675,100 hectares, or 29% of total national territory. High forests take up about 25% of this area, and coppices – more than 42%. The remaining 33% include 'specialised production forests' (*i.e.*, plantations of timber or wood paste production, tree farming, or non-timber production forests: cork, chestnuts, etc.), and 'other forests', such as scrubs, maquis, rocky or riparian forests, all rarely managed (Table 2).

Most of the species are native or spontaneous; a few exotic species are generally used for industrial forestry ('special forest crops' category).

Species composition

In high forests, conifers predominate, both with regard to the area they occupy (56.3%) and timber volume (63.1%). The most important species is Norway spruce (*Picea abies* Karst.), followed by mountain pines (*Pinus sylvestris* L., *Pinus nigra* Arnold, *P. laricio* Poiret) and European larch (*Larix decidua* Mill.). Most of coniferous forests are situated in the Alps (mountain and subalpine spruce, fir, larch forests), but some important ones (*Pinus laricio* Poiret) can also be found in the Southern Apennines. Broadleaved species (both in high forests and coppices) make up two thirds of total growing stock, the principal species being beech (*Fagus sylvatica* L.), deciduous and evergreen oaks (especially *Quercus cerris* L.), poplar and chestnut.

During the last 130 years, the forest area in Italy increased from 5,300,000 hectares in 1870 to 6,860,000 hectares in 2000. After a continuous decline in forest area following the end of the First World War (1918), growth was noted and the forest area had progressively increased until 1945. Since the 1950s, forests again have begun to expand, mainly because of the natural colonisation of the abandoned agricultural lands (Source: Statistics Office of the State Forest Service). The most recent estimate is EUROSTAT – 1998, based on a common, international definition of forest (minimal cover 10% and minimal area 0.5 hectare). According to this estimate, forest area in Italy is 9,857,000 hectares, including 6,860,000 hectares of high stands, coppices and shrubs and maquis, while the remaining part is represented by small woodlots (rocky, riparian forests or shrubby vegetation) (Source: Statistics Office of the State Forest Service).

Three-fifths of the Italian forests is considered available for wood production, and two fifths are classified as not available, partly for conservation and partly for economic reasons. Virtually, all forests are semi-natural, with some areas of plantations, including introduced species, such as some poplar species, Douglas fir, radiata pine and eucalyptus; the area of forest and other wooded land undisturbed by man is small. Soil and water conservation is the main goal and constraint of forest management. In fact, forestry practices are carefully controlled and restricted under specific rules, aiming at sustainable planning and management of forestland. Clear-cutting of high forests has recently been forbidden, and operations leading to natural regeneration, such as selection systems and shelterwood systems (group, strip and edge), are strongly encouraged. This kind of management has determined shifting of many even-aged forests (developed from past clearcutting or afforestation) to uneven-aged or irregular forests. Coppices are largely widespread, especially with private owners. The most common system is a simple coppice with two rotation standards left to favour seed production and substitution of old stumps. The selection system has been applied in many beech coppices, especially in public properties in mountain municipalities. Compound coppice (coppice with standards) is a system which has been used in some areas of central Italy for pure or mixed oak stands. More and more coppice stands, especially on public properties, are being converted to high forest. Another important aim of Italian forestry is to foster natural diversity and evolution in forests; therefore mixed forests are promoted and the spontaneous re-colonisation of broadleaved species in coniferous plantations is strongly encouraged nowadays.

Volume and increment

The national wood volume of high forests is about 405 million m^3 (about 211 m^3/ha), with a total annual increment of 15,127,900 m^3 (7.9 m^3/ha/year on average). Taking into consideration only trees with d.b.h. >17.5 cm, the total growing stock lowers to 341 million m^3, and the current annual increment is 5.1 m^3. Among spontaneous species, spruce and beech show greater averaged increments (9.4 m^3/ha/year and 8.5 m^3/ha/year, respectively). Currently, the annual harvesting in high forests seldom exceeds 50% of the annual growth, and harvesting accounts for 35% of the current increment, on average. The mean annual harvesting is the only information available in official statistics, and estimated between 9 and 7 million cubic meters, but many authors admit that the data reported in official statistics may represent only a half of the current harvesting.

2. Logging and wood processing

Italy is the major consumer, producer and trader of forest products in Europe. Its share in the European paper and wood-based panel production accounts for nearly 10%. The paper industry is based mainly on imported pulp. However, the country is the biggest producer and consumer of non-wood fibre pulp in Europe. Italy is also the major importer of lumber. The large and dynamic furniture industry exports a half of its production and is the major consumer of panels and sawnwood. Consumption of forest products per capita is around the European average level.

The bulk of industrial activities are based on the import of raw materials and semi-finished products, while domestic supply is only capable to cover small niches of the market (poplar logs used for plywood and mechanical pulp production, coniferous timber applied in construction activities in some mountainous areas, etc.).

In Fig. 1, data on production, exports, imports and apparent consumption of semi--finished products is presented. It is noteworthy that Italy is the major importer of semi--finished products, being a leading exporter of certain finished products, like furniture, window frames and special-use paper. By 2002, Italy had been the biggest exporter of furniture worldwide, while currently it is the second-in-line after China. In the future, the process of de-location will probably bring about a reduction in domestic demand (or a stabilisation of imports) of semi-finished products.

Despite its large wooded surface area, domestic supply of timber is limited and not evenly distributed in Italy. According to ISTAT (2000), the total amount of utilised timber was 9,242,130 cubic meters, including fuel wood (59%) and industrial roundwood (41%). The latter is mainly (70%) represented by broadleaves (45% coming from poplar plantations) and used as sawnwood (53%), panels and pulp (20%), agricultural poles (13%) and other semi-finished products (14%). The significant volume of industrial roundwood originating from poplar plantations illustrates a low utilisation rate of natural forests. This situation results from various causes, but mainly is due to the fact that most Italian forests grow in mountain areas, where the costs of felling and logging operations are high, and forest

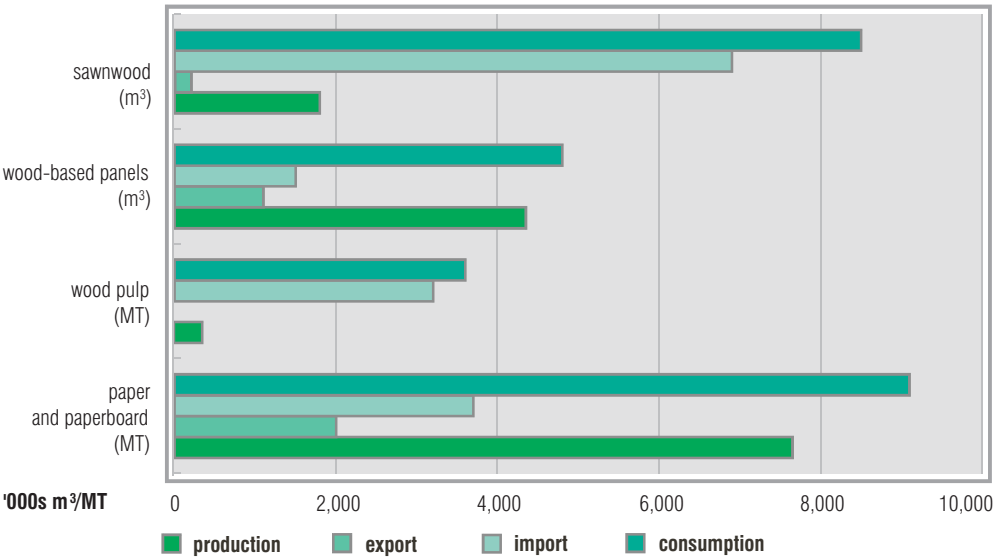

Fig. 1. Imports, exports, production and consumption of wood products in Italy (Source: FAO-ECE Timber Committee)

management must comply with the strict forest policies aimed at soil conservation and watershed protection. All this makes Italian timber non-competitive in comparison with that coming from the neighbouring countries. The recent investigations show (no official statistics exists on this issue) that there are 8,000–9,000 forest enterprises in Italy that employ around 24,000–28,000 forest workers (including both, part-time and full-time employees).

The economic role of the forestry sector in Italy is rather minor. Following the Italian accounting system, the Gross Domestic Product from the forest-related activities (wood and non wood forest products) represents only 1.2% of the GDP of the primary sector (average of the last 20 years) and 0.05 of total GDP. The GDP of the woodworking sector is about 6% of GDP.

In rural areas, firewood production is an important underground economy developed locally.

The Italian wood industry is the result of an age-old manufacturing tradition in woodworking. Most industries operating in the sector have more than 100 years of working experience; a number of them are still handicraft firms, while only a few have reached the status of proper wood industries during the recent decades. Figures in Table 3 summarise the strong and weak points of the Italian wood sector.

The wood industry sector covers all phases of the production chain. It consists of 87,900 firms with more than 413,000 employees. The wood sector is a relevant component of Italian economy. With its strong contribution to GDP (5–6% on average) it is, together with fashion, one of the most important sectors of the 'Made in Italy' mark known worldwide. The weak point is that more than 60% of the raw material (wood) is imported; more than 50% of the Italian wood production is firewood. The woodworking firms (industries and/or handi-

Table 3. Italian wood manufacturing sector in figures

Production value	Millions of euros	38,100
Export	Millions of euros	12,578
Import	Millions of euros	5,463
Balance	Millions of euros	7,115
Employment	Unit	423,782
Employment in firms with more than 20 employees	Unit	128,278
Firms	Number	87,900
Firms with more than 20 employees	Number	2,865

Source: Federlegno-Arredo, 2003.

crafts) are distributed throughout the whole Italian national territory. Moreover, from the economic point of view, the woodworking process is based on small and medium-sized companies and clusters (industrial districts with a high level of specialisation/integration of industries). Triveneto (Veneto, Friuli Venezia Giulia, Trentino), Lombardia (Brianza), Toscana, Marche and Puglia are the major geographic areas where the districts are located. These areas generate 60% of the Italian exports.

3. Forest protection

Soil and water protection are the long-lasting major goals of Italian forest management, due to the very irregular, morphological features of the country. At the same time, the national demand for recreation and nature-use has significantly increased in recent decades.

The NFI distinguishes Italian forests on the basis of their prevailing function, as shown in Table 4.

Table 4. Woodland categories and prevailing functions

Category	Prevailing function (%)			
	productive	protective	ecological	recreational
High forests	72.7	18.6	8.5	0.3
Coppices	82.2	14.3	3.5	0.1
Plantations	100.0	0.0	0.0	0.0
Other forests	4.8	89.3	5.7	0.2

Sources: ISAFA, 1985.

Italian forests are really multifunctional, but only scarce data is available on all their social functions. Italy hosts three of the bio-geographic regions recognised by the EC Habitats Directive, thus it houses a wide variety of vegetation types (150).

4. Legal and organisational aspects of forest holding

Forest law

Only sixty years after the unification of the Italian State (1861) the Central Government became finally able to outline forest policy and adopt important laws in this sector (Colpi *et al.,* 1999). The most important national law of 1923 is still in force, yet currently forests are managed under regional regulations conforming to the relevant national legal framework.

The provisions adopted at national level in the period 2000–2002 are of particular significance and can be summarised as follows:

- The National Act No. 353 of 21 November, 2000: new law on forest fire control which replaced the old one of 1975.
- The National Act No. 57 of 5 March, 2001: general law containing provisions on the improvement of the market conditions to favour the sustainable development of the forestry sector. According to the criteria and principles set out by the Ministerial Conferences on the Protection of Forests in Europe (MCPFE), it supports the creation of new jobs (especially for young people) and provides for combating damage caused by forest fires and for the implementation of eco-certification programmes.
- The National Act No. 227 of 18 May, 2001: new forest law which replaces the old one of 1923. It provides for a new, general framework for the actions to be implemented by the Regions, mainly at local level, gives the definition of forest, and promotes the forestry-related activities, forest research and information. Moreover, it provides for the establishment, within the National Council for Economics and Labour (CNEL), of a National Observatory for the Marketing of Forest Products and Services entrusted with a task to promote activities following the principles of sustainable forest management.
- The Decree No. 124 of 19 April 2002 of the Ministry of Economics and Finance provides, *inter alia*, for an opportunity for forest owners to write off from their taxes a significant part of their expenses relating to the improvement in the management and protection of forests; this measure aims at preventive actions in woodlands, especially where the risk of forest fires is high.
- The National Act No. 120 of 1 June 2002 which represents Italy's ratification of the UNFCCC Kyoto Protocol relating to 'carbon sink'. The process of drafting new guidelines for its implementation and for the updating of those of November 1998 is ongoing.

The Italian National Forest Programme (PFN), as developed under the direction of the Ministry of Agriculture and Forestry, was launched in 1987 and expired in 1997. Nevertheless, its guidelines are still valid and complied with, because they are in line with the international recommendations, and were confirmed in 1998. Despite the absence of a new NFP, a general framework for the activities to be carried out in agriculture and forestry in the period of 2001–2003 is provided in a plan drafted by the Ministry for Agricultural and Forest Policies. This document underlines the close, mutual integration of the agricultural and forestry sectors, and recognises the importance of sustainable forest management for the conservation of natural resources and implementation of the fundamental socio-economic role of forests.

Since January 2000, the NFP's role has in practice been carried out by the Regional Rural Development Programmes (PSR), as drafted and implemented by 19 Regions and 2 Autonomous Provinces enforcing UE rules. These Programmes were operated from 2000 to 2006, as a framework for all agriculture- and forestry- related activities, at local level.

Ownership structure

Forest land in Italy is in private (60%) and public ownership (40%). The local municipalities possess a large proportion (68%) of public-owned forests. The average size of the private-owned forest property is 7.51 hectares (General Census of Agriculture, 2000). Privately owned woodlands are usually very scattered and seldom kept within a forest management plan. That is one of the major problems of the national, active management of forest resources.

Distribution of forest types by the ownership category and management regime is presented in Table 5.

Table 5. Italian forests by ownership category and management regime ('000s ha)

	State and Regions	Municipalities	Other public	Private	Total
High forests	198	1,019	193	1,379	2,789
– Coniferous	111	636	103	588	1,438
– Broadleaved	87	383	90	791	1,351
– (of which poplar)	4	4	5	105	118
Coppices	148	600	167	1,932	2,847
Compound coppices	30	157	32	548	767
Total	**376**	**1,776**	**492**	**3,859**	**8,403**

Sources: ISAFA, 1985.

The following box presents recent data on the forest ownership structure (data refers only to the actively managed land, not to the whole Italian forest land).

Data on Italian forest enterprises (Agricultural Census 2000):

- Number of enterprises with semi-natural forests = 605,222
- Number of enterprises with plantations = 54,672
- Total = 659,894 enterprises with some forest land
- Semi-natural forests within active farms = 4,548,158 ha
- Land used for plantations in active farms = 162,652 ha
- Total forest land = 4,710,810 ha
- Number of enterprises with >100 hectares of forestland (semi-natural forests) = 6,648
- Number of enterprises with >100 hectares of plantations = 1,103
- Total number of forest enterprises with >100 ha = 7,751 (= 25.4% of the total number of enterprises in Italy = 2,593,090)

Public access to forests

Likewise in other Mediterranean countries, the social and economic role of non-wood forest products (NWFP) is traditionally of high importance for local communities in Italy (Table 6). Market demand for chestnuts, hazelnuts, mushrooms, truffles, berries is so high that almost all the Regional Administrations have introduced property rights regulations to control the collection of NWFP. These products are no more public free-access goods, but products which can generate a remarkable source of income to forest owners and their associations (Colpi *et al.*, 1999). For example, specific provisions on gathering mushrooms have been set forth, because community pressure was too high (Croitoru and Gatto, 2001).

Collection of natural products is generally forbidden in private gardens, in forests close to houses, or when cultivation is licensed (e.g. truffle). Restrictions usually do not apply to forest owners; they may pick up unlimited quantities without a permit or under a permit, but free of charge (Mantau *et al.*, 2001, p. 452–455).

Table 6. Production of major non-wood forest products in 2000

Chestnut	'000s tonnes	63.2
Cork	'000s tonnes	14.5
Hazelnut	'000s tonnes	14.2
Pine-kernel	'000s tonnes	3.3
Acorns	'000s tonnes	2.7
Strawberries	tonnes	212.4
Blueberries	tonnes	125.8
Truffle	tonnes	97.9

Source: ISTAT, 2003.

After the recent review of the Italian Constitution, the central governmental authorities have delegated the entire competence in the forestry and hunting sectors to the Regions (Italian Constitution, Article 117). The Central Government maintains a role in the provision of a general planning framework in the sector. Hunters have free access to private forests if these are not closed for specific purposes. The National Act (Legge Nazionale) 157/92 provides for the opportunity to sell hunting rights to special hunting enterprises (Aziende Faunistico-Venatorie). The number of individual hunters has been constantly decreasing from 1.5 million in 1986 to almost half of it in 1999 (821,000 hunters). Meanwhile, the number of hunting enterprises has increased (ISTAT, 2003).

The Italians used to come to forests for tourism and recreational purposes 4 times a year, and each time they spent 3 hours and 45 minutes there, on average. The number of forest visits decreases from Northern to Southern Italy. 2% of all visitors to Italian forests are foreigners (Scrinzi *et al.*, 1995).

According to the NFI, 2% of the forest area was specific for the production of NWFP; the area of 17,100 hectares (or 0.2 % of the total forest area) was classified as forests with a prevalent tourism–recreational function.

Forest certification

Forest certification represents a field relating to sustainable forest management. Although the harvest of productive wood from Italian forests is very low, Italy is ranked among the top wood processing and furniture making countries in the world. Here, the impact of forest certification is significant and still increasing. FSC standards were adopted in Italy in 2001. About 22,000 hectares of plantations and natural forests are currently certified under the European Programme. The FSC scheme is considered rather unsuitable for Italian forests due to the fact that they are too small and too fragmented. Nevertheless, FSC Italy manages training courses on forest certification and the chain-of-custody. Reportedly, a good number of firms working in the wood-processing sector have already acquired certification for the chain-of-custody. In 2001, Italy submitted its national forest certification scheme to the Pan-European Forest Certification (PEFC) authority, which is now subject to the PEFC endorsement process.

Forms of forest holdings and public forests

According to the general census of agriculture (ISTAT, 2000), the number of agricultural farms with forests is 605,222, with an average area of 7.51 hectares. They fall mostly in the class of a smaller area-average (<5 ha, see Table 7).

Table 7. Land structure of agricultural farms with forests

Size (ha)	Forest area (ha)	Number	Average area	Share (%)	
				number	area
<5	258,128.62	361,375	0.71	5.67	59.71
5–20	498,938.43	168,073	2.97	10.97	27.77
21–100	748,153.88	62,564	11.96	16.45	10.34
>100	3,043,047.91	13,210	230.36	66.91	2.18
Total	**4,548,158.84**	**605,222**	**7.51**	**100.00**	**100.00**

Source: ISTAT, 2000.

Owners of small forest estates practically do not invest in their management. Once, forest management used to be a job complementary to farming activities, but now it is almost neglected.

According to the recent agricultural census (2000), the wooded area of agricultural firms decreased during the last decade by about 14%, while the total number of agricultural firms which own or manage forests decreased by about 18%.

5. The structure and tasks of the national forest administration

The Ministry for Agricultural and Forestry Policies is the supreme forest policy authority responsible for co-ordination of the regional policies which are autonomous.

In the last decade, the Italian National Government started a relevant decentralisation process. The process is still going on. This applies particularly to its last part (devolution to the level of Provinces and Municipalities). However, implementation of most of the development policies (rural and regional development) is currently performed at regional level. The role of the central administration is only confined to coordination of regional policies and representation in EU institutions. To some extent, it also plays the role of a policy-maker, mainly as regards the industrial sector.

Forms of private forest owners associations

Since the early 1990s, an important increase in the number of forest associations and unions has been noted, including the National Federation of Forest Associations (Federforeste). In June 2000, it grouped 62 enterprises with a total area of 400,000 hectares of forests. This seems to be the best way to overcome difficulties and limitations of property fragmentation. This direction should be continued and strengthened in the future in order to reduce costs and make the local timber production more market-competitive.

4. Education in forestry

Forestry educational systems – secondary, technical, high

Universities are the major institutions of forest education. Forest sciences are currently in the curricula of 12 Italian Universities. The educational system has recently been reformed to adapt to the European standard. Now, the courses are organised on a 3+2 year basis. Some of the Universities offer a Bachelor's Degree (3 years) in wood technology, and are generally organised on the basis of contracts signed with industries.

Secondary technical education (and training) is organised by the Regions and financed, on a case basis, by the EU Social Fund, the Regions, or, in a small proportion, by the industrial sector.

5. Forest research

Forest research in Italy is carried out by several organisations:

- institutes and departments of the Forestry Faculties of Italian Universities;
- three research institutions of the Italian National Research Council (CNR);

- two forest research institutes (Institute for Applied Research in Forest and Range Management – ISAFA – and Institute for Applied Research in Silviculture – ISSA) being the scientific branches of the Ministry of Agriculture and Forestry (MIPAF);
- the Italian Academy of Forest Science (AISF), a non-profit institution having among its tasks the promotion and dissemination of research on scientific, technical, economic and legal issues related to silviculture and environmental protection.

Through its research institutes, Italy has joined the international research networks, like the European Forest Institute (EFI) and the IUFRO. 23 forest research organisations are networked at national level through the National Union of Forest Institutes (UNIF).

Funding for forest research in Italy is ensured through:

- national and regional public resources, with research contracts financed by the Ministry of Higher Education and Scientific Research, Ministry of the Environment, National Institute of Agricultural Economy, Regional Agencies for Agriculture and Forestry;
- partnerships with other EU research organisations in the framework of EU-funded research programmes (e.g. COST, ENV and FAIR) and LIFE-Nature funding.

Scientific and technical consulting is provided to the Italian Ministry of Agriculture and Forestry mainly by a network of Research Institutes of applied research in agriculture (CRA) comprising, as aforementioned, two forest research institutes (ISAFA and ISSA). ISAFA supports MIPAF in the design and coordination of the National Forest Inventory.

Other academic organisations conduct studies and research on topics relevant to the national and European policies on forests and nature conservation, through specific contracts with national agencies. Since the end of the 1990s, the scientific community has provided, under specific projects, full knowledge on several issues, such as: development of a technical and scientific framework for sustainable forest management in NATURA 2000 forest sites and in National Parks, or drafting national forestry legislation, etc.

However, lack of a unified policy planning framework, like a National Forest Programme (NFP), to address goals, provide legal and political instruments and funding in the field of sustainable forest management (*i.e.* training, education and research) seems a severe obstacle in the development of a fruitful cooperation between scientific research and forest policies in Italy.

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Latvia

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The Republic of Latvia (Latvija, official: Latvijas Republika), territory: 64,600 km², population: 2.3 million, capital city: Riga.

1. Forest characteristics

Forest cover and species composition

Latvia is a heavily forested country, with 45% of its territory covered by forest – a total of 2,942,800 hectares. 87.4% of this forest is of economic value. Latvia can boast 1.25 hectares of forest per capita – a figure 4.5 times the European average, and between 1935 and 2005, forest areas in Latvia increased 1.7-fold.

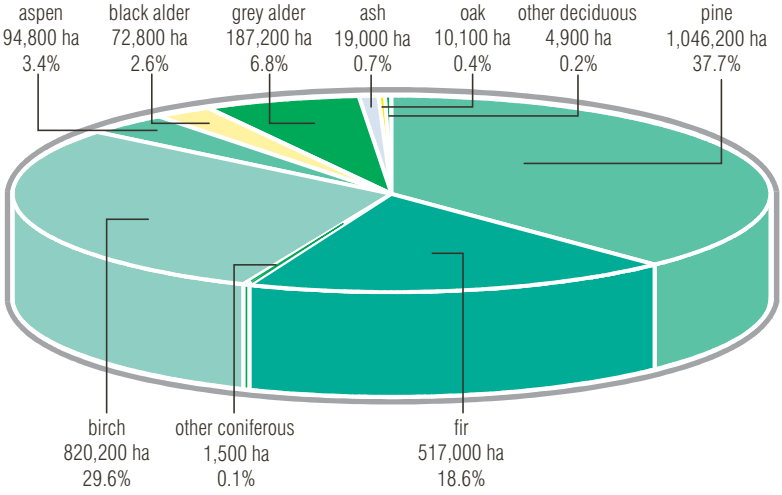

Fig. 1. The distribution of tree species in all forests, 2003 (Source: State Forest Service, 2003)

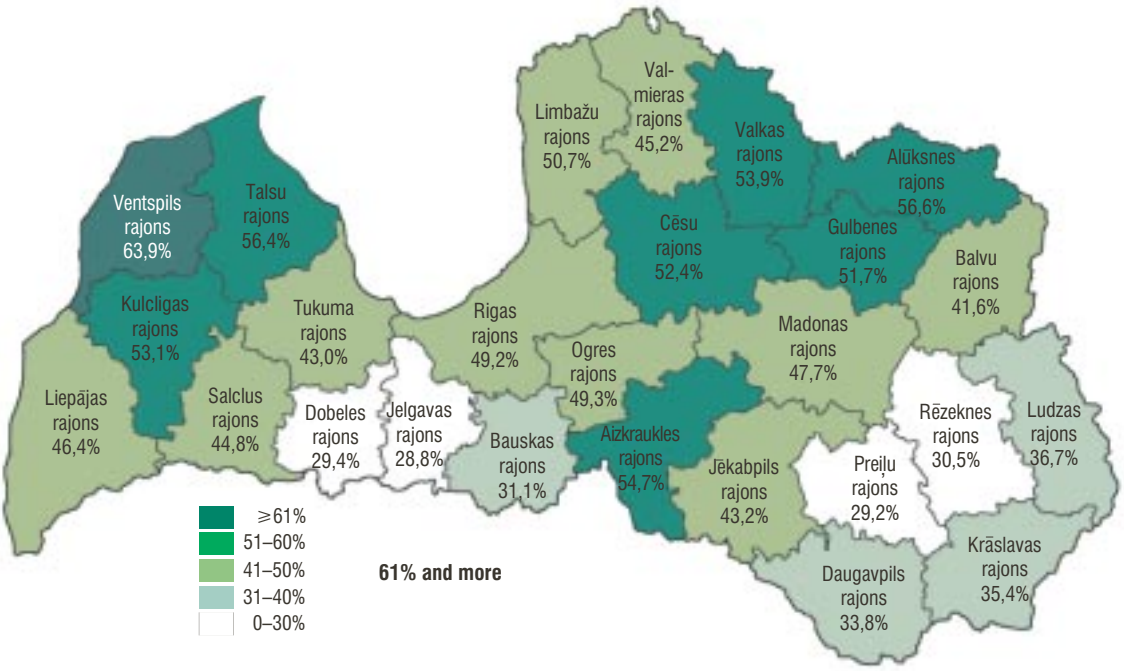

Fig. 2. Forest cover in different areas of Latvia in % (Source: State Forest Service, 2003)

In most of Latvia, forests are dominated by three tree species: pine, spruce and birch, together constituting 87% of the forest area and as much as 92% of the growing stock. Coniferous stands (59% of the total in terms of stock volume) are the most typical forests in Latvian conditions. In state-owned forests, coniferous trees constitute 69% of all stands, a contrast with those under other forms of ownership, where pine and spruce account for only 43% of the total area.

The most heavily forested regions of Latvia are Kurzeme and Vidzeme, in contrast to Latgale and Zemgale. There are significant differences in the forest cover of various Forest Districts, ranging between a 28.8% cover in the Jelgava District and 63.9% in the Ventspils District. The largest proportion of state-owned forest is found in Kurzeme and Zemgale, while the structure of ownership in Vidzeme and Latgale represents a greater share of privately owned forests.

Volume and increment

The total growing stock of trees in the forests of Latvia is 578 million m^3. This is 3.3 times the figure at the beginning of the 20th century. Over the last 20 years, the growing stock has increased by 194 million m^3, or approximately 10 million m^3 a year. This reflects the increase in the total area of forestland, as well as an increase in growing stock, a key aspect of forestry work.

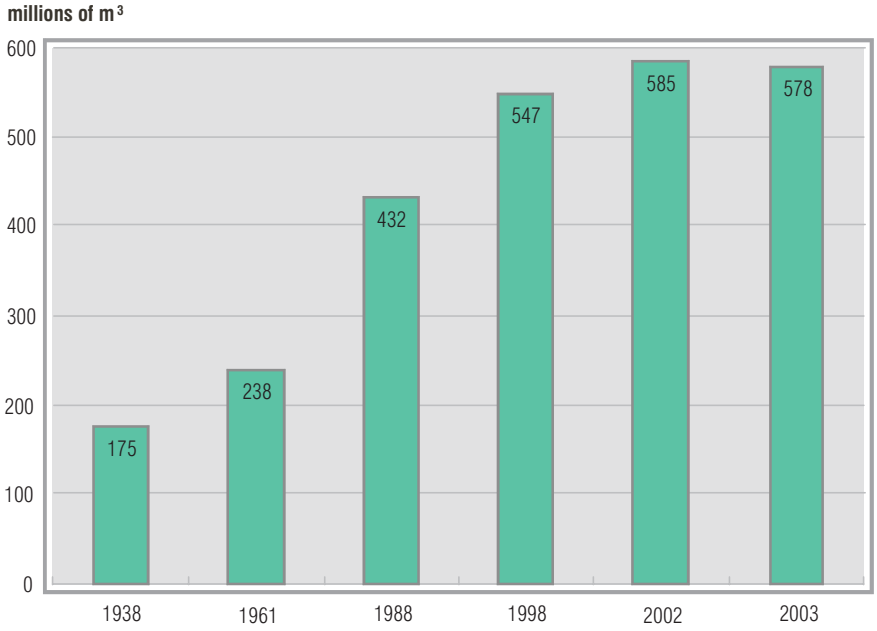

Fig. 3. Changes in the growing stock (Source: State Forest Service, 2003)

Total current annual increment is calculated at 16.5 million m^3, of which 9.6 million m^3 is in conifer stands. Current annual increment in standing volume is 6.3 m^3 per ha. Natural die-off is calculated at 3.3 million m^3 a year.

2. Logging and wood processing

Since Latvia regained its independence, the annual volume of timber felled has increased from 4 to 12 million m^3. This reflects the vigorous incorporation of private forests into this economic activity, as well as changes in the norms governing forest management. The volume felled has stabilised over the last several years, while the last 5 years have also brought stabilisation in the annual volume of wood recovered from forest utilisation – approximately 11–12 million m^3. A stable and predictable policy with regard to timber harvesting in state-owned forests (at a rate of approximately 4 million m^3 a year) is a guarantee of even and balanced utilisation of wood resources. In private forests, the volume of wood recovered in recent years has been in the order of 6.7–7.5 million m^3 a year.

In 2003, 80% of felled timber by volume represented the main felling, 16% was felled in the course of thinning, 1.3% through sanitary felling, 0.7% – in stand reconstruction felling, 0.7% – in illegal felling, and 1% – in other types of felling.

The wood-processing industries constitute the segment of the forest sector producing a concrete end-product and adding value to the wood and timber produced. By skilfully using

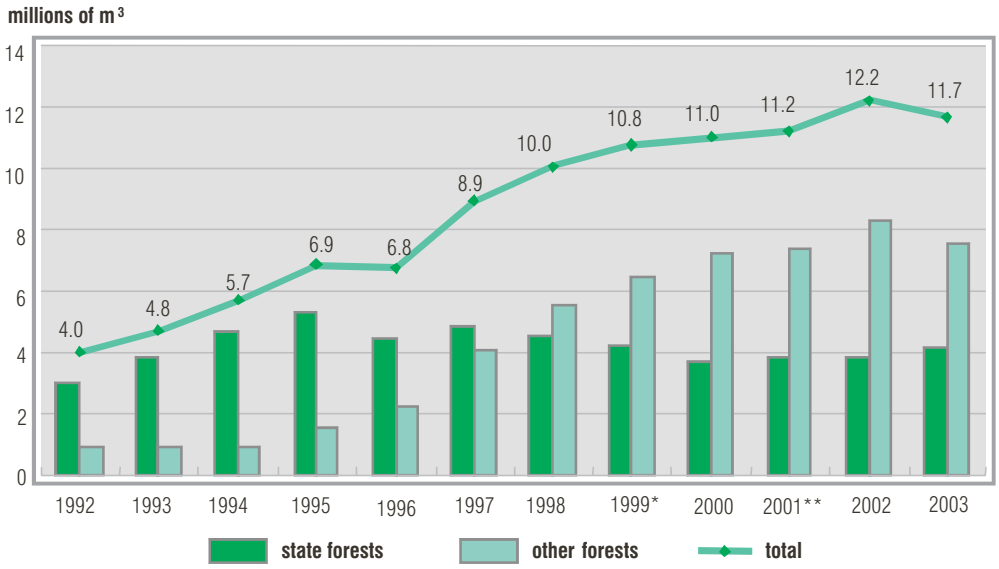

Fig. 4. Changes in felling volume (Source: State Forest Service, 2003)

* Volume of felled timber calculated for 12 months.
** Volume of felled timber specified by experts.

locally-available, renewable wood resources, the wood industry with its sub-branches in saw milling, wood-based panels, wooden packaging, furniture, joinery, carpentry products, etc., has become one of the most active sectors of the national economy, which contributes significantly to stabilising the country's foreign trade balance. Since 1996, the value of exports of wood-industry products has increased more than twofold, reaching a total value of LVL 750 million in 2004. The wood industry is one of the country's largest export branches, its international competitiveness increasing thanks to the ability to react promptly to export market demand. Wood processing is Latvia's only industry to show a positive export/import balance. In 2004, wood and wood products accounted for 30.5% of the country's total value of exports. According to expert evaluation, the forest sector, employing approximately 7% of the entire labour force, contributes 10–14% to Latvia's GDP.

Sawn wood

Important developments have taken place in sawn wood production since 1993, with total output increasing 10-fold and product value increasing 15-fold. In 2004, Latvia produced a total of approximately 4 million m^3 of sawn wood, of which 2.92 million m^3 (73%) was exported. The import of sawn wood, mainly from Russia, Belarus and Estonia, has increased from 388,200 m^3 in 2003 to 687,800 m^3 in 2004.

On the global softwoods market, the Latvian share is of 1.3%, *cf.*, a 2.7% share of total export by volume.

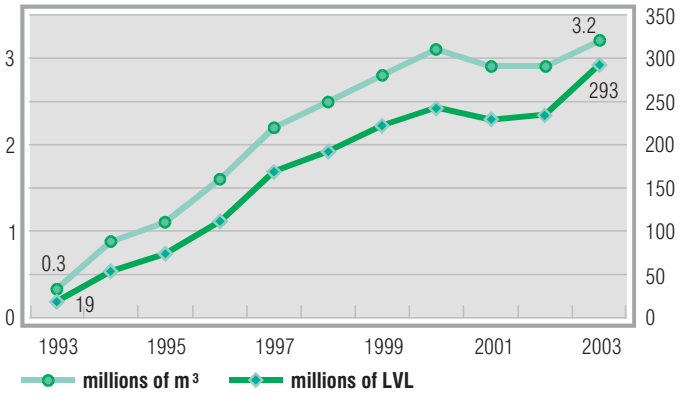

Fig. 5. Production of sawn wood by volume and value (Source: Department of Forest Policy – MA)

Round wood

Round wood is utilised as follows: production of sawn wood (54.2%); export, mainly fuel wood and pulpwood (30%); and the manufacturing of plywood, matches, log houses, garden items, lathe-turned and planed items and components, wood chip pellets, charcoal, etc. Approximately 90% of round wood export is in the form of unprocessed pulpwood. In 2004, the export of pulpwood increased by 3.5% (by 34.9% in terms of value) over the previous year, reaching a total of 4.05 million m^3. Because Latvia's pulpwood market is substantially regulated by the large Nordic pulp and paper concerns, the major export destinations for pulpwood are Sweden, Finland, and Germany. In round wood import, sawn logs predominate, which in Latvia are converted into products of higher added value. Compared to 2003, the 2004 round wood import increased by 73.6% (in terms of value by 85.2%), reaching 797,500 m^3, of which 67% were softwoods, and 37% hardwoods. The major countries exporting wood to Latvia, are Russia, Lithuania, and Belarus.

Plywood and other wood based panels

The volume of plywood manufacturing has tripled since 1993, while the product value has increased 5-fold. This has been achieved by adding greater value to the products rather than through higher specific wood consumption per product unit. Latvia is the biggest manufacturer of plywood in Eastern Europe (mainly meeting construction needs) and is also increasing the production of plywood for general use. In 2004, the export of plywood was 11.1% higher than in 2003 (an increase in terms of value by 17.9%).

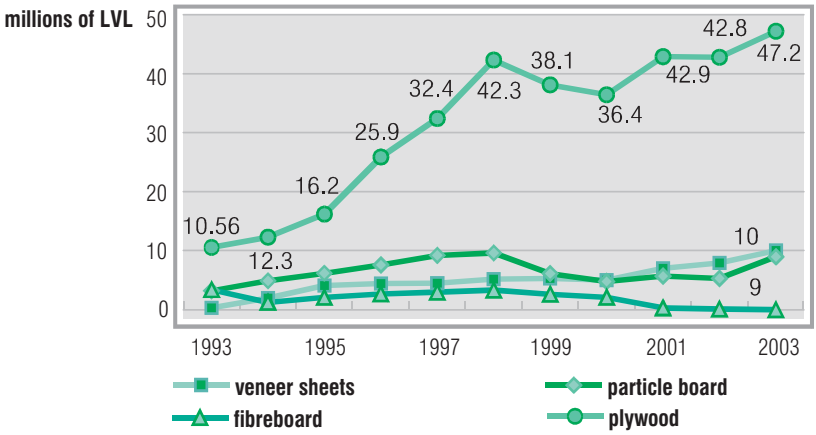

Fig. 6. Export of plywood and other wood-based panels by value (Source: Department of Forest Policy – MA)

Furniture

In 2003, Latvia produced furniture for a total value of LVL 90.5 million. In 2004, the value of furniture exports was LVL 78.9 million. The increase in value compared to 2003 is 8.9%. The major export destinations for furniture are Denmark, Germany, and the UK. The value of imported furniture, mainly from Poland, Lithuania and Italy, was LVL 26.25 million.

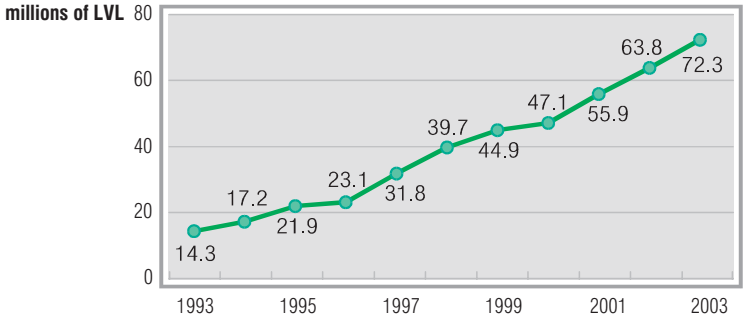

Fig. 7. Export of furniture by value (Source: Department of Forest Resources – MA. Central Statistics Board data)

Joinery and carpentry products

The value of doors, windows and boarding/surfacing materials for construction has increased tenfold compared with 1993, currently constituting 6.8% of the total value of wood industry products. In terms of value, the export of joinery and carpentry products in 2004 increased by 16% compared with 2003.

Wooden packaging materials

Wooden packaging materials, which actually mean blanks and pallets, can be produced with relatively small investment and conventional technologies. This is done mainly by small and very small enterprises, using low or medium quality grades of non-coniferous sawn wood. However, in Latvia there are about ten enterprises turning out high quality wooden packaging products that meet EU demands.

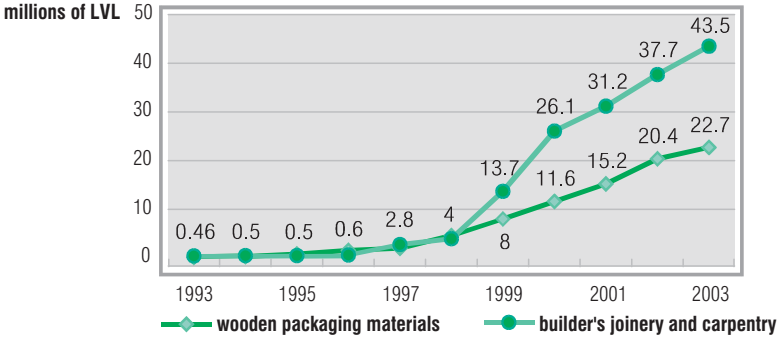

Fig. 8. Export of builder's joinery, carpentry and wooden packaging materials by value (Source: Department of Forest Resources (ZM). Central Statistics Board data)

3. Nature protection

The major objective of establishing protected areas is to protect and conserve the diversity of nature: rare ecosystems in their natural state, habitats for specially protected species, unique and aesthetically appealing landscapes and the landscape traditional to Latvia, geological and geomorphologic sites and features, etc.

By 2004, further establishment of protected natural areas and micro-reserves had taken the total forest area under protection to a total of 506,106 ha.

Nature Reserves, National Parks and Biosphere Reserves are established in accordance with an act of law adopted by the Latvian Parliament (Saeima). Areas within such protection categories as Protected Landscape Areas, conservancy areas, Nature Parks, and Nature Monuments are in turn established by decisions of the Cabinet of Ministers.

The State Forest Service (SFS) determines the legal status of such protection categories as micro-reserves and specially protected forest sites in which management activities are limited.

69% of all forestland for which restrictions have been imposed constitutes state-owned forest.

In most of the protected areas, restrictions on forest management are accompanied by restrictions on other types of activity.

Table 1. The area of protected forest (ha)

Protection category	State-owned forest	Other kinds of ownership	All forest
Strict nature reserves, including:	7,576.5	921.3	8,497.8
– strict-regime protection zones	2,802.8	0.0	2,802.8
– partial-regime protection zones	4,773.7	104.6	4,878.3
– buffer zones	0.0	816.7	816.7
National Parks, including:	43,959.8	32,703.6	76,663.4
– strict nature reserve zones	6,084.5	61.3	6,145.8
– nature reserve zones	19,438.9	12,150.8	31,589.7
– landscape protection zones	16,695.5	15,266.7	31,962.2
– cultural or historical zones	258.9	720.1	979.0
– neutral zones	1,482.0	4,504.7	5,986.7
Nature Reserves	59,502.7	11,960.2	71,462.9
The Northern Vidzeme Biosphere Reserve	2,254.6	486.2	2,740.8
Nature Parks	19,618.3	18,763.7	38,382.0
Protected Landscape Areas	14,852.1	42,549.1	57,401.2
Protected dendrological collections	468.7	61.2	529.9
Protected geological and geomorphological nature monuments	547.1	591.7	1,138.8
Micro-reserves	14,530.4	379.6	14,910.0
Buffer zones around micro-reserves	17,584.9	127.7	17,712.6
The belt of protected dunes along the Baltic Coast and Bay of Riga	4,468.2	2,607.6	7,075.8
The belt of restricted economic activity along the Baltic shore	45,760.9	22,861.1	68,622.0
Protected zones alongside waterways*	4,482.3	7,752.8	12,235.1
Protected zones around wetlands*	3,260.0	1,410.2	4,670.2
Protected zones surrounding urban districts	14,311.1	29,641.2	43,952.3
Forests within administrative city limits	49.6	472.6	522.2
Specially protected forest areas	53,192.7	7,231.9	60,424.6
Total area of protected forest land	**282,706.5**	**169,291.9**	**451,998.4**

* The data on the restricted zones alongside waterways and around wetlands is incomplete.
Source: State Forest Service, 2003.

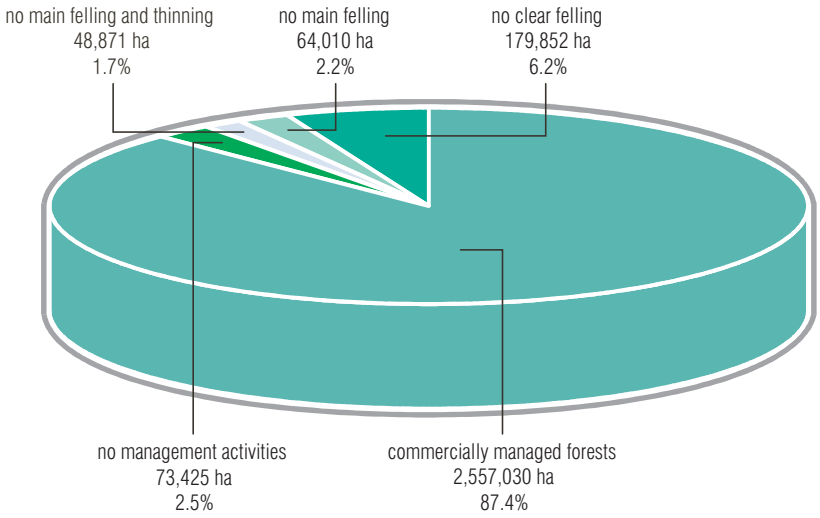

Fig. 9. The proportion of restrictions to forest management activities in all forests (Source: State Forest Service, 2003)

4. Legal and organisational forms of forest holdings

Forest ownership

The structure of forest ownership has changed substantially since Latvia regained its independence in 1990. In the course of land reform, former owners or their successors had landed properties returned to them. However, the increase in the proportion of forests that are privately owned compared with 1935 is very much due to farmland falling into disuse in this period. As at the beginning of 2005, the State owned and managed 1.47 million hectares of forest (approximately 50% of the country's forested area).

About the same area of forestland is owned by individuals, enterprises, local governments and the church.

Public access to forests

In line with Latvia's Forest Policy (FP), "public forest property is official capital, a guarantor of achieving the nation's ecological and social interests, while forest property in its totality guarantees the economic interests of its owners. Irrespective of the ownership category, forests are a national asset, with free access for the general public, while any restrictions to the interests of forest owners are imposed on the utilisation of forest products".

For private forest owners owning up to 50 hectares, the volume of cutting is set in relation to the annual felling norm laid down in the forest management plan. Such norms are usually established for a 10 or 15-year period, and the owners are entitled to cut down even

several years' worth of norms in a single year. This means that in the private sector, the availability of wood resources is regulated only by the current market situation.

On the other hand, forest is of special importance for a considerable part of the population, not only from the point of view of subsistence, but also for recreational and outdoor activities. In many countries, Latvia among them, the importance of forests for recreation has increased substantially.

An opinion poll carried out in early 2005 had 82% of respondents considering mushrooming and berry picking to be popular spare-time pursuits, thus attesting to the great interest Latvians show in utilising the recreational potential offered by forests and woodlands. The Latvian FP emphasises that one of its social goals is to balance the interests of the public and forest owners with regard to utilisation of the valuable social features of the forest. Moreover Latvia, unlike some other EU countries, ensures free public access to forests regardless of ownership, except where otherwise restricted on the basis of specific legal provisions.

Thanks to its increasing game populations, Latvia is in a position to offer excellent hunting opportunities and well-organised hunting events, an attraction for the hunting fraternity both at home and from abroad.

The stock company Latvia State Forests (Latvijas valsts mezi [LVM]) is among the organisations most actively developing recreational opportunities and improving amenities in the forests under its management. State forests are public property and the LVM's task extends beyond extracting maximum profit from forests to providing the public and visitors coming to Latvia with high-quality recreational opportunities, while at the same time showing the necessary concern for environmental impact.

The woodlands of Latvia already have some 300 different recreational sites and facilities, which can be used by any member of the community. The number of similar sites is increasing from year to year. In 2004, the LVM set up over 20 new recreational sites. In 2005, it is envisaged that more than a hundred new facilities of this type will be established, with total investments in such sites reaching 400,000 LVL.

Year by year, such LVM recreational facilities as watch towers, educational trails, cultural and historical sites, picnic areas with convenient infrastructure and recreational sites with improved amenities are gaining in popularity with the public.

The forest educational trails established by the State Forest Service (SFS) in many parts of Latvia have already won public recognition. Serving recreation, education, training, and as visual aids, they are popular with students, environmental experts, historians, and private forest owners.

Forest law and forest policy

Since regaining independence, Latvia has assigned key-sector status to forest-related industries, which have recorded successful growth under the conditions of market economy. The factors favouring development are: high-quality and readily-accessible forest resources serving as a basis for production; long-standing traditions in forestry and wood processing; a high level of expertise and last but not least – the determination of the authorities and forest-sector shareholders to reach a unanimous understanding regarding

the forest sector's long-term developmental goals and the basic principles under which to achieve them, as set out in the Latvian Forest Policy (FP) – a document approved by the Cabinet of Ministers on 28 April, 1998. The major FP goal is sustainable management of forests and forestlands.

Subordinate FP goals are, in turn:

- to prevent any reduction in forest cover, to maintain and enhance forest productivity, to consolidate value and to promote the afforestation of marginal agricultural and other surplus land,
- to ensure the sustainable development and efficiency of the forest sector by complying with ecological constraints and reacting to the social situation, while providing for the generation of maximum added value,
- to conserve and maintain forest biological diversity at the current level,
- to balance the public's and forest owners' interests in utilising the socially-valuable features of forests and establishing labour relations in the forest sector,
- to develop (via promotion of forest education, science and information sharing), the expertise and skills required for updating the FP, to streamline the legal framework and to improve forest management practices in the interests of sustainable development.

State subsidies

The state's funding supports stabilisation of long-term forest functions, game management and the overall development of the forest sector. For this purpose a Forestry Development Fund (FDF) and a Game Management Development Fund (GMDF) have been established. The FDF funds various support and development programmes, forest research, and forest expansion and training services for forest owners. In 2004, thanks to SFS support, a total of 27 research projects were completed, valued at a total sum of LVL 441,852. In 2005, a total of 49 projects worth LVL 998,143 were funded. The GMDF was funding research and development projects in game management. In 2004, 11 projects worth a total sum of LVL 117,000 were carried out and in 2005, 13 projects worth a total sum of LVL 117,000 were funded. Since 2000, the SAPARD programme (Special Action Programme for Agriculture and Rural Development) has been underway in Latvia. The sub-programme for surplus farmland afforestation (1.8 million LVL, of which 50% is public funding: EU – 75%, the Latvian government – 25%), and that for diversification of the rural economy, relate directly to forest sector development. As of 1 January 2004, afforestation projects for a total area of 3,969 ha had been submitted, with forest already planted on approximately 1/6 of this area. Between 2004 and 2006, the European Agricultural Guidance and Guarantee Fund (EAGGF) and the European Regional Development Fund (ERDF) were to co-finance the development of private forestry and the forest sector, as provided for by the unified programme document.

The EAGGF has earmarked EUR 9.35 million for:

- increasing the economic, ecological, and social value of private forests,
- creating forest-owner associations,
- investments to improve and rationalise timber harvesting, primary processing and trade,
- afforestation of surplus farmland,

- support for the substitution of low-value forest stands and tree species,
- restoration of forestry potential in areas that have suffered from forest fires and natural calamities (including the regeneration of forest stands destroyed by the storm of January 2005).

As of 1 April 2005, 122 agreements for the utilisation of the Structural Funds had been concluded, for a total sum of EUR 1.88 million. The majority of these fall under the heading Afforestation of Abandoned Farmlands (69 projects), and Investments for Improving and Rationalising Timber Harvesting, Primary Processing and Trade (42 projects).

5. Structure and tasks of the national forest administration

The Forest Advisory Board

The Forest Advisory Board (FAB), established in 1997 by the Minister of Agriculture, is an authority allowing government and forest-sector shareholder representatives to meet in order to discuss the economic, ecological, and social aspects of forests. The shareholder groups represented in FAB are forest owners or managers, the wood-processing industries; service providers, environment and nature conservationists, employee organisations (trade unions), vocational and higher educational establishments and local governments. The FAB is a kind of forum for agreeing and coordinating various shareholder interests, aiming for a well-balanced and streamlined policy that ensures sustainable development of the forest sector.

Forest sector governance

The major task of forest-sector governance is to implement FP goals by placing all the instruments at its disposal and creating a political climate favourable to the meeting of overall FP goals. Since 2000, the regulatory and supervisory functions aimed at the achievement of FP goals have been vested in state institutions – the Ministry of Agriculture (MA) with the State Forest Service (SFS) as its executive unit. The Latvijas Valsts Mezi discharges the ownership function. A similar organisational arrangement implies that the public function of the State as an authority and its private function as an owner are split institutionally.

The Ministry of Agriculture (in cooperation with forest sector shareholders):

- develops the FP and ensuing strategies, as well as related programmes and drafts the regulatory acts on forest management and utilisation, environmental conservation in forest operations and game management;
- represents the Latvian forest sector in international organisations and processes, coordinating international cooperation and preparing international agreements;
- researches public opinion and promotes public awareness regarding the forest sector;
- assesses and analyses the situation regarding forest resources, develops proposals for improving forest productivity and forest utilisation and informs the public on forest products turnover.

The SFS is the authority responsible for pursuing the FP in respect of the whole of the nation's forests. Its mission is to implement, control and support functions in line with basic FP principles.

Functions within SFS jurisdiction include:

- supervising compliance with the legislative and regulatory acts in all forests regardless of ownership category, and assessing the effectiveness of legal acts,
- creating preconditions for stabilising the forest's long-term functions, promoting the development of private forestry and keeping the public informed of the situation with regard to forest resources,
- ensuring forest protection against fire and maintaining forest fire control in all the country's forests.

The SFS comprises the Head Office and territorial units – the State Regional Forest Districts, which function as the forest authority in a given region and the Forest Research Station, an entity established to carry out special assignments. The SFS is running a system of forest expansion and advisory services for private forest owners. A total of 35 educational trails have been laid out in regional forest districts for the purpose of providing training on forestry issues and the acquisition of practical skills.

The stock company Latvian State Forests (LVM)

By way of discharging the State's ownership function in relation to its forest property, the LVM manages a total of 1.65 million hectares of forest, of which 1.4 million hectares are stocked forestlands. The FP ensures that the State, as owner, has two major goals in managing its forest property – increasing the value of forest capital and ensuring profits for the forest owner. The LVM engages in forest management throughout the entire rotation cycle. It starts by producing top-quality forest tree seeds and planting stock, using local materials. This is the task of the LVM Seeds and Plants (Seklas un stadi) business unit, which produces and also sells planting stock for ornamental tree and shrub species. The LVM Forest (Mezs) business unit handles forest cultivation: tree planting, stand tending, forest protection, forest management planning and environmental conservation. The LVM Round wood Supplies (Apalkoksnes piegades) business unit is involved in producing and supplying round wood assortments, such as sawn logs, veneer logs, etc to processing enterprises. The LVM Recreation and Hunting (Rekreacija un medibas) business unit offers recreational services and opportunities for outdoor activities in the forest for both locals and foreigners. The current annual increment in LVM forests is 7 million m^3, with the annual allowable cut kept within the limits of 4 million m^3, thus providing stable and predictable resource availability for the Latvian wood industry. The LVM is a thriving enterprise, achieving in 2003 a turnover of LVL 46 million, and in 2004 – as much as LVL 65 million. In 2004, the company invested LVL 10 million in the value of forest capital. Payments to the State and local government budgets exceed LVL 20 million.

Private owners associations

The FOA was founded in 1993 as an association of private forest owners. The main task of this organisation is to promote forest management and trade in timber and forest pro-

ducts, as well as to offer advice and expansion services, including training and education. A further task is to promote co-operation among private forest owners.

FOA has contracts with 42 experts (consultants) to implement their expansion system. The FOA has 5 regional offices: 1 in the central part of Latvia and 4 in the administrative regions of Kurzeme, Vidzeme, Zemgale and Latgale.

The Latvian Forest Owners Association is a unique national umbrella organisation for certification in line with the PEFC system, with members accounting for a total of 1.4 million hectares of privately owned forests.

6. Education in forestry

The Ogre Forestry Technical College (OFTC)

The OFTC was founded in 1945. It is located 40 kilometres southeast of the capital Riga. The OFTC currently provides secondary technical education in:

- Forestry – silviculture,
- Construction of wooden framework buildings,
- Forestry machinery,
- Economic management,
- Forestry – silviculture – for students with secondary education – admission according to the results of the school-leaving certificate competition – duration of studies – 2 years,
- Forestry worker – duration of studies – 3 years.

Between 1945 and 2005, the number of graduates (by specialisation) were:

- Forestry: 2,875,
- Logging technologies: 499,
- Planning in forestry enterprises: 92,
- Forestry machinery: 56,
- Forestry workers: 32.

Forestry faculty of the Latvian University of Agriculture

The Forestry Faculty of the Latvian University of Agriculture is located in Jelgava (40 kilometres south of Riga) and offers the following programmes:

Full-time basic study programmes

Speciality	FORESTRY		WOOD PROCESSING
Study programme	**Forestry** (academic)	**Forest engineering** (professional)	**Wood processing** (professional)
Degree or qualifications	**B.Sc.** in forestry	**Engineer** with the right to pursue a Master's degree	**Engineer** with the right to pursue a Master's degree

Part-time basic study programmes

Programme of study	**FOREST ENGINEER** Second-level professional higher education programme	**FORESTRY** First-level professional education programme	**WOOD-PROCESSING TECHNOLOGIES** First-level professional education programme
Degree or qualifications	**Engineer** with the right to pursue a Master's degree	**FORESTRY TECHNOLOGIST**	**WOOD-PROCESSING TECHNOLOGIST**

Master's degree and Ph.D. programmes

Area of study Ph.D. programme	**FOREST SCIENCE**			**MATERIALS**
Sub-area of study and M.Sc. programme	Forest ecology and forestry	Forestry work and technologies	Forest economics and policies	Wood materials and technologies
Degree	Master of forestry	**M.Sc. in engineering**	**M.Sc. in forestry science**	**M.Sc. in engineering**
Scientific degree	Ph.D., forestry	**Ph.D., engineering**	**Ph.D., forestry science**	**Ph.D., engineering**

The Forest Faculty includes the following departments: the Silviculture Department, Forest Utilisation Department, Wood Processing Department and the Work Environment Department. Number of graduates: forestry: 2,512 (graduates and bachelors), forest engineering: 565 (graduates and bachelors), wood-processing technologies: 1,699 (graduates and bachelors). To date, 72 persons have obtained Master's degrees in Forestry Science and Engineering.

7. Forest research

The Latvian State Forestry Research Institute Silava (LSFRI Silava) is a leading centre of research and applied studies, whose main areas of work involve a study of the structure and components of the forest ecosystem, the design of new technologies, and recommendations for sustainable and ecologically-justified forest management, and for the ongoing regeneration of forest resources.

This Institute has a staff of 91, of which 75 are scientists, researchers and engineers.

At present, no basic funding is allocated from the State budget. The Institute finances its activities on the basis of tenders.

The main income on the basis of public open tender comes from the Forest Development Fund (with funding for the monitoring of forest resources also coming from the FDF), international collaboration projects and the Latvian Council of Science.

Important issues and research covered by the Institute:

- Forest ecology and silviculture,
- Forest tree breeding and genetics,
- Forest regeneration and establishment,
- Forest protection,

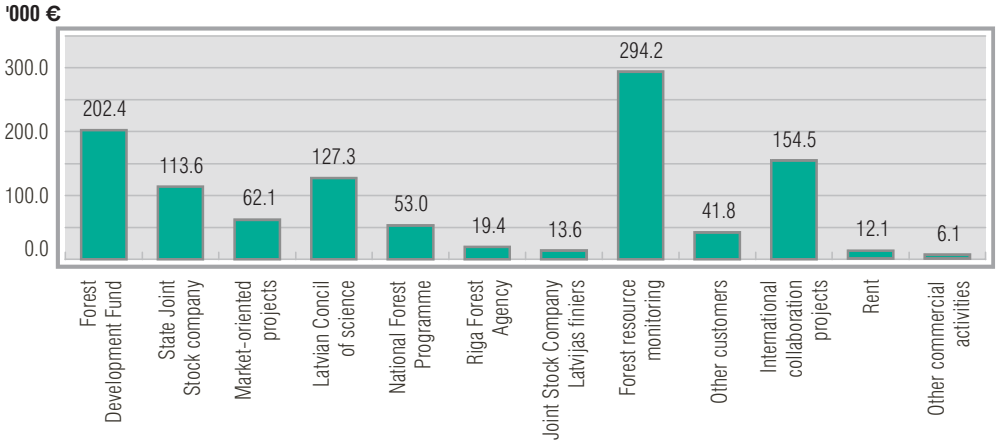

Fig. 10. Sources of financing research in 2004

- Game management,
- Forestry work,
- Minor forest utilisation and the processing of forest raw materials,
- Wood processing,
- Forest economy and policy.

The Institute is also a participant in several international research projects.

Over the last few years, scientists at the Institute have been working on a long-term forest-selection and seed-development programme, recommendations for the establishment of sweet cherry plantations, new technologies for preparing and forestry use of compost from the sludge of runoff water, a methodology for evaluating the biological properties of peat substrate, economically advantageous drying regimes for pine, fir, birch, ash and oak, recommendations for the growth of timber to be used for energy purposes on land not being used by agriculture, as well as the seasonal use of container-grown seedlings in forest regeneration and afforestation. Specialists have determined the chemical processing of the pine and spruce litter, have developed and registered 10 preparations that can be used in various sectors of the forest economy, and have designed and introduced technologies for the processing of pine and spruce litter.

The results and conclusions of the latest and most important research is presented in co-operation with the Forest Faculty of the LLU in an annual collection of scholarly articles entitled Forest Sciences (Mežinātne), as well as the journal Baltic Forestry in the English language, which is published in collaboration with the relevant research institutions in Lithuania and Estonia.

References:

Forest sector in Latvia 2003, Ministry of Agriculture of the Republic of Latvia, 2003, 35 pp.
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Lithuania

Diana Mizaraite and Remigijus Ozolincius

The Republic of Lithuania (Lietuva, official: Lietuvos Respublika), territory: 65,300 km², population: 3.5 million, capital city: Vilnius.

1. Forest characteristics

Forest area

Forest inventories in Lithuania date back to the middle of the 16th century, when Grigorij Volovich wrote a report on "The inspection of woods and game crossing tracks...", in which he described the condition of state forest tracts in those times. In the 19th century, a forest inventory of Lithuania was carried out by Russian, Polish and German specialists. In turn, the country's institutions of national forest inventory and management planning were established in 1922. All the country's forests were inventoried in 1958–1963, 1966–1977, 1978–1987 and 1988–2001. Until 1966, this work was carried out on the basis of Russian instructions. However, from that year on, scientific progress encouraged the planning of inventories and management work on the basis of soil typology. Finally, a renewed implementation of the Lithuanian national forest inventory as a continuous, combined, multi-stage sampling system began in 1998.

According to data from the 2004 state forest inventory, there are some 2,069,000 hectares of forest in the country, or 31.7% of its total area. Forest stands grow on 1,968,000 hectares of the above. There are 0.60 hectare of forest land per person and the respective volume of wood is 113 m³.

The significant increases in Lithuania's forest cover in the two decades following the Second World War were a reflection of the afforestation of old clear-cuts, forest openings and the areas not suitable for agriculture (Fig. 1). Between 1949 and 1965, Lithuania was

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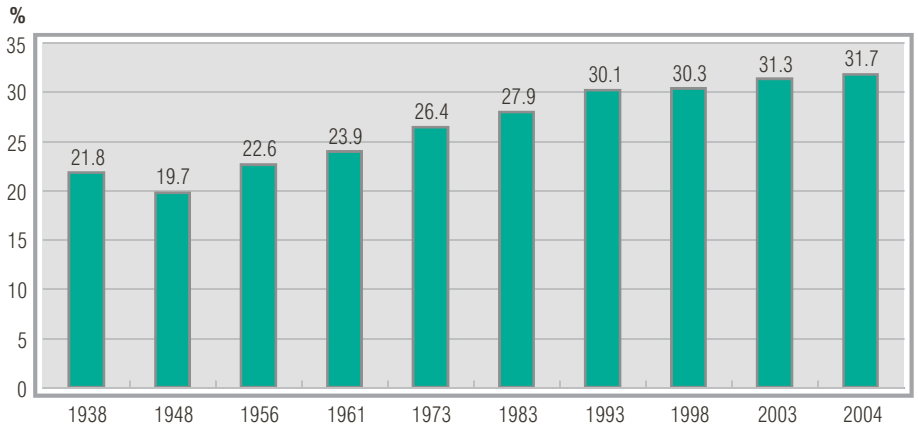

Fig.1. Forest cover in Lithuania, 1938-2004 (Source: State Forest Survey Service, 2004)

afforested with 13–20 thousand hectares of forest annually. In recent years, inventories have recorded up to 4–5 thousand hectares annually of new forest on abandoned meadows and forest margins.

Lithuania is currently made up of 31.7% of forest, 53.3% of agricultural land, 5% of urban land, 4% of water, 2.2% of wetlands and 3.3% of unused land. The most forested part of Lithuania is the southeast, especially the regions of Svencioniu (54% of cover), Varenos (66%), Traku (42%) and Salcininku (43%). The southern and northern parts of the Central Lowland contain the smallest amount of forest. Apparently, no less than 500,000 hectares (7–8%) of low-productivity, hilly and unfavourable agricultural land is to be transformed into forest.

Species composition

There are eight main tree species forming stands in Lithuanian forests: Scots pine (36.4% by area), spruce (22.4%), birch (20.2%), black alder (6.4%), grey alder (6.2%), aspen (3.0%), ash (2.6%) and oak (1.9%) (Fig. 2). All other tree species together account for only 0.9%.

The 716,000 hectares of pine stands are concentrated in the south and southeast, representing mostly *Vacciniosa* (41%), *Vaccinio-myrtillosa* (17%), *Oxalidosa* (11%) and *Myrtilosa* (7%) associations. The growing stock of pine stands is around 234 m^3/ha and the average age is 63.

The 440,000 hectares of spruce stands are most widespread in the central and western parts of the country. Spruce cover had increased considerably in the years up to 1990, but the period 1992–1996 saw storm winds, drought and the pest beetle *Ips typographus* do such major damage that a fifth of all spruce stands died or were thinned out and thus transformed into stands of other species. Spruce stands suffer greatly from the severe gales occurring once every 20 to 30 years. Spruce stands most often represent forest associations *Myrtillo-oxalidosa* (30% by area), *Oxalidosa* (25%), and *Oxalido-nemorosa* (15%). The growing stock of spruce stands is 188 m^3/ha and the average age is 46.

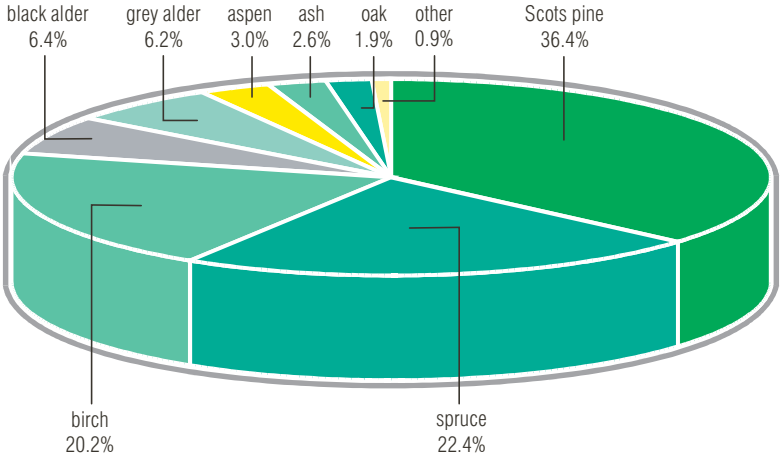

Fig. 2. Forest stand area by dominant tree species (Source: State Forest Survey Service, 2004)

Birch stands grow over 398,400 hectares and are quite evenly distributed across the country, though most common are in the centre. Their area is increasing steadily and now accounts for one-fifth of all stands in Lithuania. In recent years, birch stands have spread onto abandoned agricultural land, meadows and pastures. Birch stands most often represent associations *Myrtillo-oxalidosa* (18% by area), as well as *Aegopodiosa* (15%), *Oxalidosa* (13%), *Caricosa* (8%) and others. The growing stock of birch stands is at the level of 168 m^3/ha, while the average age of stands is 49.

Aspen stands cover 59,400 hectares and are most widespread in central Lithuania, on the most fertile sites. The area of aspen stands decreased twofold in the 1990s, though the volume of the species in other stands was the same as in pure aspen stands. Areas under aspen are increasing thanks to the poor cultivation of young stands, natural regeneration on abandoned clear-cuts and the conversion of destroyed spruce stands. Aspen stands represent *Aegopodiosa* (33% by area), *Myrtillo-oxalidosa* (16%) and *Hepatico-oxalidosa* (16%) associations. The growing stock of aspen stands is 213 m^3/ha and the average age is 46.

Black alder stands grow on 125,900 hectares and are distributed evenly over the wettest sites in Lithuania. In more recent years, black alder has spread onto abandoned flooded meadows and pastures. Its stands constitute associations *Caricosa* (20%), *Filipendulosa* (13%), *Calamagrostidosa* (11%), *Carico-mixtoherbosa* (10%) and others. The growing stock of black alder stands is of 291 m^3/ha, while the average age is 47.

Grey alder in turn accounts for some 122,600 hectares of forest and is spread across the whole country except for the south. The proportion of all Lithuanian forest of this type remains quite stable. Grey alder stands are often found in associations *Aegopodiosa* (33%), *Hepatico-oxalidosa* (19%) and *Oxalidosa* (18%). The growing stock of grey alder stands is 124 m^3/ha and the average age is 33.

Oak stands grow on 37,300 hectares and are most common in central Lithuania, being almost totally absent in the southeast. The proportion of all stands in which oak predomi-

nates has remained quite stable, with felled mature oak stands being regenerated by oak. Oak stands are in forest associations *Hepatico-oxalidosa* (34%), *Aegopodiosa* (27%) and *Oxalidosa* (20%). The growing stock is 244 m³/ha and the average age is 88.

Ash stands grow on 50,700 hectares and are most widespread in central Lithuania. Since the 1960s, the area under ash stands has increased 2.5-fold. However, recent years have brought a major decline in the state of ash stands, with more than 50% of stands being affected. Ash stands represent associations *Carico-mixtoherbosa* (42%), *Aegopodiosa* (31%) and *Hepatico-oxalidosa* (15%). The growing stock of ash stands is 168 m³/ha and the average age is 56.

Volume and increment

In Lithuania, the average tree stand age is 54 years. The average timber volume of forests is 197 m³/ha. The total timber volume now reaches 387.9 million m³. The gross annual increment is 12.5 million m³ and the annual current increment is 6.4 m³/ha. Current trends show the area of forest in Lithuania to be expanding, along with the average volume and amount of timber accumulating in the forests (Fig. 3).

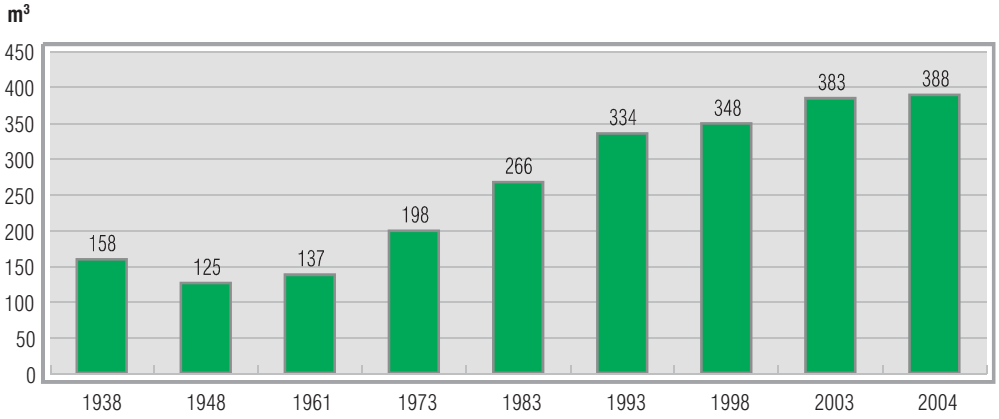

Fig. 3. Growing stock volume, 1938-2004 (Source: State Forest Survey Service, 2004)

2. Logging, wood processing and non-timber products

The amounts of timber logged in Lithuania have increased steadily over the last five years (Fig. 4). In 2003, 6.46 million m³ of timber was logged in the country's forests. The amount of timber logged from state-owned forests was 3.76 million m³. State-owned forest enterprises and National Parks (including contractors) in turn logged 3.40 million m³, while 0.36 million m³ of wood was sold as growing stock.

Over two-thirds of the state forest enterprises employ contractors to carry out 100% of their logging activities. With the increasing number of private forests, the amounts logged

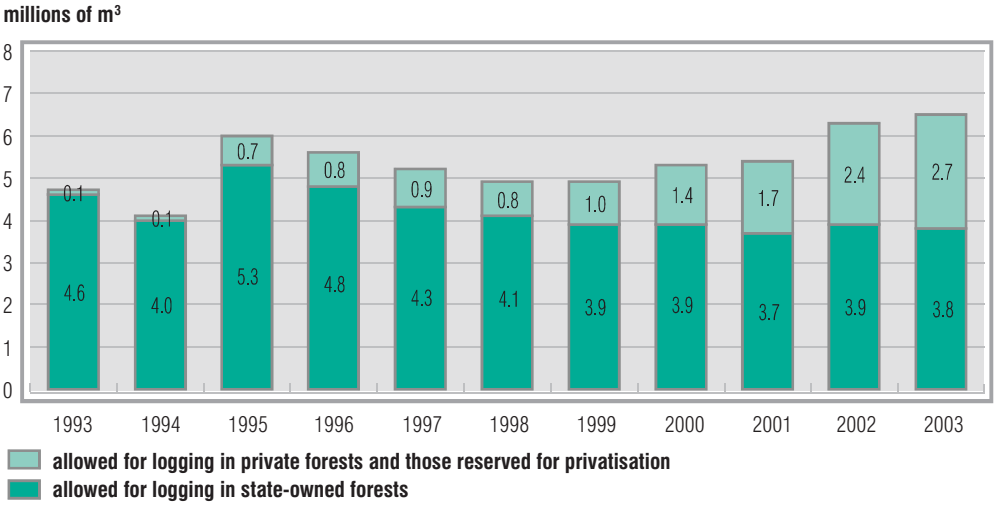

Fig. 4. Felling in Lithuania, 1993-2003

Table 1. Structure of the timber industry's gross added value (%)

Type of economic activity	2001	2002	2003
Production of timber and timber products (except furniture)	1.4	1.6	1.7
Production of pulp, paper and paper products	0.3	0.3	0.3
Publishing and printing	1.1	0.8	1.0
Production of furniture and other production	1.0	1.1	1.2
Total timber industry	**3.8**	**3.8**	**4.2**
Total manufacturing industry	**20.5**	**19.3**	**19.8**

Source: Department of Statistics, 2004.

are also increasing. In 2003, logging of approximately 2,700,000 cubic metres of timber was permitted in private forests.

Timber processing is a very old and traditional branch of Lithuanian industry. In 2003, it generated a 4.2% gross added value (Table 1).

In terms of gross added valued, in 2003 Lithuania's **timber industry** was a leader among all branches of industry. Between 1 January and 1 October 2003, foreign direct investment in the production of timber and timber products increased from 156.4 million Lt to 233.9 million Lt (where 1Lt = 0.35 EUR). The number of investing companies also increased. One of the biggest foreign investments in Lithuania is the Stora Enso sawmill in Alytus.

The **furniture industry** is one of the most prosperous branches of industry in Lithuania, and there is no doubt that its future prospects are good. The number of companies and employees is growing along with the increasing output and exports. This process became especially dynamic once the Swedish furniture wholesale company IKEA had become

a partner to the majority of larger furniture-makers. In domestic and foreign trade, the Lithuanian furniture industry is represented by 15 companies. These are well-equipped and experienced companies. A majority (12 out of 15) of the largest companies export more than three quarters of their production. Furniture exports in 2003 were worth more than 1 billion Lt. In monetary terms, the rate of annual growth in the value of exports exceeds 30–35%.

The main **non-timber products** of Lithuanian forests are their mushrooms, berries, hazel nuts, medicinal plants and Christmas trees. Approximately 120 species of edible mushroom grow in Lithuanian forests, with 10–15 species being collected by the public for their own consumption. The annual mushroom harvest is some 54,000 tonnes.

Many mushrooms and berries are exported to other countries. The most popular are chanterelles (70–80% of all mushrooms), boletus (10–15%) and blueberries (75–80% of all berries). Boletus mushrooms are exported to Italy, Germany, France and Finland, while chanterelles go to Germany, France, Austria and Sweden. Lithuania also exports a few other mushroom species.

Among the forest's "social" services, it is important to mention recreation, as well as hunting (there are 36,000 hunters in Lithuania).

3. Forest protection

In line with their management regimes and functions, the forests in Lithuania are categorised as follows:

Group I: Reserve forests. These include state-run strict nature reserves with separate administration, the strict reserves of state parks and biosphere-monitoring reserves. Another category within this group constitutes the small strict reserve, *i.e.* a small protected area surrounded by forests with other purposes (non-protected) that does not come under separate administration. Reserved forests occupy 1.2% or 24,420.4 hectares of the total forest area, their stands including 62.8% of pine, 13.7% of birch, 9.0% of black alder and 8.5% of spruce. The majority of stands in this group are over 66 years old. Forestry operations (e.g. cutting) are not permitted. Reserved forests are established in state-owned areas.

Group II: Special purpose forests, divided into the following two subgroups:

Forests for ecosystem protection, *i.e.* protected forests of telmological, pedological, zoological or botanical-zoological significance, gene-resource forest reserves and reserves of the same type located in National and Regional Parks, as well in biosphere – monitoring territories. This group also includes forests with protected natural landscape features, soil-protection (anti-erosion) forests and coastal forests protecting the shores of the Baltic Sea and the Curonian Lagoon. The main purpose of management is to preserve, maintain and restore forest ecosystems or their components, natural landscape features, protected habitats and protected valuable biological and natural features, as well as to protect the soil against water and wind erosion.

Recreational forests are forest parks, resort forests, city forests and recreational forest sites. The main purpose of management of these forests is to establish and preserve a re-

creational forest environment, establish favourable conditions for recreation, tourism, hiking, cultural and other activities in nature and to lower the impact of these activities on nature.

Forests of group II occupy 246,043.6 hectares or 11.9% of the total forest area, including 46.3% of pine, 15.6% of spruce and 14.0% of birch stands.

Group III: Protective forests. These are protected forests within geomorphological, geological, hydrographic and cultural state reserves and reserves of the same type that are located in National and Regional Parks, as well in biosphere-monitoring territories, buffer zone forests within the National and Regional Parks, protective forest zones in state parks, forests of recreational and aesthetic value near roads, resort protective forests, forests sheltering agricultural land, forests as protective zones around bodies of water, forests around factories, seed stands and forests for research and training. The main aim of management is to establish productive stands that can fulfil protective functions for soil, air, water, the living environment, and fields. Another aim is to reduce the negative impact of human activities in National and Regional Parks, strict reserves, reserves and bodies of water and to improve environmental conditions in those zones affected by pollution from factories, to preserve landscapes along roads, to create favourable local climatic conditions for agriculture, to preserve fields against wind and water erosion and bodies of water against pollution and to maintain the water-level regime and reduce fluctuations in its level. Forests of this group occupy 332,506.4 hectares or 16.1% of the total forest area. Pine stands are also prevalent (43.6%) and the average age is 53 years.

Group IV: Commercial forests. These are all the forests not included in groups I–III. The main purpose of management (with all environmental requirements given consideration) is to establish productive stands, provide a continuous supply of timber, purify the air and maintain a stable level of ground waters. Group IV forests occupy 70.8% or 1,466,149.4 hectares of the total forest area.

Lithuania's system of protected areas consists of 4 state-owned strict nature reserves, 1 strict culture reserve, 1 Biosphere Reserve, 5 National Parks, 30 Regional Parks, 254 state-owned reserves and 101 municipal reserves, as well as 683 protected nature heritage features. Protected areas occupy 786,900 hectares, or approximately 12% of the country. Almost half of the 384,400 hectares of protected areas is situated on forestland, constituting 18.8% of the total area of forestland in the country.

4. Forest ownership structure and public access

In Lithuania, the various types of forest ownership have been shaped by the political, economic and social situation at different times in history. There is no exact data for when the first private forest ownership was established. However, the first written information on the ownership of forests dates back to the times of Lithuania's Grand Duke Zygimantas-Augustas. In accordance with the 'Valakai' law enacted in 1557 "...private property is distinguished and the borders with state forests are clearly marked". Over time, the area of forest has changed, as has the overall breakdown by ownership type. These changes were influenced by land reforms, forest nationalisation and restitutions to former owners. Until

1920, land reform dominated the private-property sector in Lithuania. Private forest owners possessed approximately 65% of the all the country's forestland, while state-owned forests amounted to approximately 35% of the total. In the years 1919–1937, land reforms involved 600,200 hectares of forestland, which was taken away from private forest owners and added to the state forest pool. By 1938, only approximately 173,000 hectares of private forests remained, constituting 16% of the total area of forestland in Lithuania.

In 1940, private forests were further nationalised by the Soviet government, with another 93,200 hectares of forest returning to the state forest pool. During the German occupation (1942–1944), a large number of forests alienated by the Soviets were returned to farmers. Following the German occupation, a period of Soviet rule commenced. In the 1950s, all private property in Lithuania was abolished. Under Soviet rule, the kinds of forest identified were those belonging to state forestry enterprises, agricultural enterprises and other users (urban forests, strict reserve forests, military district forests and others). In 1961, state forest enterprises managed 71% of all forests, agricultural enterprises – 25.9% and other users – 3.1% of forestland. Up to 1991, all forests had belonged to the State, and so it was until the restoration of Lithuanian independence when some of the state forests were returned to private landholders.

In accordance with the Lithuanian Republic's 1994 Forest Act, forests are divided into state-owned and private. The structure of forest ownership has been changing, due to the ongoing land-reform process ever since Lithuania regained its independence. The reform of forest land started more than 10 years ago and is continuing (Fig. 5). Between the years 1993–2002, some 20–90 thousand hectares of forest were annually returned to private forest owners.

The process of the restitution of forest to former owners and their successors is still not complete, with 397,300 hectares (19.2% of the national total) still being earmarked for

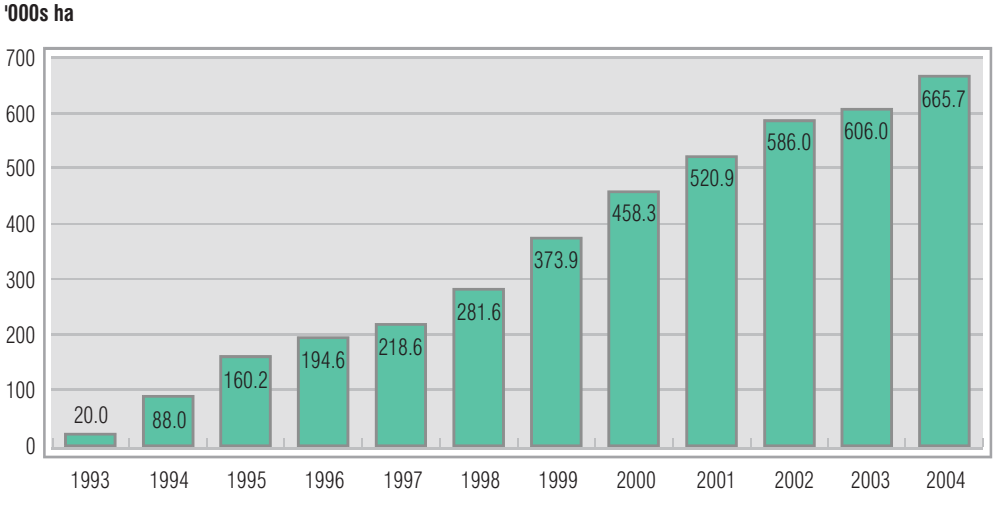

Fig. 5. Forest regeneration in Lithuania, 1993–2004 (Source: Private Forests in Lithuania, 2003. Department of Forests, Ministry of the Environment)

restitution of ownership rights. These forests are supervised by state-run forest enterprises. Private forest owners own 641,900 hectares (2004), or approximately 31% of all Lithuanian forests by area. The largest areas of private forests are in the Anyksciai, Kupiskis, Rokiskis, Telsiai, Tytuvenai and Utena regions, where they constitute more than 40% of total forestland. In Lithuania, no fewer than 208,900 owners manage private forests. Some forest holdings belong to more than one owner and for this reason, the number of private holdings is lower than the number of forest owners (a figure of 141,400). The average size of a private forest holding is 4.5 hectares, with 74.7% of forest owners owning up to 5 hectares of forest only.

In 1997, the status of forests of state importance, by virtue of a decree issued by the Lithuanian Government, was formalised. State-owned forests account for 49.8% of the national total and are under the management of 42 state forest enterprises.

Most of Lithuania's forests are open for use by the general public. Members of the public are permitted to visit forests, collect berries, mushrooms and medicinal plants and rest. It is, however, forbidden to carry out these activities on private forestland within 100 metres of a forest owner's homestead or in forests that are ascribed to a certain management group and strictly protected (as strict reserve forests). The most frequently visited forests are those with a special recreational purpose, constituting 73,500 hectares or 3.4% of total forest areas.

5. Legal and organisational aspects of forestry

Forest policy

The forest policy document Forestry and Wood Industry Development Programme was approved by the government of Lithuania in 1994 and was subsequently updated in 1996. It was the first government-approved document dealing solely with the forestry sector since the restoration of Lithuania's independence in 1990. In 2001, the government of Lithuania

Table 2. The four aspects of Lithuanian national forest policy

Policy aspect	Policy priority
General	1. Preservation and enrichment of forest resources 2. Ensuring a variety of forest-ownership forms 3. Society's participation in the resolution of major forestry issues 4. Information to society about forest conditions and management 5. Development of research, education and training on forest issues 6. Strengthening and development of international relations
Economic	1. A rational distribution and continuous usage of forest resources, an increase in forest productivity and improvements in timber quality 2. An increase in the economic efficiency of forestry
Ecological	1. Ensuring the stability of ecosystems 2. Preservation of biodiversity and improvement of forest health
Social	1. Meeting society's general forest-related needs 2. Development of state and private forest sectors in the rural context

Source: Lietuvos mišku politikos kryptys ir ju igyvendinimo strategija. Musu girios, 2002, No.3.

decided to draw up a new forest policy strategy for the country. The new Policy of Lithuanian Forestry and its Implementation Strategy was approved in September 2002 by the government of Lithuania (Lietuvos … 2002). This policy defines the key instruments for forest-policy implementation in the period up to 2015. A detailed action plan 2003–2006 for the implementation of these instruments has already been drawn up and its implementation has commenced. The Lithuanian national forest policy focuses on four aspects, namely general, economic, ecological and social. Each aspect in turn comprises separate policy priorities as summarised in Table 2.

Forest law

In order to provide an effective regulatory environment and to govern forestry-related activities in line with the requirements of SFM, the government of Lithuania has issued and, where necessary, amended a number of rules and regulations in support of the 1994 Forest Act (amended in 2001). The rules and regulations issued between 1994 and 2004 include the following:

Rule/regulation	Provisions
Property rights:	
Land Act	This Act shall establish the relations regarding ownership, management and use of land in the Republic of Lithuania. It applies to all landowners, managers and users.
Land Reform Act	This Act shall regulate the order of Land Reform and the procedure of land privatisation.
Act on the Restoration of Ownership Rights to Existing Real Property	This Act shall regulate the procedure and conditions of land restoration, as well as recognition of the need for continuity in the restoration of real property ownership rights to citizens of the Republic of Lithuania.
Forest management:	
Forest Act	The purpose of the Forest Act is to regulate reforestation, forest protection and usage and to establish legal preconditions for management of forests under all the different types of ownership. The Act applies to all forest owners, managers and users.
Protected Areas Act	The Act shall regulate social relations related to the system and management of protected areas. The Act applies to all forest owners, managers and users.
Regulations on the Management and Use of Private Forests	These regulations apply to all forest owners, managers and users.
Special Conditions of Land and Forest Use	These conditions apply to all forest owners, managers and users.
Regulation on Forest Use and Protection in Nature Protection Areas	The Regulation applies to all forest owners, managers and users.
Sanitary Regulation on Forest Protection	The Regulation applies to forest managers, owners, users and visitors.
Rules of the Fire Prevention Service	The rules apply to all forest owners, managers, users and contractors responsible for forest harvesting.

Rule/regulation	Provisions
Forest management:	
Regulations on Reforestation	The regulations apply to forest managers and are recommendations for forest owners.
Rules for Thinning and Sanitary Felling	These rules apply to managers and users of state-owned forests.
Regulations for Final Felling	These regulations apply to all forest owners, managers and users.
Non-wood related activities in forests:	
Hunting Regulations	These regulations apply to hunting area owners, users and managers.
Rules for Visiting Forests	These rules apply to forest owners, users, managers and forest visitors.
Rules for the picking of mushrooms in forests	These rules apply to users of non-wood products.

5. Structure and tasks of the national forest administration

Since regaining independence, Lithuania has passed through several changes in the structure of its forest authorities: the Ministry of Forestry of the Republic of Lithuania (1990) was followed by the Ministry of Agriculture and Forestry of the Republic of Lithuania (1996); and the Department of Forest and Protected Areas under the Ministry of the Environment of the Republic of Lithuania (1998). Since 2002, the Department of Forests at the Ministry of the Environment has been the government's leading forest agency, primarily responsible for forest policy and legislation as regards the country's forestry sector (Fig. 6).

Forestry administration is also handled by the Forests Control Division of the State Environmental Protection Inspectorate, the General Forest Enterprise and the State Service for Protected Areas. All these institutions, like the Department of Forests, report to the Ministry of the Environment.

The Forests Control Division of the State Environmental Protection Inspectorate is responsible for monitoring the implementation of the Forest Act. It also performs a control function with respect to forest condition, utilisation, reforestation and protection – whether forests are privately or state owned. It administers the issuing of licenses for forest felling by private forest owners and state forest managers and plays an advisory role, guiding private forest owners with regard to forest use, reforestation, maintenance and protection.

The General Forest Enterprise is the state forest management institution coordinating forest use, reforestation, maintenance and protection in state-owned forests.

The State Service for Protected Areas is responsible for coordinating nature protection and conservation in Lithuania, including such operations in forests. All these institutions combined constitute the state forest administration.

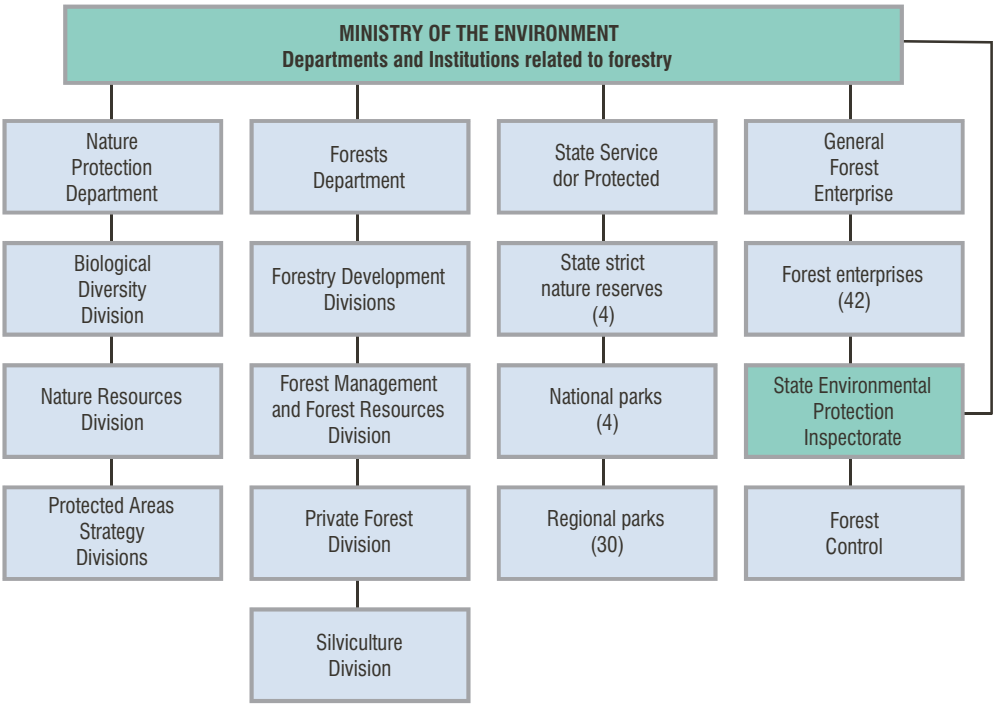

Fig. 6. Departments and institutions related to forestry

Private owner associations and other forestry-related NGOs

The Forest Owners Association of Lithuania (FOAL) is an organisation representing and bringing together private forest owners. FOAL was established in 1993 and has 38 local units. Regional units of FOAL will be established in all regions of Lithuania. The main purposes and activities of the Association are: to represent forest owners' interests with the Government and other institutions, exert its influence on legal acts, provide consultancy services for private forest owners, arrange training and educational courses for forest owners, support cooperation between forest owners and to cooperate with Forest Owners Associations abroad.

The Private Forest Extension Centre (PFEC) was established in 2000. Its founders are the Forest Owners Association of Lithuania, the Lithuanian Chamber of Agriculture and the Danish Forestry Extension. The PFEC is a non-profit organisation, whose primary objective is to promote, support and strengthen the sustainable development of the private forest sector in Lithuania by providing advisory, training and commercial services to forest owners. The PFEC actively participates in arranging training sessions and educational courses concerning private forests and publishing specialist material and literature.

Over the last decade, more than 20 private forest owners' cooperatives have been established in Lithuania. This process is still ongoing. The Forest Owners Association of

Lithuania (FOAL) supports the development of this network of co-operatives and other forest-related companies. The latter provide a full range of forestry-related services and employ more then 130 skilled specialists. The services provided by forest owners' cooperatives include: information, consultancy, teaching and education, as well as timber trade, forest management plans, afforestation, forest cutting, etc.

The main non-governmental organisations establishing forest policy in Lithuania are the Forest Owners Association of Lithuania, the Union of Foresters, the Lithuanian Green Movement and the Association of the Lithuanian Wood Working Industry.

The Union of Foresters is a public professional foresters' organisation, re-established in 1989. The Union of Foresters aims to participate actively in the solution of major forestry problems. It contributes to deliberations on forest legal acts and the making of administrative decisions. It holds seminars, meetings, expositions and field trips and develops international relations with organisations of foresters from other countries. The monthly journal for foresters Musu girios is published by this organisation.

The Lithuanian Green Movement is a public environmental-protection organisation established in 1988. Its main areas of campaigning are the protection of the Baltic Sea and its basin, the protection of forest reserves and natural landscape areas, power, transport and reform of international financial institutions. It supports other environmental protection NGOs and activist groups and works towards the environmental education of society. The work and objectives of the Lithuanian Green Movement are expressed through periodic press releases, involvement with other mass media, meetings and pickets.

The Lithuanian Wood (Lietuvos Mediena) association was established in May 1993. This is a voluntary union of woodworking, industrial and trade companies. The association coordinates and carries out the tasks of its members and represents their economic interests with various Lithuanian government institutions and international organisations. At the beginning of 1998, Lietuvos Mediena had 45 members representing the 60 largest companies in the woodworking industry. It is a member of the European Confederation of Woodworking Industries.

6. Education in forestry

The Lithuanian Agricultural University (Faculty of Forestry) and Kaunas College of Forestry and Environmental Engineering are institutions of higher education in forestry. The primary studies include undergraduate and postgraduate courses in forestry and applied ecology.

Since 1994, students at the Faculty of Forestry may participate in forestry and ecology study programmes. During their studies, future foresters can choose to specialise in forestry, forest utilisation, Forest Economics and management or game management for a Bachelor's degree, Forestry Engineer or Master's degree qualification. Future ecologists may choose to specialise in agro-ecology, forest ecology or aquatic ecology for a Bachelor's and/or Master's degree in ecology and environmental sciences. Graduates who wish to work in the scientific field can continue their studies at doctoral level. The Faculty of Forestry has educated more than 2,700 specialists in forestry and 200 in environment protection. Its three departments are: Forestry, Forest Management and Ecology.

In 2002, the Kaunas forestry school was transformed into the Kaunas College of Forest and Environment Engineering. Forestry specialists study there under programmes of higher (non-university) studies. They receive the qualifications of Forestry Engineer.

7. Forest research

Established on the 20th of October 1950, the Lithuanian Forest Research Institute (LFRI) is the main forest research organisation in Lithuania. Over the last 50 years, the Institute's scientific activities have covered studies on forest biology and ecology, typology, hydrology, stand productivity and stability, as well as harvesting, forest regeneration, forest genetics and tree breeding, forest management, forest economics, forest protection and game management.

The LFRI is a state institute subordinated to the Ministry of Education and Science. It is associated with the Lithuanian Academy of Sciences and is a member of IUFRO. The main directions for scientific research laid down by the Lithuanian government are:

- biological diversity and sustainability of forest ecosystems,
- reforestation, forest productivity, protection and utilisation,
- conservation of forest genetic resources and forest tree breeding,
- forest policy and social and economic problems.

Research is in turn divided into the following departments:

- Silviculture,
- Ecology.
- Tree genetics and breeding,
- Forest protection and game management,
- Forest resources, economics and policy,
- Molecular genetics and biotechnology.

The LFRI has a staff of approximately 90 employees, of which approximately 50% conduct research, with more than 20 researchers holding scientific degrees. Most employees work at LFRI's head office in Girionys, Kaunas district.

The Lithuanian Forest Research Institute, the Lithuanian University of Agriculture and Vytautas Magnus University are entitled to jointly organise doctoral studies. Doctoral studies in forestry are organised together with the Lithuanian University of Agriculture, while those in the fields of ecology and the environmental sciences are conducted together with Vytautas Magnus University. There are 20 postgraduate students studying for doctoral degrees at the LFRI.

The LFRI's serial publication is 'Baltic Forestry', the journal of forest science in Lithuania, Latvia and Estonia. This is an English language, international, peer-reviewed scientific journal (with a summary in Russian). It is jointly published twice a year by several universities and institutes in Latvia, Lithuania and Estonia. 'Forestry' (Miškininkystė), the journal of forest science, is published in cooperation with the Lithuanian Agricultural University (in Lithuanian, with a summary in both English and Russian).

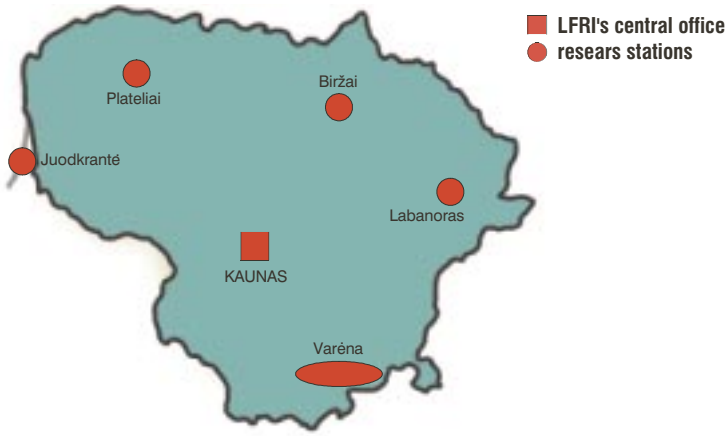

Fig. 7. Lithuanian Forest Research Institute

The LFRI's total annual research budget is approximately Lt 2 million (1 EUR = 3.45 Lt), half of which is provided by the State. The other half comes from grants from various international programmes and commissions of the forest sector.

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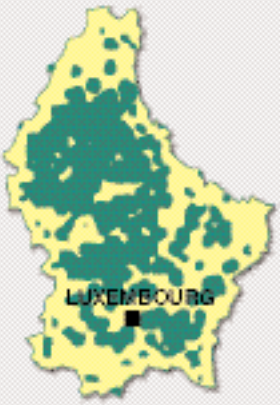
Luxembourg

Antonina Arkuszewska

The Grand Duchy of Luxembourg
(Grand-Duche de Luxembourg),
territory: 2,600 km²,
population: 452,000,
capital city: Luxembourg.



1. Forest characteristics

Forest area

The forest area in Luxembourg (The Grand Duchy of Luxembourg), including forests, bushes and other wooded land, according to the typology of the Food and Agriculture Organisation (Temperate and Boreal Forest Resources Assessment 2000), is 89,150 hectares, which accounts for 34.3% of the total national territory of the Grand Duchy (2,586 km²). The forest area per capita is 0.20 hectare.

Detailed data on forests were obtained as a result of the inventory performed in 1998–2000[1] on a grid of 1,000×500 m of sample plots, the radius of which varied between 1 and 30 m, depending on the type of collected data.

On the basis of the differentiation of the natural conditions in Luxembourg, four ecological regions are distinguished: Oesling in the north, Gutland in the central part, the watershed of the Minette River in the south-west, and the Moselle Valley in the south-eastern part.

The Oesling Region is characterised by the largest forest cover – 41.6% of the total, as well as by the greatest fragmentation of forests. In the Gutland Region, forest coverage accounts for only 31.2%. The least forested area is the Moselle Valley representing 3.5%.

Antonina Arkuszewska – Forest Research Institute, Warsaw.

[1] It was the first forest inventory in the Grand Duchy of Luxembourg where the methods applied were comparable to those in Walloon: Lecomte H. and Rondeux J, 1994: L'inventaire forestier wallon: breve presentation methodologique. Silva Belgian, 101: 9-16; Rondeux J. and Lecomte H. 2001: L'inventaire forestier wallon: Rev. For. Franc., LIII : 263-267.

Table 1. Forest land categories

Land category		Area (ha)
Forests	poplar plantations	84,450
	clear-cuts	550
	compartment lines	450
	barrens (10–50 ares)	250
	clearings (10–50 ares)	150
	bushes (10–50 ares)	150
	other	750
	sub-total	**86,750**
Other woodlands		1400
Bushes		1000
Total forested area		**89,150**
Other areas in forests	clearings (>50 are)	50
	barrens (>50 are)	700
	ponds (>50 are)	150
	sub-total	**900**
Total forest area		**90,050**

Species and age structure

As for stand structure, there are high, one-storeyed (65.3% of total forest area), two-storeyed (13.6%) and three-storeyed forests (0.8%), high forests with vertical structure (0%), and coppice forests (13%), high and coppice forests with single storey (0.5%), high stands with coppice in the second storey (0.9%), plantations (4.0%), and pioneer vegetation (1.3%).

In Luxembourg, broadleaved forests predominate, covering 68.6% of total forest area, and include beech and oak woods – 46.8%. Among coniferous forests, spruce stands predominate, covering 20.4% of the forest area.

High broadleaved forests are subject to management rules, as most of them are public forests (62%), while coniferous forests (81% of spruce stands and 71% of other conifers) belong to private owners. The share of coppice forests is considerable. They cover 9,550 hectares[2]. Most of them, *i.e.* 8,950 hectares (81%), are in private hands, and account for nearly 20% of the area.

As regards tree age, forests in Luxembourg are characterised by a substantial share of old beech and oak stands. The stands of other species are considerably younger due to their shorter lifetime, or because they have been recently introduced into the forest species composition.

* [2] It was until quite recently that oak stands had covered almost 13,000 ha. It was the consequence of the forest management focused on tan production. Because of that, in the 18th and 19th centuries, regeneration period in coppice oak stands was 16–20 years.

Table 2. Share of stand types in total forest area

Stand type	Total area	
	ha	%
Beech forest	20,650	24.3
Oak forest	19,150	22.5
Broadleaved, valuable species	6,800	8.0
Mixed broadleaved	8,300	9.8
Mixed with dominant broadleaved species and others	3,350	4.0
Total broadleaved	**58,250**	**68.6**
Spruce	17,350	20.4
Pine-larch	1,600	1.9
Douglas fir	2,700	3.2
Mixed coniferous	1,650	1.9
Mixed with dominant coniferous species and others	2,900	3.4
Total coniferous	**26,200**	**30.8**
Clear-cuts	550	0.6
Grand total	**85,000**	**100.0**

Table 3. Distribution of species in one-storeyed high stands by age class

Species	Age class (years)										Total (ha)	Area with stocking <20%
	0–20	21–40	41–60	61–80	81–100	101–120	121–140	141–160	161–180	>180		
Beech	1,300	750	700	400	2,000	3,450	4,800	2,950	500	50	16,900	
Oak	950	350	500	400	550	750	1,700	1,700	800	50	7,750	
Valuable broadleaves (ash, maple, cherry)	650	600	50	100	50	0	0	0	0	0	1,450	
Other broadleaves	700	400	150	100	0	50	0	0	0	0	1,400	
Broadleaves total	**3,600**	**2,100**	**1,400**	**1,000**	**2,600**	**4,250**	**6,500**	**4,650**	**1,300**	**100**	**27,500**	
Main coniferous species:	4,400	10,550	3,850	1,600	250	150	0	0	0	0	20,800	
Spruce	3,450	8,700	3,300	1,250	150	50	0	0	0	0	16,900	
Douglas fir	850	1,500	250	50	0	0	0	0	0	0	2,650	
Other conifers (fir, black pine, Sitka spruce)	250	150	0	0	0	0	0	0	0	0	400	
Conifers total	**4,650**	**10,700**	**3,850**	**1,600**	**250**	**150**	**0**	**0**	**0**	**0**	**21,200**	
Grand total	**8,250**	**12,800**	**5,250**	**2,600**	**2,850**	**4,400**	**6,500**	**4,650**	**1,300**	**100**	**48,700**	**9,900**

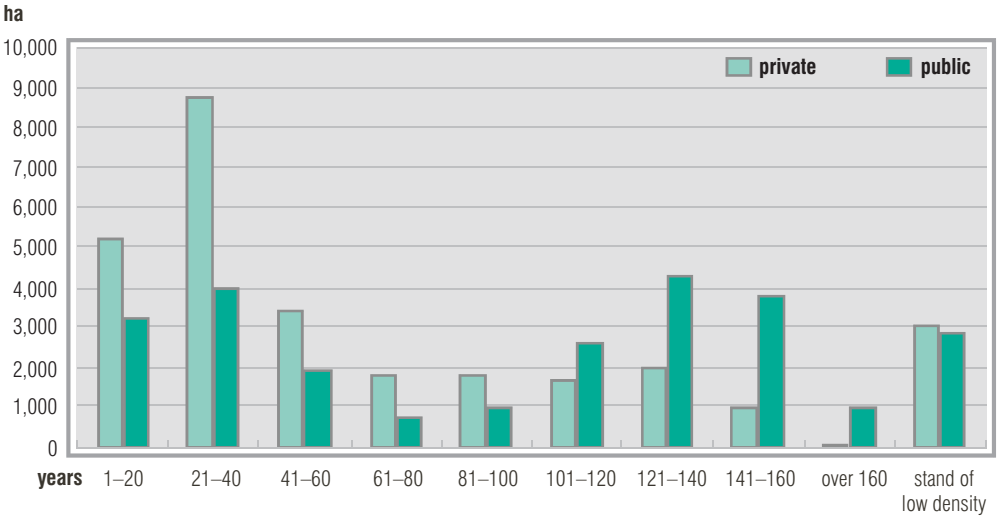


Fig. 1. Share of age classes in one-storeyed stands by ownership category

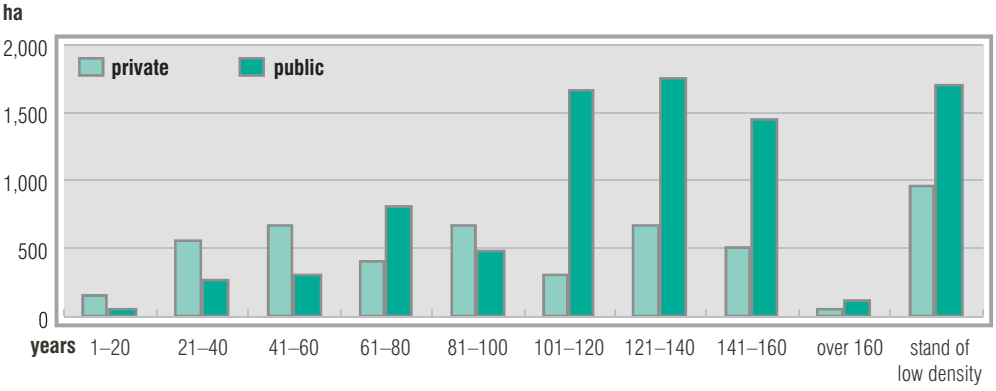


Fig. 2. Share of age classes in the upper layer of multi-storeyed stands by ownership category

In multi-storeyed stands, age is determined separately for each storey. Coppice stands are mainly 20–40 years old (8,700 hectares within 9,550 hectares of total coppice stands). Forest management types vary by age class, and in relation to ownership type. In public forests, the proportion of old stands (above 100 years of age) is definitely higher, whereas in private forests those of younger age classes predominate (Figs. 1 and 2).

Volume, increment and harvest

The total stock of merchantable timber is 23.3 million m^3, of which beech accounts for 4.8 million, oak – 2.9 million, and spruce – 1.4 million m^3. The volume is 308 m^3/ha, on average.

Table 4. The volume of merchantable timber in forests by ownership category

Ownership category	Volume (m^3/ha)		Total stock (m^3)
	Stands subjected to forest measurement	All stands	
State-owned forests	258	216	1,935,000
Communal forests	332	307	8,900,000
Forests of other public institutions	295	231	265,000
Public forests in total	**315**	**284**	**11,000,000**
Private forests	**302**	**269**	**12,215,000**
Total	**308**	**276**	**23,315,000**

During the inventory carried out in 2000, the quality of the stock was also assessed. Trees of very good quality accounted for only 7% and 6.5%, of good quality – for 47.3% and 41.4%, of poor quality – 54.4% and 50.7% of private and public forests, respectively. Trees outside quality classes represented 1.3% and 1.4%.

Wood harvesting is relatively easy, thanks to the dense network of skidding tracks and forest roads. Only in the Oesling Region, harvesting on about 25% of the area is difficult due to the terrain relief. During the three inventory years (1998–2000), harvesting was carried out on 13% of the forest area. Sanitary cuttings are applied on more than 80% of the stand area without taking into account the time-factor. Nevertheless, the intensity of cutting is rather low. The selection of plus trees is still marginal and accounts for less than 1% of the forest area.

Annual harvesting amounts to about 326,000 m^3 of merchantable timber overbark, of which about 186,000 m^3 come from public forests, and 140,000 m^3 – from private forests. Wood is processed mostly into sawnwood. There are sawmills with a total processing capacity of about 63,000 m^3, however the paper industry and large wood processing plants are not there.

2. Forest protection

Forests in Luxembourg feature high biodiversity and a complex structure; forests with 5–14 tree species composition predominate; single, very old trees appear in forests on about 13% of the forest area. The forest borders with different objects, like roads, fields, water-courses and reservoirs, thus, a great proportion of the forest area forms an ecotonal zone, even much more diverse biologically than the interior of the forest itself.

Protection forests cover 8,100 hectares, including 2,558 hectares of reserves, and 5,545 hectares of buffer zones.

There are two National Parks in Luxembourg. The German-Luxembourgian Park is the first international park performing a nature protection function. It was established in 1964 and covers almost 35,000 hectares on the Luxembourgian side. 37% of it is forested. Another one, the Belgian – Luxembourgian Park, is under development. In the Luxemburg area, it embraces the la Haut-Sure district measuring about 28,000 hectares, where the forest area accounts for 50%.

3. Forest ownership, organisational structure and legal basis

Ownership categories

Forests in Luxemburg fall within two ownership categories: private forests and public forests. In both types of forest, implementation of sustainable forest management tasks is mandatory. Management in public forests is carried out by the Administration of Waters and Forests and supervised by the Ministry of Agriculture, Viticulture and Rural Development. The Administration of Waters and Forests' services are responsible for the development of 10-year management plans, nature protection, forest management, as well as for hunting and fishery management. Preparation of annual plans and direct management of public forests proceeds in two stages and embraces 6 regions divided into 61 forest districts.

Table 5. Forest areas by ownership category

Ownership category	Area, ha	Share, %
Communal forests	29,250	32.8
State-owned forests	9,500	10.7
Forests owned by other institutions	1,150	1.3
Public forests altogether	**39,900**	**44.8**
Private forests	**49,250**	**55.2**
Total	**89,150**	**100.0**

The number of private forest owners is estimated at 12,000 (following the 1982–1985 inventory of private forests). In 1985, the area of private forests was of 50,115 hectares, but in 1990, it decreased to 47,922 hectares, as a result of buying out of the state-owned forests by the ARBED Association. The Oesling Region is characterised by the largest share of private forests (81.9%). In the Gutland Region, private forests account for only 38.4%, while in the Moselle Valley, all forests are in public hands.

Forest law

The Environmental Code published in 1997 provides the legal basis for all the activities carried out in public forests. It includes all[3] obligatory, legal provisions (also international ones) pertaining to land-use management, atmosphere, noise, hunting, water, energy, environmental hazards, forests, nature parks, and nature protection issues.

* [3] The oldest legal provisions pertaining to forestry, the fragments of which can still be found in Environmental Code, come from Edict on Forests given by the Archduke Albert and Archduchess Isabelle, dated 14 September 1617, and the Regulations of 13 August 1669 on Waters and Forests.

Forest policy

The forest policy of the Grand Duchy, aiming at the protection of forest resources, is expressed in the legal acts providing that any change influencing the state of forest plots requires prior consent of the Minister, and even of the Grand-Duke. The remaining instruments are not of a prohibitive nature, but play the role of an economic stimulator. This is accomplished through a financial support given to the land referred to in the land-use plans as forestland. The 1995 Act specifies, in detail, in what situations it is possible to obtain refinancing and the amount thereof. For example, the State budgetary funding for the afforestation and regeneration of private-owned lands amounts to EUR 9.92 – 37.18 per are; for the conversion of coppice stands into standard ones – EUR 24.79 per are; and for the pruning of selected trees species – EUR 4.96 per are.

Public access to forests

Public forests are generally accessible, while private forests are open for public access only under certain conditions. More than a half of forests are inaccessible for hunting.

Forest organisations

The most important professional institutions and forest organisations dealing with forestry issues are as follows:

- Associations
- The Union of Forest Breeders ASBL (le Groupement de Sylviculteurs ASBL),
- The National Association of Private Forest Owners for Business Protection (with its 5 regional units at Lintgen, Our Saper, Clervaux, Wilt and Rambrouch),
- Professional Offices,
- The independent research station EFOR dealing with forest management and land-use management,
- Companies,
- the civil association BOESCH-VDB-Letzeburg provides: advise and mediation in the field of industrial forestry and development of plans, organisation of sales and purchases of planting material, supervision of forest works, and preparation of expertises for private forest owners,
- WINANDY in Pol-Esch a Sure, deals with forest management and forest use issues, and provides expertise.

4. Education in forestry

The main research centre dealing with both, research and education for forestry needs is the Faculty of Agronomics in the University of Gembloux (Faculté universitaire des Sciences agronomiques de Gembloux). Research is carried out there in five major areas:

biochemistry and biology, plant and animal production, processing, water and soil resource management, land-use management, and research on environment health.

Forestry studies are located at the Department of Environmental Sciences and Technology. The first 2 years of study embrace all the subjects common for all students of the university, while the next semester subjects are common for all faculty students. Specialisation starts afterwards. After completing three years of study, the graduates obtain the title of bio-engineer up to a Bachelor's degree, and after five years of study – a Master's degree.

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Malta

John Neville Ebejer

The Republic of Malta
(Repubblika ta' Malta),
territory: 320 km^2,
population: 300 thousand,
capital city: La Valetta.

Malta is a very small island, occupying 320 square kilometres, with population of 300,000, thus being one of the most densely populated countries in the world.

No forests can be found in Malta. The tree cover is less than a million square metres, and the only forested areas are the remnants of forests covering a total of 100,000 square metres.

Vegetation on the island is typically Mediterranean, with gardens, some steppe, and mostly cliff and coastal vegetation. Nonetheless, the island is rich with plant species of around 500, a good number of which are endemic.

The 'afforestation' projects, in which the Department for the Parks and Landscapes (Ministry of Rural Affairs and Environment) has been involved for the past 10 years, are aimed at the establishment of recreational areas for the general public, rather than serving any forestry or related, industrial purposes.

John Neville Ebejer – Senior Environmental Inspector, Department for the Parks and Landscapes, Ministry of Rural Affairs and Environment, Fort San Luc.

The Netherlands

G.M.J. (Frits) Mohren and Floor Vodde

The Kingdom of the Netherlands (Koninkrijk der Nederlanden), territory: 41,500 km², population: 16.4 million, capital city: Amsterdam.

1. Forest characteristics

Forest area

Some time ago, large parts of what is today the Netherlands[1] were nearly completely covered by forests (notably in the eastern and southern parts of the country which have Pleistocene deposits). The more marshy areas of the Holocene located in the western and northern parts of the country, near the sea, formed more open landscapes, as was probably the case in the vicinity of the large rivers crossing the country from east to west. Forests covered the drier sandy deposits, as well as the more fertile sites in the eastern and southern parts of the country. Around 2,000 years ago, local population started to practice a form of shifting cultivation, thereby reducing the forested area. After that, forests were gradually destroyed by overexploitation and grazing, until – at the start of the 19th century – only about 2% (70,000 hectares) of the land was still covered by forests. These forest remnants were situated on the poorer soils of the eastern part of the country, on hunting estates and around country houses. However, from that time onwards, afforestation was resumed by both, private landowners and the State (in the latter case, primarily from the second half of the 19th century). The beginning of the 20th century saw continuation of the afforestation process, mainly to procure employment, but later, also to landscape the new polders (see Table 1 for an overview of land use in the Netherlands in the 20th century).

G.M.J. (Frits) Mohren and **Floor Vodde** – Forest Ecology and Forest Management Group, Centre for Ecosystem Studies, Wageningen University.

[1] This paper draws heavily from Schmidt *et al.* (1999), Al & Kuiper (2000), Den Ouden & Mohren (2004), and Vodde *et al.* (2005). The authors of those papers are gratefully acknowledged for providing information and data.

Table 1. Percentage share of land use in the Netherlands in the 20th century

Land use	1900	1950	1980	1990
Forest	8.2	7.6	9.0	9.7
Heather/peat moor	13.1	3.4	1.4	1.3
Moor, beach, land outside dikes	5.0	3.7	2.9	2.6
Water	6.6	3.4	2.2	2.4
Agricultural land	63.7	73.1	72.9	70.8
Built-up area	1.6	2.9	5.9	7.5
Other	1.8	5.9	5.7	5.7

Source: Dijkstra, 1997.

According to recent estimates (Dirkse *et al.*, 2002, Al & Kuiper, 2000), the Netherlands has about 360,000 hectares of forest, which corresponds to ca 10% of forest cover. Forest distribution is rather uneven, with the more-densely-populated provinces located in the western part of the country (Holland[2]) and the agricultural provinces in the north and south--west having just 1% to 4% of forest cover, while other provinces – 10% to 20%.

Species composition

In view of both, the history and the prevailing site conditions in the majority of Dutch forests, it is easy to understand why Scots pine (*Pinus sylvestris*) has long been the main forest species (Table 2). Until about 1970, in more than half of all Dutch forests this species had dominated. However, it has declined to 35–40% due to increased introduction of broadleaved species. This was partly the result of the changes taking place in forest management. Furthermore, afforestation on the fertile soils of the new polder areas involved broadleaved species in the first place.

The other major coniferous species (*Pseudotsuga menziesii*, *Larix* spp., *Picea* spp. and *Pinus* spp.) predominate in about 25% of the forests; these species having been planted in the past for timber production. To meet the changing targets of forest management, seeing more emphasis being placed on native broadleaved species, spruce plantations are increasingly being converted. Douglas fir has so far been maintained as a timber tree, but it is of course a non-native species, only enjoying a high regeneration potential in forests where nature conservation goals are not predominant.

The second most important tree species in Dutch forests are oaks (*Quercus robur* and *Q. petraea*). These are especially appreciated for their high-quality timber production and role in nature conservation. Sessile oak (*Q. petraea*) is rarer than the rather common penduculate oak (*Q. robur*), which is considered somewhat less drought-tolerant. In many older Scots pine plantations, the natural regeneration of oak has been stimulated with a view to greater numbers of deciduous trees in the stand being achieved. Another important

* [2] The name Holland, now referring mainly to the western provinces is derived from 'Holtland', meaning 'wooded land' (see e.g. Buis, 1993).

Table 2. Distribution of main tree species between 1950 and 2002 as % of area

Tree species	1952–63*	1964–68*	1980–83*	1992**	1996**	2002***
Pinus sylvestris	55.2	50.6	41.9	35.8	35.4	36.8
Pinus spp.	6.4	8.1	7.9	6.6	6.3	5.0
Pseudotsuga menziesii	6.5	7.4	6.7	6.1	6.6	7.2
Larix spp.	9.7	9.4	7.7	6.6	5.9	7.3
Picea spp.	5.5	6.7	6.7	4.7	4.6	4.4
Other coniferous	0.9	0.5	0.6	0.7	0.7	0.7
Quercus robur and *Q. petraea*	7.3	7.5	11.5	14.3	15.7	17.4
Fagus sylvatica	2.2	2.2	3.0	3.6	3.7	3.0
Populus and *Salix* spp.	3.2	4.1	6.5	6.6	6.1	6.3
Other deciduous	3.1	3.5	7.5	15.0	15.0	11.9
Total percentage	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total ha	**183,329**	**196,323**	**234,624**	**281,196**	**279,567**	**260,301**

* Source: CBS, 1985.
** Source: Seubring, 1997.
*** Source: SBH, 2003.

broadleaved species is common beech (*Fagus sylvatica*). The area covered by this species (probably the climax one over large parts of the Netherlands), is increasing. This is partly the result of the abandonment of coppicing (where oak is much more tolerant than beech) – once, the main silvicultural system. The impact of afforestation in the new polders and in the western part of the Netherlands is reflected in the increasing areas under poplar (*Populus*), willow (*Salix* spp.), and other broadleaved trees. Recently, more attention has also been paid to less-abundant native tree genera of more fertile soils, such as *Malus, Pyrus, Crataegus*, etc.

The phytosociological composition and classification of Dutch forests have recently been revised completely, and are described by Stortelder *et al.* (1999).

Standing volume, annual increment and annual cuts

The Dutch forest is relatively young. In 1980, only 3% of it was more than 100 years old, while at least 51% of forest was under 40. In 2000, 11% of the forest area included stands more than 100 years old, while 34% was under 40 (Table 3). The Dutch forest is growing older, as the proportion of old stands increases. While the average age of trees was 43 in 1982, this figure had risen to 53 twenty years later.

In 2002, the growing stock over the major forest area of approximately 300,000 hectares in the Netherlands, was ca 59 million m^3 of wood, or 197 m^3/ha (Ministry LNV, 2003, see also Table 4). In 1988, the figures were 45.7 million m^3, or 153 m^3/ha. The annual increment per hectare declined from 8.4 m^3/ha in 1988 to 7.8 m^3/ha in 1992/3, only to increase again to an average of 8 m^3/ha in 2002. These figures indicate that the annual cut is about 60% of the total annual increment, resulting in an increasing growing stock. The annual increment

Table 3. Percentage share of age classes in total forest area in 1980 and 2000 (%)

Age (years)	1980	2000
0–20	18	10
21–40	33	24
41–60	25	25
61–80	15	21
81–100	6	9
101–120	2	9
121–140	1	2
>140	0	0

Source: Dirkse *et al.*, 2002.

Table 4. Changes in standing volume, annual increment, and harvest of timber over bark (>7 cm diameter) ('000s m^3)

Year	Standing volume	Annual increment	Harvest per year	Harvest as % of the annual increment
1992	48,309	2,198	1,178	54
1993	49,311	2,211	1,214	55
1994	49,895	2,209	1,292	58
1995	50,849	2,258	1,324	59
1996	51,657	2,245	1,339	60
1997	52,700	2,236	1,455	65

Source: Seubring, 1997.

is likely to have increased in recent decades, as a result of nitrogen deposition (Mohren, 1991).

The increase in standing volume is likely to continue in the coming years, as a result of the increased emphasis on nature-conservation in most Dutch forests. The desire to have large trees in the forest will result in longer rotations and increasing mean tree age. Moreover, the contribution of standing dead trees and fallen trees, also of larger dimensions, will change the biomass characteristics in different ways. At this moment, some 65% of the annual increment is harvested, dead wood formation (natural mortality) accounts for about 10% of the increment, and 25% of the annual increment is added to the growing stock. The percentage of harvested wood from coniferous species is higher than that from deciduous trees (85% and 41% respectively, reflecting the gradual conversion from coniferous to deciduous forests (Ministry LNV, 2003). The exact outcome of these and other influences, like changing site conditions due to forest soil development and pollution, as yet remain unclear.

Between 1992 and 1997, the annual cut increased from 1.2 to 1.5 million m^3, resulting in a rise in the percentage harvest from 54% to 65%. Private owners may harvest up to 80% of their annual increment, while other forest owners, notably nature conservation organisations, harvest much less.

In the past, most cutting was in the form of clear-felling. However, as a result of the increased attention being given to combined timber production and nature management, a change towards small-scale and selective harvesting methods has been taking place recently, with more emphasis being placed on thinning rather than on the final cut.

The Netherlands utilises about 15 million m^3 of timber (roundwood equivalents). 0.9 million m^3 of this is tropical timber. National production accounts for only 0.9 million m^3. The bulk of the timber used is imported (19.7 million m^3), of which 6 million m^3 is re-exported.

2. Categories of forest protection

The main types of protected forest area in the Netherlands are: the Forest Reserve, the A-locality Forest, the Nature Monument, the National Park, the NATURA 2000 Birds or Habitats Directive Area, and the National Ecological Network. Most forests in the Netherlands are inextricably incorporated into other protected areas. Hence, most of the categories below include forests, as well as other nature areas. The types of forest protection networks often overlap other categories.

Forest Reserve

The purposes of the Forest Reserve Network are conservation and the study of spontaneous processes in forest ecosystems. Dutch Forest Reserves have an official (but no legal) status. They can be referred to as: Strict Forest Reserves, Forest Reserves, or Forest Research Reserves. In practice, the terms Strict Forest Reserve and Forest Reserve are regularly used to refer to Forest Research Reserves, *i.e.* forest areas that have been assigned by the Ministry of Agriculture, Nature and Food Quality within the National Forest Reserves Network as a representative example of Dutch forests (Broekmeyer 1999a; Broekmeyer and Szabo 1993). Furthermore, the terms Strict Forest Reserve and Forest Reserve are often used by nature management organisations to distinguish these forest areas from those playing different function(s). The areas within the two categories are respectively non-managed or managed in order to maintain their high natural values (Parviainen *et al.,* 2000). The management policy in Forest Reserves is to avoid management interventions or human disturbance for at least 50 years, unless these are necessary to prevent external influences. The area of individual Forest Reserves ranges from 3 to 440 hectares. In 2000, the Ministry of Agriculture, Nature and Food Quality selected the last of the 60 reserves in The Netherlands. Many Forest Reserves are among the Habitats Directive areas (Koop *et al.*, 2000).

A-locality Forest

A-locality Forests are officially protected forest areas, which are considered the best representatives of the original, natural forest in the Netherlands, of high botanical quality. A-locality forests have no legal status. As part of the National Forest Policy Plan (1993), scientists have selected and described over 330 areas, representing the best examples of

the 33 Natural Forest Associations, occurring in the Netherlands. In some cases, these areas represent almost complete forest associations, in other cases, only fragments (Al & Van der Jagt, 1995; Van den Bos, 2002). The 330 areas of A-locality forests vary in size from less than 10 hectares to several hundred hectares.

Natural Monuments

A natural monument is a protected area, with legal status under the Nature Conservation Act of 1998, which is of general importance for its valuable scientific or aesthetic natural features (Van Vliet *et al*., 2002). Management activities are aimed at the maintenance of these, whether related to biodiversity, scenic beauty or other aspects (Van Vliet *et al*., 2002). About 233 areas have been selected, covering 312,000 hectares, of which 200,000 hectares comprise the Wadden Sea (representing 85% of the territorial sea area of the country) (Van Vliet *et al*., 2002). Almost all Dutch Natural Monuments are also part of the NATURA 2000 network, except for some 4,000 hectares (Ministry LNV 2002b).

National Parks

Dutch National Parks are areas of at least 1,000 hectares, consisting of natural habitats, wetlands and/or forests, characterised by outstanding aesthetic features, flora and fauna. Within National Parks, nature management and development are intensified, nature and environmental education are stimulated, and different types of nature-oriented recreation and research are favoured (Hazendonk *et al.,* 2000, Van Vliet *et al.,* 2002, Van Wijk *et al.,* 2003). National Parks belong to the core areas of the National Ecological Network. Their status is official, but does not include legal protection (Ministry LNV 2000). The Government intended to have established a total of 17 National Parks and one cross-border Park by 2004. The De Hoge Veluwe Park (established in 1935) and Veluwezoom Park (established in 1930) are autonomous national parks and do not fall under the current National Park policy.

NATURA 2000 Birds and Habitats Directive Areas

NATURA 2000 areas consist of ecosystems and landscapes that are characteristic for the Netherlands, and also are of international importance (RIVM, 2002). Legal protection is provided under the EU Birds and Habitats Directives. These areas are categorised as Special Protection Areas under the Nature Conservation Act 1998 and conform to the EU-Directive management objectives to protect natural and semi-natural habitats and wild flora and fauna (Van Vliet *et al.*, 2002). Currently, 79 Birds Directive Areas and 141 Habitats Directive Areas have been designated (Natuurcompendium, see RIVM *et al.,* 2003). These areas – together with a new list of areas proposed and adapted in spring 2003 – bring the total area of the NATURA 2000 network in the Netherlands to about 740,000 hectares, of which virtually all the sites on land are also part of the EHS (RIVM & Stichting DLO, 2002). On average, the individual areas are of about 2200 hectares in size. The total NATURA 2000 area in the Netherlands encompasses 1.1 million hectares (Ministry LNV 2001).

National Ecological Network (EHS)

The National Ecological Network is an integrated network of the existing natural habitats and forest areas, and the new ones to be developed. It is being set up to protect species and ecosystems by providing protection areas and ecological corridors for plant and animal populations to survive. By 2020, the Ecological Network will have encompassed 750,000 hectares of forest and other natural habitats. This will include the establishment of wildlife corridors in the Nature Policy Plan and the Structure Plan for the Rural Areas, 25,000 hectares of rural sites, 250 country estates and 18 National Parks. The EHS will be an integrated part of the Pan-European Ecological Network (PEEN) (Ministry LNV 2000). Approximately 40% of the EHS enjoys legal protection under Article 6 of the Habitats Directive for NATURA 2000 areas. Protection for the remaining 60% depends on regional development plans. Indirect protection is laid down in the Act on Spatial Planning and the Structural Plan for the Rural Areas (RIVM 2002, Lammers *et al*., 2002).

Disturbances and threats

The high degree of urbanization in the Netherlands not only means that forests are highly valued for recreational and nature-related purposes, but also that they are threatened by a variety of effects of human activities. Due to industry and intensive agriculture (including widespread intensive livestock farming), forests are under strong influence of pollution (acidification and eutrophication), and due to water-level control, sometimes they also suffer from drought (Van Tol *et al.*, 1998). In addition, forest fragmentation is causing ecological concern. Traditional forest threats, such as pests and diseases are considered less relevant, partly due to the declining emphasis on wood production.

Industry and traffic may cause high levels of **NOx emission**, which episodically lead to ozone concentrations high enough to damage trees and other plants. SO_2 levels have steadily declined since the mid 1970s, and are no longer a source of concern. In general, the direct effects of gaseous air pollutants are negligible, except during episodes with high ozone concentrations (Mohren, 1991). The main pollution resulting from intensive agriculture is the high nitrogen load, to a large extent emitted as NH_3, leading to extremely high levels of nitrogenous deposition in forest and natural ecosystems. Average deposition has increased over the past decades from 15–20 kg/ha/yr, to values of over 50–60 kg/ha/yr, with extremes of over 100 kg/ha/yr locally, close to agricultural areas. This deposition has caused acidification and eutrophication of forest soils, and has led to imbalances in tree nutrition, with nitrogen being abundant, while other minerals are in short supply (Mohren *et al.*, 1986). Most likely, this excess nitrogen has also led to an increase in growth and in the accompanying water use, and thus to more pronounced summer droughts. A clear consequence of increased nitrogen availability lies in changes in forest undergrowth (herbs, grasses and mosses) towards increased proportion of nitrophilous species. Forest biodiversity has clearly suffered from excess nitrogen, in that microsite differences have disappeared.

Tree species react differently to these disturbances. Tree health and forest vitality have been monitored since 1984, and the vitality during the monitoring period 1984–1997 (mainly

viewed as a percentage of foliage on a tree) of *Quercus* and *Fagus,* varied between 60% and 90%. Vitality of Scots pine (*Pinus sylvestris)* varied between 80% and 95% (Reuver 1997). The vitality of Douglas fir (*Pseudotsuga menziesii*) and Norway spruce (*Picea abies*) has been declining steadily, possibly through an increased confounding influence of warmer weather and more pronounced dry periods during the growing season.

The main traditional hazards threatening forests are weather events and **forest fires**. Along the coast, wind reduces forest growth, while damage-inflicting gales may occur about once every decade on a large scale, while small-scale windthrows occur virtually every year. At present, gaps from windthrows are often designed for conversion of predominantly coniferous stands into mixed and deciduous ones using natural regeneration.

Climate change is a more recent concern, interacting with nitrogen deposition and wind-throw risk. As a result of climate change, it is expected that dry periods during summer may occur more frequently, such that water-demanding species like Norway spruce and Douglas fir may be under threat. The same applies, to some extent, to a possible increase in extreme events, as may be associated with climate change. An increase in **storm frequency** and intensity may result in an increased windthrow.

Until recently, forest fires, mainly of anthropogenic origin, were a very serious threat. Fire prevention and fire fighting included (in the high-risk forest areas like the Veluwe area with its mainly Scots pine stands) intensive watching, originally from towers, and later, also from small planes. With the decrease in area of pure pine stands, and the increase in mixed stands, the number of fire incidences have declined, probably also because of more responsible behaviour on the part of forest visitors.

As a result of less emphasis being put on timber production, **damage by fungi** (e.g. *Lophodermium seditiosum, Gremmeniella abietina, Melampsora* spp*., Marssonina* spp.) and insects (*Ips typographicus*, *Tomicus* spp.) is considered less important than before. Nevertheless, regulations are still in force prohibiting dead trees with bark from being left in the forest in certain periods. On the other hand, the population abundance of organisms (*Sphaeropsis sapinea*, *Agrilus biguttatus*), increased under the impact of eutrophication and acidification, may now create a threat to the environment. Dutch elm disease is still a problem, but affects more urban and roadside afforestation, than forests themselves.

Herbivores, such as red deer, roe deer and wild boar continue to play an important role in forestry in the Netherlands, as is the case elsewhere in Western Europe. Due to the continuously increasing population densities (see e.g. Kuiters *et al.*, 1996), these herbivores may cause damage to young plantations, and may even prevent natural regeneration over large areas. As natural regeneration becomes a more and more prominent silvicultural method (see below), the need to reduce game abundance down to an acceptable level is growing. At the same time, grazing by large herbivores, such as horses and highland cattle is used in some areas as a management tool to keep large natural areas open, and to stimulate micro-differentiation in vegetation composition and structure.

Forest management

In 2001, 95% of the Dutch forests were dense forest complexes, of which 80% can be considered high forest (Table 5). Most of these are first- or second-generation forests

Table 5. Distribution of forest area by forest type (%)

Forest type	1984	1996	2002
Mono spp. deciduous <20%	17.3	17.7	21.8
Mixed deciduous	10.7	13.3	15.0
Mixed deciduous – coniferous	3.5	6.1	7.1
Mono spp. coniferous <20%	40.0	37.9	30.1
Mixed coniferous	3.3	2.8	5.7
Mixed coniferous – deciduous	11.0	11.3	14.3
Open	12.5	9.8	6.0
Clear-cut area	1.7	1.1	0
Total	**100.0**	**100.0**	**100.0**

Source: Dirkse *et al.*, 2002.

established through afforestation in the late 19th and early 20th centuries. To date, the prevailing silvicultural systems have been clear-cutting with replanting and coppice.

As a result of afforestation work, most forests were established as even-aged, monocultural plantations. Until about 1970, the emphasis had been on timber production and the rationalisation of forest management. Afforestation on relatively poor sandy soils, often covered with heather, was done mainly using Scots pine, later to be replaced by more demanding and productive species, like Norway spruce and Douglas fir. Between 1950 and 1980, large areas in the new polders were also afforested. These areas in the main consisted of better soils, so the newly-reclaimed lands were planted with poplar and willow. Nowadays, new afforestation is marginal, and is taking place mainly on the former agricultural land, again using deciduous species.

Most of the plantations were managed in a clear-cut system, with regular thinning at 5–6-year intervals. The clear-cut areas were relatively small, usually of less than 4 hectares. Coppice was historically an important silvicultural system in the Netherlands. Major species managed as coppice were oak (used for tannin and fuelwood), and ash and willow (coppice shoots used for water works and dike building). Willow coppicing was done in shorter rotations of up to 4 years. Coppicing gradually declined in importance, and in 1983, its use was reduced to only 7% of the Dutch forests. Since then, it has diminished even more, although coppice systems attract some attention from nature conservation agencies, as part of the strategy to maintain some traditional, human-induced wetland ecosystems.

Traditionally, silvicultural systems using natural regeneration had not received much attention, mainly because of a widely-held belief that most Dutch forests were too young, with insufficient soil development, to allow the use of natural regeneration instead of planting after clear-cutting. However, after 1970, more emphasis was placed on the role of forests in the protection of nature, and natural processes received more attention. This was strongly stimulated by the windthrow events in late 1972 and in spring 1973, which resulted in extensive damage to the existing stands. Due to the extent of the damage, it was not possible to immediately clear and reforest all of the affected areas, and in many of these, a good natural regeneration took place. This proved that natural regeneration was silvi-

culturally possible, as the ecological conditions had gradually evolved since the time of origin of the first plantations. A second strong stimulus for the use of natural regeneration was a change in the subsidy system for private forest owners: up to that time, replanting after clear-cutting had been subsidized to a maximum of 75% of the planting costs. In 1995, however, it was decided to abandon the scheme for reforestation subsidy and to replace this by an annual subsidy to compensate for the general public services provided by the forest. As a consequence, it became highly uneconomical to use artificial regeneration, and many forest managers subsequently changed to natural regeneration techniques.

During the 1970s, countries all over Europe witnessed increased interest in the forest functions other than timber production. The forestry profession reacted with the development of a concept of multiple-use forestry, in which several forest functions are considered explicitly, albeit with timber production usually remaining the leading one. As a result, forest planning remained very firmly based on cutting regimes and rotational planning. Nevertheless, the growing emphasis on nature conservation objectives in forestry (e.g. Al, 1995) led to certain specific silvicultural methods designed to enhance valuable natural features in forest. Some of these, so-called nature technical forest management practices (Londo, 1991), even entail the killing of trees by removing a strip of bark or by pulling them over, or the use of large herbivores. The so-called mosaic method (Koop & Siebel, 1993) was used to accelerate the conversion of monoculture, even-aged forests into uneven-aged, mixed ones.

Changing conditions of a political nature (more attention to nature conservation and recreation), as well as those in regard to economics (lower timber prices, smaller subsidies) paved the way for more attention to be paid to close-to-nature forestry, in part inspired by the nature-oriented forestry that had been practiced for centuries by central European foresters. As a result, a new silvicultural approach, called Integrated Forest Management (IFM, Dutch: geïntegreerd bosbeheer), was developed around 1990. In IFM, several forest functions are pursued in an integrated (combined) manner, although the main compromise is a small-scale trade-off between timber production and nature conservation. With IFM, the use of natural processes is stimulated. Keywords are natural regeneration, native timber species, mixed, uneven-aged stands, small-scale or selective cuttings, the presence of dead wood, large stems and no use of biocides. At present, IFM is stimulated throughout the country, actively supported by instructional material (courses, handbooks) and professional demonstrations.

The introduction of Integrated Forest Management in the Netherlands coincides with the development of ecosystem management on the landscape scale, in which forest and other natural areas are considered together, and in which traditional planning methods based on sustained yield are not of overriding importance anymore. By making all relevant forest functions explicit, this allows for the involvement of a wide range of stakeholders (beyond the traditional forest owner and forest manager). It also provides for the application of certification systems and the communication of management objectives to a wide variety of forest users. Inevitably, forest planning has become more complex, as a consequence.

3. Legal and organisational aspects of forestry

Forest ownership

In the Netherlands, forest ownership is rather diverse. Forests are owned either by private owners (33%), the State (34%), local authorities and other public-private bodies (17%), or nature conservation organisations (16%).

At present, more than 50% of all Dutch forests are publicly-owned. Most (66%) of these public forests are owned by the State, about 28% by municipalities, and the remainder – by provinces and public-private organisations, such as drinking-water companies (Dirkse *et al.*, 2002). Around 1940, the areas of forests owned by municipalities and the State were more or less equal, but since that time, the state-owned forest area has increased considerably. This reflects the opinion, which prevailed during most of the 20th century, that due to the long production cycles, as well as the multiple functions of forests (of which many cannot gain financial reward through market mechanisms), the State holds a major responsibility to maintain forests. Thus, during much of the 20th century, the State took over many of the private forests being sold by their owners. The State Forest Service (Staatsbosbeheer) is in charge of managing these forests.

The non-public forests are owned either privately, by nature-conservation organisations or by drinking-water companies. In contrast to the relatively large tracts of State-owned forest, the forest plots owned by private persons are characteristically small. About 56% of the private forests are of between 0.5 and 5 hectares in size; while only 12 private owners have more than 500 hectares of forest. For most private owners, forestry is not the main source of a livelihood, the forests rather being maintained as parts of estates, ancestral lands, or outdoor recreation areas for the family. For small private landowners in particular, the motive to maintain forests is mostly amenity- or conservation-related, rather than productive or financial. Consequently, forest owners tend to be rather individualistic and not professionally-oriented towards forestry. As a result, forest management on private lands can be very variable or even absent altogether.

The financial results of private forest enterprises have mostly been negative in recent decades (Berger *et al.,* 2003). Notwithstanding the fact that, for many forest owners, financial gains from forestry are not the major motive for maintaining forests, the associated continuous financial losses and relatively high level of inheritance tax have forced several private forest owners to sell their forests. Until the 1970s, these forests had mainly been bought by the State. But since that time forests have increasingly been acquired by nature conservation organizations, in many cases with the financial support of the government. Recently, private forestry has again been increasing somewhat, especially through the afforestation of farmland.

Within the Ministry of Agriculture, Nature and Food Quality (formerly the Ministry of Agriculture, Nature Management and Fisheries) the **Department of Nature Management** is responsible for legislation and national programmes with respect to forests. In addition, this Ministry has the final responsibility for designating all nature conservation sites. **Municipalities** may formulate local policies in development plans, which once approved

are binding for ten years. Apart from the areas protected by national legislation, they are free to plan the rural area, provided certain policy directions are observed. **Provinces** develop less-binding regional plans. The provinces are, in addition to the municipalities, responsible for the spatial planning and designation of the National Ecological Network (EHS). The provinces as a governmental authority own only a tiny part of the forest and nature areas.

The **National Forest Service** is an independent governmental administrative body, managing a large part of the natural heritage in the Netherlands, be these forests or nature protection areas. The organisation's mission is to work towards a sustainable living environment for humankind, plants and animals, in active co-operation with citizens and the representative organisations and institutions. The National Forest Service owns a total of 235,000 hectares of nature areas, of which about 90,000 hectares are forest. About one third of the State-owned forest does not have any productive function, while the remaining two thirds are categorised as multifunctional, with equal attention being paid to production, nature and recreation. The National Forest Service owns and manages 38 Forest Reserves. A-locality forests under the National Forest Service are managed as natural forests, or as forests with an emphasis on nature (though they may contain exotic species).

Table 6. Forest area and forms of ownership in relation to nature protection areas

Owner	Forested area		Nature protection areas (%)
	ha	%	
State	105,860	31	23
Municipalities	48,190	14	20
Nature conservation organisations	53,325	16	80
Private owners	121,265	36	23
Unknown/other	31,205	3	42
Total	**359,845**	**100**	×

Source: Dirkse *et al.*, *2002,* Broekmeyer *1999a.*

The Foundation for Nature Monuments (Vereniging Natuurmonumenten), a public--private nature conservation organisation, established in 1905, owns around 350 nature areas. Its mission is to contribute to the quality of the natural environment in the Netherlands by preserving space for nature in all its manifestations, and to preserve nature, landscapes and the related cultural history by acquiring land for nature conservation and subsequent management of those areas to maintain and increase their conservation value. The organisation manages 86,495 hectares, of which it owns 69,934 hectares (Vereniging Natuurmonumenten 2001, 2002). **Provincial Trusts for Scenic Nature and Landscape** (De (Provinciale) Landschappen) are public-private co-ordination bodies for each of the twelve Dutch Provinces, which were nearly all established during the 1920s and 1930s. The joint provincial trusts manage over 600 nature areas, covering 90,000 hectares in total. The objectives are different for each province, but the key activities include nature management, conservation and development, thereby emphasising the involvement of local inhabitants.

In the Netherlands, about 1,500 private owners of forest with more than 5 hectares account for half the area of privately-owned forest, or about 59,000 hectares (RIVM *et al.,* 2003). Private forest owners may be organised into forest owner associations (Bosgroepen) in which forest management and planning, as well as timber sales are performed jointly with more owners.

Forest law

The first Dutch Forest Act (1917) was initially developed as a temporary measure to halt the rapid decline in the forest area. It was replaced in 1922 by the official Forest Act, and in 1962, by the current Forest Act. The Act contains the obligations to report on felling activities and to replant within three years of felling. In some special cases, an exception can be made, but the area must be compensated for elsewhere. The maximum felling area is five hectares, though most final cuts do not exceed one hectare. As the Forest Act imposes restrictions on private forest owners, compensation in the form of subsidies is available for forest management.

The Estate Act dates from 1928 and provides taxation benefits to owners of estates on condition that the properties are maintained for at least 25 consecutive years. The owner is not allowed to fell any forests, which in most cases cover the majority of the estate's area. The amendment of the law in 1989 increased the range of fiscal compensations against additional conditions of preservation and the opening of estates to the public. In 1995, an area of 70,000 hectares in total was subsumed under the Estate Act (Al 1995).

The Nature Conservation Act of 1968 was amended in 1998, but to date (2005) it still has not been approved by Parliament. Under this Act, areas can be designated as nature monuments for (rare) plant and animal species, for historical or aesthetic reasons, or on account of existing soil conditions. The Act also provides a legal basis for the designation of special protection areas, as required under the Birds and Habitats Directives. Species protection has recently been moved to the newly adopted Flora and Fauna Act. As the two laws are complementary, it is regrettable that, due to recent developments at governmental level, the new Nature Conservation Act and Flora and Fauna Act have not been approved simultaneously (Hazendonk *et al.,* 2000; Van Vliet *et al.,* 2002).

The Flora and Fauna Act (2002) replaces the former Birds Act, the Hunting Act, the Act on Endangered Exotic Animal Species and parts of the Nature Conservation Act. The regulations in this new Act focus on species protection (Van Vliet *et al.,* 2002).

The Act on Spatial Planning (1962) gives power to each administrative level for planning the spatial structure. The plans they present are indicative, apart from the development plans elaborated by the municipalities, which are binding (Al 1995, Lenders *et al.,* 1997). The regulations concerning the protection of important species and habitats, as laid down in the EU Habitats and Birds Directives, have been transposed into the new Nature Conservation Act and the Flora and Fauna Act. Special Protection Areas may be eligible for extra subsidies from the EU-LIFE programme for the implementation of management measures (Van Vliet *et al.,* 2002).

Nature conservation generally concentrates on guiding managers through subsidy regulations. Under the new Management Programme (Programma Beheer, introduced in

2000, Ministry LNV 1997) two new subsidy regulations have been defined, one for nature management in general, and another for nature management by farmers on agricultural land. The new system will include fixed nature conservation targets. Under the first regulation, which is important for forest protection, compensated are the costs of maintenance of the existing nature and the loss of income due to alteration of the main function of the property. Several levels and sets of compensation are available, dependent on the type of management measures, which allow private owners to make their own decisions (Al & Kuiper, 2000; Van Vliet *et al.,* 2002).

4. Education in forestry

Professional education

Forestry education in the Netherlands spans a tradition of more than 100 years (Van den Bosch, 1986). Wageningen University, at which academic education in forestry takes place, started out as a vocational school for agriculture, horticulture and silviculture, developing from the National Agricultural College at the end of the 19th century into an international centre for life sciences.

Professional education is at present provided by a range of vocational-education and training centres (Dutch MBO) throughout the country. In programmes that may vary in length from 1 to 4 years, these centres provide education for students that will work, in practice, in the field of forest and nature management. Both, in the case of higher and vocational education, forest and nature are considered together, not in separate programmes. At present, the total number of MBO students in Forest and Nature Conservation and related fields is around 450.

The Dutch Universities of professional education (Dutch: HBOs) provide Bachelor's and Master's degrees in Forest and Nature Conservation (Bos-en Natuurbeheer). The main institution for this is the University of Professional Education at Larenstein (www.larenstein.nl), which provides a 4-year Bachelor's degree programme in Forest and Nature Conservation. It can be supplemented by a 1-year professional Master's degree programme, or followed by a 2-year Master of Science programme at general university level, e.g. the M.Sc. in Forest and Nature Conservation at the Wageningen University. The specializations at Larenstein comprise Urban Forestry, Tropical Forestry, The International Timber Trade, Real Estate Management, and Civil Engineering. At present, the total number of students in Forest and Nature Conservation at Larenstein is about 500, with a current, annual intake of over 100 students for the 4-year programme in Forest and Nature Conservation.

Scientific education

Scientific education in forestry and related fields is provided by the Wageningen University and Research Centre at Wageningen (www.wur.nl), which incorporates the previous Wageningen Agricultural University. Until 1998, Wageningen University had provided a 5-year

academic programme in Forestry, as well as a 2-year M.Sc. programme in Tropical Forestry. After 1998, the forestry programme was expanded to include nature management, and became the B.Sc./M.Sc. programme in Forest and Nature Conservation. This change reflected a shift of interest in society, where traditional forestry was combined with nature conservation and nature management (Van Baren *et al.*, 1998). In the wake of the sometimes-heated discussion between forestry professionals and nature conservationists in the 1970s and 1980s, integration took place at the level of practical forest and nature management, at policy-making and governmental level, and at the research institutes. Throughout society, forests and nature were gradually merged into one domain of research, management, governance and policy-making. The change from pure 'Forestry' to the larger 'Forest and Nature Conservation' curriculum in 1998, instantly has lead to a doubling of the student inflow that has persisted to the present time (2005).

In line with the Bologna principles, the Wageningen University was one of the first in the Netherlands to implement the Bachelor/Master model. It offers a 3-year B.Sc. programme in Forest and Nature Conservation, followed by a 2-year M.Sc. programme in Forest and Nature Conservation. The separate M.Sc. course in Tropical Forestry was also merged into the new programme. Within the Forest and Nature Conservation programme, two basic specialisations exist: Policy and Management, and Ecology and Management, with the possibility to specialise in tropical issues (forestry, wildlife management) or temperate-zone issues, as well as in special fields, such as agroforestry, community forestry, etc. The total number of students in Forest and Nature Conservation at the Wageningen University is about 380, with an annual intake of about 80 students, 40 at freshman level in the B.Sc. programme, and about 40 in the 4th year, starting the M.Sc. programme. Of the current (2005) 40 new M.Sc. students, about 20 are from abroad, and about 20 have a B.Sc. from Universities of Professional Education, such as Larenstein.

The Wageningen University offers a strong, thesis-oriented Ph.D. programme, as part of the activities of several graduate schools. The majority of Ph.D. projects in Forest and Nature Conservation come under the C.T. de Wit Graduate School in Production Ecology and Resource Conservation. A Ph.D. project at Wageningen takes about 4–5 years of preparation, field work and thesis writing.

Since 2001, the Wageningen University has been closely linked with the Agricultural Research Department of the Ministry of Agriculture, Nature Management and Food Quality. Together, they form the Wageningen University and Research Centre. Recently, two Universities for Professional Education – Van Hall (mainly agriculture) and Larenstein – have also been brought under the Holding of the Wageningen University and Research Centre, currently comprising 7,500 employees, some 9,000 B.Sc./M.Sc. students and about 1,200 Ph.D. students. It provides both academic and professional education, training and research.

5. Forestry research

Research institutions

The main research institutions in forestry are incorporated within the Wageningen University and Research Centre (see preceding section), comprising the University Groups in Forest Ecology and Forest Management (Prof. G.M.J. Mohren) and Forest and Nature Conservation Policy (until recently Prof. H. Schanz, currently vacant), as well as the relevant research teams within the Research Institute for green world research (Alterra). Alterra was established in 2000, through a merger of the Institute for Forestry and Nature Management, and the Staringcentre for Integrated Land and Water Management.

Within the Wageningen University and Research Centre, research on forestry, forest and nature conservation issues takes place within the Environmental Sciences Group, notably its Centres for Ecosystem Studies and for Landscape Studies. Within these Centres, the full spectrum of research, ranging from curiosity-driven fundamental research to strategic research, and to fully market-driven contract research takes place, with funding coming from the Dutch Government, notably the Ministry for Agriculture, Nature Management and Fisheries, and the Ministry of Environment, from the National Science Foundation, from private industry, and from a wide range of international institutions and funding bodies.

Other research institutions, occasionally engaged in forestry research, are the Universities of Nijmegen, Utrecht and Amsterdam. Wood science and wood research is carried out by the Foundation for Wood Research (SHR, www.shr.nl). A large collection of wood samples from all over the world is maintained by the National Herbarium (www.nationaalherbarium.nl).

Directions of Research

Research in forestry essentially runs along four lines:

- fundamental research taking place at university departments, aimed at a better understanding of forest ecosystems and their role in maintaining the planet's life support systems (biodiversity, exchange of water and carbon, regulation of temperature and moisture, primary production of biomass and raw material for industrial purposes);
- fundamental research on the relationship between forest and society, forest functioning and governance, community involvement and adaptive management, etc.;
- strategic research on sustainable use and sustainable management of forests as a natural, renewable resource in a societal context (urbanised vs. rural, livelihoods vs. industrial exploitation, adaptive management strategies, scenario analysis, etc.) and
- market- and customer-driven research on management and policy issues, involving forests and nature. Increasingly, strategic research issues are linked to Millennium Development Goals, such as poverty reduction, sustainable development, etc.

Directions of research are set by scientific standards and academic challenges by the strategic research plans of universities and research institutions, and by research agendas

of funding agencies, such as the Dutch Government and the EU research programmes. Market-driven contract research is defined by problem owners in discussions with researchers. With the emphasis on forest and nature in a landscape context, in direct contact with a demanding society in a highly-urbanised environment, research has been moving away from traditional forestry subjects, such as tree improvement and growth and yield, to focus rather on the role of forests and forestry in current issues, such as biodiversity conservation, global change, local livelihoods and governance, etc.

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★ Poland

Stanisław Zając

The Republic of Poland (Polska, official: Rzeczpospolita Polska), territory: 312,577 km², population: 38.2 million, capital city: Warsaw.

1. Forest characteristics

Forest area

In accordance with Polish law, forest is land with an area of at least 0.10 hectare covered with forest vegetation, such as trees or shrubs and herbaceous vegetation, or being only temporarily devoid of the same. Such lands should be appropriated for forest production, or be included as a nature reserve area in a National Park, or else be entered on a register of nature monuments. Moreover, lands included under forest resources must be subject to forest management or used in a way that meets forest management needs, also including buildings and urban structures, water melioration facilities, forest territorial division lines, power transmission line areas, nurseries, timber stockyards, or car parks and tourist facilities. Thus forests and forest resources, as defined by Polish law, differ from the concept of forest and forest resources referred to in international statistics. According to the former definition, forest resources included forestlands as provided in Polish law, along with afforested, shrubby, or boggy areas, or those unsuitable for other purposes.

Once, forests covered almost the whole territory of our country. However, Poland's forests have undergone substantial changes as a result of both expansion of agriculture and the demand for timber. Even at the end of the 18th century, there was still a 40% forest cover in Poland (according to its borders at that time), but this figure had fallen to just 20.8% by 1945. Deforestation and associated destruction of stand species structure resulted in a decrease of biological diversity in forests and landscape depletion, soil erosion and

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disturbance of the overall water balance. Reversal of this process came about in the period 1945–1970, when Poland's forest cover increased to 27.0% as a result of the afforestation of 0.9 million hectares. The average annual afforestation rate in that period was 36,000 hectares, while in the peak phase between 1961 and 1965 this was more than 55,000 hectares. At present, the total area of forestland in Poland is 9.0 million hectares. This is equivalent to 28.7% of the national territory. The forest area managed by the State Forests National Forest Holding (SF NFH) is 7.58 million hectares. Poland's forest area per capita is estimated at 0.23 hectares and ranges between 0.08 hectares in the Province of Silesia and 0.67 hectares in the Lubuskie Province.

Species composition

In terms of spatial structure by species, coniferous species dominate in Polish forests, occupying 5.4 million hectares (77% of the total forest area). Among coniferous species, pine covers the largest area – 70% (4.8 ha). Broadleaved forests cover an area of 1.6 million hectares, which represents 23% of the total forest area. Among the broadleaved species, oak and birch, constituting 67% (0.5 million ha), occupy the largest area. Private forests show a similar structure, with coniferous forests in 2003 accounting for 73% (1.2 million ha) and broadleaved habitats representing 27% (0.4 million ha) of the total.

Poland has mainly retained forests on the poorest soils and, as a result, coniferous forest habitats predominate in the habitat structure of the SF NFH, accounting for 57% of the total forest area, as compared with the broadleaved forest habitats on the remaining 43.9%.

Volume and increment

The mean timber resources of the forest stands in Poland amount to 213 m^3/ha and are significantly higher in the forests managed by the SF NFH (222 m^3/ha) than in private forests (119 m^3/ha). Poland is a country with a relatively large forest area and forest resources higher than the European average. Our country possesses the third largest volume of standing timber in the Region (after Germany and France), totalling (including all forms of ownership) 1.9 billion m^3.

As at the beginning of 2004, the estimated standing timber resources of the SF NFH reached 1.55 billion m^3 of gross merchantable timber. In the last two decades (1984–2004), the increment in gross merchantable timber in the forests managed by the SF NFH was approximately 0.9 billion m^3. Some 0.5 million m^3 of merchantable timber were harvested in the same period, *i.e.* approximately 56% of the total increment. The mean annual increment in the SF NFH in the same period was 6.74 m^3/ha. In turn, the mean annual increment in gross merchantable timber has reached 7.48 m^3/ha over the last five years.

As far as the volume structure of forests managed by the SF NFH is concerned, coniferous species predominate. In 2004, the standing timber of the SF NFH resources amounted to 1.23 billion m^3 (79% of gross merchantable timber), while the figure for broadleaved species was 0.32 billion m^3 (21%). The volume structure of private forests is similar, constituting 0.1 billion m^3 (73%) for coniferous species and 0.05 billion m^3 (27%) for broadleaved species.

2. Logging and wood processing

Timber harvesting and wood processing are managed in Poland with regard to equilibrium in forest ecosystems and within limits that guarantee forest sustainability and growth in forest resources. In accordance with these principles, in 2004 some 30.5 million m^3 of net merchantable timber were harvested in Poland, of which 29.0 million m^3 came from forests managed by the State Forests National Forest Holding, 1.3 million m^3 from forests held by private owners and 0.2 million m^3 from National Parks. More than 73% of the merchantable timber harvested are conifers, while broadleaved species account for less than 27%. More than 40% of the country's harvest comes from four provinces: West Pomerania (zachodniopomorskie – 3.4 million m^3), Warmia and Masuria (warmińsko-mazurskie – 3.2 million m^3), wielkopolskie (2.7 million m^3) and lubelskie (2.6 million m^3).

Total sales of timber in 2004 amounted to 30.8 million m^3 and increased by only 2% compared with 2003. Sales of merchantable timber totalled 28.5 million m^3 (25.8 million m^3 in 2002). This strong growth in sales was the result of an upturn, not seen for many years, in the timber business and the demand for raw materials.

In 2004, the revenue of the SF NFH amounted to PLN 4.45 billion, including PLN 3.71 billion from timber sales, whereas expenditures were PLN 4.38 billion. In the same year, the SF NFH achieved a (net) financial result of PLN 68.7 million on their business operations. It is noteworthy that the SF NFH carries out independent financial management of the property entrusted to it. Contrary to many other entities administering state-owned forests in Europe showing a loss, SF NFH generates a surplus, with revenues exceeding expenses.

3. Categories of forest protection

There are various forms of legally protected 'areas of outstanding, natural beauty' in Poland, including: National Parks, nature reserves, landscape parks, areas of protected landscape, nature-and-landscape complexes, areas of ecological utility and documentation sites (Fig. 1). 23 National Parks have been so far established across the country. These occupy a total area of 317,400 hectares, of which 190,400 hectares (60%) are forests. The National Parks account for approximately 1% of the total territory of Poland. Seven such Parks have been included on the Biosphere Reserve List (*i.e.* Babiogórski, Białowieski, Bieszczadzki, Kampinoski, Karkonoski, Słowiński and Tatrzański National Parks), and in addition, the Białowieski National Park has been recognised as a UNESCO World Heritage Site. Three National Parks: Biebrzański, Słowiński and Ujście Warty (The Warta River-mouth) have been embraced by the Ramsar Convention on Wetlands of International Importance, especially as Waterfowl Habitat. Some 21% of the total area of National Parks is subject to strict protection (including 16.4% of forest land) and 60% is under partial protection. The remaining 19% represents farmland, areas occupied by National Park infrastructure, and private lands with the status of protected landscape.

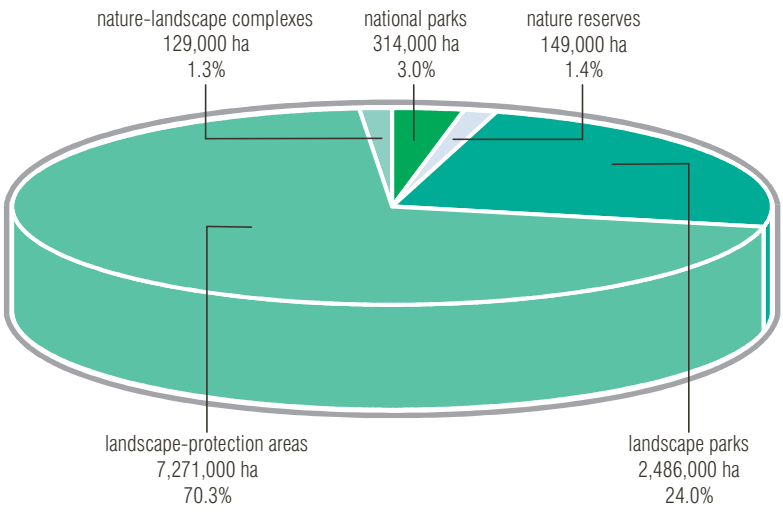

Fig. 1. The areas outstanding for their special natural and scenic qualities – under legal protection in Poland in 2002 (Source: GUS 2004)

Nature reserves include natural or almost totally undisturbed ecosystems, biocenoses and plant communities, or are established for the purpose of preserving unique features of wildlife. As at 2004, the total area of Poland's 1,385 nature reserves of all types covered 162,400 hectares, of which 101,700 hectares constituted forests, including the 1,100 nature reserves established within the territory of the SF NFH alone, with a total area of 106,300 hectares. 66 of the latter were strict reserves with a total area of 2,900 hectares. The total number of strict forest reserves on land of all forms of ownership was 691, with a total area of 52,200 hectares. The distribution of reserves throughout the country is uneven. Most of them are located in the Carpathian Mountains and their southern uplands, as well as in the Drawskie, Kaszubskie, Mazurskie and Wielkopolskie Lakeland areas.

Landscape parks are areas protected by law in view of their valuable natural, historical and cultural features, whose purpose is to maintain, popularise and disseminate these values in accordance with the principle of sustainable management. The 120 landscape parks, established by the decisions of Provincial Governors, cover a total area of 2,603,700 hectares, 1,391,700 hectares (53%) of which are covered by forests.

Areas of protected landscape are spatially separated areas with various types of ecosystems that are embraced by protection in view of the value of their distinctive scenic terrain. Management of these diverse ecosystems should ensure the ecological equilibrium of the natural environment is maintained. In areas of protected landscape, considerable attention is attached to water, wastewater and waste management. Areas of protected landscape play a role as ecological patches and corridors, connecting more valuable natural habitats, thus creating one coherent ecological network. There are 445 such natural sites, covering a total area of 7,129,200 hectares, of which 2,325,500 hectares (33.6%) are occupied by forests.

Nature-and-landscape complexes, areas of ecological utility and documentation sites constitute the local forms of nature conservation. In 2004, 7,016 such sites were listed on an inventory for Poland, covering an area of approximately 12,900 hectares and representing 0.9% of the total area under legal protection and 0.4% of the national territory.

Pursuant to the provisions set out in Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Flora and Fauna and, previously, in Council Directive 79/409/EEC of 2 April 1979 on the Conservation of Wildfowl (the co-called Habitats Directive and Wildfowl Directive, respectively) Poland is now required to establish Special Areas of Conservation (SACs) on its territory, embracing mainly forest areas and to be included in the NATURA 2000 EU Ecological Programme. Implementation of this Programme will provide for the ecological security of the natural heritage for present and future generations by protecting valuable natural or near-natural habitats and rare species of flora and fauna.

In 2004, the Minister of the Environment approved 72 Special Protection Areas (SPAs) for wildfowl covering a total of 3.3 million hectares, including 61 areas in SF NFH territory, and designated 184 Special Areas of Conservation covering 1.1 million hectares for approval by the European Commission. The majority of areas under NATURA 2000, particularly the SACs, are situated in forest areas under the management of the SF NFH, where SPAs cover 0.9 million hectares and SACs – 0.3 million hectares. The majority of SPAs and SACs are located in large forest complexes, such as the Tuchola, Augustowska, Piska and Białowieża Primeval Forests.

Protection forests are another form of nature conservation established in Poland's forests, the major purpose being to protect soil and water supplies. These include forest stands affected by industry, stands having special natural values and valuable fragments of native wildlife, stands under permanent study and experimental sites, selected seed stands, stands that constitute refuges for protected species of fauna, stands that are within the administrative boundaries of cities or within a distance of up to 10 kilometres from the administrative boundaries of cities with more than 50,000 inhabitants, stands within protection zones around health resorts, stands around sanatoria, and stands that serve national defence and security. Protection forests cover more than 3.5 million hectares (11% of the total national territory). The majority of protection forests are located in areas administered by the SF NFH (47% of the total forest area) representing an area of 3.3 million hectares – a result of the SF NFH's long-term policy concerning the multifunctional nature of forests. In municipally owned forests, this figure is 35% and in private forests – no more than 5%. Among protection forests, the largest area is occupied by those protecting water resources (1.4 million ha) followed by stands under the impact of industrial and urban areas (0.54 million ha) and stands surrounding cities (0.46 million ha).

The major protection forests have been established in mountainous areas and the areas exposed to industrial impact. Depending on their main function, protection forests are subject to modified procedures that can entail strict limits on clear-cutting, increases in felling age and adjustments to the species composition in line with the functions served and recreational management.

4. Legal and organisational forms of forest holdings

Two forms of public forest ownership can be distinguished in Poland: forests owned by the State Treasury (*i.e.* state-owned forests) and forests owned by municipalities (*i.e.* municipal forests). State-owned forests include: forests administered by the SF NFH, forests administered by the National Parks and those included in the State Treasury Agricultural Property Resources and, to a lesser extent – those being at the disposal of either the Military Property Agency or other ministries. The area of forests administered by both, the SF NFH and the National Parks is steadily increasing, while the total area of the other forests continues to decrease.

Forest ownership

With regard to the ownership structure, forests in Poland are, in general, public-owned (82.5%), including forests under the management of the SF NFH – 78.4% of the total (Fig. 2). Public-owned forests occupy an area of 7.4 million hectares, of which 7 million hectares are forests administered by the SF NFH.

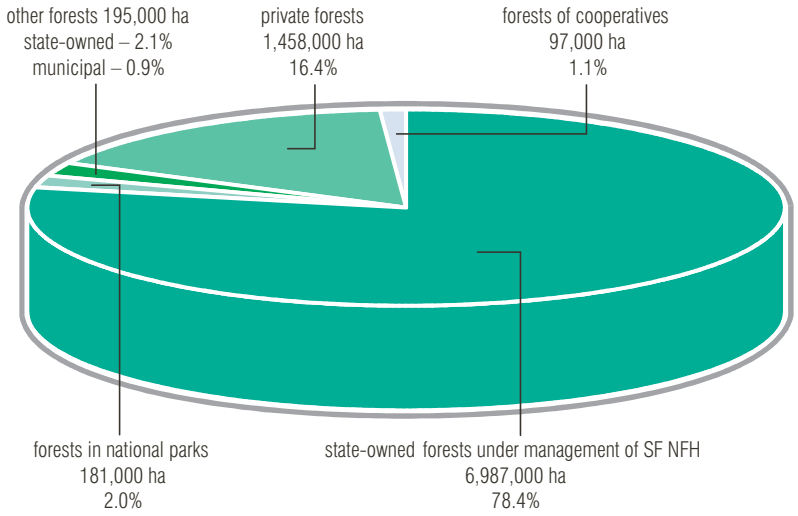

Fig. 2. The ownership structure of forests in Poland in 2004 (Source: Yearbook 2004)

Of the remaining 0.4 million hectares of public-owned forests, 0.2 million hectares are forests within National Parks. Privately owned forests occupy 1.6 million hectares, of which 93% are forests owned by private individuals. In recent years, a steady increase has been recorded in forest areas in private hands. The share of the total forest area that is protected within National Parks has risen significantly, from 1.0% in 1985 to 2.0% in 2003.

Types of forest holdings

As at 1 January 2005, the State Forests National Forest Holding included 428 Forest Districts, the basic organisational units, along with 5,671 Forest Subdistricts, the number of which has been declining and this trend is expected to continue.

Private forest holdings in Poland are very fragmented, the average area being 1.43 hectares per owner (in some EU countries this figure is between 30 and 60 hectares). As in other European countries, the forests in Poland are part of agricultural holdings. Of the country's total number of 839,000 agricultural holdings, over 523,000 (62.3%) include less than 1 hectare of forest area, and as few as 4.2% include areas of up to 5 hectares. The proportion of private forests varies geographically, the greatest number being found in the provinces of Małopolska – 187,500 hectares (43.5% of the province's total area), Mazovia – 330,600 hectares (42.2%) and Lubelskie – 218,900 hectares (39.0%). The provinces with the lowest share of private forests are: Lubuskie – 8,100 hectares (1.2%), West Pomerania – 10,400 hectares (1.3%) and Lower Silesia – 13,500 hectares (2.3%) [Gołos 2004a].

Decisive factors that make it impossible to pursue effective management in private forests in Poland include high fragmentation of forest properties, insufficient information on the volume of resources and timber harvests, and the low level of business operations conducted by forest owners. This points to the need for radical solutions that would enable an accurate evaluation of private forests, but first and foremost that would create conditions for the proper management and protection of these forests. The most urgent task in this respect is to carry out a large-scale inventory of the status of private forests and to develop simplified management plans for private forests and state aid mechanisms for forest owners.

Public access to forests

Forests are where people, especially city residents, go for rest and recreation. The estimated number of people who have visited forests along tourist trails (for hicking, bike and horseback riding) amounted to 16.5 million, of which 11 million visited National Parks and 5.5 million – forests administered by the State Forests National Forest Holding.

The SF NFH has a significant overnight accommodation base under its management, and this has for some years been made increasingly available to tourists. The SF NFH offer attractions for both individual tourists and organised tourist groups, including training and recreation centres, hunting lodges and guest rooms.

In order to enhance forest attractions for the public, 20 Promotional Forest Complexes (PFCs) have been established, covering a total area of 0.94 million hectares. The establishment of PFCs within the SF NFH is just one element of the implementation of Poland's Policy on the Protection of Forest Resources. Thanks to these Complexes which promote the environmentally-sound and multifunctional forestry, it has been possible to shape public awareness and attitude towards ecology, forests and forestry, and has also led to the development of multifaceted, rational cooperation with conservation organisations and environmental NGOs. The achievement of these aims is facilitated by the existence within PFCs of a well-developed, free, educational and tourist infrastructure, comprising environmental

education centres (14), nature/forest exhibition rooms (17), open-air teaching sites (23), educational trails (84), dendrological parks and gardens (12), so-called green schools and overnight accommodation facilities.

Promotional Forest Complexes and particularly the areas administered by the SF NFH have helped to promote the social function of forests by providing education to children and youth. In 2003, this was done within the framework of, among other things:

- 10,000 classes in State Forests Educational Centres attended by 370,000 students,
- 4,000 meetings with foresters at schools attended by 156,000 pupils,
- 3,300 meetings organised outside schools, attended by 100,000 people.

Moreover, the SF NFH has so far organised 681 competitions, in which 72 thousand people participated, as well as 3,700 exhibitions, open-air activities, rides and excursions, in which 400,000 people took part.

In order to improve public access to forests, tourist trails and forest roads are maintained in good condition. In 2003, capital expenditures on forest access roads amounted to PLN 4.7 million.

Forests are also places where by-products are harvested (berries, mushrooms, herbs, etc.). In 2003, 5,600 tonnes of berries, 8,400 tonnes of other forest fruits and 2,800 tonnes of mushrooms were harvested throughout Poland, especially in the SF NFH forests. The total value of the harvested mushrooms and other forest floor products amounted to over PLN[1] 83 million, or an annual average of 9 PLN/ha.

A subsidiary activity of the SH NFH is to produce Christmas trees and nursery material for stocking. Plantations of Christmas trees cover an area of 1,500 ha, while the total number of trees acquired is 110,500.

Game management, which in the 2003/2004 season was carried out by 2,506 hunting clubs operating within 257 hunting districts, embraced a total area of 1.86 million hectares (in which forests accounted for 1.11 million hectares, or 59.7%). In 2004, game management was pursued in 4,760 hunting districts, covering an area of over 2.6 million ha.

As a result of free public access to forests, forest holdings of all ownership types are threatened by various types of damage and losses (fire, property destruction, loss (theft) of property and timber), and face additional costs of liquidating such damage. The annual value of losses incurred by the SF NFH over the last five years ranged between PLN 6.0 and 7.6 million. The percentage share of particular losses in forests within total losses due to harmful activities by the public amounted to:

- 56.5% – losses relating to the theft of timber from the state-owned forest,
- 20.3% – theft or destruction of property belonging to the Forest Districts,
- 16.1% – poaching,
- 7.1% – losses resulting from unlawful use of forests.

Private forest owners also report high losses being, mainly the result of arson (approximately 90% of all fires). The annual number of fires in the territories of the SF NFH range from 2,000 to 8,000, representing 49% of all forest fires recorded in Poland.

* [1] 1 € = 4 PLN.

Forest law

Pursuant to the provisions laid down in the Forest Act of 28 September 1991, sustainable forest management must be performed with due consideration for the following objectives:

- conservation of forests and their favourable impact on climate, air, water, soil, human living conditions and health, as well as the natural (*i.e.* ecological), balance,
- protection of forests, especially those constituting fragments of the national natural heritage, or those of particular value,
- protection of soil and those areas particularly exposed to pollution or damage, or of special social importance,
- protection of surface waters and groundwater, drainage-basin retention, particularly in watershed areas and areas supplying groundwater reservoirs,
- production of wood on the principles of highest yield, as well as raw materials and by-products of forest use.

The above mentioned forest management objectives can be categorised under two main objectives: forest sustainability and the provision of multifunctional purposes for forests, the factors determining forest management policy in Europe since the 1991 Rio de Janeiro Conference, which promoted a new model for European forest management.

State-owned forests are classified into national strategic natural resources under the Act of 6 July 2001 on the Preservation of the National Character of Poland's Strategic Natural Resources. By virtue of this Act, forests are not subject to any ownership transformation, and any claims by former owners or their heirs concerning loss of forest property due to nationalisation after Word War II are to be satisfied in the form of compensation paid from the State Budget under specific provisions.

The Constitution of the Republic of Poland dated 2 April 1997, whose Article 76 provides that "Public authorities are held responsible for conducting a policy of environmental conservation for both present and future generations", and whose Article 86 imposes an obligation on everyone to "care for the environment and be accountable for any acts leading to its deterioration", is the highest ranking Act directly relating to forests.

Three further Acts constitute the legal grounds for protection of forests, nature conservation and protection of forestry-related lands. These are: The Framework Environmental Protection Act of 27 April 2001, the Act on Nature Conservation of 16 April 2004 and the Act of 3 February 1995 on the Protection of Agricultural and Forest Land.

The provision of EU funds, particularly for afforestation of agricultural lands, is governed by the provisions of the Act of 28 November 2003 on Supporting Rural Area Development from the appropriate Section of the European Agricultural Guidance and Guarantee Fund, while tax-related aspects are set forth in the Forest Tax Act of 30 October 2002.

Game management issues are regulated by the provisions of the Hunting Law dated 13 October 1995. Provisions relating to private forest owners associations are included in the Act of 29 June 1963 on Municipal Land Management and the Association Law of 7 April 1989.

The 1997 National Policy on Forests and the 2003 National Programme for the Augmentation of Forest Cover are other important documents pertaining to forests and forestry in Poland.

5. Structure and tasks of the national forest administration

Forests constituting the property of the State Treasury are managed by the State Forests National Forest Holding. The SF NFH is headed by the Director General of the SF NFH, assisted by the General Directorate of the State Forests and the Directors of 17 Regional Directorates of the State Forests (RDSFs in Białystok, Gdańsk, Katowice, Kraków, Krosno, Lublin, Łódź, Olsztyn, Piła, Poznań, Radom, Szczecin, Szczecinek, Toruń, Warsaw, Wrocław and Zielona Góra). The State Forests National Forest Holding also comprises the following departments with nationwide authority: the Forest Gene Bank in Kostrzyca, the Forest Culture Centre in Gołuchów, the State Forests Information Centre in Warsaw, the Centre for Research and Implementation in Bedoń, the Forest Technology Centre in Jarocin and the State Forests Information Department in Łódź. Forest Districts constitute the basic SF NFH organisational units (430), headed by Forest Inspectors who enjoy some degree of autonomy in the pursuit of forest management in their Districts on the basis of forest management plans. As such, they are responsible for the overall condition of the forests in their areas. The State Forests National Forest Holding also comprises regional service departments that act on its behalf and report to the Directors of RDSFs.

With regard to the state-owned forest management system, State Forests National Forest Holding is an organisational unit with limited legal status, which makes it difficult, among other things, to distinguish between the sphere of authority of the SF NFH ensuing from the State Treasury's ownership rights (*dominium*) and the administrative authority (*imperium*) [Wierzbowski 2005].

Despite its limited legal status, SF NFH enjoys a high degree of autonomy, which is manifested in, among other things, its financial independence. Moreover, the above-mentioned organisational units of the SF NFH are themselves composed of organisational structures designed for carrying out training, educational and social activities. 9 Forest Protection Teams and 11 Inspection Regions together form an integral part of the General Directorate of the State Forests.

The provisions of the Forest Act apply to all forests regardless of the legal form of their ownership (Article 2). However, despite the said regulation, provisions concerning state ownership predominate in this Act. This is justified by the existing ownership structure (over 80% of forests are owned by the State Treasury). The Forest Act distinguishes between various powers to exercise supervision over forest management, based on the criterion of ownership type. State-owned forests are supervised by the minister responsible for the environment, while supervision over management of other forests has been entrusted to County Heads (Starosta). These administrative bodies may in turn delegate, by way of agreement, forest management and supervision tasks, including the issuing of first instance administrative decisions, to Forest Inspectors, and from 1 January 2006 – to the Directors of RDSFs. Such agreements are very common. The forest administration system in Poland constitutes an organisational model not found anywhere else in Europe.

The State Forests National Forest Holding is not a forest owner, but merely represents the State Treasury (which owns the forests). The SF NFH exercises supervision over state-owned forests, except for those within the National Parks and those administered by the

Agricultural Property Agency, or have been given over for perpetual lease. The SF NFH administers state-owned forests by:

- conducting forest management,
- managing land and other related fixed and liquid assets,
- regularly monitoring the condition of forests,
- conducting inventories of forest land and timber resources,
- regularly monitoring and forecasting the level of fire hazard to forests and the occurrence of tree damage by insect pests and fungal diseases,
- financing research work ensuring the development of forest sciences and creating the foundations for economic operations,
- implementation of the settlements laid down in the Forestry Principles and Agenda 21 adopted at the 1992 Earth Summit in Rio de Janeiro, the Declaration of European Forestry Ministers concerning the Protection of European Forests (Strasbourg 1990, Helsinki 1993, Lisbon 1998, Vienna 2003) and the Kyoto Protocol (1997) concerning the role of forests in carbon accumulation.

With Poland's accession to the European Union, the SF NFH has also been required to implement the EU NATURA 2000 Programme, namely the provisions set out in two EU Directives: the Birds Directive 79/409/EEC of 2 April 1979 and on the Conservation of Wildfowl, and the Habitats Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats, Fauna and Flora. The SF NFH also implements its own programmes aimed at preserving biological diversity and the reintroduction of endangered flora and fauna species, amongst others the Programme for Preservation of Forest Genetic Resources, the Programme for the Restitution of fir in the West Sudety Mountains, the Programme for the Restitution of Yew and the Programme for the Reintroduction of Capercaillie.

Private owners associations

Associations of private forest owners operate in accordance with the Association Act of 1989 which has granted them a legal status. Every such association acts under its own statute which specifies its activity profile. In 2002, the first four associations of private forest owners in Poland were established. This happened on the initiative of the IUCN Foundation Poland (International Union for Conservation of Nature – now The World Conservation Union) and the consulting company Beltra Resources Ireland, which implemented a project entitled 'Promotion of environmental protection and sustainable forest development in Poland', financed by the European Union's PHARE Access Programme. The above-mentioned four associations in the Małopolskie Province also established the National Union of Associations, a nationwide representation, with its headquarters in Zawoja. Its long-run objective is to incorporate into the Union all associations of private forest owners in Poland following their declaration of will [Gołos 2004b].

A second wave of associations being established began in December 2004. One of these was an association organised on the independent initiative of private forest owners in the Radom area. In the summer of 2005, two more associations filed for registration, with headquarters in Busko Zdrój and Jędrzejów (Świętokrzyskie Province) and in Kolbuszowa and Ropczyce (Podkarpackie Province). The National Union of Private Forest Owners Asso-

ciations in Zawoja is likely to apply soon for membership in the Confederation of European Forest Owners (CEPF) with its headquarters in Brussels. Table 1 provides essential data concerning associations of private forest owners in Poland.

The governing authorities of the associations, including the General Assembly of Members, Management Board and Supervisory Board, are appointed every three years. The General Assembly is an association's highest authority, its main function being to adopt relevant resolutions. The Management Board is responsible for management of all current activities of an association. The role of the Supervisory Board, composed of three persons, is to exercise control over the activity of the Management Board. All functions in the Management Board (President and Vice-Presidents, Secretary and Treasurer) are performed on a voluntary basis. Management of an association's property is based on estimates of revenues and expenditures. Associations may undertake business operations, but their profits must be set aside exclusively for the fulfilment of statutory tasks. The fulfilment of statutory tasks is based on voluntary work by all members.

Table 1. Associations of private forest owners in Poland

Associations	Forest area in association (ha)	Number of members (persons)	The largest forest area owned by one member (ha)	Fee (PLN/month)
Gorczańskie	90	29	15.0	5.0
Słopnickie	60	21	13.0	1.0
Wielickie	21	15	10.0	5.0
Zawojskie	150	70	7.0	3.0
Radomskie	130	17	15.0	5.0
Jędrzejowskie	270	58	35.0	1.0
Buskie	170	48	32.0	3.0
Total/Average	**891**	**258**	**18.1**	**3.3**

Source: Yearbook 2004.

6. Education in forestry

As any sphere of social and economic life, forests and forestry require scientific support and well-trained specialists. Training of foresters is carried out in high schools (*i.e.* secondary technical schools) and in the forestry faculties of three agricultural universities: in Cracow, Poznań and Warsaw. In recent years, reforms have been introduced to both high school and academic education with the aim of meeting EU standards. The daytime (intramural) studies at the forestry faculties in Cracow and Poznań offer five-year graduate programmes for a Master's degree. Since the 2002/2003 academic year, day courses at the Warsaw Agricultural University's Forestry Faculty have been split into two levels: a 3.5 year undergraduate-level programme of study, followed by a 1.5 year graduate-level programme of study for a Master's degree. Since the 2002/2003 academic year, teaching has begun in new types of high school: 3-year high schools with a professional profile (so called 'profiled

technical lyceums'), and in 4-year technical high schools (so called 'technical lyceums'). Similarly, forestry technical high schools have been reorganised into 'technical forestry lyceums'. In the new-type forestry technical high schools, school uniforms are obligatory (as set forth in school statutes). Recently, special classes with forest-related curricula have appeared both in the new-type lyceums and in traditional technical high schools, as well as in post high schools (colleges).

Extramural studies in forestry are planned for the 2005/2006 academic year at the Forestry School Complex in Tuchola. Moreover, a number of universities have now introduced postgraduate studies in forestry. In the 2002/2003 academic year, 3,697 students (Table 2) pursued various forms of study at forestry faculties. Additionally, forestry education is also possible at secondary level in 13 technical high schools (in Białowieża, Biłgoraj, Brynek, Goraj, Lesko, Milicz, Rogoziniec, Rzepin, Stary Sącz, Tuchola, Tułowice, Warcino and Zagnańsk – Table 3).

Table 2. Graduates of state universities – faculties of forestry

Form of studies	Total no. of students		Including women		Total students					
					bachelor's degree (eng.)		master's degree		master's degree (complementary)	
	students	graduates	students	graduates	students	graduates	students	graduates	students	graduates
Intramural	2,281	297	654	63	162	–	2,119	297	–	–
Extramural	1,584	224	206	23	1,390	159	–	–	194	65
Evening	121	8	14	3	121	8	–	–	–	–
Total	**3,986**	**529**	**874**	**89**	**1,673**	**167**	**2,119**	**297**	**194**	**65**

Source: Yearbook 2004.

Table 3. Graduates of forest technical schools (technical and profiled technical lyceums) with forestry and wood technology curricula in the school year 2003/2004

Lyceum	Students		Graduates	
	2002/2003	2003/2004	2002/2003	2003/2004
Technical	1,310	712	339	505
Profiled	1,073	1,865	–	–
Total	**2,383**	**2,577**	**339**	**505**

Source: Yearbook 2004.

Forestry faculties offer four-year intramural or extramural doctoral programmes (Table 4). A Doctor's degree in forest sciences can also be earned at the Forest Research Institute, after completing extramural doctoral studies and acceptance of a doctoral dissertation.

The total number of scientific and teaching staff at all forestry faculties in Poland is 280, including:

- Forestry Faculty, Agricultural University of Cracow – 102,

Table 4. Doctoral studies in forestry sciences

Years	Total		Postgraduate students				Number of commenced doctoral dissertations		Undefended doctoral dissertations after the last academic year	
			intramural		extramural					
	total	incl. women	total	incl. women	total	incl. women	total	incl. women	total	incl. women
2000	136	41	68	26	68	15	49	14	27	3
2001	171	72	85	39	86	33	49	20	25	8
2002	202	60	101	40	101	20	22	6	12	3
2003	175	51	90	34	85	17	76	21	50	13
Total	**684**	**224**	**344**	**139**	**340**	**85**	**196**	**61**	**114**	**27**

Source: Yearbook 2004.

- Forestry Faculty, Warsaw Agricultural University – 87,
- Forestry Faculty, Agricultural University of Poznań – 91.

In addition, professional foresters have their own important, opinion-making voluntary organisations. These are: the Polish Forest Society, with 3,395 members in 2002, and the Association of Engineers and Technologists of Forestry and Wood Processing, with 9,456 members.

7. Forest research

Forest research is conducted at three academic faculties of forestry and the Forest Research Institute (IBL) in Warsaw. The Institute employs a staff of 225, including 14 on a part-time basis. The Institute's staff consists of 12 full professors, 6 associate professors, 64 assistant professors and 20 assistants. The main emphasis of the Institute's research is in programmes pertaining to the following subjects:

- multiple forest functions, sustainable development and balanced use of forest resources,
- biology and ecology of forest associations and characteristics of forest environments and habitats,
- hydrology and forest reclamation,
- impact of industrial emissions and other anthropogenic factors on forests, restoration of forests in deforested areas,
- silviculture, tree-planting outside forests and afforestation of non-forest lands,
- forest protection and methods for enhancing biological resistance of stands,
- wood and non-wood utilisation of forests,
- game management,
- forest management, productivity and monitoring,
- forest economics and its relations with other sectors of the national economy, organisation and management principles and methods of forest policy, and history of forestry,

- improvement of the technological processes and methods of forestry management,
- work safety in forestry.

Forest research programmes are financed by the State Forests National Forest Holding, the Ministry of Education and Science, the National Fund for Environmental Protection and Water Management, the Ministry of the Environment and the Chief Inspectorate for Environmental Protection. Moreover, research programme funds are also provided from foreign institutions and other organisations.

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★ Portugal

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The Portuguese Republic (República Portuguesa), territory: 92,400 km², population: 10.3 million, capital city: Lisbon.

1. Forest characteristics

Forest area and species composition

The total forest area in Portugal is of about 3,500,000 hectares, corresponding to about 38% of Continental Portugal. The four main species are maritime pine (*Pinus pinaster,* Ait), cork oak (*Quercus suber,* L.), Tasmanian blue gum (*Eucalyptus globulus*) and holm oak (*Quercus ilex*), together accounting for about 88% of total forest area.

The area covered with maritime pine is mainly located in the northern and central parts, at altitudes between 700 m and 900 m. Cork oak and holm oak forests (Portuguese *montados*) are respectively located in the littoral and in the interior part of the south of Portugal. Eucalypts are concentrated in the Atlantic coastal zone, with a maximum width of 65 km, encompassing all of the Portuguese coast and medium altitude of up to 500 m. Other less relevant softwood and hardwood species include stone pine (*Pinus pinea*), oak (*Quercus spp.*), and chestnut (*Castanea sativa*).

Forest land and timber growth rates are far from reaching their full economic and ecological potential. The enlargement of the area of forest to cover 5,280,000 hectares (or 60% of total land area) remains possible through the afforestation of about 1,900,000 hectares of marginal land. Productivity gains of about 20% would also be attainable through improved management in maritime pine and eucalyptus stands. However, since 1970, afforestation and reforestation have lagged far (ca 54%) behind deforestation, due to severe forest fires. Likewise, the area of some 1,230,000 hectares abandoned by agriculture has only been afforested to the tune of 380,207 hectares. This happened despite the fact that the supply of timber and cork lags behind the demand for those commodities from forest industries.

Table 1. Forest area distribution

Species	Area (ha)	% of total area
Pinus pinaster	1,038,291	31
Quercus suber	736,852	22
Eucalyptus globulus	703,359	21
Quercus ilex	468,906	13
Pinus pinea	100,480	3
Castanea sativa	60,000	2
Quercus spp.	133,973	4
Other hardwoods	100,480	3
Other softwoods	33,493	1
Total area	**3,375,834**	**100**

Source: Inventário Florestal Nacional, 1995 – Direcção Geral das Florestas.

Table 2. Forest fire areas

Species	Area (ha)				
	2001	2002	2003	2004	2005
Maritime pine	20,630	34,246	110,096	10,326	90,606
Other softwoods	794	1,654	2,129	1,224	1,226
Eucalypt	6,672	14,125	50,030	10,139	65,129
Holm oak	3,119	3,743	4,116	2,291	1,602
Cork oak	2,782	2,485	30,335	9,467	3,929
Other hardwoods	2,750	2,578	6,799	1,851	3,069
Mixtures	2,854	5,370	33,708	15,304	29,369
Others	5,717	960	43,533	5,596	18,521
Total	**45,318**	**65,160**	**280,746**	**56,198**	**213,450**

Source: Direcção Geral dos Recursos Florestais: no published data.

Table 1 illustrates the overall picture as regards the distribution of several species. Forest fires, a recurrent problem in Mediterranean ecosystems, were particularly acute in the years 2003 and 2005 (Table 2). The largest area burnt was covered with maritime pine (39%) and eucalypt (20%), followed by mixtures (12%) and cork oak (11%). Unfortunately, the incidence of fires is great enough to have modified the areal distribution of forests, as indicated in Table 1.

Volume and increment

Annual production of wood is of around 12,000,000 m^3, (Goes 1991) of which maritime pine and eucalyptus account for about 90% (11,000,000 m^3), destined mainly for pulp and papermaking, as well as for the production of sawn timber, plywood and particleboard.

Table 3. Mean annual increments in wood production

Species	Increment m^3/ha/year
Eucalyptus globulus	10.0
Pinus pinaster	5.3
Castanea sativa	1.7
Pinus pinea	1.4
Quercus rotundifolia	0.6
Quercus suber	0.5
Other softwoods	3.1
Other hardwoods	1.4

* Source: Goes, 1991.

Table 3 indicates the mean, annual increments (high by continental European standards), and the total volumes of the most important forest species.

Cork oak and holm oak together account for 36% of total forest area, though their contribution to wood production is mainly restricted to pruned branches and biomass. Their economic importance is related mainly to cork and fruit production. Where cork oak forests are concerned, it needs to be noted that Portugal has a dominant position in the world as a cork producer, with about 170,000 tonnes of cork per year. Holm oak and cork oak forests are also particularly beneficial in terms of fruit production, with respective mean yields of 200 kg and 70 kg per hectare annually (Goes, 1991), the acorns being designated for the feeding of hogs pasturing in the field.

Stone pine provides about 70,000 m^3 of wood per hectare annually, as well as pinion nuts and resin. Pinion is currently a source of great, commercial interest. Its mean production is of the order of 80 kg per hectare annually, giving a national total of 2,500 tonnes.

Chestnut forests are grown for both, wood and fruit, with total areas of 40,700 and 19,600 hectares, 83.4% of which are located mainly in the northern province of Trás-os-Montes e Alto-Douro (Martins, 2001).

2. Logging wood processing

The main destinations for the wood being processed are the sawnwood, pulp, particleboard and fibreboard industries. The supplies of wood for these industries come from both, forest management operations and industrial residues. The annual productive capacity of the sawn wood industry (comprising products, such as construction wood, wooden boxes, pallets, or wood planks) is of about 1,500,000 m^3 (Goes, 1991; CESE, 1996), corresponding to a total wood consumption of about 4,000,000 m^3. Pinewood accounts for about 87% of the wood consumed by this industry, with eucalyptus representing 8%. The waste goes mainly to energy production, as well as to the particleboard, fibreboard and

pulp industries. However, according to Goes (1991) about 3.3 million green tonnes (or 94% of the residues available from forest management) were not being used industrially. As regards sawmill residues, only about 5.1% went unused. In the case of the latter, energy production consumed around 70% of the total, while pulp and board manufacture – about 24% (Goes, 1991).

The average number of sawmills as of 1993 (CESE, 1996) was about 1,220, with workforce of 14,400, giving an average of 12 staff per mill. As of 1993, there were about 6,451 furniture factories employing about 40,150 people (CESE, 1996). Most such factories (62%) with 65% of total headcount were located in the north. 85% of the factories employed fewer than 9 people.

The seven mechanical and chemical wood processing plants, employing about 3,100 workers, manufacture annually 1,617,000 tonnes of products on average (CESE, 1996), with exports in 2002 amounting to about 1,131,000 tonnes (DGF, 2002). In the late 1980s, the mean figures for the consumption of eucalyptus and pine timber by the pulp industry were of ca 5,500,000 and 1,700,000, respectively (Goes, 1991). Paper and cardboard accounted for about 1,067,386 tonnes of exports in 2002 (DGF, 2002). The tonnage exported in 1995 was lesser (550,000 tonnes) (CESE, 1996), as produced by 65 units with 4,000 workers. In 1996, there were 14 industrial plants in the particleboard and fibreboard sectors, producing medium density fibreboards (MDF) and plywood. Their outputs were of about 770,000, 472,000, 400,000 and 29,000 m^3, respectively (CESE, 1996). Exports in 2002 were of about 218,000, 323,000 and 8,155 tonnes for particleboard, fibreboard and plywood, respectively (DGF, 2002). Portugal already holds a good position in the particleboard and fibreboard industries, as a result of industrial restructuring and consolidation. This has allowed development of a consistent strategy towards globalisation, outsourcing and locating of productive capacity in places near the potential, important export markets.

As of 1993, the cork industry comprised about 550 plants with 10,000 staff (CESE, 1996), of which only about 15% employed more than 20 people. At the time, more than 85% of those units were concentrated in the northern Council of Santa Maria da Feira. The production of cork stoppers amounted to about 13,000 tonnes (19,600 tonnes exported) in 1993 (CESE, 1996), and apparently increased in 2002, when the reported exports were of about 21,399 tonnes (DGF, 2002). The production of stoppers is the main cork-processing activity and the one achieving the highest value, and hence harvesting the highest quality cork planks. Cork stopper exports worth EUR 507 million corresponded to more than 50% of total cork exports by value in 2002 (Table 4). Other cork products absorbing the residues of the cork industry and forests are agglomerated cork panels for thermal, acoustical and mechanical insulation. In 1996, industries engaged in the production of agglomerated cork were around 30 in number, and employed 3,200 staff (CESE, 1996). The export of those products (DGF, 2002) reached a significant amount of EUR 329 million in 2002.

Table 4 illustrates the overall picture regarding the importance of forest products to external commerce. The products in question account for about 7% of total exports (or 2% of GDP), while imports represent ca 3.6% of the national total (equivalent to 1.41% of GDP). It may be noted that pulp and cork products are those for which the ratio of exports to imports is higher.

Table 4. Economic statistics for forest products

Forest products	Exports ('000s euros)	Imports ('000s euros)	Ratio Exports/Imports (%)
Wooden furniture	153,054	191,405	80
Wood products	408,880	511,724	80
Paper products	853,391	907,347	94
Resinous products	34,903	17,925	195
Pulp	428,040	64,058	668
Cork products	903,266	139,084	649
Total	**2,781,534**	**1,831,543**	**152**

Source: DGF, 2002.

Forest protection

The forest protection areas, including 12 Natural Parks, 9 Forest Reserves, 3 Protected Landscapes and 9 National Reserves, occupy a territory of 587,102 hectares, corresponding to about 18% of all forests. The individual areas vary in size between the 101,600 hectares of the Serra da Estrela Natural Park to a minimum of about 3,773 hectares for places like the Serra do Açor, 529 hectares for Paul do Boquilobo or 1594 hectares for Arriba Fóssil of Costa da Caparica.

2. Legal and organisational forms of forest holdings

Ownership structure

Table 5 gives a detailed picture of ownership and size structures as regards forest property. Private, non-industrial owners account for as much as 53.7% of coniferous stands and 88.2% of broadleaved ones. Pulp and paper companies, State and communal forests account for 7.7%, 2.2% and 13.4% of the total, respectively.

As may be noticed from Table 6, the size structure of forest ownerships varies from the small holdings in the northern and central regions to much larger ones in the south. The northern and central regions (the Northwest, Northeast, Central West and Central East) have smaller holdings of a size class of 0–4 hectares accounting for 73.1% to 91.5% of the total number of holdings, and 18.1% to 53.5% of the total forest area. In the southern provinces of Alentejo and Ribatejo Oeste, huge-sized holdings of 100 and more hectares account, respectively, for 81.5 % and 70.5% of total forest area, and 22.4% and 1.5% of the total number of holdings.

Ribatejo Oeste may be considered a transitional province between the North and South since, notwithstanding the areal fraction (70.5%) of larger holdings, 84.8% of smaller holdings, belonging to the size class of 0–4 hectares, occupy 8.3% of the province's total area.

Table 5. Forest land by management type and tree species ('000s ha)

Management type	Total		Conifers		Broadleaved species						Total	
					eucalypt		cork oak		other			
	area	%	area	%	area	%	area	%	area	%	area	%
Forests	75	2.2	60	5.6	0	0.0	0	0.0	15	2.0	15	0.7
Communal forests	430	13.4	410	37.9	0	0.0	0	0.0	20	2.7	20	0.9
Private owners	2,453	76.7	581	53.7	482	71.7	687	96.4	700	95.3	1,869	88.2
Forest industries	246	7.7	30	2.8	190	28.3	26	3.6	0	0.0	216	10.2
Total	**3,204**	**100.0**	**1,081**	**100.0**	**672**	**100.0**	**713**	**100.0**	**735**	**100.0**	**2,120**	**100.0**

Source: Mendes and Dias, 2002.

Table 6. Distribution of forest holdings of different size (%)

Regions		Class size						
		0–4	5–9	10–19	20–49	50–99	100 and more	total
Northwest	No. of Holdings	89.7	6.4	2.2	1.2	0.2	0.3	100.0
	Forest area	34.4	13.6	9.0	10.2	4.1	28.7	100.0
Northeast	No. Holdings	90.6	6.6	2.2	0.4	0.1	0.1	100.0
	Forest area	53.7	19.9	13.2	5.4	3.4	4.4	100.0
Central West	No. of Holdings	91.5	5.8	1.7	0.8	0.1	0.1	100.0
	Forest area	53.1	18.4	10.7	10.8	2.4	4.6	100.0
Central East	No. of Holdings	73.1	14.3	7.3	3.9	0.7	0.7	100.0
	Forest area	18.1	13.8	14.1	15.3	5.9	32.8	100.0
Ribatejo Oeste	No. of Holdings	84.8	6.5	3.6	2.5	1.1	1.5	100.0
	Forest area	8.3	3.8	4.1	6.6	6.7	70.5	100.0
Alentejo	No. of Holdings	23.8	12.0	15.6	14.9	11.3	22.4	100.0
	Forest area	0.5	0.9	2.5	5.4	9.2	81.5	100.0
Algarve	No. of Holdings	58.9	142.0	11.6	9.5	3.5	2.3	100.0
	Forest area	7.5	7.5	12.5	23.2	17.9	31.4	100.0
Continental Portugal	No. of Holdings	85.0	8.0	3.0	2.0	1.0	1.0	100.0
	Forest area	15.0	7.0	7.0	9.0	7.0	55.0	100.0

Source: Mendes and Dias, 2002.

3. Trends and historical background of the forest economy

A correct evaluation of the current situation of the forest economy requires knowledge of the historical framework, underpinning the main programmes and financial incentives to forestry that existed in Portugal in the 1980s and 1990s, as well as the perspective on forest

resources and the policy since the mid 19th century. Forest area tripled between the mid-19th and 21st centuries, after several centuries of deforestation reflecting overexploitation for shipbuilding and charcoal production, or intensive farming and husbandry. From the 1960s and 1970s onwards, the area of cultivated agricultural land began to decrease as a result of intense rural emigration. Its consequence was the extension of the area of forest land. In the late 1970s, afforestation was, nevertheless, insufficient to cover all the abandoned farmland.

The principal parallel trends to forest development in the 19th and 20th centuries were the following (Mendes and Dias, 2002):

- conifers, mainly maritime pine, increased in cover from 210,000 hectares in 1867 to 1,293,040 hectares in 1967–1978. To that total area, public intervention contributed 25,600 hectares through protective afforestation of coastal dunes, as well as 318,000 hectares of afforested communal land,
- in the south of Portugal, being not an area of great intervention by the public forest services, cork oak and holm oak forests increased in an area from 370,000 hectares in 1867 to 1,174,390 hectares in 1995–1998,
- eucalyptus rose from zero cover in the mid 19th century to 672,149 hectares in 1995–1998, as a result of increased interest on the part of the pulp and paper companies, and a desire of private forest owners to follow the demand these companies generated, and
- only as late as in the 1990s was there a trend towards increased interest in the organisation of forest associations capable of carrying out forest investment and management plans, notwithstanding the above noted substantial fractions of 76.6% of non-industrial private ownership of Portuguese forest. From the 19 associations in 1977, the number rose to 67 in 1998 and to 110 in 1999.

After the peaceful Revolution of 1974, some massive interventions took place in the forest economy. The first entailed the so-called Portuguese Forest Project (PFP), funded by the World Bank, which was planned in the 1970s and implemented between 1981 and 1988. Thereafter, a new external source of funding, the EEC pre-accession funds, supported the Forest Action Programme (PAF), which was implemented from 1987 to 1995. A third wave of public intervention involving the Forest Development Plan (PDF) and Regulation (EEC) No. 2080/92, occurred from 1994 to after 1999, at which time Portugal was a full member of the European Union.

The main objective of the PFP was the overcoming of the aforementioned predicted shortages in wood supply for export-oriented, pine-based pulp and paper industries, through the establishment of commercial plantations of conifers and eucalyptus, mainly in northern and central Portugal. By contrast with the PAF, fast-growing species were not given any incentives and were in fact subject to new regulations restricting such planting. Pulp and paper companies, the main industrial agents of the PFP were no longer supported by afforestation programmes. The new private stakeholders of the PAF were the forest owners associations and forest contractors. The Forest Services remained the public agency eligible for the funding of projects in public and communal forests.

As a consequence of the PAF, the annual average afforestation area increased from 16,489 hectares, for the recent PDF, to 36,000 hectares. A more generous package of

financial incentives and a stronger reliance on the private owners sector, in which private forests account for 76.6% of total forest area, have certainly contributed to this outcome.

In overall terms, the main results of the PAF were afforestation of 113,561 hectares of former agricultural lands and 211,054 hectares of stand improvement investments, as set against the target levels of 400,000 hectares for each. The shortfalls reflected excessive optimism in target-setting, signalling a weakness in the policy-planning capability, as well as the absence of better-organised industrial partners, such as the pulp and paper industries, or others. These were also financial constraints from the government preventing the allocation of domestic funds needed to match the EEC funding, and the absence of the conditions for improving the capabilities of private owners in northern Portugal to organise themselves into associations.

The statistics of the PAF show the principal beneficiaries (with 70.2% of total investment) to have been private owners. More than half of the remaining funds were allocated for public projects in the communal lands of northern Portugal. Those projects obtained only 17.4% of total investment under the PAF, a considerable regression relative to the PFP.

The data for regional implementation of PAF projects reveal that the north accounted for 21.3% of total afforestation and stand improvement investments, compared to 54.5% for new plantings under the PFP. The equivalent figures for the central region were of 28.8% and 19.3%. In turn, the funds for the southern regions of Alentejo and Algarve increased, respectively, from 8.1% to 31.5% and from 1.1% to 10.4%, for all projects. This regional pattern was concomitant to the changes happening in tree-species interventions. As a result, maritime pine dominant in northern and central Portugal fell from 49.9% under the PFP to 33.9% in the PAF, while cork oak (dominant in Alentejo) increased from 1.4% under the PFP to 36% under the PAF. Eucalyptus interventions also decreased from 28.8% of the total (PFP) to 4.8% (PAF). Within short, the main beneficiaries of the PAF were forest owners in Alentejo, with cork oak and broadleaved species, as opposed to northern or centrally--located owners with dominant maritime pine and eucalyptus planting. This drastic change is surely related to the property structure in Alentejo, with its large-scale agro-forestry of a sufficient dimension and cash flow to support the organisational skills needed to implement actions of economic significance (compare the small-scale forestry operations in the northern and central parts which lack an efficient, collective organisation to the same end). This new pattern of forest investment provides an improvement to the cork sector in which Portugal is a world leader.

The next wave of public and European support for afforestation came under Regulation (EEC) No.2080/92, seeking financing mainly for the arborisation of agricultural land with the initial purpose of reducing farm surpluses, as well as under the Forest Development Plan (PDF) specific to Portugal and financed from the Community Support Framework for the period 1994–1999. These two programmes were implemented in line with the trends towards greater reliance on the private sector and the provision of financial support in the form of grants. As a result of Regulation (EEC) No. 2080/92, afforestation with cork oak enjoyed much better support than it had previously, and an additional bonus, non-existent before, was created to compensate for 20 years' foregone revenues from agricultural use of afforested lands.

The PDF supported a wide range of actions, such as afforestation, forest improvement and reforestation (including areas damaged by fires in the five-year period mentioned before), establishment of forest nurseries, stronger support for multiple use of forest nurseries or selection and production of good-quality seeds and seedlings. Other actions considered were: the construction of forest roads and reservoirs, multiple use of forest land (such as apiculture, game hunting, grazing or collecting aromatic plants), the favouring of group projects (at least, five forest holdings) and non-supporting of the plantations of fast--growing species.

The PDF and Regulation (EEC) No. 2080/92 together resulted in the afforestation of 60,905 hectares annually, compared to the 36,068 hectares mentioned previously for the PAF. In addition, there was a backlog of applications which could not be funded by the PDF and had to wait for the Third Community Support Framework which came into effect in 2001. The dynamics in the 1990s induced the aforementioned significant upsurge in the number of forest owners associations. This denoted an improved capability on the part of forest owners to organise, with a view to engaging in forest investment and drafting management plans. The PDF and Regulation (EEC) No. 2080/92 also confirmed a shift towards a more substantial support given for cork oak, holm oak and stone pine stands, with a regional correlation shifting the emphasis from the north and the centre to the south of the country. As a result of Regulation (EEC) No. 2080/92, the funds for planting and stand improvement in respect of cork oak, holm oak and stone pine amounted to 41.6%, 16.5% and 18.7%, compared to 3.5% for maritime pine.

The importance of all those instruments supporting the forest sector is reflected in the improvement in the twentieth century of the annual rates of afforestation under several programmes: 9,235 hectares annually from 1939 to 1965, 12,085 hectares annually from 1966 to 1980, 16,489 hectares annually under the PFP, 36,086 hectares annually under the PDF and 60,905 hectares annually under the PDF and Regulation (EEC) No. 2080/92. Another trend is towards improvement in the quality of private forestry in correspondence with the preponderantly private nature of ownership of Portuguese forests. However, those ameliorations in the organisation and implementation of forest plans were not enough to make up for the losses due to forest fires. Those losses amounted to 1,263,298 hectares (Mendes and Dias, 2002) of forest burnt between 1966 and 1999, with a negative budget in 2001 to 2003 (Table 2) and in 2004 (56,198 hectares of burnt) against afforestation of ca 680,677 hectares in the same period (1966 to 1999) to warrant an adequate supply for forest industries. The latest forest programmes developed and implemented in Portugal have a common feature – they depend on external funds, mainly those from the EU. A need arises for an internal and sustainable source of funding, and measures, like the recent legislation levying a tax on fuel consumption for public investments in the forest sector, should be taken to guarantee the long-term development of the forest sector. If the scale factors essential to the planning are to be obtained and execution of forest operations is to be assured, a better and more intensive cooperation between forest industries and forest producers is also desirable.

4. Evolution and tasks of the national forest administration

The administration of Portuguese forests is the responsibility of the Ministry of Agriculture, Fisheries and Forestry. Its main agency is the Forest Services (Direcção Geral dos Recursos Florestais), whose institutional structures at central and regional levels can be found at www.dgrf.min-agricultura.pt.

The major priority of the Forest Services since its establishment in the mid-19th century has been the afforestation of new areas, along with a continuous and gradual change in the institutional and functioning strategies, and filling the ever-present gap between the policy goals planned, and the results actually obtained (Mendes and Dias, 2002).

In the 19th century, public intervention was confined to the management of a narrow area of state-owned forests. At the beginning of the 20th century, forest policy moved towards protective afforestation of the 25,600 hectares of coastal dunes.

The next and greater intervention occurred between the early 1920s and 1930s and the mid-1970s, coinciding with the political change towards a dictatorial regime. That change translated into an authoritarian model of implementing forest policy, entailing afforestation of communal lands, with neglect for traditional uses thereof by local communities. The main outcome of this period (1935 – 1972), was the Afforestation Plan, covering 318,000 hectares in the central and northern parts of the country. Between the 1930s and the present, the essential activities of public services were focussed on the management of those forests on behalf of the local communities. Some of the forested areas were kept within the aegis of the Forest Services which draws part of its funds from them.

The first real intervention of the Forest Services in private forests (since its inception in the 19th century) was the above-mentioned Portuguese Forest Project (PFP), which reflected circumstances of reduced engagement of the Forest Services in communal forests in the mid 1960s. That decline accelerated with the end of the dictatorial regime, and was also concurrent with a tentative, effective support for private forests through the creation in 1966 of the public agency called Fundo de Fomento Florestal (FFF). The FFF was soon discontinued, as its activity was not sufficient to meet the needs of the forest industries.

Under the PFP, the Forest Services assumed direct responsibility for the implementation of afforestation projects on the public and communal lands dependent on it, and on the lands under private ownership supported by a funding loan payable, for no more than 60 years, with the revenues coming from successive fellings. In the end, the Forest Services intervened mainly on commons in northern and central Portugal. Portucel, a pulp and papermaking industrial group, operated on the lands of its own, leased or acquired for that purpose, planted mainly with the fast-growing species and featuring intensive silviculture.

During the following Programa de Acção Florestal (PAF), the Forest Services analysed, in retrospect, some of the shortcomings of its direct interventions in the former programmes. And so began a change in its strategy, from direct intervention to incentive-based regulation, with the greater involvement of private contractors and owners. The financial incentives of the PAF were then different from those under the PFP. Instead of loans to be paid using the revenues from felling, the new incentives entailed grants varying from 30% to

100% of total investment cost, with a preference shown for broadleaved species, such as cork oak forests, and projects for multiple use of forests with grazing, agro-forestry and stand improvement being included.

Most of the private projects supported by the PAF received no intervention from the Forest Services, or any forest industry: forest contractors played the larger role, given the reduced dimension of private lands and the scarcity of forest associations to implement their own projects. A by-product of the PAF was the appearance of a network of private contractors.

The above-mentioned increase to 110 forest owners associations in the aftermath of the EU co-financed Programmes, like the PDF and Regulation 2080/92/EC, must be seen as a change in the right direction, though still insufficient to bring a more substantial change to forest management on their lands. A more significant role of private markets in forest policymaking, in terms of effectiveness of cooperative associations of private forest owners involved in the process, must be complemented by a powerful political will to reform, decentralise and prevent the ageing of the Forest Services staff.

5. Education in forestry

Education managed by the Forest Services and the Ministry of Internal Administration

The education and training of forest guards, enabling them to be admitted into and progress through public careers, date back to 1914. Before1968 – the year when the Centro de Formação Profissional de Monserrate was established – this type of education, among several other professional-practical types of training (forest operator, cork stripper, apiculturist, resin extractor or machine operator) had been pursued in an odd and dispersed way, at a rate of attendance of 200/year. The Monserrate Centre allowed for a consolidation of formative projects directed to private forest holdings. In 1984, in turn, the new Centro de Operações e Técnicas Florestais da Lousã enlarged the supply of professional education and allowed for module specialisation aimed at training operators of mechanical saws, forest cranes, debarkers, wood splitters and operators of extraction machines, etc. In turn, the Escola Nacional de Bombeiros was created by the Ministry of Internal Administration, with a view to providing firemen with the adequate knowledge, theoretical and practical, related to fire prevention, issuance of standards pertaining to fire fighting techniques, materials to be used in emergency, or assistance to local people.

Education managed by the Employment and Professional Training Institute (Instituto do Emprego e Formação Profissional) of the Ministry of Employment and Social Security

Initial education. Under the tutelage of the Ministry of Employment and Social Security, there are two modalities of technical education: apprenticeship and qualification.

Apprenticeship is an extra-scholar modality created in 1984, targeted at youngsters from 14 to 20 years old. These students must have had at least nine years of compulsory schooling. The courses are composed of a general programme and a more specific, technical component, including training in industrial firms. A successful conclusion of the courses provides a vocational certificate corresponding to the normal education systems at level II (nine years of schooling) and level III (twelve years of schooling).

Pre-apprenticeship provides a level-I vocational certificate. This type of schooling is likely to disappear, as it does not meet the requirement of providing teaching for full nine years.

The qualification courses, an alternative to the apprenticeship courses, offer education for a length of time in excess of 1,400 hours. They are targeted at the unemployed or youngsters aged 16 and over, who are seeking their first job.

At the beginning of the 1990s, the courses of apprenticeship for the forest sector numbered around 42 at level II, encompassing themes, such as carpentry and woodworking (CESE, 1996). At that time, there were about 400 students graduating with apprenticeship certificates. In the same period, there were about 16 qualification courses for the woodworking and cork-stopper industries. As regards the cork industry, in general, two courses were provided at level II and level III. For the paper-processing industries, there were about five courses at level II, three at level III, and one at level I.

Continuous education. This kind of education covers all branches of professional activity. Its goals include the deepening of theoretical and technical knowledge, as well as modification of the attitudes and behaviours acquired during the standard, initial education to the needs of professional activity.

The continuous education courses are of three types targeted at specialisation, improvement or profession change. In the mid-1990s, there were about fifteen such courses, involving areas such as woodworking and the furniture industries, and encompassing themes, such as CAD-CAM system, numerical computing, marketing, wood finishing and furniture production, or conservation and the restoring of wood components. In the same period, cork-industry workers were provided with about twenty courses in areas, such as the electronic selection of stoppers, cork preparation and drying, stopper washing, machinery maintenance, electro-pneumatics, computing software and technical language.

Technical and professional training managed by the Ministry of Education. Under the tutelage of the Ministry of Education, there are two modalities of professional education in the areas of forest production, natural-resources management, furniture, cork, paper and graphic arts. These two modalities are Technical-Professional Education (hereinafter ETP, the Portuguese acronym) and Professional Schools.

The ETP was initiated in 1983 and originally encompassed two types of courses: the Technical- Professional Courses of three years' length, equivalent to complementary high-school education, providing a level-III certificate, and the Professional Courses (a year plus six months of professional training) ending with a professional certificate at level II.

The professional schools, existing since 1989, provide the kind of teaching promoted through joint cooperation of the Ministries of Education and Employment. These schools have a private juridical status and offer certifications for qualified professionals, mainly at level III. Their financing is 100% public, with partial funding from the European Social Fund.

The ETP provides instruction in forestry (level III), agroforestry (level III), maintenance of equipment for agriculture and forestry (level III) and trains foresters in the management of forest resources and forest production (level II).

Four other courses at level III related to environmental management are also available. In the mid-1990s, about 52 Professional and Technical Professional courses at level III were held, teaching subjects related to forest production and natural resource management. A mean number of ninety students a year attended those courses (CESE, 1996).

The number of ETP schools related to the forest industries was much smaller, especially if compared with the market needs of the industries. In the mid-1990s, there were 5 ETP courses at level III for the wood industries, 1 ETP course at level III for the cork industry and 20 ETP courses for the paper sector.

Higher Education. In Portugal, two universities, the Technical University of Lisbon – Institute Superior of Agronomy (ISA) and the University of Trás-os-Montes e Alto Douro (UTAD) provide Licentiate's degrees in Forest Engineering. Since 1983, the licentiateship of ISA has offered specialisations in Forest Production; Natural Resource Management and Forest Product Technology. The licentiateship of UTAD has no alternative specialisations. The Polytechnic Institutes of Beja, Bragança, Castelo Branco, Coimbra and Viseu also provide Licentiate's degrees, as well as Bachelor's degrees in Forest Resources and Forest Engineering. In the period 1968–2004, about 390 and 200 students respectively earned their Licentiate's and Bachelor's degrees.

For the forest industry, additional Licentiate's and Bachelor's degrees are provided by the Universidade de Beira Interior.

The National Forest Research Station Estação Florestal Nacional (EFN) of the Instituto Nacional de Investigação Agrária e Pescas (www.iniap.min-agricultura.pt) is as an institution of the Ministry of Agriculture, Fisheries and Forestry responsible for applied research, experimental development and demonstration in forest science. Forest research is also carried out at universities, as well as in the forest industry itself. EFN has a staff of 73, as is indicated in Table 7.

This staff has been declining steadily since the mid-1990s, at which time there were ca 150 personnel. Without new admissions of specialised researchers and technicians, the activities of EFN will come to a halt, and in less than 10 years the Institution will be literally closed-down.

Table 7. Personnel of EFN in 2004

Personnel	Number
Researchers	32
Licentiate-level Technicians	9
Bachelor-level Technicians	6
Computing Specialists	1
Professional Technicians	13
Administrative Personnel	5
Field Personnel	7
Total	**73**

Sources of research financing

As of 2003, the overall situation as regards research funding of the EFN was as follows:

Table 8. Sources of funding of the EFN

Source of financing	EUR	Total (%)
State Capital budget*	172 583	54.3
AGRO**	97 210	30.6
POCTI***	13 945	4.3
PRAXIS***	11 177	3.5
Sale of products and services	22 807	7.1

Source: Relatório de Actividades da EFN-2003.
* Portuguese acronym-PIDDAC - Programa Integrado de Investimentos da Administraçao Central.
** European Union co-funded Programme managed by the Agricultural Ministry for demonstration of agricultural and forest techniques.
*** European Union co-funded Programme managed by the Ministry of Science and Higher Education.

Important issues and research strategies of the Institute, at present and in the future

Over the last seven years, the EFN has developed and implemented 65 projects related to the main Portuguese forest species: maritime pine, stone pine, cork oak, holm oak, acacia and eucalypts. The traditional scientific areas encompassed genetic improvement, forest protection, multiple use, forest-product valuation, growth and yield models and the environment and biodiversity. Table 9 quantifies the projects developed, by scientific area and species.

Table 9. Projects developed in the EFN in 2000, 2001 and 2002

	Forest improvement	Forest protection	Sustainable management	New forest products	Growth and yield models	Environment and biodiversity***
Maritime pine	4	7	–	2	5	5
Cork oak	6	3	–	–	4	5
Holm oak	1	–	–	–	–	1
Stone pine	3	–	–	–	–	–
Chestnut	2	3	–	–	–	–
Other species*	–	–	–	3	–	3
Other areas**	–	–	8	–	–	–
Total	**16**	**13**	**8**	**5**	**9**	**14**

Source: Relatório de Actividades da EFN-2002.
* Black oak, acacia, eucalypt.
** Aquaculture, biological agriculture, beekeeping and soil microbiology.
*** Including studies in biodiversity, remote sensing and GIS, hydrology and carbon sequestration.

The results of these scientific projects were 175 publications and 220 participations in seminars, congresses, as well as in national and international meetings.

Most of the projects involved cooperation with public and private agencies, such as Universities, Polytechnical Institutes, Agricultural Services and industries.

Some of the key strategic areas, representative of the progress in knowledge and demonstration and hence constituting important research directions, are:

- Characterisation of non-tradable goods and services, such as fish repopulation and breeding in different intensity regimes of production, in the lagoons and rivers of the South, development of the beekeeping techniques or improvement of the culture of the traditional, aromatic and medicinal plants;
- Modelling of biodiversity indicators in the Geographic Information Systems to evaluate the productive potential of forest ecosystems, cartography for the inventory of cork oak and holm oak forests based on satellite images, modelling and calibration, at stand and landscape levels, of the main descriptors of biodiversity in maritime pine forests to several forestry regimes, and evaluation of biodiversity by reference to flora, large mammals, reptiles and amphibians.
- Establishment of maritime pine clone orchards, proceeding from genotypic selection aimed at gains in the productivity of individual trees, in volume and shape of trunks; establishment of maritime pine seed orchards, collection of reproductive material (grafts) for the afforestation of 10,000 to 12,000 ha/year; performance of lineage trials on the existing genetic plots to guarantee the selection of new plus trees for seed production; genetic improvement of stone pine for pinion production; evaluation of genetic, biochemical and morphological interactions in cork oak through the characterisation of enzymatic systems; optimisation of germination techniques of maritime pine seeds.
- Strategies pertaining to the protection of maritime pine and chestnut trees and stands against biotic agents; study of nematode species and vector agents in pine stands; optimisation of norms for the management of maritime pine to minimise the mass incidence of pests and diseases, such as those caused by defoliators, bark and wood-boring beetles; analysis of potential impacts of fungal attacks, such as those by *Armillaria* spp., on cork oaks and their consequences to cork quality for stoppers; studies to minimise the incidence of chestnut cancer and chestnut ink diseases, or the selection of clones which show higher resistance to disease.
- Development of models for wood production in maritime pine stands, for pinion fruit in stone pine stands and for cork production in cork oak stands; evaluation of the management regime impacting the vertical structure of stands; improvement of the technological valuation of softwood and hardwood timber; evaluation of carbon sequestration in fast-growing species, such as eucalypt, through continuous measurement of the cycling of carbon dioxide and water vapour in forest layers.

The strategic objectives of the EFN are thus the constant optimisation of the above and related areas of forest research, implying a continuous linking of the national and European institutions of influence in the forest sector, to the benefit of the whole society. To pursue those objectives, the EFN must be reinvigorated by the admission of young researchers

and technical staff, and the necessary conditions must be created by the Agricultural Ministry to assure efficient functioning in coordination with the improved public extension services, paying the necessary attention to private associations of forest producers.

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Slovakia

Vladimír Šebeň

The Slovak Republic (Slovensko, official: Slovenská republika), territory: 49,000 km², population: 5.4 million, capital city: Bratislava.

1. Forest characteristics

Forest resources encompass lands permanently set aside to serve forest functions. These include areas covered by forest tree species or clearings that are to be reforested, *i.e.* both land with existing stands and land without any stands but serving forestry objectives and designated for forestry activity.

The area of forestland resources has been steadily growing. Since 1970, it has increased by 4.7%, mainly due to afforestation of land unsuitable for agriculture, changes in

Table 1. Changes in forest resources and stand area (classification according to ownership and use)

Land type	Area of forest land and stand area (year/ ha)						
	1970	1980	1990	2002		2003	
				ha	%	ha	%
Forest resources	1,918,571	1,952,656	1,976,538	2,008,349		2,004,226	
Stand area	1,826,564	1,861,642	1,921,705	1,928,709		1,929,310	
SA used by state entities, ha/%				1,201,879	62.3	1,185,971	61.5
SA used by non-state entities, ha/%				726,830	37.7	743,339	38.5
SA owned by state entities, ha/%				825,374	42.8	814,553	42.2
SA owned by non-state entities, ha/%				1,103,335	57.2	1,114,757	57.8

Source: National statistics from the Lesoprojekt Zvolen Forestry Information Centre.
SA = stand area.

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Table 2. Development of forest resources, stand area and forest cover in Slovakia

Kind	1996	1997	1 998	1999	2000	2001	2002	2003
FR area (ha)	1,987,909	1,990,603	1,989,443	1,991,557	1,997,961	2,006,438	2,008,349	2,004,226
Stand area (ha)	1,923,719	1,919,911	1,919,266	1,921,951	1,921,414	1,927,388	1,928,709	1,929,309
Forest cover (%)	40.5%	40.6%	40.6%	40.6%	40.7%	40.9%	41.0%	40.9%

Source: National statistics from the Lesoprojekt Zvolen Forestry Information Centre.
FR = forest resources.

the status of agricultural land overgrown by forest tree species (so-called 'white plots'), and a gradual harmonisation of forestland economic plans with the records in Registers of Land & Mortgages in the planning of forest management.

For the purposes of planning, implementation and documentation of forest management measures, along with the monitoring and evaluation of the condition and development of forests, forest stands are divided into spatial units of forest organisation, namely forest-use units and sub-compartments. Where required, sub-compartments can be further divided into partial plots (areas with a very varied age or tree-species composition) or into temporary stand groups (in regenerated forest stands).

The natural and economic conditions of the forests in the Slovak Republic

The conditions of forest sites in the Slovak Republic have been mapped in detail according to a system of forest types. Vegetation zones, soil, moisture and relief conditions are the basic characteristics used in forest types and the higher unit of management, the set of forest types. Since stands classified for management purposes under the same set of forest types react similarly to silvicultural, felling and protection treatments, these are the units used in the development of management models.

Table 3. Classification of forests by vegetation zone

Altitudinal vegetation zone	Altitude (m)	Annual precipitation (mm)	Vegetation period (days)	Average annual temperature (°C)	Area	
					(ha)	(%)
Oak	below 200	600 and less	180	8.5 and more	142,532	7.39
Beech-oak	200–500	600–700	165–180	6.0–8.5	265,824	13.78
Oak-beech	300–700	700–800	150–165	5.5–7.5	453,640	23.52
Beech	400–800	800–900	130–160	5.0–7.0	401,612	20.82
Fir-beech	500–1,000	900–1,050	110–130	4.5–6.5	415,010	21.52
Spruce-beech-fir	900–1,300	1,000–1,300	90–120	3.5–5.0	187,640	9.73
Spruce	1,250–1,550	1,100–1,600	70–100	2.0–4.0	41,460	2.15
Dwarf pine	1,500 or more	1,500 or more	60 or less	2.5 or less	20,991	1.09
Total stand area:					**1,928,709**	**100.00**

Source: National statistics from the Lesoprojekt Zvolen Forestry Information Centre.

Table 4. Classification of forests by soil, moisture and relief conditions

Soil relations		Area		Soil relations		Area	
		(ha)	(%)			(ha)	(%)
01	Extremely limestone	66,543	3.4	11	Nutritious	738,086	38.3
02	Limestone	102,319	5.3	12	Sandy	26,704	1.4
05	Acidic	144,747	7.5	13	Humid	90,887	4.7
08	Loess	111,356	5.8	16	Stony	77,034	4.0
09	Dry	54,986	2.8	17	Debris	33,809	1.8
10	Fresh	229,258	11.9	Others		252,980	13.1
Total stand area:						**1,928,709**	**100.0**

Source: National statistics from the Lesoprojekt Zvolen Forestry Information Centre.

The natural conditions within a management set of forest types are similar. The current condition of forest stands varies and frequently departs considerably from the target condition. It is represented by stand types, *i.e.* forest stands with the same tree-species composition regardless of age. The superior unit to stand type is the management set of stand types.

The management set of forest types and management set of stand types together form so-called 'operational sets'. An operational set is a unit with similar site and stand conditions used in general planning.

Forest categories

In accordance with the forestry legislation in force, forests are classified according to function under commercial, protective and special-purpose.

The role of commercial forests is to produce high-quality timber while simultaneously fulfilling other functions. Due to the increasing need for forests to fulfil functions beneficial to the public, the proportion of forests classified as commercial has been steadily declining compared with the situation in the past.

Table 5. Present state and changes in area by forest category

Forest category	Year									
	1970		1980		1990		2002		2003	
	in '000s ha/%						ha/%			
Commercial	1,415.4	77.5	1,439.1	77.3	1,367.1	71.1	1,289,422	66.9	1,284,456	66.6
Protection	117.3	6.4	183.8	9.9	258.5	13.5	320,037	16.6	324,840	16.8
Special-purpose	256.1	14.0	187.6	10.1	230.9	12.0	319,250	16.5	320,014	16.6
Land earmarked for afforestation	37.8	2.1	51.1	2.7	65.2	3.4	–	–	–	–
Stand area together	**1,826.6**	**100.0**	**1,861.6**	**100.0**	**1,921.7**	**100.0**	**1,928,709**	**100.0**	**1,929,310**	**100.0**

Source: Overall information from Forestry Information Centre of Lesoprojekt Zvolen.

The protection forests category includes stands with a basically protective (ecological) function. Protection forests are those growing on exceptionally unfavourable sites, in high-mountain locations, in the zone where dwarf pine grows (to ensure soil protection) and other locations.

Special-purpose forests reflect specific national or group needs, which have a significant influence or restricting effect on the manner such forests are managed. These are designated particularly in order to protect water and natural curative sources. Other forests are important from the point of view of nature protection, recreation, game management, research and education. Forests affected by air pollutants, though requiring a different management approach, are nevertheless also included in this category.

Silvicultural systems

The proportion of forms planned within the shelterwood system has been increasing since 1990, while the proportion subject to clear felling has been decreasing. The planning of silvicultural systems during forest regeneration in the forest management plans valid since 2000 has been approaching the ideal state, because the natural conditions of the forests in the Slovak Republic allow for this shelterwood system to be applied on approximately 70% of stand area, the selection system on approximately 10% and clear felling on the remaining 20%. The main reason that the planned proportion of shelterwood forms has so far not been achieved is because the volume of incidental felling continues to remain high.

Table 6. Overview of silvicultural systems and their forms as anticipated in the forest management plans with effect from 1990, 2001 and 2002

Silvicultural system	Forms of silvicultural system	Year					
		1990		2002		2003	
		% of felling area / % of stands number					
Clear-felling	small-area	55.5	52.1	25.9	26.7	25.0	25.7
	large-area	9.2	7.9	12.9	8.2	12.4	7.8
	conversion	3.2	3.3	2.3	1.8	2.0	1.7
	conversion	16.6	15.6	–	–	–	–
	partial felling	84.5	78.9	41.1	36.7	39.4	35.2
Shelterwood	clear-felling total	7.1	6.1	36.6	32.2	38.8	34.6
	small-area	0.8	0.7	5.5	5.0	6.3	5.8
	large-area	6.2	8.8	14.4	16.6	13.1	15.0
	final felling	14.1	15.6	56.5	53.8	58.2	55.4
Selection	total shelterwood	1.4	5.5	2.4	9.5	2.4	9.4

Source: National statistics from the Lesoprojekt Zvolen Forestry Information Centre.

Species composition

Tree species composition must be adapted to particular site conditions (presently also to forecasted global climatic changes), as well as to social requirements regarding the optimal fulfilment of all forest functions. For this reason, the requirement that there should be a variety of forest stands has been promoted over the long term. Appropriate biodiversity is increasing substantially, as well as the ecological stability of forests, creating preconditions for their preservation, even in the event of substantial changes in site conditions due to anthropogenic or natural effects.

Table 7. Present tree species composition in Slovakian forests compared with former and target-prospective composition

Tree species	Tree species composition %		
	Former	Target-prospective	Present
Spruce/fir	4.9 / 14.1	18.2 / 6.7	26.5 / 4.1
Pine/larch	0.7 / 0.1	4.2 / 6.7	7.3 / 2.3
Other coniferous	0.9	1.2	1.1
All coniferous	**20.7**	**37.0**	**41.3**
Oaks	19.9	17.7	13.4
Beech/hornbeam	48.0 / 2.6	35.9 / 0.9	30.7 / 5.7
Maple/ash/elm	3.2 / 0.4 / 0.9	3.0 / 0.5 / 1.2	1.9 / 1.4 / –
Robinia/birch/alder	– / 0.1 / 0.3	0.1 / 0.2 / 0.3	1.7 / 1.4 / 0.7
Poplar /willow	0.1 / 0.1	0.2 / 0.1	0.9 / 0.1
Other broadleaved	3.7	2.9	0.8
All broadleaved	**79.3**	**63.0**	**58.7**

Source: The Zvolen Forest Research Institute 1988, The Zvolen Forest Research Institute 1998, the Lesoprojekt Zvolen Forestry Information Centre.

It is not only a favourable overall tree-species composition, but also particularly the species diversity in respective forest stands that indicate the degree of stability and resistance of forests. The table below, showing area of forest stands according to degree of mixing of coniferous and broadleaved tree species provides an overview of the species diversity in forest stands.

Table 8. Area of forest stands according to degree of mixing

Forest category	Coniferous forests		Broadleaved forests		Mixed coniferous and broadleaved forests	Clearing	Total (ha)
	Coniferous tree species >91%	Coniferous tree species 75–90%	Broadleaved tree species >90%	Broadleaved tree species 75–90%			
	ha/%						
Commercial	250,985	74,297	603,570	102,643	244,627	8,334	1,284,456
	19.5	5.8	47.0	8.0	19.0	0.6	
Protective	116,450	20,516	109,832	17,747	59,708	587	324,840
	35.8	6.3	33.8	5.5	18.4	0.2	
Special-purpose	120,210	25,055	98,167	17,980	56,767	1,835	320,014
	37.6	7.8	30.7	5.6	17.7	0.6	
Total	487,645	119,868	811,569	138,370	361,102	10,756	1,929,310
	25.3	6.2	42.0	7.2	18.7	0.6	

Source: National statistics from the Lesoprojekt Zvolen Forestry Information Centre.

Volume and increment

The standing volume in the forests of the Slovak Republic has been increasing over recent decades, to reach 428.2 million m³ of dbh >7 cm under bark as of 31 December 2003. Average standing volume per ha is 223 m³ dbh >7 cm under bark.

Table 9. Changes in standing volume since 1970 (in millions of m³ dbh >7 cm under bark)

Indicator	1970	1980	1990	2002	2003
Standing volume total	313.3	324.0	348.5	423.2	428.2
including: coniferous	169.0	170.0	178.9	202.4	202.6
broadleaved	144.3	154.0	169.6	220.8	225.6
Standing volume per ha in m³	**171.0**	**174.0**	**181.0**	**221.0**	**223.0**

Source: National statistics from the Lesoprojekt Zvolen Forestry Information Centre.

The increase in the total standing volume and standing volume per hectare (*cf*. the situation in 1970) is due to several factors. The most important are:

- Above-normal area distribution (composition by area) of premature 50-year-old forest stands. In line with their relatively high volume increment, great supplies of timber are accumulated in them. As these stands have not yet reached maturity, regeneration felling is not carried out on them;
- The introduction of new yield tables, developed on the basis of domestic empirical materials, in forest management practices (the forest management plan effective since 1 January 1993). By applying records to standing volumes in the forests of the Slovak Republic, these figures can be made more accurate;

- The effect of overall changes in the environment, especially climate change, increasing nitrogen depositions, the concentration of carbon dioxide, etc., which have yet to be studied in depth.

Presumably, the recent increase in total standing volume due to the introduction of the new yield tables will continue to the end of the present cycle of forest management plans, with updates carried out in accordance with these new tables. This will eliminate the present effects caused by making standing volume figures more accurate. As they grow older, the increment of 50–90 year-old forest stands with above average proportions and their standing volume will decrease, as in the oldest of these stands regeneration has already begun.

Total current increment is an indicator of yield that shows the annual volume production of forest stands. Since 1988, this increment has been decreasing due to the age structure, meaning an increasing share of older stands (50–90 years old) with lower increment. Stands with the largest increments (coniferous tree species aged 30–50 years) have a lower than average area distribution, the ultimate effect being a reduction in overall current increment.

Table 10. Change in increment since 1980

Increment	1980		1988		2002		2003	
	total	per ha	total	per ha	total	per ha	total	per ha
	('000s m^3)	(m^3)	('000s m^3)	(m^3)	('000s m^3)	(m^3)	('000s m^3)	(m^3)
Total current increment	8,842	4.75	13,423	6.79	11,391	6.00	11,451	6.03

Source: National statistics from the Lesoprojekt Zvolen Forestry Information Centre.

Table 11. Current increment by forest category

Total current increment (TCI)	Forest category					
	Commercial		Protection		Special-purpose	
	('000s m^3)	(m^3/ha^{-1})	('000s m^3)	(m^3/ha^{-1})	('000s m^3)	(m^3/ha^{-1})
	7,910.9	6.20	1,481.9	4.87	2,058.7	6.47

Source: National statistics from the Lesoprojekt Zvolen Forestry Information Centre.

2. Logging and wood-processing

Timber felling

Incidental felling complicates the implementation of planned annual tending and regeneration felling. In the years 1990–2001, these constituted almost half of all felling, while in 2002 they fell to 35% of the total.

The amount of timber felled in the forests of the Slovak Republic fluctuated a great deal in the years 1980–1999. It fell from more than 5.8 million m^3 in 1980 to below 4.5 million m^3 in the years 1991–1993. The following years, 2001 and 2002, saw another upward trend (to approximately 6.2 million m^3).

Table 12. Overview of felling carried out in Slovakia in the years 1980, 1990, 2002 and 2003

Indicator	Felling of wood with dbh >7 cm ub ('000s m³), including incidental felling ('000s m³/%)							
	1980		1990		2002		2003	
Coniferous	2,758	1,000	2,777	1,838	3,209.5	1,727.4	3,508.5	2,375.8
		36.2		66.2		53.8		67.7
Broadleaved	3,106	314	2,499	766	3,038.7	430.4	3,143.5	300.9
		10.1		30.7		14.2		9.6
Total	**5,864**	**1,314**	**5,276**	**2,604**	**6,248.2**	**2,157.8**	**6,652.0**	**2,676.7**
		22.4		**49.3**		**34.5**		**40.2**

Source: National statistics from the Lesoprojekt Zvolen Forestry Information Centre.

In 2003, timber felling by state forest organisations reached a volume of 3,949,000 m³, that by non-state entities being 2,702,000 m³ (a total 6,652,000 m³). Regeneration felling constituted 4,591,000 m³ (69%), with tending felling 2,042,000 m³ (31%).

Motomanual technology dominates in timber felling, with a prevalence of the whole-tree method (more than 70%). Recently, this method has been limited to forest depots, since non-state forest owners do not have such facilities as mechanised log depots at their disposal for timber handling, meaning that assortments are produced in the forest. In tending and regeneration felling of coniferous stands, the whole-tree method has also been partially used, with mechanised delimbing or shortening carried out at the forest depot.

Recently, technical innovations, mainly in felling machines and harvesters, have improved the efficiency of this work around the world (resulting in favourable ergonomic and ecological parameters, expansion on to 45% slopes and the application of computers). Considerable attention is also being paid to ecological measures in the legislation of EU Member States. These include replacement of the lubricants used in power saws (from crude oil to ecologically more suitable ones based on plant oils). Their use is nevertheless limited by such unsuitable properties of these lower-quality oils as their shorter storage period, solidification at low temperatures and surface polymerisation. High-quality, environmentally friendly oils are in turn high-priced. In this aspect, the forestry of Slovakia has been lagging behind.

Extraction and transport of timber

The volume of extracted timber corresponds directly to the amount felled. Relevant data is available only for state forest organisations, because complete information is not forthcoming from the non-state sector. The total volume of harvested timber in state forest organisations for the years 2000–2003 was approximately 3.7–3.8 million m³.

Table 13. Structure of timber extraction in Slovakia's state forest organisations

Extraction method	Proportion of timber extraction in total volume by year (%)			
	2000	2001	2002	2003
Animals	11.77	11.32	11.12	14.0
Portable and self-propelled winches	0.03	0.04	2.30	1.7
Forest cables	2.52	2.53	2.51	4.2
Tractors: tracked	1.55	1.49	1.41	0.8
universal	30.97	31.17	30.16	26.6
skidder	52.53	52.05	50.06	50.3
Hauling truck-and-trailers	0.63	1.40	2.44	2.4

Source: Statistical report of MP, Slovak Republic: Les S (MP SR) 1-01; The Zvolen Forest Research Institute.

The wood-processing industry

There are state and non-state sectors within the forestry industry. Forest properties under state ownership, as well as some forests that have yet to be returned to their original owners, are managed by the state organisation responsible for forestry. The forests under the ownership of non-state entities (communities, municipalities, urban areas, the church, private individuals, etc.) are managed by entities created specially for this purpose or by their owners themselves. The wood-processing industry has been entirely privatised. Stock companies or other private companies have been established without any state participation.

In the past, the building up of processing capacities in the wood-processing industry depended on the available possibilities for timber felling. Since broadleaved tree species are dominant in Slovakia, enterprises or combines were established for their comprehensive processing. The rather random development of the wood-processing industry since 1990 ensured that capacities for the processing of hardwood were considerably reduced. Production has been orientated mainly towards softwood. Many small sawmills have been established, which are interested in only saw logs for the production of sawn wood as a final product. Production capacities for the further processing of these semi-finished products are insufficient. In the majority of cases, production of proper end-products from wood (e.g. furniture) cannot compete with foreign companies, due to out-dated technology. A large amount of rough timber, as well as semi-finished products, ends up being exported. The domestic wood-processing industry fails to make use of the most valuable timber assortments, from which veneers could be produced. Small-sized saw logs (up to 20 cm) are not being utilised in mechanical wood processing and so this wood is processed into pulpwood, of which there is a surplus. This should be exported at relatively low prices in order not to encourage depreciation.

The wood-processing industry can today be evaluated in detail according to its orientation or production programme. Essentially, it may be divided into the pulp and paper industry, the wood industry (mechanical wood processing), the production of agglomerated

boards, plywood material and veneers, building-joinery production and the furniture industry.

The **pulp and paper industry** is highly stabilised, with a professional approach to development. This condition is maintained by the long-term interest of foreign investors in access to these operations. The Slovak Pulp and Paper Mills stock company, Ružomberok (SCP, a. s., Ružomberok) has been restructured for the production of coated papers. The Bukocel Pulp Mill stock company, Hencovce (Bukocel, a. s., Hencovce) has been restructured with a view to improving the quality of its paper products and dissolving pulp, as well as more fully utilising its technological facilities.

The **wood industry** is in a complex situation, with many bankruptcies, many shutdowns of production and plants, indebtedness to banks, forest management problems, etc. The technical and technological level is not up to the standard in European Union countries. Its exported products have low added value.

Agglomerated boards and plywood material and veneers is an industry that needs to equip domestic sheet material lines with facilities for finishing (coating) surfaces with foils of various designs in order to equal the level of quality achieved by the prestigious producers in the European Union. Medium-density fibreboards, which represent the most up-to-date kind of agglomerated boards, are not being produced in Slovakia. This means the furniture industry depends on imports of these products.

This industry needs to achieve an annual production capacity of 125,000 cubic meters of particleboard, and their surfaces need to be coated at the SWEDWOOD Slovakia, Ltd. plant, branch enterprise Malacky I. There has also been an intensification of particleboard production at the KRONO-SPAN Slovakia, Ltd. plant in Prešov – to 150,000 cubic meters annually. Another welcome development is that the A. N. B. stock company, Žarnovica has commenced production of glued-board from hardwood, with an annual production of 1000 square meters.

Table 14. Overview of the processing of wood of quality classes 1–5 by sectors of the wood-processing industry in the Slovak Republic (in '000s m³ under bark)

Sector	Actual figures for			Expected in 2003	Outlook for 2004
	1990	2001	2002		
Wood industry	2,300	2,755	3,468	3,600	3,800
Pulp and paper industry	1,880	1,687	1,726	1,800	2,100
Wood-processing industry – total	**4,180**	**4,442**	**5,194**	**5,400**	**5,900**

Source: Ministry of the Economy of the Slovak Republic.

3. Categories of forest protection and forest functions

Forest functions in Slovakia are classified as publicly beneficial (non-wood-producing) and productive (wood-producing). Publicly beneficial functions are ecological and environmental (social). The main ecological functions are: anti-erosion protection, water management, avalanche control, deflation control and bank protection. Social functions involve for

example: recreation, water protection, conservation, health-resort and therapy, game management and educational research.

The forest management applied in Slovakia is functionally integrated, aimed at harmonising and improving the degree to which production and publicly beneficial forest functions are served. The basic unit for classifying forest stands, based on prevailing functions, is the 'functional type'.

In accordance with the forestry legislation in force, forest stands are classified under the following three forest categories, depending on their prevalent type of function:

- **commercial forests**, constituting 66.6% of the stand area,

Table 15. Overview of areas according to function type - protection forest

FT	Attribute	Specific function	Area (ha)	%
09	Protection against erosion	Protection against erosion	36,047	1.9
10	Production and protection against erosion		21,233	1.1
11	Water management and protection against erosion		14,928	0.8
12	Water and anti-erosion protection		17,763	0.9
13	Recreation and protection against erosion		886	0.0
14	Curative, medicinal and protection against erosion		298	0.0
15	Nature and anti-erosion protection		40,908	2.1
16	Protection against air pollution and erosion		105,091	5.4
17	Game management and anti-erosion protection		1,160	0.1
Total			**238,314**	**12.3**
18	Water management	Water management	1,042	0.1
19	Production and water management		1,141	0.1
20	Protection against erosion and water management		24,462	1.3
21	Nature protection and water management		9,000	0.5
49	Air pollution and water management		35,790	1.9
Total			**71,435**	**3.9**
22	Protection against avalanches	Protection against avalanches	90	0.0
23	Water management and protection against avalanches		2,037	0.1
50	Protection against air pollution and avalanches		2,680	0.1
Total			**4,807**	**0.2**
24	Bank/shore protection	Bank protection	817	0.0
51	Air pollution and bank protection		371	0.0
Total			**1,188**	**0.1**
25	Deflation control	Deflation control	3,173	0.2
26	Game management and deflation control		34	0.0
52	Air pollution and deflation control		1,673	0.1
Total			**4,880**	**0.3**
Grand total			**320,624**	**16.8**

Source: Lesoprojekt Zvolen (Permanent Forest Inventory 2003).

- **protection forests**, including stands with prevailing ecological functions, as has been declared for over 16.8% of the stand area (6.1% on exceptionally unfavourable sites, 2.8% at high alpine locations – mainly forests in the spruce altitudinal vegetation zone, 1.1% in the dwarf pine zone and 6.8% in forests for ensuring soil protection),
- **special-purpose forests**, including stands with prevailing social functions, which constitute over 16.6% of the stand area (in grade 1 and 2 protection zones for water resources, in protection zones for natural curative resources and sources of naturally-occurring mineral waters, in spa forests and forests in the neighbourhood of facilities for curative and preventive care, in suburban forests and other forests with significant sanitary and recreational functions, in forest game reserves and independent pheasant farms, in protected regions and other parts of forests that are important in terms of nature protection, in parts of forests affected by air pollutants classified under zones of endangerment, in parts of forests intended for forest research and education at forestry schools and vocational schools, and in parts of forests where a specific form of management is required to safeguard other important public interests).

According to information from Lesoprojekt Zvolen, forests of the purely 'production function type' cover only approximately 12% of total stand area in the Slovak Republic. 81% of that area of forests with a primary production function also fulfil ecological or social functions. Protection forests and special-purpose forests (approximately 33% of the stand area in the Slovak Republic) fulfil primary ecological or environmental functions. The proportion of functional types in protection forests is shown in Table 15.

4. Legal and organisational forms of forest holdings

Forest ownership and public access to forests

Table 16. Structure of forests (stand area) by ownership category and use by particular entities

Entities	Stand area (ha)				Proportion in 2003 (%)	
	till 31 December 2002		till 31 December 2003			
	ownership	use	ownership	use	ownership	use
State	825,374	1,201,879	814,576	1,185,971	42.2	61.5
Private	249,172	117,688	231,259	113,968	12.0	5.9
Shared ownership	462,808	398,222	469,130	416,966	24.3	21.6
Church	61,207	39,815	61,430	40,188	3.2	2.1
Agricultural Co-operatives	1,899	4,301	2,379	4,946	0.1	0.2
Municipal	187,311	166,804	186,519	167,271	9.7	8.7
Unknown	140,938	–	164,017	–	8.5	–
Total	**1,928,709**	**1,928,709**	**1,929,310**	**1,929,310**	**100.0**	**100.0**

Source: Lesoprojekt Zvolen (Permanent Forest Inventory 2003).

State Forests. Forests under state ownership are being managed by the following state forestry organisations: Lesy SR, š. p. Banská Bystrica (The Forests of the Slovak Republic State Enterprise, Banská Bystrica), Lesopol'nohospodársky majetok, š. p. Uliè (the Forest--Agricultural Estate State Enterprise, Uliè) and Štátne lesy TANAP-u (the State Forests of the Tatra National Park). These organisations come under the jurisdiction of the Ministry of Agriculture of the Slovak Republic. In turn, Vojenské lesy a majetky SR, š. p. Pliešovce (the Military Forests and Estates of the Slovak Republic State Enterprise, Pliešovce) comes under the jurisdiction of the Ministry of Defence of the Slovak Republic. State-owned forests are used by educational facilities (the Technical University in Zvolen and the Secondary Forestry Schools in Banská Štiavnica, Liptovský Hrádok and Prešov) on the basis of leasehold contracts with the Forests of the Slovak Republic State Enterprise, Banská Bystrica.

The largest state organisation in forestry is the Forests of the Slovak Republic State Enterprise, Banská Bystrica. This has 26 Branch Enterprises (in Šaštín, Smolenice, Palárikovo, Levice, Topol'èianky, Prievidza, Trenèín, Považská Bystrica, Žilina, Èadca, Námestovo, Liptovský Hrádok, Beòuš, Èierny Balog, Slovenská L'upèa, Žarnovica, Krupina, Kriváò, Hnúšt'a, Revúca, Rožòava, Košice, Prešov, Bardejov, Vranov nad Topl'ou and Sobrance) and two specialised Branch Enterprises (Semenoles Liptovský Hrádok and the Forest Technology Enterprise in Banská Bystrica).

Non-state forests. The non-state sector comprises private, municipal and church forests, as well as the forests of agricultural co-operatives and those of shared ownership. The legal and organisational form of entities in the non-state sector consists of land communities with or without legal personality, associations founded under the Civil Code, business companies, private individuals with or without registered business activities, as well as special units (commercial, contributory) of municipal offices.

The largest of these areas of forest is that under shared ownership (462,808 ha owned, 398,222 ha in use), followed by privately owned (249,172 ha owned and 117,688 ha in use), municipal (187,311 ha owned and 166,804 ha in use), church holdings (61,207 ha owned and 39,815 ha in use), and agricultural co-operatives (1899 ha owned and 4301 ha in use). The area of forests of unknown ownership amounts to 140,938 hectares (according to Table 3).

The forest law in force, including government help for forestry

The political and socio-economic changes since 1990 have also affected the forestry industry and its relevant institutions, though only partial amendments have been made in the last few years to the forestry acts currently in force. For this reason, there is presently an urgent need for the adoption of a new forestry act.

Acts and decrees relating to forestry:

- Forest Act No. 61/1977 with subsequent amendments.
- Act of the Slovak National Council No. 100/1977 Digest on management in forests and the state administration of forestry in the wording of subsequent regulations.
- Act on forest reproductive material and on the amendment of certain acts (currently awaiting approval).

- Decree of the Ministry of Forestry and Water Management of the Slovak Republic No. 103/1977 Digest on the Procedure for the Preservation of Forest Land Resources in the wording of subsequent regulations.
- Decree of the Ministry of Agriculture of the Slovak Republic No. 65/1994 Digest on Registration of Forest Lands and Construction.
- Decree of the Ministry of Agriculture of the Slovak Republic No. 5/1994 Digest on Forest Management Planning in the wording of subsequent regulations.
- Decree of the Government of the Slovak Republic No. 49/1997 Digest on the Declaration of Forest Regions.
- Decree of the Ministry of Agriculture of the Slovak Republic No. 79/1995 Digest on the Forest Guard Service.
- Decree of the Ministry of Agriculture of the Slovak Republic No. 244/1997 Digest on Marking and Registration of Wood Felling.
- Decree of the Ministry of Agriculture of the Slovak Republic No. 31/1999 Digest on Forest Management Files.
- Decree of the Ministry of Agriculture of the Slovak Republic No. 64/2001 Digest on Forest Reproductive Material, its Production and Documentation.

The latest major forestry-policy document based on a government programme is the Mid-term Concept of Forestry for the Period 2004–2006. Its three main priorities are subdivided into several aims, which Slovakia's forestry had to tackle during the EU accession period, since these had a direct impact on National Forest Programme development.

- **Priority area 1: Settlement of forest ownership and forest use.** Cases involving more than 300,000 hectares of forest land have to be settled in the restitution process; most remaining applicants are either owners of small forest areas, who either lack all the necessary documents to verify ownership or else whose sections of forest land are not identified. Another important task ahead concerns compensation for the increased costs owners incur due to measures taken in line with public interest. Also requiring special attention is the support extended for establishing forest owner associations. The large number of small parcels of land causes problems in their management, the result being a need to introduce a system of measures aimed at combining these sites.
- **Priority area 2: Ensuring forest management in line with sustainability principles.** The main aims under this priority area are: evaluation of forest ecosystem conditions and their protection against injurious agents, the development of functions of forests (productive and non-productive and in environmental protection), the enhancement of biodiversity in forests, optimal forest management in protected areas and forest technology innovation in line with environmentally-friendly criteria.
- **Priority area 3: Increasing forestry effectiveness.** In this case, the aims are: to increase the intensity of timber production and utilisation, to transform the state forest enterprise into a joint stock company (with a 100% share for the government), to ensure transparency of the domestic and foreign timber market, to strengthen the technological links between forestry and wood-processing, development of a forestry information system and finally, the application of economic accountancy in forestry.

In addition to its role in wood production, forestry also ensures fulfilment of publicly beneficial functions in the country. It is therefore in the interests of the State to improve forests, eliminate the consequences of injurious agents and to promote ecological considerations in the development of production processes. This has been effected with financial support from the State for specific programmes conducted in the public interest.

In 2002, State support to forestry in the Slovak Republic was provided within the framework of 2 programmes: Public Services in the Agrarian Sector and Improvement of Forest Land Resources.

In addition to the budget from the Ministry of Agriculture's Forestry Section, regular transfers have been provided from other budget sources for forestry's entrepreneurial entities. These were specifically for the elimination of flood damage and safeguarding works during floods.

A total SKK 24 million from other sources have been used.

Table 17. State support for forestry in the Slovak Republic in 2003 for operations in the public interest (millions of SKK)

Use	State forest organisations under		Non-state sector	Total
	Ministry of Agriculture of Slovak Republic	Other sectors		
Forestry operations	77	15	129	221
Investments	33	–	–	33
Other activities	55	46	–	101
Grand total	**165**	**61**	**129**	**355**

Source: Forestry Section at the Ministry of Agriculture of the Slovak Republic.

5. Structure and tasks of the national forest administration

The Central authority of state administration in the field of forestry and game management in the Slovak Republic is the Ministry of Agriculture. Through its Forestry Section, it ensures, within the limits of its jurisdiction, fulfilment of the tasks ensuing from Forest Act No. 61/1977 with subsequent amendments, as well as Act No. 100/1977 on forest management and state administration of forestry with subsequent amendments.

The Forestry Section of the Ministry of Agriculture plays an important role in developing state forestry policy, engages in administration on behalf of the State within the scope of its jurisdiction as laid down by law, develops concepts in relevant fields, and handles the administration of issues within its jurisdiction. In cooperation with other ministries, it considers the suggestions and experiences of regional state administration and scientific institutions. It co-operates in developing international relations, as well as ensuring fulfilment of commitments resulting from international agreements and membership in international organisations. An important activity of the Forestry Section is the issuing of universally binding legal regulations (guidelines, instructions), the unification of procedures for their application, review of decisions in administrative proceedings, supervision and organising of staff meetings for the state administration for forestry, and game management in county offices.

Regional authorities of the state administration

The duties of the state administration for forestry and game management ensuing from the relevant acts (Acts No. 61/1977, No. 100/1977 and No. 23/1962 with subsequent amendments) are discharged at local level by the departments of lands, agriculture and forest management in County and District Offices. The main activities of County Offices are the proceedings relating to forest management plans, while District Offices mainly focus on silvicultural operations.

Private owners associations

The Union of Regional Associations of Non-state Forest Owners in Slovakia. The members of this Union are 10 regional associations, with the following areas of managed forest: Šariš – Zemplín 91,531 ha, Spiš 47,000 ha, Liptov 65,894 ha, Turiec 15,208 ha, Žilina 26,526 ha, Kysuce – Kysucké Nové Mesto 9817 ha, Kysuce – Èadca 17,672 ha, Trenèín 21,230 ha, Gemer 41,619 ha and Orava 2200 ha. Altogether this constitutes 338,697 hectares of forestland, of which forest plots under the ownership of private individuals constitute 5%, while community lands constitute 95%.

The Union has participated in developing remarks on proposals for Acts on forests, nature and landscape protection, a legislative proposal for an Act on game management, a decree on property damage and similar documents. Its representatives have sat on various commissions of the central authorities of state administration. The regional associations' own activities have mainly focused on education of their members (regarding the Labour Code, timber sorting, verification of ownership, the Special Accession Programme for Agriculture and Rural Development – SAPARD, taxes and accountancy, etc.).

The Association of Owners of Private Forests and Forests in Shared Ownership in B. Bystrica County. This Association is active in 13 districts of Banskobystrický County. It has 102 members, managing 24,212 ha of forest estates. In 2002, the main activity of this Association was focused on legislative standards (in forest management, nature and landscape protection, land registry, etc.) and the management of forests. Members of the Association were involved in drawing up forestry-related documents and participated in various specialised undertakings organised by the forestry institutions.

The Association of Municipal Forests in Slovakia. This Association enjoys nationwide jurisdiction. Its membership comprises 62 owners with a total forest area of 137,703 ha or 73% of the total area of municipal forests. Its primary mission is to advance the justified requirements of forest-owning municipalities. Furthermore, it co-operates with other departments and provides consultancy services for members aimed at establishing suitable economic, social, organisational and legislative conditions. In 2002, the Association's activities were aimed at processing remarks to various conceptual materials at the Ministry of Agriculture's Forestry Section level. Its members participated in several professional undertakings organised by the forestry organisations.

The Union of Church-owned Forests in Slovakia. This Union's members are the Episcopates of Nitra, Banská Bystrica, Rožòava, Spiš Episcopate Košice and the Greek Catholic Episcopate of Prešov and Jasov Abbey. Its representatives have participated in

various undertakings organised by the Forestry Section of the Ministry of Agriculture, as well as by other organisations involved in forestry in Slovakia.

The Association of Forestry Employers of Slovakia. In 2002, this association's membership included 20 organisations, including 2 state enterprises, 8 municipal and urban forests, 5 contributory organisations and 5 construction organisations in forestry. The total number of members was 13,334. The Association of Forestry Employers of Slovakia is a member of the Association of Employer Unions and Associations in the Slovak Republic, which regularly sends topical materials to its members. In 2002, the Association of Forestry Employers of Slovakia pursued effective discussions with social partners within the framework of a small tripartite meeting. It entered into a higher-level Collective Agreement for the year 2003 to apply to forest management. Through the mediation of its commissions, it discussed current issues regarding co-operation with the unions of the wood-processing and furniture industries. It also organised public-relations activities, seminars for managers, recreational and educational events for children, etc.

6. Education in forestry

The forestry education systems – secondary, technical and high

Under the Ministry of Education of the Slovak Republic, the education of a new generation to meet the needs of forestry is being ensured by the Forestry Faculty of the Technical University in Zvolen (M.Sc., Ph.D.), as well as by Secondary Forestry Schools (in Banská Štiavnica, Liptovský Hrádok and Prešov).

In the 2002/2003 academic year, 978 students studied at the Forestry Faculty of the Technical University in Zvolen. 144 students graduated. 102 students (including 20 newly-accepted) were studying for a Ph.D., while 7 students obtained their doctorates (4 in ecology, 1 in forest phytopathology, 1 in plant protection and 1 in amelioration).

The 2002/2003 school year saw three secondary forestry schools educate 878 pupils in full-time studies, 32 in part-time studies and 111 in higher professional education.

The secondary forestry vocational schools in Modra Harmónia, Banská Štiavnica, Bijacovce, Sigord and Tvrdošín provided education and training, mainly for employees in the forestry profession. In the school year of 2002/2003, some 266 pupils completed their studies.

Since 1 July 2002, higher territorial division units have established secondary forestry schools and forestry vocational schools (under Act No. 416/2001 on the transfer of certain authorities from state administration organs to municipalities and higher territorial division units).

The Institute for the Education and Training of Employees in Forestry and Water Management of the Slovak Republic has played an important role in further education. It has organised 114 educational activities, attended by a total of 1,950 participants.

In co-operation with other countries and within the Leonardo da Vinci Programme, the Institute for the Education and Training of Employees in Forestry and Water Management of the Slovak Republic has completed a project for professional forestry workers, which was

developed in German and entitled ILEGEFOS. This involved the development of basic textbooks and multimedia CDs. A second project, entitled GAIAS LOGOS, concerned the creation of a CD-based multilingual dictionary of forestry terminology.

7. Forest research

The forest research in Slovakia is carried out at the Zvolen Forest Research Institute.

Table 18. Number of employees at the Zvolen Forest Research Institute

	31.12.2002	31.12.2003	30.06.2004
Researchers	78	75	74
Operating personnel	45	34	30
Service personnel	33	19	18
Management personnel	20	10	8
Total	**176**	**138**	**130**

Table 19. Sources of research financing. Status as at 30.06.2004

Economic results	In '000s SKK
Total revenue	**64,000**
Including: state task-related funding	1,500
Service allocation transfer	29,210
Subsidies for (government) research projects	3,000
Revenue from distribution of own products and services (other)	28,290
– including: rents	1,200
Other revenue	2,000
Total expenditure	**64,000**

The Institute's important issues and research directions, present and future

Medium-term prospects of the organisation. Further development of the Zvolen Forest Research Institute will be determined by continuing the integration process on a branch scientific-research basis, Slovakia's accession to the European integration area and further development of the system for national financing of science and technology. The experience of other European countries attests unanimously to a trend towards integration into larger national as well as international research centres. It would appear that in the three-year period 2004–2006, a key activity in the further orientation of our Institute will be membership and activities in the European Forest Institute, which following its internalisation, will become an important coordinating centre for European forest research.

In future, the Zvolen Forest Research Institute will move towards a broader and more ecologically and environmentally oriented form of forest research, both at the applied level and also partially in the purely scientific area. In view of this, we may expect to see the Zvolen Forest Research Institute involved in research activities for the environmental sector. A key research programme of the Institute must above all involve participation in the system of state programmes, with the aim of ensuring preparation in 2005 of an independent state programme (sub-programme) for forestry, which will be aimed at sustainable forest management.

Where marketing activities of the Institute are concerned, key areas for collaboration with other institutes will be established, with an emphasis on the utilisation of European financial sources for those entities involved in forestry, rural development and certain environmental activities. Another important marketing activity in the medium term will be cooperation in forest practices, mainly with major entities (the Lesy SR State Enterprise, municipal and church forests, etc.), as well as those major industrial enterprises that have some impact on the environment and forests (U.S. Steel, Slovalco, SCP, etc.). A new area for development of marketing activities will be efforts to penetrate the field of providing specialised services within the entire European integration area.

In international collaboration, the Institute will continue to develop cooperation with such key international institutions as the EFI, FAO, UN ECE, UN FF, UN FCCC, UN CBD, JRC and others. Direct participation of the Institute in international (primarily European) projects and network interlinking should be more intensive. The Institute will continue activities aimed at the establishment of a "Regional Programme Centre of EFI" in Zvolen.

The Institute's personnel development activities will concentrate on stabilising the number of employees at a level of 120–130 and improving the age and educational structure of its staff. In future, the Institute will also try to provide the facilities (in cooperation with the universities) for a part-time form of study for a Ph.D. degree.

The important results of the State and sector-related scientific and technical programmes conducted at the Forest Research Institute in Zvolen, within the framework of separate priorities in science and research, have been: the impact of global warming and anthropogenic activities on forest ecosystems, the preservation and reproduction of forest gene pools, species and ecosystem diversity, the identification of threats to forests posed by a complex range of harmful agents and integrated protection of forests, methods and procedures for sustainable forest management and their application, research on the impact of technology on forest ecosystems, modelling of environmentally-sound technology and optimising the utilisation of forest resources, research on methods and modelling of economic evaluations of the functions and services provided by forests, principles governing state forest policy and tools for fulfilment of the same, and research aimed at improving the game environment and its management.

Slovenia

Franc Perko

The Republic of Slovenia (Republika Slovenija), territory: 20,300 km², population: 1.9 million, capital city: Ljubljana.

1. Forest characteristics

Forests may be said to symbolise Slovenia. They cover more than half of the country and constitute an essential element of the landscape. With forest cover of 57%, Slovenia ranks 4th among European countries in this respect. Of the total area of Slovenia (2,025,469 ha), forests take up 1,157,824 hectares, and are distributed in such a manner that they dominate as much as three quarters of Slovenia's territory. This high level of forest cover is due to Slovenia being a mountainous country, with more than one third of its territory over 600 m above sea level, two thirds of which is covered by forest. Half the land in Slovenia has an incline greater than 20% and a good fifth greater than 35%. Three quarters of those areas with an incline greater than 20% are forested, while forest cover amounts to 90% on slopes of more than 35%. Forest has thus mainly been preserved in higher and steeper locations less suitable for agriculture, where the protective role of forest assumes even greater importance.

Under Slovenian geological, climatic and hydrological conditions, this important role of forests can be seen in the protection of settlements, technical infrastructure and agricultural land against natural disasters. The present situation, allowing for the use of land in relatively stable agricultural production, can only be maintained in Slovenia through a relatively high forest cover.

Thus for Slovenia, lacking other natural resources, the economic significance of forests is major.

Slovenia is characterised by great natural diversity due to a varied geological conditions, a broken relief and the fact that the country is at the conjunction of Continental, alpine and sub-alpine climates. Due to its geographical position and relief, Slovenia is influenced by the Mediterranean, the Alps and the Pannonian Lowlands. Because of the varied climatic

Table 1. Changes in forest area in Slovenia in the period 1875–2003

Year	Forest area ('000s ha)	Forest cover (%)
1875	737	36
1947	879	43
1961	961	48
1970	1,026	51
1980	1,045	52
1990	1,077	53
2000	1,134	56
2003	1,158	57

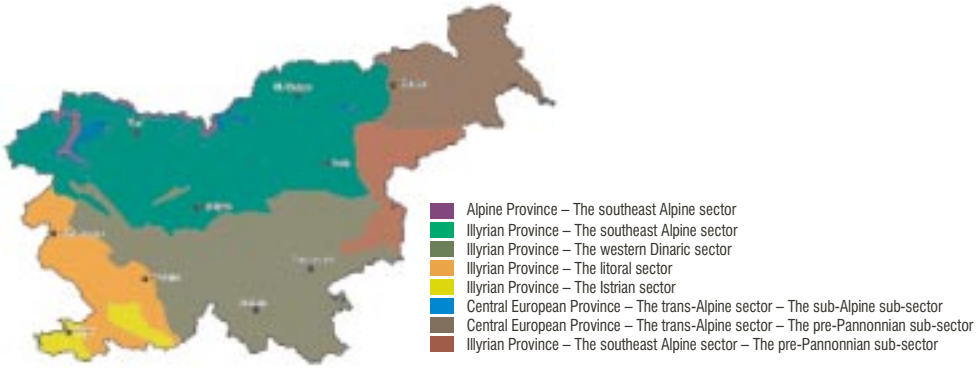


Fig.1. The phytogeographical division of Slovenia

conditions, a highly diverse vegetation structure can be found in the relatively small area of Slovenian forests. The major part of Slovenia falls within the Illyrian Floristic Province, with the highest regions being in the Alpine Province and the extreme north-eastern part of the country in the Central European Province.

The Littoral and Istrian sector is at the extreme western edge of the country. There, the influence of the Mediterranean gives rise to Mediterranean vegetation in the littoral flatlands. In spite of the strong Mediterranean influence, the climate of the Karst – an upland limestone region not far from the coast – is much colder. Due to the more severe continental influence, a cold littoral climate is formed there, reaching to the foot and slopes of the Dinaric mountain range. Southerly winds have free passage through the Soèa Valley into the interior of the country, all the way to the steep slopes of the Julian Alps.

The southeast Alpine sector of the Alpine Province. A moderate sub-polar climate predominates at high altitudes, reaching from the Julian Alps to the Karavanke Mountains and the Savinja Alps. This climate also exerts an influence on the climate of the sub-Alpine region, where the influence of the littoral and humid-continental climate can also be felt. The upper tree line in the Alpine region is found at between 1,700 and 1,800 m above sea level, with mountain pine (*Pinus mugo*) and individual larches (*Larix decidua*) reaching to those

Table 2. Distribution of forest sites in Slovenia and their timber production potential (based on site coefficients – Rk)

Forest site	Rk	Area (ha)	Share (%)
Willow and alder forest	9.2	8,075	1
Oak and hornbeam forest	10.5	93,976	7
Oak forest	5.1	36,321	3
Thermophilous deciduous forest	1.0	62,314	5
Pine forest	4.2	42,371	4
Beech with oak forest	10.2	123,869	11
Beech forest on carbonate parent rock	7.6	307,689	27
Acidophilus beech forest	7.7	193,013	17
Fir forest	12.1	52,948	5
Dinaric fir-beech forest	9.7	175,943	15
Spruce forest	7.7	16.640	1
High alpine forest	6.6	44,663	4
Total	**8.0**	**1,157,822**	**100**

Source: National Forest Development Programme.

Table 3. Survey of endangered and other forest-dependent plant and animal species

	Endangered forest-dependent species	Forest-dependent species	All endangered species	All species in Slovenia
Plants	47	950	330	3000
Amphibians	11	17	18	19
Reptiles	10	10	20	20
Birds	46	95	116	365
Mammals	25	70	29	79

Source: Ministry of Agriculture, Forestry and Food - Slovenian Forests and Sustainable Forestry.

heights. Beech forests already begin to appear in open areas 200 m below the tree line, at first, with abundant larch trees, whose numbers are markedly smaller at lower altitudes.

The southeast Alpine sector of the Illyrian Province is most extensive and is linked to humid continental climate with deciduous forests, in which numerous Illyrian plant species can be found. The extensive region stretching from the foothills of the Alps to the fringes of the Pannonian Lowlands is, for the most part, covered with beech forests. Mountains at higher altitudes are covered by fir and beech forests, whose composition is similar to Dinaric, but with much poorer vegetation. The forests of hornbeam (*Carpinus betulus)* and sessile oak (*Quercus petraea*), that used to be common, have managed to survive in Slovenia.

Volume and increment

Over the last 50 years, the forest area has increased by 31%, the growing stock by 157% and increment by 169%. With the exception of the first decade after World War II, when the cut exceeded the increment due to the needs of the country's restoration, planned professional work in the following decades increased the growing stock and improved its quality and the tending of forests. Both, the growing stock and the exploitation of the timber production potential of Slovenian forests have reached approximately 75% of the optimum. However, within the growing stock structure, there is too low a proportion of trees of large diameter, these being the indicator of quality and value increment. Likewise, there is still room for improvement in biological variety and mechanical stability. Considerable funds have been spent on forest road construction in order to achieve greater accessibility; in the mid-50s, accessibility amounted to only approximately 2 m/ha, while today it is 10 times higher.

Important progress has also been made in timber production. Most tasks have been mechanised. Planned tasks include the drafting of cutting and skidding plans in addition to silvicultural plans. The degree of accessibility of forests by forest roads is adequate for the planned forest management. There are 24,000 kilometres of public and forest roads in Slovenian forests, and the average road density is 20 m roads/ha.

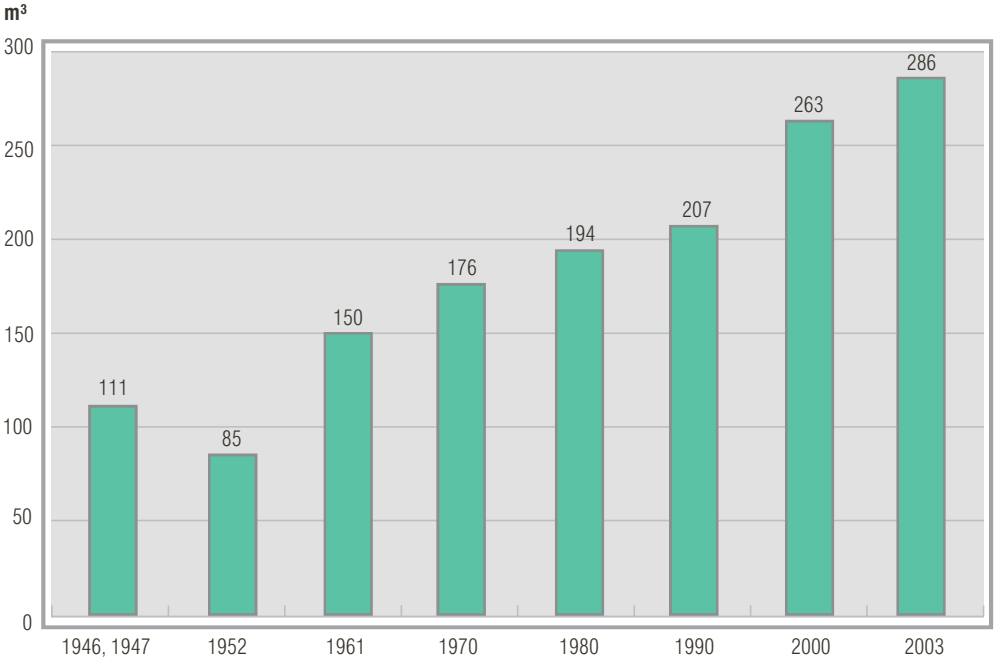


Fig. 2. Growing stock in millions of m³

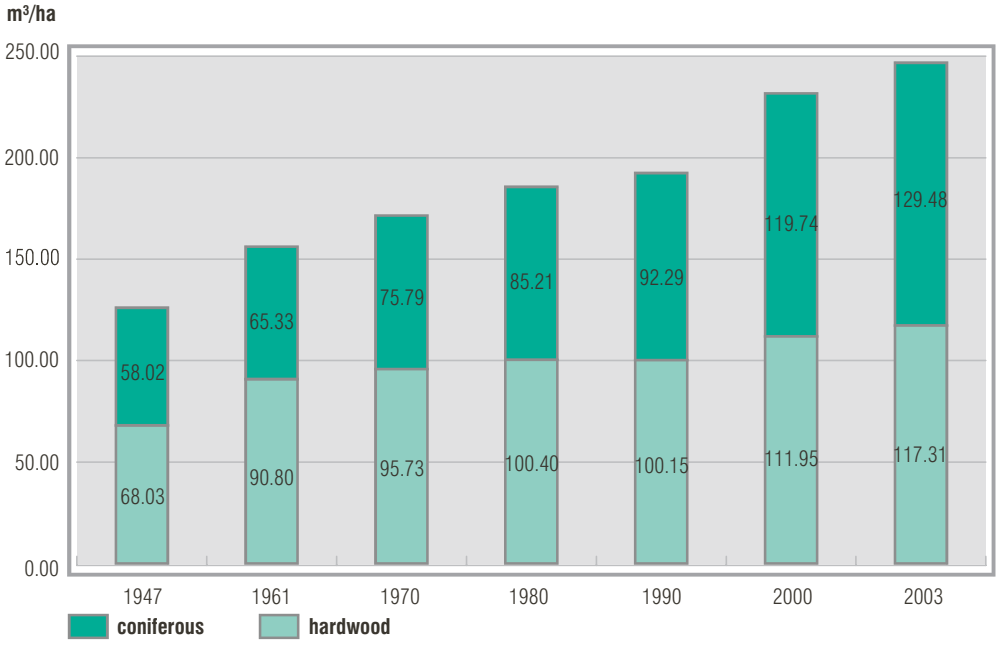


Fig. 3. Growing stock in m³/ha

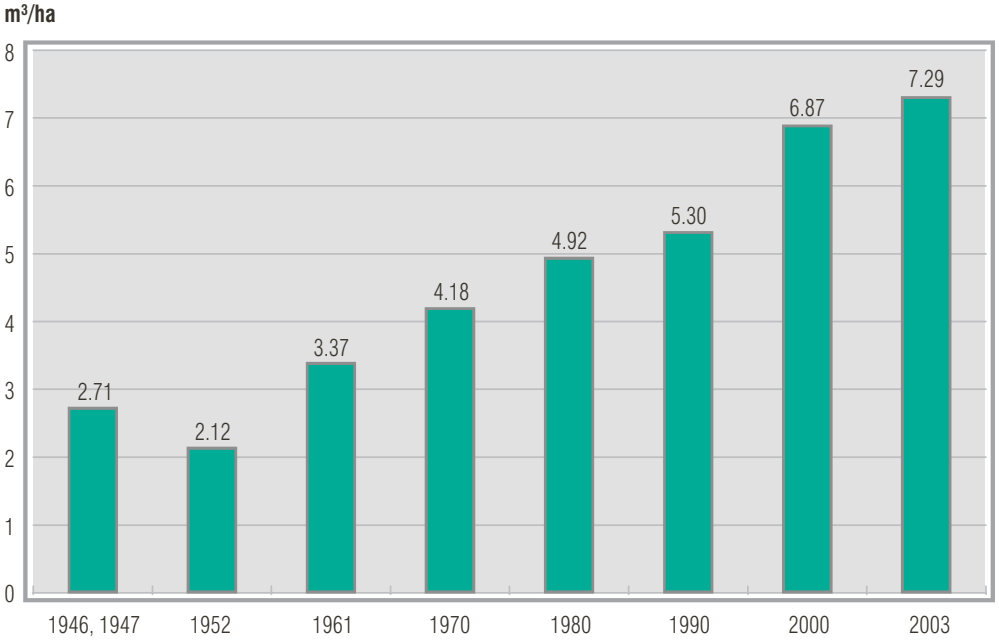


Fig. 4. Increment in millions of m³/ha

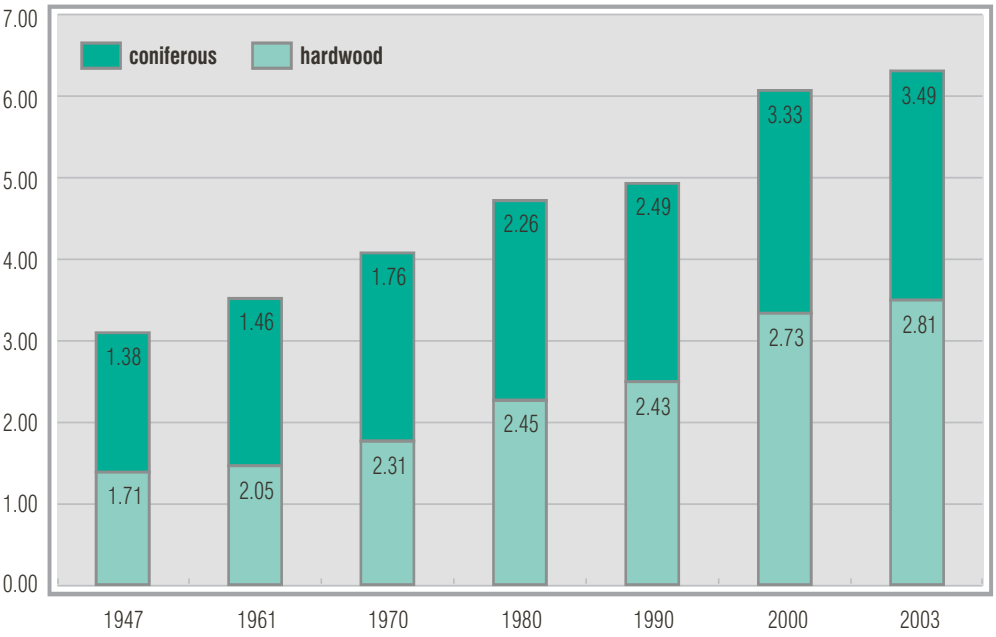


Fig. 5. Increment in m³/ha

2. Logging and wood processing in Slovenia

Forest enterprises

There are more than one hundred enterprises in Slovenia registered to engage in timber production and other forest work. In 2002, only 73 of these registered enterprises were actually operative (4 large, 6 medium-sized and 63 small enterprises). Altogether, they employed 1,807 people (587 in large, 713 in medium-sized and 922 in small enterprises). Sixteen of these enterprises are well equipped and proficient, licensed to work in state forests, but also performing work in private forests. Licenses for work in state forests is valid for twenty years and embraces the cutting and skidding of timber, sale of wood assortments, the carrying out of protective and silvicultural work and other tasks required to ensure the social and ecological functions of forests, and the construction and maintenance of forest infrastructure. In addition to license holders, there are thirty-five agricultural-and--forestry or forestry co-operatives in the forestry business mostly purchasing timber and partly performing tasks in forests.

Instead of being performed by trained forestry enterprise employees or adequately equipped forest owners, a high proportion of the felling and a somewhat smaller share of the skidding in private forests is performed by inadequately-trained and ill-equipped forest owners, their family members and acquaintances. Unfortunately, there is lack of money and

insufficient interest on the part of forest owners (who usually own small forest properties or consider themselves proficient enough for this work) to take a training course in these dangerous and varied operations, undertaken under a variety of conditions, which should be performed by timber cutters, tractor operators and silviculture specialists.

Table 4. Cut in Slovenian forests in gross m^3 and ratio of cut and increment to cut and growing stock for specific periods (years)

Year	Cut (millions of m^3)	% of increment	% of growing stock
1939	3.30	112	
1945–1954	4.54	166	
1956	2.91	111	2.5
1961	2.89	86	1.9
1965	2.95	77	1.8
1970–1979	2.94	70	1.6
1980–1989	3.26	66	1.6
1990–1999	2.32	49	1.1
2000–2003	2.72	39	1.0

The wealth of wood available in Slovenia's forests can only be fully taken advantage of and ennobled by the wood industry. The Slovenian wood industry focuses strongly on exports and represents 10% of Slovenia's total exports. Of the total export value of USD 1.12 billion brought in by the wood industry in 2002, two thirds were contributed by the furniture industry. In 2002, there were 961 active wood enterprises employing 21,750 employees. The table below illustrates how these enterprises were divided by size and type in 2002.

Table 5. An overview of the Slovenian wood industry

	Total	Large	Medium-sized	Small
Sawmills	176	1	5	170
Veneer and boards	32	4	10	18
Building joinery	142	7	8	127
Other products	286	4	5	277
Furniture	325	14	26	285
Total	**961**	**30**	**54**	**877**

In 2002, the Slovenian wood industry employed 4.6% of the country's total workforce, accounting for 2.3% of GDP and 10.2% of exports. The added value per employee in the wood processing and furniture industry in 2002 was EUR 15,454.

3. Categories of forest protection

In addition to damage frequently caused by the weather (wind, sleet, snow), Slovenian forests are also endangered by air pollution and forest fires on the Karst. In many places, the natural regeneration of forests with tree species appropriate to the forest site is inhibited or even prevented by an excessive population of herbivores. The proportion of felling necessitated by natural disturbances and air pollution has been increasing in recent decades. Due to the increasing scope of protective-sanitary cuts, the proportions of the necessary tending cuts and planned cuts have been decreasing. Disruptions make planned forest management difficult, weaken the bio-ecological stability of forests and make forest management more expensive.

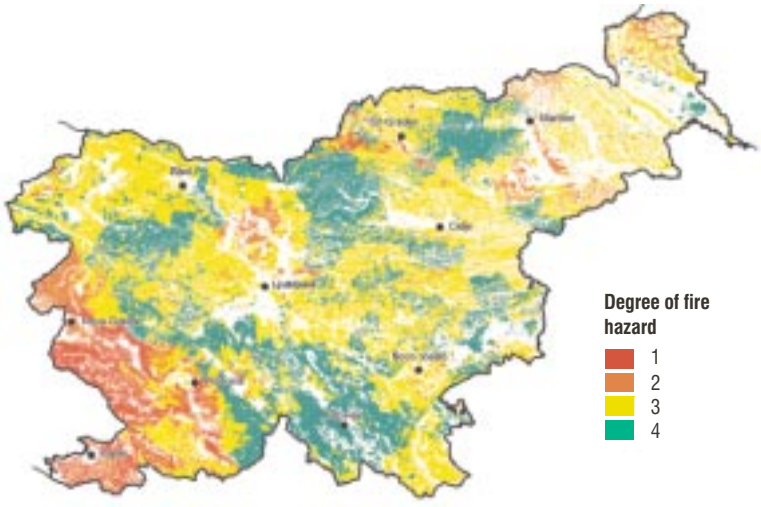


Fig. 6. Fire hazards in forests

Table 6. The cut in Slovenian forests in the period 1994–2003 by type of cut

Type (cause) of cut	Share (%)
Tending	63
Protective – sanitary	24
Other causes	13

Table 7. Proportion of the protective-sanitary cut in the total cut in the period 1994–2003 (in %)

Total	Coniferous	Broadleaved
30	39	17

Table 8. Proportion (in %) of heavily damaged trees (foliage loss over 25%)

Year	Coniferous	Broadleaved	All tree species
1987	43	9	24
1989	39	8	23
1990	35	4	18
1991	31	6	16
1993	27	13	18
1995	38	18	25
2000	32	17	22

Source: Slovenian Forestry Institute.

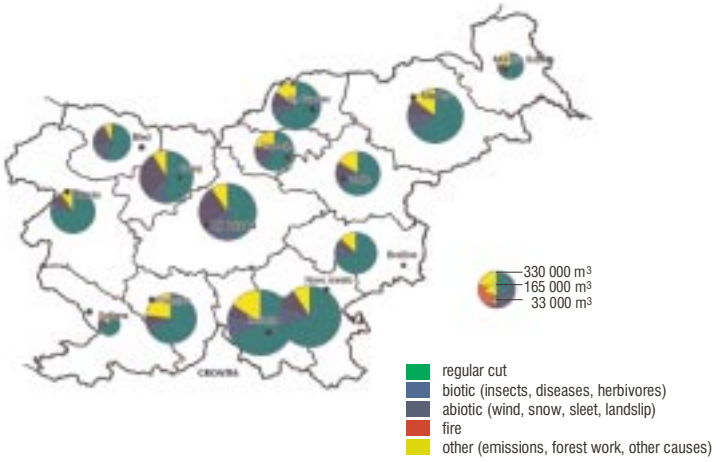


Fig. 7. Purpose of cuts (1995–2003)

4. Legal and organisational forms of forest holdings

Forest ownership

Prior to the political changes in Slovenia, 65% of the forests were private property and 35% were public. However, it is expected that once the process of denationalisation has been completed, only approximately 20% of forests will be owned by the state. Private forest estates in Slovenia are small, with an average area of only 3 ha. In 30% of the total forest area, forest estates are smaller than 3 ha and commonly consist of many separate plots. Such forests are certainly not of economic value to their owners. Larger forest estates can be found in the mountainous regions, where forests represent an important source of income for farms at high altitudes. Private forest property is becoming even more fragmented as the number of forest owners increases. According to the latest data, there

are approximately 314,000 forest owners in Slovenia. The high fragmentation of forest property is a serious obstacle to professional work in private forests, optimal timber production and full utilisation of the forest potential. Fragmentation also affects the type and structural variety of private forests.

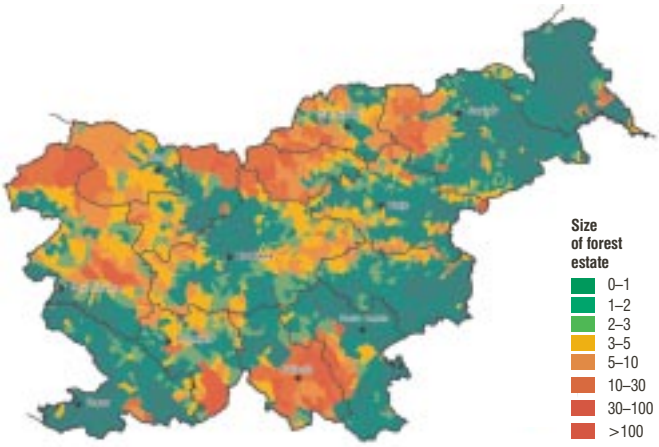


Fig. 8. Forest ownership structure for all ownership types

Forest law

Slovenia's forests, a renewable natural resource, are ranked high among the country's natural assets for which the Constitution specifies conditions governing exploitation, as defined by the statute. The Forestry Act of 1993 regulates the protection, cultivation and exploitation of forests in order to ensure:

- sustainable and multipurpose management, in accordance with the principles of environmental protection and natural values;
- permanent and optimal functioning of forests as ecosystems;
- implementation of all their functions (ecological, social and productive) on a permanent basis.

The National Forest Development Programme and forest management plans form the legal basis for the management and use of all forests (irrespective of ownership) as a renewable natural resource. The National Forest Development Programme, adopted by the National Assembly, defines policy with regard to sustainable forest management and provides guidelines for the conservation and development of forests and the conditions for their multipurpose exploitation. Forest management plans include:

- regional forest management plans;
- regional hunting and reproduction plans;
- forest management units;
- silviculture.

These plans are developed by the Slovenian Forest Service. The silvicultural plans, as implementation guidelines for forest management units, satisfy the interests of owners and

the public. These plans bring together forestry experts from the public forestry service as planners and designers of forest development – thus ensuring implementation of the multiple role of forests, which is in the public interest – and the owner, with his needs, wishes and opportunities to manage and carry out planned operations, such as silviculture, protection and felling. Trees to be felled are selected by the public forestry service expert, together with the forest owner.

Forest regulation has a very long tradition in Slovenia. The first known forest-related law, the Ortenburg Forest Regulation, was written in 1406. Another well-known regulation, which established sustainability in forest management, thus ensuring permanent wood supplies, was Empress Maria Theresa's Forest Regulation for Carniola of 1771. Almost two centuries later, the Forestry Act of 1953 provided that forest management plans be developed for all forests, irrespective of ownership and size of the property. With the independence of Slovenia, a new, modern Forestry Act was passed in 1993. The tradition of planning forest use is also several centuries old. The realisation that forests might be economically valuable did not emerge in those regions where it is so encroaching that it constitutes a threat to agriculture, but rather in the dry and warm Mediterranean climate, where it is difficult to sustain the existence or regeneration of forests. The first wood shortage in Slovenia occurred on the Karst, from where timber was transported to Trieste and littoral cities in Istria. It was there that the first economic measures were adopted, by which some municipal communities were ensured a permanent supply of firewood from the neighbouring forests.

The beginnings of forest management on the Slovenian territory are related to the forests belonging to the Idrija mine (a mercury mine discovered in 1493), Trnovo Forest and forests in the vicinity of Tolmin and Bovec. The first timber yield regulation for the Idrija forests dates back to 1724, while the next comes from 1759. The first plan for Trnovo Forest was developed in 1771. In the second half of the 19th century, owners of large forest estates in what is today Slovenia began to formulate forest management plans on their own initiative. Those of the high karst of Koèevsko and Notranjska pioneered an original method of forest regulation and management, which differed from the German school established in Europe at that time. This can be called an autochthonous contribution to the development of forestry and forest regulation in Slovenia. Using the plan developed in 1892 for the Koèevje forests owned by Count Auersperg, Leopold Hufnagl created his own system of selection management. He consistently opposed the established clear-felling system in the forest of the high karst of Koèevski Rog. His intention was to prevent the spread of karst, and in this context a simultaneous, well-organised afforestation operation was carried out in the Slovenian Karst, gaining worldwide recognition. Hufnagl can also be called the pioneer of the nature conservation concept in Slovenia, because he placed under protection some remnants of the virgin forests in the Koèevje region. In the area of Notranjski Snežnik, on the large Schönburg-Waldenburg estates, Heinrich Schollmayer-Lichtenberg took up Hufnagl's concept of selection management and introduced an original control method to forest regulation and management. The idea was immediately put into practice in the large neighbouring estate of Windischgraetz in the forests of Javorniki, Nanos and Hrušica. The Postojna forest management region is a unique example in Slovenia, where the control method has been applied in a forest area of more than 20,000 hectares since 1890. The concept was also known elsewhere in Europe. In the 1950s, the management system was

introduced for the entire Slovenian forest area, irrespective of ownership. By 1968, the first regulation of all forests in Slovenia had been implemented and revisions had been developed for a number of management units. Based on this knowledge and experience, Slovenian forestry began the development of regional forest management plans (14 regions). Thus far, four regional forest management plans have been developed for all regions (for 1971–1980, 1981–1990, 1991–2000 and 2001–2010). Under the provisions of the Forestry Act passed in 1993, the National Assembly of the Republic of Slovenia adopted the National Forest Development Programme at the beginning of 1996.

5. Structure and tasks of the national forest administration

Institutions which, in addition to forest owners, influence the conservation and development of forests in Slovenia are: the Ministry of Agriculture, Forestry and Food (Forestry Section), the Ministry of the Environment, Spatial Planning and Energy, the Slovenian Forest Service, the Fund for Agricultural Land and Forests of the Republic of Slovenia, the Department of Forestry and Renewable Resources at the Biotechnical Faculty, the Slovenian Forestry Institute (all these institutions being budget-funded), along with two NGOs, namely the Forestry Association (since 1938 publisher of its own professional, scientific journal Gozdarski vestnik) and the Hunters Association of Slovenia. Agricultural and forestry co-operatives and their parent organisation, the Association of Cooperatives of Slovenia, are also involved in forestry (timber purchase and some forestry work). Of the 103 members of the Association of Cooperatives of Slovenia, 35 are involved in forestry. Work in state forests is performed by concession-holders – the former managers of these forests. Concessions are issued for felling and skidding, the sale of forest products, the performance of protection and silviculture work, and for the construction and maintenance of forest infrastructure. Numerous other companies also carry out forest work.

The most important role is that of the Slovenian Forest Service, a public forestry service that directs the development of all forests in Slovenia. It is organised at state level (central unit), regional level (14 regional units) and local level (93 local units and 430 forest districts), and employs 766 staff, of which 676 are forestry experts. They are distributed accordingly and their services cover the entire area of Slovenian forests. As prescribed by the Forestry Act, the Slovenian Forest Service monitors the state and development of forests and forest protection, provides policy on forest management, forest space, individual trees and groups of forest trees outside settlements, constructs and maintains forest roads, keeps records and maintains forestry databases. It also provides professional advice and training for forest owners, supervises the production of seeds and saplings of forest tree and shrub species, and contracts out operations that are co-financed from the state budget of the Republic of Slovenia.

The Chamber of Agriculture and Forestry of Slovenia is an organisation representing the interests of farmers, agricultural organisations and owners of agricultural land and forests. It represents its members, promotes agriculture, forestry and fisheries and offers its members a range of professional advice in the field of agriculture.

The task of the Forestry Section at the Ministry of Agriculture, Forestry and Food is to draw up legislation regarding forestry, monitor the Slovenian Forest Service and cooperate with it in the preparation of programmes at state level. There is close co-operation between the Ministry of Agriculture, Forestry and Food and the Ministry of the Environment, Spatial Planning and Energy regarding issues, such as the condition of forests, protection of rare ecosystems and species and the establishment and management of protected areas. Educational programmes are implemented by the Department of Forestry and Renewable Resources (established in 1949) at the Biotechnical Faculty in Ljubljana and the Secondary School for Forestry and Wood Processing in Postojna (founded in 1948). The first Slovenian forestry school was opened in 1869 near Snežnik Castle in the Lož Valley. Its two-year course was primarily intended for young generations of farmers to ensure they would be able to manage their forests efficiently. Research work is performed by the Forestry Institute of Slovenia (established in 1947) and the Department of Forestry and Renewable Resources at the Biotechnical Faculty, both cooperating closely with the Slovenian Forest Service in applied research.

The main task of the Fund for Agricultural Land and Forests of the Republic of Slovenia, representing the owner (the State), is responsible management of state forests.

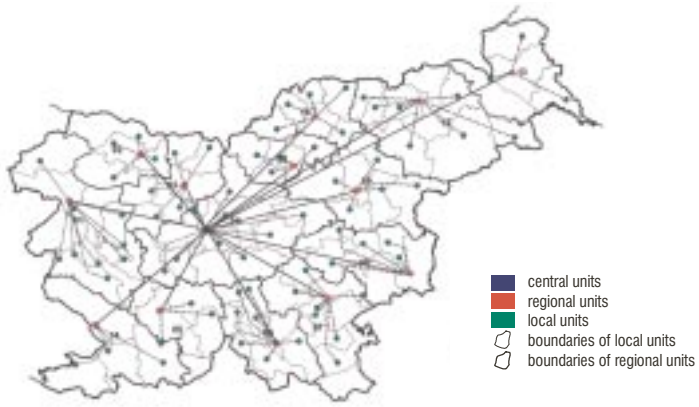


Fig. 9. Organisation of the Slovenian Forest Service

6. Forest research

The Slovenian Forestry Institute (SFI)

The Slovenian Forestry Institute has more than 50 years experience in serving the public as the nation's leading forestry research institute. Today, about 60 scientists and support staff conduct R&D on the expanded and diverse aspects of forestry, including the Public Service of the Ministry of Agriculture, Forestry and Food and the Ministry of Higher Education, Science and Technology.

The SFI adheres strictly to the concept of close-to-nature, sustainable and multifunctional forestry, complying with:

- the Forest Act (1993),
- the Development Programme for Forests in Slovenia (1996),
- the main documents agreed upon at the Earth Summit (UNCED 1992): Statement of Principles on Forests, Convention on Biological Diversity, Convention on Climate Change, Rio Declaration, Agenda 21, Chapter 11,
- the resolutions and decisions within the framework of the Ministerial Conference on the Protection of Forests in Europe (MCPFE: Strasbourg 1990, Helsinki 1993, Lisbon 1998, Vienna 2003),
- the Convention on the Protection of the Alps (Alpine Convention 1991),
- Forest Focus, Kyoto protocol and
- EU Forestry Strategy (1998), etc.

Generally, the mission of the SFI is to advance the stewardship of Slovenia's forest resources and to foster public understanding of forests and forestry and their importance to Slovenia.

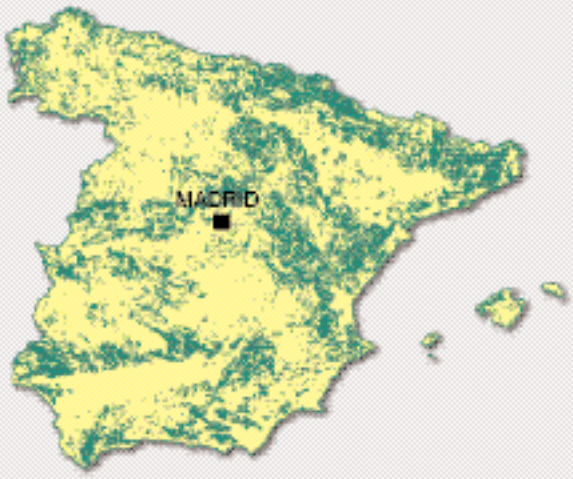
Specific objectives of the SFI are to:

- enhance understanding of the structure and functions of forest ecosystems, with emphasis on natural processes critical to their long-term health and productivity,
- foster close-to-nature, ecosystem-based multifunctional forest management, with consideration for timber and non-timber resources, along with other social and economic benefits, while incorporating the best available scientific and traditional knowledge on forest and forestry;
- provide research and development services to the Forest Service,
- maintain productive capacity, resilience (namely ecosystem resistance to change under stress) and biological diversity – key factors in ensuring a healthy forest ecosystem,
- strengthen ecologically-sustainable forest management and practices,
- maintain carbon reservoirs and so manage forests that they may serve as a net carbon sink,
- conserve old-growth forests and threatened forest ecosystems,
- promote high-level research and increase the "critical mass" in the field of forestry,
- develop better understanding of the effects of climate change and the Kyoto Protocol commitments on forest ecosystems,
- monitor forest condition, with assessments and reports
- provide certification of sustainable forest management/labelling of wood,
- promote the use of wood,
- promote wood as a renewable source of energy,
- apply environmentally-sound techniques and technologies,
- establish organic links between forestry and forest industries – sound use of wood,
- cultivate an *espirit* de corps among foresters.

★ Spain

Isabel Cañellas, Miren del Río, Fernando Montes and Roberto Vallejo

The Kingdom of Spain (Reino de España), territory: 506,000 km², population: 41.8 million, capital city: Madrid.



1. Forest characteristics

Forest area

Forests play an important role in Spain. They house a significant part of the flora and fauna, moderate the climate, produce water and air, prevent soil erosion, regulate hillside erosion, absorb CO_2 and offer natural and wild land to meet the cultural, economic and recreational demands of society.

Our forest area extends over more than 26 million hectares, or 51% of the country, with forests occupying an important place in our tradition and history, and providing a wide range of services and goods to the benefit of the whole of society.

Forests with a canopy cover of over 20% occupy 10.7 million hectares, while woodlands with a sparse tree cover account for 3.2 million hectares, according to the data from the Second National Forest Inventory of 1996. Scrub and/or herbaceous vegetation, along with open terrain with little or no vegetation occupy the remaining 12.1 million hectares and make up the total forest area.

Due to the climatic conditions in Spain, forests, scrubby stands, herb lands and semi-desert vegetation which occur in some parts of Spain correspond to different structural types on the Peninsula, the Balearic Islands and the Canary Islands archipelagos. Intensive human activities in the past, mainly grazing, firewood harvesting and forest fires have also influenced forest structure.

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Species composition

Forest area distribution by stand composition reveals approximately equal shares of coniferous (45%) and broadleaved stands (44%), with the remaining 11% of mixed stands (Fig. 1). The species accounting for the largest proportion of coniferous stands, either as dominants or co-dominants, are *Pinus pinaster*, which covers an area of approximately 1,600,000 hectares, *Pinus halepensis* with 1,500,000 hectares, and *Pinus sylvestris* with 1,200,000 hectares. In broadleaved stands, the best represented species are *Quercus ilex*, extending over nearly 2,000,000 hectares, *Fagus sylvatica* over 450,000 hectares, and *Quercus pyrenaica* over almost 400,000 hectares. These figures do not include open stands; however, also these must be taken into account, since they are an inseparable and crucial part of the Mediterranean woodland that covers most of the Peninsula, being a mainstay in many districts. Inclusion of this additional figure would appreciably increase the amounts of land cover**,** especially in the case of the holm oak, which extends over approximately 1,400,000 hectares of land with a sparse tree cover, including grazing forests (dehesas).

Table 1 shows the area occupied by the main forest species, distinguished as dominant or co-dominant species. It does not include either conifer-broadleaved mixed stands or open stands.

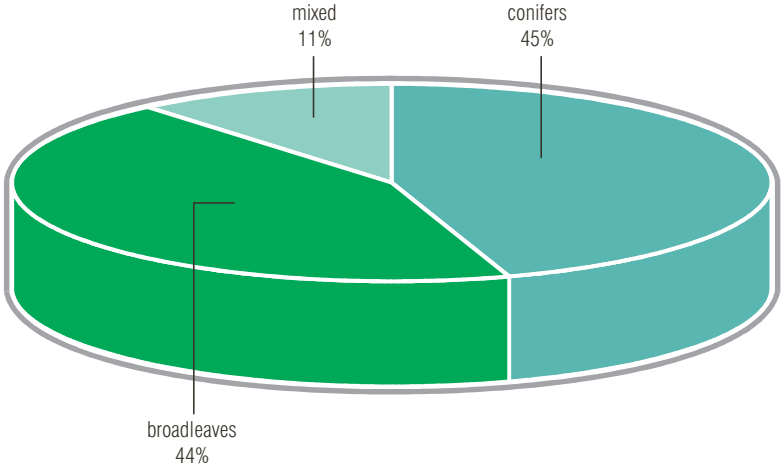

Fig. 1. Forest area distribution by species composition

Table 1. Area of the main tree species in Spanish forest ('000s ha)

Species	Dominant	Co-dominant with others	Total
Pinus pinaster	1,058	626	1,684
Pinus halepensis	1,365	135	1,500
Pinus sylvestris	840	370	1,210
Pinus nigra	525	338	863

Table 1. continued from page 418

Species	Dominant	Co-dominant	Total
Pinus pinea	223	147	370
Juniperus thurifera	124	83	207
Pinus uncinata	75	0	75
Pinus canariensis	72	0	72
Quercus ilex	1,473	503	1,976
Fagus sylvatica	343	105	448
Quercus pyrenaica	313	68	381
Quercus suber	117	256	373
Quercus faginea	88	181	269
Castanea sativa	102	111	213
Quercus robur	38	171	209
Olea europea	17	58	75

Ownership structure

Where types of land tenure are concerned, the forest area is divided among the State and the Autonomous Communities, other public bodies and the private sector, as shown in Table 2. As regards tenure of forest land with tree cover, the figures for area are very similar to those for the land surface as a whole. A comparison of these figures with the average for EU countries reveals that Spain has a remarkably small proportion of land owned by the administrations of the State or Autonomous Communities, though this imbalance is offset by the land owned by other public bodies (local administrations). The figures for private ownership are similar to the European average.

Table 2. Forest area by ownership category

Form of ownership	'000s ha	%
State and Autonomous Communities	1,188.58	4.49
Other Public (local Administrations)	7,494.22	28.83
Private	16,833.32	65.81
Other	467.94	0.87
Total	**25,984.06**	**100.00**

In terms of altitudinal distribution, 45% (or 5,980,000 ha) of the Spanish forest area is located at over 800 m a.s.l., while 62% (8,107,000 ha) is over 600 m a.s.l. These data make the protective nature of Spanish forest clear (see Table 3).

Table 3. Forest area distribution by altitude

Altitude (m)	'000s ha	%
0–199	2,059	7.92
200–399	3,617	13.92
400–599	4,092	15.75
600–799	4,453	17.14
800–999	4,393	16.91
1,000–1,199	3,319	12.77
1,200–1,399	1,845	7.10
1,400–1,599	1,084	4.17
1,600–1,799	655	2.25
1,800–1,999	231	0.89
⩾2,000	236	0.91
Total	**25,984**	**100.00**

Growing stock

Spanish forests have 600 million cubic meters of wood, 60% privately owned, with growth exceeding 30 million m^3/year. Table 4 presents the stock in terms of number of trees, basal area, wood volume and annual increment by reference to species composition. This shows the importance of pine stocks and – among broadleaved species – of beech stocks.

Table 4. Stock in terms of number of trees, basal area, timber volume and annual increment by species

Species	N>7	B.A. (m^2)	Vb (m^3)	IAVC (m^3)	N<7
1	2	3	4	5	6
Exotic conifers	17,735,695	533,367.90	3,428,608.60	234,299.20	19,692,175
Pinus sylvestris	426,886,927	11,896,479.90	65,554,661.80	2,542,007.70	457,824,974
Pinus uncinata	29,368,579	968,965.90	5,360,836.10	154,464.50	27,078,402
Pinus pinea	44,640,152	1,501,270.20	6,303,707.70	250,673.80	24,557,912
Pinus halepensis	333,904,561	7,050,136.00	26,762,842.60	1,083,459.30	392,139,780
Pinus nigra	208,688,362	5,064,807.00	25,131,838.80	898,783.50	250,135,952
Pinus pinaster	129,582,054	4,424,208.90	28,496,250.30	2,263,523.20	88,501,417
Pinus pinaster Mediterranean	292,241,209	9,178,888.30	44,811,715.00	1,891,126.60	248,276,407
Pinus canariensis	22,101,902	1,038,186.00	6,883,953.60	172,426.50	23,602,896
Pinus radiata	78,436,054	3,609,499.40	27,920,854.00	2,031,843.10	96,627,599
Abies alba	30,393,053	988,816.20	6,587,422.90	205,066.50	48,326,605
Abies pinsapo	571,445	40,865.80	229,184.60	4,364.90	503,539
Juniperus thurifera	17,188,316	395,038.50	1,121,364.30	27,796.20	27,312,029

Table 4. continued from page 420

1	2	3	4	5	6
Quercus robur, Q. petraea	49,228,687	1,861,961.50	10,987,944.50	396,546.30	89,495,861
Quercus pyrenaica	129,166,011	2,203,145.40	9,028,971.30	422,926.00	250,303,960
Quercus faginea	27,355,206	442,395.50	1,390,475.60	61,203.10	61,292,550
Quercus ilex	165,621,219	4,266,962.50	9,931,275.80	60,913.70	521,401,265
Quercus suber	16,869,556	904,942.10	2,274,468.20	20,115.00	19,844,824
Riverine trees	13,360,304	358,915.00	2,063,469.10	168,009.50	26,262,672
Populus nigra, Populus x canadensis	18,565,571	616,281.00	4,529,231.30	409,555.20	17,038,230
Eucalyptus spp. Mediterranean	63,211,067	825,293.40	3,940,714.90	783,976.20	93,790,928
Eucalyptus spp. Cantabrian	58,920,322	978,435.10	7,348,103.80	1,557,221.20	108,648,380
Olea europaea	2,919,581	84,395.30	176,764.10	3,058.70	5,590,320
Fagus sylvatica	186,429,508	6,912,467.70	46,322,204.90	1,246,149.80	266,060,917
Castanea sativa	58,924,871	1,902,976.50	9,248,356.00	489,472.40	71,399,755
Pinus sylvestris and *Pinus uncinata*	47,715,168	1,404,212.40	7,607,375.90	255,790.80	56,034,647
Pinus sylvestris and *Pinus nigra*	356,921,491	7,040,712.80	31,283,972.40	1,385,550.80	485,339,066
Pinus sylvestris and *Pinus pinaster*	47,345,431	1,180,515.00	6,254,572.90	283,905.90	34,815,607
Pinus sylvestris and *broadleaves*	99,843,068	2,257,989.60	11,258,228.20	499,252.70	233,645,218
Pinus pinea and *Pinus pinaster*	54,136,726	1,401,312.50	5,977,684.90	293,412.50	55,646,017
Pinus pinea and *broadleaves*	62,717,469	1,377,915.70	6,468,087.10	216,132.10	129,858,781
Pinus halepensis and *Pinus nigra*	96,946,787	1,888,925.50	8,549,448.40	330,814.40	171,433,475
Pinus halepensis and *Pinus pinaster*	59,296,868	1,416,239.30	5,598,419.20	237,330.90	76,114,699
Pinus halepensis and *Quercus ilex*	39,320,011	626,966.90	2,638,663.00	96,241.40	127,341,135
Pinus nigra and *Pinus pinaster*	66,878,152	1,428,314.10	5,786,960.50	232.913.40	103,392,741
Pinus radiata and *Pinus pinaster cantabric*	69,716,041	1,884,905.60	10,608,804.30	872,356.10	59,480,413
Pinus pinaster and *Eucalyptus spp. Cantabric*	155,050,699	4,819,562.10	33,553,240.30	3,652,940.30	167,771,910
Juniperus thurifera and *Quercus ilex*	27,895,219	420,872.70	1,264,715.10	23,986.10	99,822,654
Quercus robur, Quercus petraea and *Fagus sylvatica*	49,839,838	1,632,471.90	8,465,471.00	287,743.50	78,911,992
Quercus pyrenaica and *Quercus ilex*	15,390,082	398,629.80	1,218,223.40	34,752.80	52,384,202

Table 4. continued from page 421

1	2	3	4	5	6
Quercus faginea and *Quercus ilex*	70,728,909	976,151,50	2,794,561.10	53,190.10	279,345,431
Quercus ilex and *Quercus suber*	88,914,596	3,492,839.30	9,174,160.30	111,860.00	150,479,643
Quercus suber and *Quercus canariensis*	10,242,722	612,794.10	1,801,473.70	17,037.10	11,000,062
Myrica faya and *Erica arborea*	16,942,666	289,252.70	1,438,057.30	191,812.40	51,512,073
Broadleaved	231,860,889	5,726,399.90	25,197,912.50	1,340,472.00	455,599,441
Coniferous and broadleaved	256,962,213	5.709,659.50	27,005,269.70	1,569,905.60	592,267,592
Scrubland, grasslands or crops with a low density of trees	319,393,024	8,991,380.60	24,405,808.60	722,174.50	978,595,104

N>7 = Number of trees of more than 7 cm in diameter; B.A. = Basal area; Vb = Wood volume overbark; IAVC = Annual increment of volume overbark; N<7 = Number of trees with a diameter of less than 7 cm.

2. Forest utilisation

The exploitation of forest products in general, and of those derived from timber in particular, has been carried out in such a manner that the continued existence of the resources has always been assured, at the same time providing direct economic benefits to society. The amount of timber felled has oscillated between 14 and 15 million cubic metres overbark per year in the last ten years, showing a small but steady increase. This represents an extraction ratio of 47%, against the 69% mean value for European countries, as a group. Approximately 60% of timber comes from coniferous trees, while 40% – from deciduous trees. A comparison of the figures corresponding to growing stock and mean increment with the volume felled reveals that these amount to 2.5% of the stock and to 50% of the annual increase in timber-yielding volume. Thus, where this activity is concerned, the principle of continued existence of forest stands is, in principle, assured.

The yield of timber (where this is considered the most important forest product on account of its economic value), shows a clear upward trend, a fact that reflects intensified reforestation with new plantations and the improvement of the existing forest stands, both of which have been taking place in recent years. Current yield is nevertheless less than consumption, accounting for only 60% of the requirements (Table 5).

Although the exploitation of timber accounts for the greatest share of forest income, this is not the only type of economic exploitation in most of Spain. The Mediterranean and continental climate that characterises the Iberian Peninsula combines with the traditional land uses to make other products important, like pasture, game, cork, etc. (Table 6).

The forest-industrial chain yields about EUR 12,020 million annually, supports more than 200,000 jobs, gives rise to exports worth EUR 2,031 million and imports of EUR 3,925 million, of which EUR 601 million comes from roundtimber or sawntimber, in other words – the raw materials of the sector.

Table 5. Wood trade balance in Spain (in thousands of cubic meters of wood under bark)

Year	Extraction	Import	Export
1985	13,604	6,958	4,253
1986	14,637	9,227	5,311
1987	14,122	9,429	5,740
1988	14,010	12,136	5,551
1989	14,717	12,646	5,323
1990	14,700	15,185	5,266
1991	14,330	16,101	5,995
1992	13,821	17,001	5,682
1993	13,756	14,518	6,251
1994	15,305	18,251	7,633
1995	16,074	18,706	8,156
1996	15,631	19,365	8,339
1997	14,958	22,106	10,036
1998	14,875	24,308	9,808
1999	14,721	24,977	10,354
2000	13,892	31,226	13,212
2001	13,006	30,698	14,340
2002	13,972	32,486	15,318

Table 6. Silvicultural production

Product	Value (millions of euros)
Timber	621
Fuelwood	56
Cork	58
Acorns	112
Chestnuts	7
Pine nuts	1
Truffles	4
Mushrooms	50
Pasture	412
Game	171
River fishing	27

3. Protected forests

The 536 natural protected lands in Spain cover 3,188,395 hectares. These are: twelve national parks, 126 nature parks, 143 nature reserves, 133 nature monuments, 35 protected landscape areas and 87 sites under other protection categories. 40% of said area is forest, with a number of visits thereto exceeding 30 million per year. Table 7 presents the growing stock and increment in forests by protection category. Protected forests account for approximately 10% of total forest stock. With regard to hunting categories, 35 national reserves, 41 controlled areas, 30,000 private hunting grounds, 8 national hunting grounds, 111 local hunting grounds and 40 social hunting grounds meet the demand for more than 1,400,000 citizens with a hunting licence.

Table 7. Number of trees, basal area, volume and annual increment in relation to protection categories

Specification	N>7	B.A. (m^2)	Vb (m^3)	IAVC (m^3/year)	N<7
National Park	22,426,082	688,624.20	3,831,409.90	159,244.20	38,258,234
Natural Park	274,830,348	8,852,807.10	39,920,594.00	1,473,780.00	425,872,760
Natural areas	59,419,182	1,463,104.30	6,900,747.70	290,756.00	106,677,188
Natural Reserves	12,386,084	328,890.20	1,744,467.40	73,671.90	21,940,719
Other protection areas	56,648,583	1.461,175.70	7,043,740.10	294,601.10	90,735,236
Without protection	4,240,658,002	110,232,123.10	534,745,370.30	27,796,504.30	7,003,017,112

N>7 = Number of trees of more than 7 cm in diameter; B.A. = Basal area; Vb = Wood volume overbark; IAVC = Annual increment of volume overbark; N<7 = Number of trees of less than 7 cm in diameter.

4. Legal and organisational aspects of forestry

Forest low and organisational structure

The evaluation and diagnosis of the regional forestry policies is structured into three main aspects: the legal framework which essentially is the legal basis for these policies and strategies; the structure and administrative organisation for the management of the natural environment in both, territorial and functional terms; and finally the plans, strategies and instruments for planning and management that have been drafted to date by the Autonomous Communities under their respective competencies.

- Legal framework: Since the approval of the 1978 Constitution, the Autonomous Communities have had the power to draft their own laws on forestry and nature conservation, while respecting the basic national legislation, which must still be based on the 2003 Forests Act. Seven Autonomous Communities have decided to draft their own forest legislation in order to provide their forestry policies with an updated framework.
- The administrative structure: The transfer of competencies to the Autonomous Communities by 1986 allowed them to establish their own management bodies for the transferred territory, although the process was by no means uniform. Some Communi-

ties have maintained a forestry body, others have established an environmental body that also covers forestry, while still others have split the responsibilities between two organisations, one for the environment and another one (the Agriculture Department) – for agriculture. Furthermore, since the devolution of power, there have been successive changes in these departmental structures, suggesting that the Regions have had no clearly defined idea about the optimum location of responsibilities for forestry matters. Almost all of the existing autonomic forestry strategies and plans coincide as regards this aspect, as well as the need to design a modern forestry administrative structure that is adapted to current needs. One such need is for a peripheral administration at county level. It's aim is to draw the forestry technicians closer to the rural environment they manage, and to enable multiple forest uses to be included in rural development plans: population stabilisation, job creation and environmental conservation, in compliance with the trends described by the working plan of the European Union Forestry Strategy.

- Regional forestry strategies and plans: At present twelve of Spain's Autonomous Communities have drafted documents on forestry policies or plans. All of these frameworks have been prepared in little over a decade, since the pioneering Andalusia Forestry Plan was brought into effect in 1989. In general, the objectives of these plans accept the principles set by international criteria. The strategies coincide in leading the administration and management of multiple usage forest systems towards an integrated and sustainable management of the natural environment, in which forestry aspects have an interdependent relationship with nature conservation.

Programmes and strategies

Regardless of the degree of optimism or realism of the forestry plans and strategies, and the degree of budgetary fulfilment, the problems that have arisen seem to reside in two issues:

- The structural problems of the forestry industry, which are due in turn to: a) the long lead time inherent to any forest policy (which distances it from the immediate decision-making process and yet further from the achievement of the tangible short-term results desired by politicians for electoral purposes, and which therefore gives rise to small budgets and an isolation of forest administration bodies; b) a widespread lack of awareness of forestry issues, ensuring considerable ignorance of real problems and a consequent lack of trust in the decisions made as regards forestry issues.
- The short-term problems in general politics. Since the Maastricht Treaty of 1993, the need to meet the convergence criteria for the Single Currency have forced the Member States to make budget cuts which (in the light of the above) were obviously not going to favour the forestry industry. Furthermore, the 1993–1997 period coincided with the application of almost all of the autonomic forestry plans, something that can largely account for their lack of completion.

Most descriptions of the structural problems in the majority of the plans agree on at least two main points:

- The universal lack of human and budgetary resources (referred to in every regional forestry plan).

- The real-world truth that budgets sustaining forestry plans are passed by Parliament for a one-year period only, ensuring that plans which envisage a review every 4–5 years receive no firm commitments over the medium or long term.

All national forest activity has been engaged in, collaboratively, between the national and Autonomous Community levels, since 1986 (when responsibility, property, infrastructure and budgets were transferred from the national forestry body, called ICONA at the time, to the Autonomic Government Departments).

The Under-Secretariat General for Forest Policy, (part of the Directorate General for biodiversity and thus the Environment Secretariat General) is the unit responsible for policy co-ordination with the Autonomous Communities. The main thrusts of this co-operative process are:

- Investment in forest hydrology, managed entirely by the former ICONA, under working arrangements with each Autonomous Community on hydrological matters. These powers are now the responsibility of the Directorate General for Biodiversity under the Ministry of Environment.
- Supplementary assistance for forest development and planning by private owners. This aid has been distributed amongst the Autonomous Communities.
- Lines of work articulated jointly with the Autonomous Communities to monitor pest outbreaks, harmful agents and air pollution, a selection of basic material for forest reproduction, the production of a forest map and inventory, and the collection of information on public forests for a permanently updated Catalogue.
- Co-ordination with the Autonomous Communities as regards the combating of forest fires.
- The development of detection, communication and forecasting infrastructure for fire hazard and risk indexes, using a network of operation centres for the coordination of aerial media and the existence of land extinction infrastructure in protected natural areas on public land.
- The set of projects aimed at developing fire prevention infrastructure, materialised in annual education and refresher campaigns, as well as staff training courses in prevention and extinction techniques.
- The aerial fire-fighting fleet includes amphibious and land-loading aircraft and helicopters.
- The Third Priority Action Plan against Forest Fires (PAPIF3) was designed on the basis of the achievements and experiences of its forerunners. The Plan was developed in coordination with the Autonomous Communities, which are responsible for the design of Regional Prevention Plans for counties under the greatest threat.
- The fight against desertification through different projects.
- The assigning by the Directorate General for Biodiversity of a large part of its annual budget to research, through agreements with Spanish universities and research centres.
- The pursuit of afforestation programmes by the Directorate General for Biodiversity, under agreements with Ministries and other bodies, on land managed by them (albeit without a quantification of objectives or management of afforestation formulae other than under the forest hydrology policy).

- In connection with the recent ratification of the 1997 Kyoto Protocol on Climate Change, the establishment of another national function or responsibility as regards the co-ordination of information and definition of the role of forests as carbon sinks.

Amongst the above programmes, the Forest Fire-fighting Programme and the monitoring of the effects of air pollution on forests are, at least, partly funded by the European Union.

When the Directorate General for Biodiversity was transferred from the Ministry of Agriculture, Fisheries and Food to the Ministry of Environment, part of the forest policy remained under the former body, primarily due to the need for horizontal integration in broader, operational units. Other responsibilities remained, because the continuity between the farming and forestry zones of rural areas is by no means clear.

The former cases include the Divisions of Forest Statistics (included in Farming Statistics) and Forest Plant Health, although the Sub-Directorate of Forest Policy has a Forest Health Service and a Cork Advisory Committee (CANCOR). The latter cases include responsibilities for the management of afforestation programmes on farmland, management of funds and design of the rural development programme, promotion of certain forest crops (the National Poplar Commission), structural action in mountainous areas and, above all, grazing forests ('dehesas') in the broad sense.

Under Regulation (EEC) 2080/92, which establishes a regime of subsidies to encourage forest investment on farmland, a multiannual programme was approved for Spain in April 1994. This Plan has been widely accepted by the Autonomous Communities, and Spain now has the best results among the Member States. Up to 31 December 1998, the total afforested area had been 400,893 hectares, in comparison with 108,564 hectares in Portugal, the second ranking country in the EU.

In addition to the significance of the area covered by the programme, other equally important aspects must be mentioned, including:

- The widespread acceptance of the measure by landowners. The number of beneficiaries is now more than 28,000, which is highly unusual for forest subsidies in Spain (where landowners tend to invest very little in the forestry sector).
- The largest afforested areas (over 72%) have been on grazed wasteland, grasslands, and land previously occupied by low-yield herbaceous cereal crops. In other words, the plantations have been concentrated on the most marginal farmland.
- A wide variety of trees have been used, both resinous (128,132 ha) and broadleaved (214,775 ha). In areas where it is technically feasible, mixed forests with a higher ecological value have been introduced gradually (53,781 ha).

4. Education in Forestry

Spanish forestry education is structured in three degrees relating to Forest Engineer, Technical Forest Engineer and Forest Ranger. The first two are university qualifications, the former having a duration of three years and the latter of five or six (depending on the university where it is done). The last of the three specialisations is vocational. Nevertheless,

since the Bologna Declaration of 1999, the National Board of Universities has been working on a new proposal regarding university qualifications, in order to adapt them to the European space for higher arts education.

The first forestry university school was found in the second half of the 19th century and until the last decade of the 20th century this was the only school that offered a Forest Engineer's education. However, during the 1990s, six new Forest Schools providing this education were opened in different Autonomous Communities (Table 8). In the same way, the availability of the Technical Forest Engineer qualifications has increased markedly over the last few years. Now, there are 16 Forestry Schools in Spain, some of them offering both qualifications and others only one cycle. In the last few years, the number of students registered has declined considerably (Table 9) for demographic reasons and probably also thanks to the excessive availability of graduates in forestry.

Table 8. List of Spanish Forestry Universities

School/University	Foundation year	Qualifications
E. T. S. de Ingenieros de Montes Universidad Politécnica de Madrid	1848	– Silvipasciculture – Forest Industry
E. T. S. de Ingenieros Agrónomos y de Montes Universidad de Córdoba	1990	– Silvipasciculture and forest management – Forest industry – Agroforestry biotechnology – Environment Management
E. T. S. de Ingeniería Agraria Universidad de Lleida	1992	– Science and forest technology – Environment Management
E. T. S. de Ingenierías Agrarias de Palencia Universidad de Valladolid	1994	– Silvipasciculture
Escuela Politécnica Superior de Lugo Universidad de Santiago de Compostela	1995	– Silvipasciculture – Industry – Environment Management
E. T. S. de Ingenieros Agrónomos y de Montes Universidad Politécnica de Valencia	1999	– Management of Environment – Natural Environmental Engineering
Universidad Católica de Avila	1999	– No specialities

Table 9. Total numbers of students registered by university (data grouped by qualifications)

Qualifications	1999–2000	2000–2001	20001–2002	2002–2003	2003–2004
Forest Technician	1,046	1,001	1,016	1,026	988
Forest Technician, expert in exploitation	4,831	4,951	4,808	4,529	2,904
Forest Technician, expert in Industry	708	714	628	562	490
Forest Engineer	2,400	2,379	2,222	2,046	2,021
Forest Engineer (2nd cycle)	1,482	1,490	1,459	1,363	1,305

The Forest Ranger education began in the middle of the 20th century with the foundation of the first Forest Ranger School at Lourizan. During the second half of the century, several new schools were opened. However, because of the increasing demand as regards environmental activities, the qualifications were changed so that there are now two formations: Superior Technician for natural areas and landscape management and Technician for forestry and natural environment conservation.

The Directorate General for Biodiversity (DGBio) established the ranks of the Forest Rangers. After 1989, the DGbio also consolidated the practice of contracting staff to conduct watch work, now known officially as National Park Rangers. The Autonomous Communities have adopted a wide range of policies with the corresponding legislation. Forest Rangers are still a corps of civil servants in some Autonomous Communities, while in others (e.g. the Canary Islands), they have become part of a broader environmental police force. The ranks have disappeared in some cases, and in others they have become auxiliary administrative corps or 'forest agents'. One aspect which has been eliminated, however, is the possibility of establishing a single national body, as this option, applicable in certain, exceptional circumstances, has not been taken up in this case. The Autonomous Communities have full responsibility for the organisation and regulation of forest officers, and there is no possibility whatsoever of creating common, linked patterns in the same manner as certain other national forces.

Perhaps a major problem to deal with is the lack of any elementary teaching about forestry in primary and secondary schools. Moreover, some misleading ideas about the role of coniferous and other taxa are sometimes included in teaching books. The inclusion of some basic knowledge about forestry and forest ecosystems may be the best tool to avoid misinterpretation of forest policies and damage to forest ecosystems by inadequate visitor's behaviour. In that regard, the CENEAM (Centre for Environmental Education), located in Valsaín – a Scots pine forest managed for more than 100 years – is an interesting initiative of the DGBio.

In Spain, the Professional Colleges, associations regulated under public law to guarantee that a professional has sufficient knowledge to perform a specific task, also cover Forest Engineers and Technical Forest Engineers. Their corresponding Colleges extend their guarantee to both, the citizens who contract a forestry expert and the professionals themselves (against unqualified intrusion). The Professional Colleges are also intended to guarantee that projects registered with them fulfil a series of formal requirements ensuring viability.

5. Forest research

The first antecedent on forest research was the creation of the Forest Institute of Research and Experiments (IFIE) in 1907, which had carried out a continuous research activity from its inception to its integration into INIA (the National Institute for Agricultural and Food Industry Research and Technology) in 1971. IFIE/INIA supported the main group of researchers and the main resources for forest research until the last decades of the 20th

century. During the last two decades, the number of studies has increased because of the strong impulse that society has given to all subjects related to the environment, as well as due to the important rise in the number of Forestry-related University Schools. The political process of fragmentation of forest administration, as well as forest research into Autonomous Communities (since 1982) has been associated with unequal development of the management of and research on forests. In many cases, the cited division has meant a strong impulse for research (e.g. more research centres, universities, teams, and competition), but also the need for good coordination between working groups.

Forest research in Spain has changed approaches and objectives, as a result of the multifunctional demands for forestry products, biodiversity conservation, forest protection, sustainable forest management, recreation, etc. However, a classical approach to forest research is still necessary for complete development of the forestry sector in Spain. In the last National Research Programme (2000–2003), forest ecosystem research was included in two main areas: Natural Resources (analysis of nutrient and water cycles in terrestrial ecosystems and global warming) and Agricultural Technologies and Resources (forest protection and sustainable forest management). The new National Research Programme (2004–2007) continues with the same objectives and a similar structure in the lines of research. The National Forest Strategy (MMA, 2002) established different objectives for forest research in Spain and different tools, in which the national network for sustainable forest management is more related to forest ecosystem research.

The main, current problems of long-term forestry research include the maintenance of the networks of permanents plots, as well as the continuity of research lines and staff over long periods of time. Forestry research is mainly based on national or autonomic programmes of a short term (3–5 years), making it very difficult to maintain permanent plot infrastructure and data collection.

The forest research field in Spain comprises different groups at Universities and Research Centres. The current status of ecological and forest research is conditioned by the following:

- The Spanish forestry sector is of enormous importance because of the large affected area (one forth of the country is covered by forests; one half of the country is in what are considered forestry areas: of woodland, scrub, grasslands, etc.), but of much more minor economic importance. However, the forestry sector is a key economic resource for the maintenance of the rural population and its dynamics.
- Forest management and administration is fragmented into different Autonomous Communities and into different state ministries; so coordination between agencies or administrations, while indispensable, does not always happen. The same situation prevails in the case of research activities, which are also divided into many regional groups. Research on forest is being developed in small groups working on different aspects and, in general, without relationship or cooperation between them. These research groups are characterised by short or medium life spans, small sizes and independent research projects.

There are two levels of research policy. At national level, the Ministry of Education and Science marks the priority research lines at the four-year planning stage of I+D+I (http://wwwn.mec.es/ciencia/plan_idi/files/Plan_Nacional_Vol_II.pdf). INIA is the coordina-

tion centre for the main projects, even operating with its own funding. There are also some stable research groups that have been maintaining the research lines of forest research (e.g. on ecophysiology, forest management, and nutrient cycles). On the other hand, priority research lines can also be defined by Autonomous Communities' policies, through their own plans and programmes that are coordinated with the state policy to a certain degree. Regional policies can mark the priority research lines depending on their interests, social and economic aspects and the importance of the forest sector to the Autonomous Community. The working term is often four years.

There is quite a large number of isolated initiatives working with a network of permanent plots for forest research dedicated to forest yields, forest products, treatments and fertilisation in short-rotation stands. At national level, inventories (National Forest Inventories) and monitoring (ICP Forest Level 1 and 2) are working in a very suitable way. Landscape-related activities are achieving some prominence among the "other uses of forest" in research programmes, as well as CO_2 fixation. We hope the current initiative of organising a network of permanent plots for sustainable forest management and conservation at national level – with the participation of all the country's administrations – could help in improving forestry research over the long term.

The general framework of sustainable forest management is essential to the central role of the forest ecosystem as regards present needs expressed by society, *i.e.*: biodiversity, global warming, desertification, recreation and erosion and water quality protection. On the other hand, the production of market and non-market goods is essential to rural development. Integration of groups working on forest ecosystem and landscape multidisciplinary research is required to accomplish the objectives included in the National Forest Strategy, and the National Research Programmes. The subjects are:

- Forest ecosystems, including studies on natural resources, biodiversity conservation and carbon sinks: within this line of research, it is essential that a monitoring network be established in virgin forests.
- Sustainable forest management, from a multifunctional approach – for which a network of permanent plots for monitoring different forest ecosystems has to be established.
- Forest health and global warming protection, for which monitoring of the permanent network established according to EU standards takes place.
- Other aspects, including forest genetic resource conservation, new technologies in forestry products and the impact on the ecosystem management and economics of forests.

The main sources of information on Spanish forest research:

- Administrative bodies
  - CICYT (www.cicyt.es): the National Agency charged with the evaluation and coordination of National Research Programmes. (Ministry of Science and Technology – www.mcyt.es, see also Ministry of Education and Science – www.mec.es).
  - DGCN (http://www.mma.es/bd_nat/menu.htm): the National Forest Service, in charge of forest policy. DGCN has a complete overall statistical description, a complete database and the best collection of cartography on the vegetation, forests and habitats of Spain.

- Research institutes and universities:
  - CREAF (www.creaf.uab.es): the Centre of Ecological Research and Forest Applications of Barcelona University – www.uab.es. The focus is on terrestrial ecology and forest ecology.
  - INIA (www.inia.es): the National Institute for Agricultural and Food Industry Research and Technology is in charge of the coordination of the Food and Agronomic National Programme of Research, in which Forest Research is included. It provides information on forest research activities and Centres in relation to the Autonomous governments.
  - departments and centres of universities related to forest research (http://www.universia.es/contenidos/universidades/index.htm).
- Networks:
  - GLOBIMED, (www.globimed.net): is a network on Global Change and Biodiversity in Mediterranean Ecosystems.
  - SELVIRED, www.inia.es/gcont/redestem/centrosydep.jsp?idcentro=70&tema=relint): is the Spanish network on Silviculture and Sustainable Management of Forest Systems within which the main public and private institutions dealing with forest research can be found (links to all participants).
  - Spanish Society of Forest Sciences (www.secforestales.org): The Spanish Society of Forest Sciences is organised into different working groups: on silviculture, sustainable management, the ecological bases of forestry, hydrology, etc.
- Databases
  - Bibliofor (http://www.grn.es/bibliofor): A general website with a good database of the literature published in Spain on forest research, and a complete list of forest research centres.

★ Sweden

Åsa Forsman

The Kingdom of Sweden
(Sverige or Konungariket Sverige),
territory: 450 thousand km^2,
population: 8.9 million,
capital city: Stockholm.

1. Forest characteristics

Sweden is the fourth largest country in Europe by area. Geographically, Sweden is characterised by its long coastline, large forests and numerous lakes. Some two-thirds of Sweden's land area is covered with forests. Despite its small population of nine million and its large territory, Sweden is a technologically advanced country with a good infrastructure, including an efficient transportation and communications system. Sweden is divided into 24 counties and 290 municipalities. The form of political/administrative system is constitutional monarchy, parliamentary democracy.

The Swedish Forest Administration consists of the Swedish Forest Agency (SFA) (before January 2006 – the National Board of Forestry) and its ten Regional Forestry Boards (RBFs). The SFA is placed under the Ministry of Industry, Employment and Communications. The SFA is responsible for the implementation of forest policy on all forest lands, and covers all three dimensions of the sustainability concept: economy, ecology and social factors. The operation of the RFBs is carried out in the Forestry Districts.

With approximately 90 districts, the RFBs play a key role in the implementation work. Thanks to their local knowledge, these districts are the backbone of the hands-on land-owner approach. The Swedish forest administration does not however manage the State-owned forests. The State forests outside National Parks etc. are managed by a commercial State-owned forest company Sveaskog.

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Table 1. Total land area of Sweden by land-use category, 1997–2001

Land use categories	'000s ha
Forest*	27,400
– of which forests available for wood supply	21,200
Other wooded land	3,200
Agriculture	3,500
Other	6,900
Total land area	**41,000**

* As defined in FRA 2000.
Source: National Board of Forestry, FRA 2000.

Ever since 1903 Sweden has had its Forestry Act. Under the revised Swedish Forestry Act of 1994, production and conservation goals are both assigned equal importance. Forest owners are held responsible for the fulfilment of these goals.

The SFA has been given the mandate of breaking down the two overall forest policy goals into more detailed sub-goals, or forest sector goals. The four main forest policy tools are: advise and information, legislation, financial support and inventory, follow up and evaluation.

The total landmass of Sweden is 41 million hectares, of which 22.6 million hectares is classified as productive forest land (productive forest land = 1 m^3/ha/year, as defined in the Swedish Forestry Act). According to international definitions, the total forest area in Sweden is just over 27 million hectares.

Species structure

About 85% of the total standing volume consists of conifers. Norway spruce and Scots pine are the most common conifers. Among deciduous trees, birch is the most common species.

Table 2. Standing volume by tree species

Species	%
Norway spruce	43
Scots pine	39
Birch	11
Other broadleaves	5
Dead or windthrown	2
Total	**100**

Source: Swedish National Forest Inventory.

Growing stock and increment

The annual growth of the Swedish forest continues to increase. Much of the forest in the central and southern part of Sweden was restored during the 19th century on the abandoned agricultural land.

Table 3. Forest land, growing stock and increment 1998–2002

Regions	Forest land ('000s ha)	Growing stock (m^3sk*/ha)	Mean annual increment (m^3sk*/ha)
N Norrland	6,723	82	2.5
S Norrland	5,748	120	3.8
Svealand	5,258	138	5.0
Götaland	4,885	172	6.7
National total	**22,614**	**124**	**4.3**

* m^3sk = Cubic metres of standing volume (stem volume over bark from stump to tip).
Source: Swedish National Forest Inventory.

2. Legal and organisational forms of forest holdings

Ownership structure

Over half of the Swedish forests are owned by private forest-owners. Forest companies own almost 25% of the forestland, while the State and other public organisations own the rest. The private forest owner segment consists of some 250,000 holdings owned by around 350,000 forest owners, of which one-third are women. The average holding size for a private forest owner is 45 hectares.

Table 4. The ownership structure of forest land

State Forest	17%
Other public	7%
Private Company Forest	25%
Private persons	51%

Source: National Board of Forestry.

Table 5. Large forestland owners in Sweden 2003

Forest owners	Productive forestland ('000s ha)
Sveaskog AB (State company)	3,460
SCA Skog AB (private company)	1,611
Stora Enso Skog AB (private company)	1,586
Statens Fastighetsverk	1,060
Holmen Skog AB (private company)	1,031
Korsnäs AB (private company)	329
Scaninge Timber AB (private company)	385
Fortifikationsverket (private)	100
Persson Invest Skog AB (private company)	52
Uppsala Akademiförvaltning (private)	38
Boxholms Skogar AB and Örmo Skogar AB (private company)	36
Skogssällskapet förvaltning AB (private company)	28

Source: National Board of Forestry.

The seven forest owners associations in Sweden group together about 90,000 members who own some 6 million hectares of total forest area.

Table 6. Some forestry data for the EU around 2000

Country	Number of inhabitants ('000,000s)	Land area ('000,000s ha)	Forest land* ('000,000s ha)	Growing stock ('000,000s m^3sk**)
EU	375.0	313.2	115.7	15,003
Austria	8.2	8.3	3.9	1,110
Belgium/Luxembourg	10.6	3.2	0.7	159
Denmark	5.3	4.2	0.5	56
Finland	5.2	30.5	22.0	1,945
France	58.9	55.0	15.3	2,927
Germany	82.2	35.0	10.7	2,880
Greece	10.6	13.0	3.6	163
Great Britain	59.0	24.1	2.8	359
Ireland	3.7	6.9	0.7	49
Italy	57.3	29.4	10.0	1,450
The Netherlands	15.7	3.4	0.4	60
Portugal	9.9	9.1	3.7	299
Spain	39.6	50.0	14.4	632
Sweden	8.9	41.0	27.1	2,914

* Forest land corresponds to ECE/FAO's "Forest".
** M^3sk=Cubic metres of standing volume (stem volume over bark from stump to tip).
Source: The Global Forest Resources Assessment 2000, main report, FAO. ISBN 92-1-116735-3. ISSN 1020-2269.

3. Nature protection

National Environmental Objectives

In 1999, the Swedish Parliament adopted 15 environmental quality objectives, describing the status of the Swedish environment by which it is sustainable in the long term. The objective set for forests was named Sustainable Forests. This objective states that the protection of the value of forest and forest soil for biological production must proceed with the protection of biological diversity, as well as cultural and social values.

Different forms of nature protection

Approximately 10% of Sweden's land is protected by virtue of some kind of nature conservation legislation. Nature reserves account for three quarters of protected lands. The Forestry Act protects roughly 3.5% of forest land from forestry activities. The environmental values of forest can be protected in a number of different ways:

National park – is a strong and long-term protection for large areas aimed to restore a typical landscape to its natural conditions. National Parks are always owned by the State.

Nature reserve – is the most common form of land protection; their size may vary from a few hectares to thousands of hectares. Nature reserves can be owned by both, the State and private persons.

Statutory protection of habitats – covers smaller habitats of high conservation values.

Civil rights agreements on nature conservation – cover areas of high environmental values can also be protected through agreements between forest owners and the State.

Voluntary set-aside forests – forest-owners set aside forest areas for nature conservation without compensation from the State.

Wildlife sanctuary – is a protected area for rare animals and animals sensitive to disturbance at certain times of the year.

Natural monument – is a small area with interesting landscapes, geological features or other natural objects.

Table 7. National parks and nature reserves till 2001

	Land area ('000s ha)	Incl. areas with tree cover* ('000s ha)	Incl. production forests ('000s ha)
National parks	592	116	
Nature reserves	3,430	1,801	
Total	**4,022**	**1,917**	**900**

* By tree cover is meant broad-leaved forest, mixed forest and coniferous forest.
Source: Swedish Environmental Protection Agency, Statistics of Sweden.

Table 8. Protected productive forest land* area till 2002

	Number	Area ('000s ha)
Legal protection of habitats	2,907	8
Nature Conservation Agreement	1,184	16
Wildlife sanctuary**	1,039	60
Natural monument**	1,433	
Total	**6,563**	**84**

* Productive forest land = 1m^3/ha/year as defined in the Swedish Forestry Act.
** Wildlife and natural monuments can exist completely or partly on forest land.
Source: Swedish Environmental Protection Agency, Statistics Sweden, Swedish Forest Agency.

Red-listed species

There are 4,120 red-listed species in Sweden. About half of them are found in forests.

Table 9. Red-listed species in forest land, 2000

Species	Total red listed*	Red listed in forest	Regionally extinct in forest	Threatened in forests**
Vascular plants	505	84	3	48
Bryophytes	238	102	11	45
Stoneworts	21			
Lichens	254	209	15	120
Macrofungi	609	550	6	216
Mammals	23	15	1	10
Birds	88	38	4	18
Reptiles and amphibians	12	6		4
Fish and cyclostomes	33			
Molluscs	143	17		7
Chelicerata	71	37		
Insects	2,037	1,032	75	447
Other invertebrates	86	11		
Total	**4.120**	**2,125**	**115**	**931**

* All red-listed species: regionally extinct, critically endangered, endangered, vulnerable, near threatened and data deficient.
** Threatened species: critically endangered, endangered and vulnerable.
Source: Swedish Threatened Species Unit.

Forest damage

Natural tree mortality has increased during the nineties. Forest damage is caused by a number of different factors. Generally, storms are responsible for the greater part of forest mortality. Some other examples of the causes of forest damage are as follows:

Moose and roe-deer – dense game populations cause severe damage, especially to pine and hardwood plantations and young forests. The level of damage varies considerably.

Fungal diseases – the most serious pest attacking Norway spruce is root rot (*Heterobasidion annosum*). The damage it causes is estimated at about SEK 500 million annually, expressed as deteriorated wood quality and lower growth.

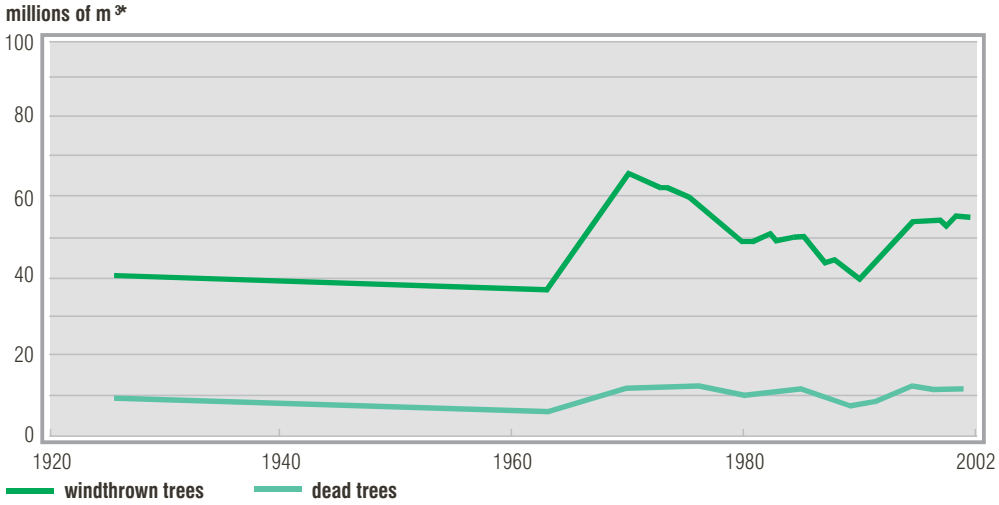

Fig. 1. Changes in the volume of dead and windthrown trees. All land-use classes (Source: Swedish National Forest Inventory)

* Cubic metres of standing volume (stem volume over bark from stump to tip).

** The figures after 1980 are the means for 5-year periods. Before that year, different investigation periods were used for reporting. The statistics do not include high mountain areas, protected areas, former military grounds, urban areas. The large increase in volume between the investigation periods 1958/1967 and 1968/1972 is the result of the hurricane storm in 1969 when around 30 million m^3 was blown down.

Recreation and hunting

The right of public access to forest. The right of public access to forest is unique in Sweden and constitutes the most important basis for recreation. It offers people the privilege to collect berries, mushrooms and flowers, or to camp for one night on a private land. The obligation on the visitor is not to cause disturbance and respect the privacy of the landowner.

Table 10. Number of animals felled during hunting by selected game species and year

Species	Number of animals felled			
	1998/1999	1999/2000	2000/2001	2001/2002
Roe deer	219,000	190,000	169,000	154,000
Moose	101,900	107,900	108,688	105,087
Mountain- and field hare	129,000	126,000	121,100	103,000
Fox	52,000	58,000	53,100	58,000
Fallow- and red deer			10,500	11,800
Rabbit	22,000	15,000	10,100	7,000
Bear	58	57	57	62

Source: The Swedish Hunters Association, The Swedish Environmental Protection Agency.

Nature tourism. The interest in nature tourism is increasing. Research shows that 4 in 10 visitors come to Sweden for leisure pursuits. The most popular activities are fishing, walking and canoeing.

Hunting. Hunting is a highly valued recreational pastime for more than 300,000 Swedes. Moose hunting is most important since moose meat is of high value. For many landowners the income from hunting is also of high economic importance.

4. Forest management

Swedish forestry is site-adapted. This means that the silvicultural methods used and the tree species selected are well-adapted to the natural site conditions which differ from north to south of Sweden.

Regeneration and cleaning

Table 11. Soil scarification, planting and cleaning 1999–2001

	Ownership ('000s ha)			
	private	companies	public*	total
Soil scarification	75	70	11	156
Planting	73	58	10	141
Cleaning	151	67	24	242

* Public means the State and other public owners.
Source: National Board of Forestry.

Thinning and regeneration felling

About 270,000 hectares are thinned annually and regeneration felling is done on about 200,000 hectares annually, which is less than 1% of the total forest area. The average stand area for final felling is approximately 4.4 hectares.

Table 12. Thinning and final felling 1999–2000

	Ownership ('000s ha)			
	private	companies	public*	total
Thinning	168	85	32	295
Final felling	106	61	7	174

* Public means the State and other public owners.
Source: Swedish National Forest Inventory.

Table 13. Average gross felling 1999–2000

	Ownership ('000,000s m³sk*)			
	private	companies	public**	total
Thinning	10.9	5.1	2.2	18.2
Final felling	19.4	11.1	1.3	31.8

* m³sk = Cubic metres of standing volume (stem volume over bark from stump to tip).
** Public means the State and other public owners.
Source: Swedish National Forest Inventory.

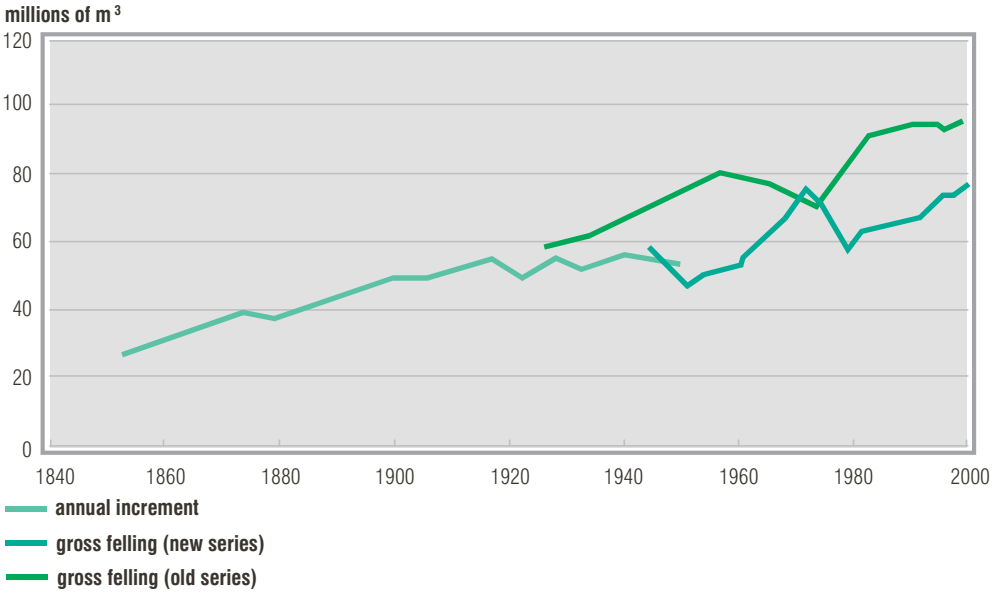

Fig. 2. Calculated annual increment since 1923 and gross felling since 1851

The wood balance

By wood balance we understand the demand for wood, as required by the forest industries and other receivers, against the forest's ability to produce the amount required. Today, Sweden's felling potential is lower than the demand for wood. For the period 2005–2014, the potential felling is estimated at 85 million cubic metres per year. By the turn of the next century, the estimated harvest volume will have oscillated between 90 and 97 million cubic metres. During the last 10 years, the consumption of raw materials has increased by 10 million cubic metres.

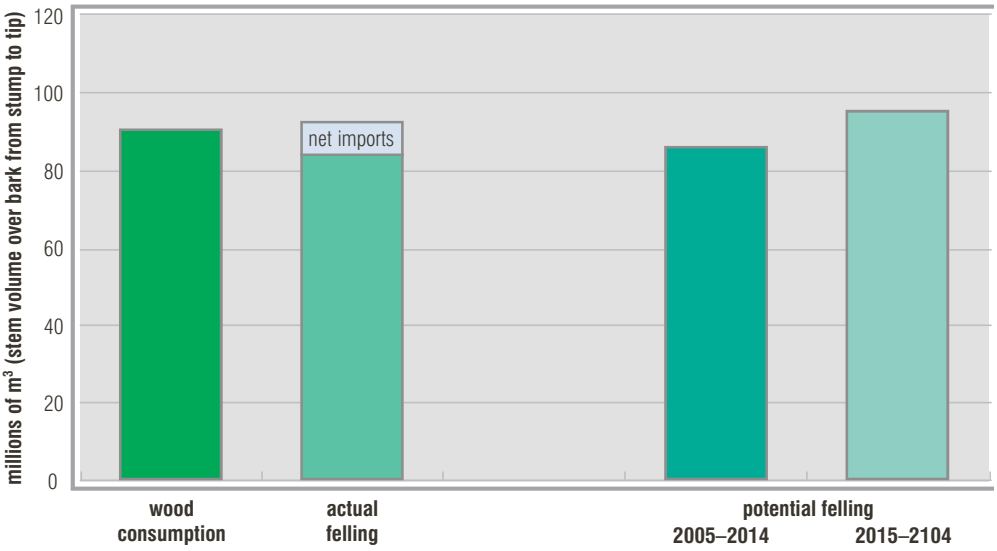

Fig. 3. Wood balance and potential felling (Source: National Board of Forestry)

Certification

Currently, two forest certification systems are used, FSC and PEFC. Over 10 million hectares are FSC-certified, and two million hectares are certified pursuant to PEFC-standards.

Green Forest Management Plan

The Green Forest Management Plan contains details concerning stand production and environmental values, and is a good basis for decision-making.

Forestry and reindeer husbandry

The Saami people (Lapps) live in the northern part of Sweden. There are 17,000 Saami in Sweden, of whom 2,500 are active in reindeer husbandry. Within the reindeer 'year--round' region, no forest operations may take place that markedly reduce the opportunities for the Saami to conduct reindeer husbandry. This is in conflict with the interest of forest owners who, in turn, are obliged to carry out forest management in accordance with the Forest Act. Therefore discussions are being held between forest owners and the Saami, before any forest operations are started.

Energy and climate

Bio-fuel. Already today, the Swedish forests play an important role as a domestic renewable energy resource creating employment, especially in rural areas. Approximately

45% of the total harvest from the Swedish forests is used for energy production. Of this, large quantities come from the by-products of the forest industry.

Table 14. Total energy supply in Sweden 2001 (%)

Nuclear power	33
Coal	4
Other	3
Oil	31
Biofuels and peat	16
Hydro power	13

Source: Swedish Energy Agency.

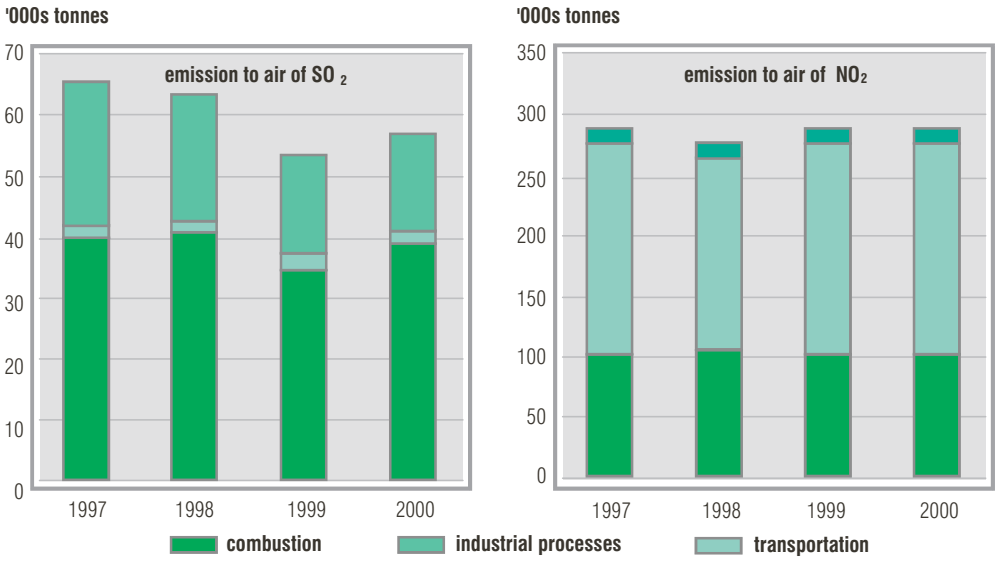

Fig. 4. Swedish emissions of SO_2 and NO_2 (Source: Swedish Environmental Protection Agency, Swedish statistics [Mi 18 SM 0201])

Forest industries

Forest is Sweden's most important natural resource. The most important products are sawn timber, pulp, paper, paperboard, veneer, and wood-based panels. 50% of the wood harvested from forest is designated for sawn timber, 40% for pulpwood, and 10% is used as a fuel. Sweden produces the following from forest resources: 15 million cubic meters of wood products, 10 million tones of pulp and 60 TWh of energy (Source: Swedish Forest Agency).

Table 15. The sawn timber industry

	1980	1990	2000	2002
Number of sawmills (>10,000 m³/year)	283	260	171	165
Production per sawmill, '000s m³ (approx.)	40	45	90	100
Total production, millions of m³	11.2	11.7	16.2	16.6
Export, millions of m³	5.9	6.5	11.1	11.5
Exports value, billions of SEK	5.4	11	18.5	20.9

Source: Swedish Forest Industries Federation.

Table 16. The board industry

		1980	1990	2000	2002
Number of mills		32	18	12	10
Production	plywood '000s m³	87	68	110	87
	particle board '000s m³	1,193	843	640	564
	fibre board '000s tonnes (incl. MDF since 2000)	433	214	191	295
Export volumes	plywood '000s m³	17	13	63	48
	particle board '000s m³	463	183	98	115
	fibre board '000s tonnes (incl. MDF since 2002)	181	65	63	84
	Export value, billions of SEK	937	539	622	499

Source: Swedish Forest Industries Federation.

Table 17. The pulp industry

	1980	1990	2000	2002
Number of mills	72	48	45	45
Total capacity, millions of tonnes	10.5	10.9	11.07	11.9
Capacity per mill, '000s tonnes	145	225	253	265
Production, millions of tonnes	8.7	9.9	11.5	11.4
Exports, millions of tonnes	3.0	2.7	3.1	3.3
Exports value, billions of SEK	6.1	11.6	16.6	13.6

Source: Swedish Forest Industries Federation.

Table 18. The paper industry

	1980	1990	2000	2002
Number of mills	62	51	48	47
Total capacity, millions of tonnes	7.2	9.5	11.1	11.4
Capacity per mill, '000s tonnes	115	185	232	242
Production, millions of tonnes	6.2	8.4	10.8	10.7
Exports, millions of tonnes	4.5	6.7	8.9	9.0
Exports value, billions of SEK	11.4	32.7	57.0	60.0

Source: Swedish Forest Industries Federation.

Table 19. The forest industries' consumption of wood and recovered paper in 2001

	Round wood ('000s m³fub*)	Waste products ('000s m³fub*)	Recovered paper ('000s tones)
Sawmilling industry		34,200	
Pulp- and paper industry	31,507	11,248	1,832
Board industry**	459	1,055	

* m³fub = Cubic metres of solid volume under bark.
** The board industry includes the particle board industry, the plywood industry and the fibreboard industry.
Source: National Board of Forestry.

Economic importance

The forestry sector is of major importance to the national economy. The forest industry and forestry account for more than 4% of Sweden's GDP, 12% of total added value in industry, nearly 11% of industrial employment, and almost 15% of Sweden's exports of goods. As regards forest products, Sweden along with the USA, Canada and Finland, is one of the world's leading exporters. Approximately 80% of the forest industry's production is exported (ca SEK 115 billion). The import of forest products is insignificant and reaches about SEK 20 billion.

The world's 10 leading producers and exporters of coniferous sawnwood, pulp and paperboard are shown in the table below.

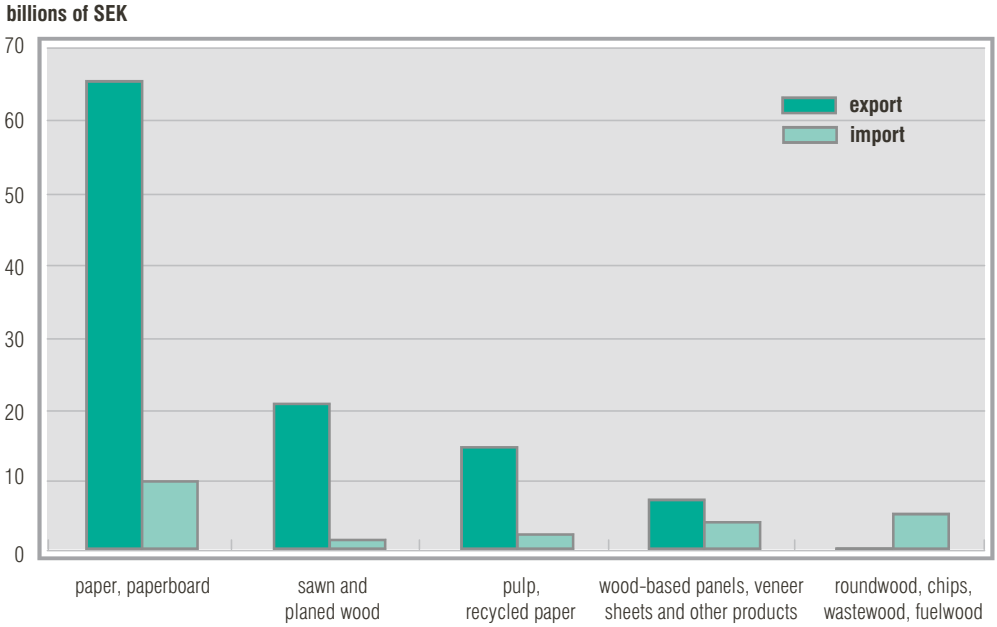

Fig. 5. Swedish foreign trade by forest industry products, 2002

Table 20. Coniferous sawnwood in 2001

Country	Production (millions of m^3)	Global share (%)	Export (millions of m^3)	Global share (%)
USA	59.3	29	1.5	2.0
Canada	46.7	23	35.1	48.0
Russia	17.5	9	7.1	9.7
Sweden	15.6	8	11.0	15.0
Japan	15.0	7	0.4	0.5
Germany	14.9	7	3.0	4.0
Finland	12.7	6	8.1	11.0
Austria	10.0	5	6.1	8.0
Brazil	7.8	4	1.1	1.5
China	4.7	2	0.1	0.1
World's total	204.2		73.5	

Source: FAOSTAT, Database.

Sweden is the fourth biggest producer of wood pulp, just after the USA, Canada and China, and one of its biggest exporters, after Canada, the USA and Brazil. Its production in 2001 was 11.4 million tonnes, and its exports amounted to 3 million tonnes. In 2001, Sweden produced 10.5 million tonnes of paper and paperboard ranking it as the 7th biggest manufacturer worldwide. The export of this product reached 8.7 million tonnes, or 13% of the global share. The highest amount of 14.5 million tonnes was exported by Canada.

Employment

In 2002, approximately 94,600 people (20% women), many of them in the economically weak regions, were employed in the forestry sector.

★ The United Kingdom

Ewan Mackie

The United Kingdom of Great Britain and Northern Ireland, territory: 244,100 km², population: 59.2 million, capital city: London.

Introduction

"The history of UK forestry and the nature of its woodlands differ fundamentally from those of the rest of Europe and Scandinavia" (FC, 2004a).

Information on certain aspects of forests and forestry contained in this report are for Great Britain (England, Scotland and Wales), rather than for the United Kingdom. This is because some information is not collected for Northern Ireland. This should be borne in mind when interpreting the report.

Two government departments regulate forestry in the United Kingdom (UK). In Northern Ireland, forestry is the remit of the Northern Ireland Forest Service (NIFS), part of the Department for Agriculture and Rural Development for Northern Ireland (DARD). In Great Britain (GB), forestry is the responsibility of the Forestry Commission (FC). In 2003, the FC underwent devolution of many of its functions to country level with the creation of FC England, FC Scotland and FC Wales.

Research relating to forestry is carried out by universities and by Forest Research, the research agency of the Forestry Commission, which is administered as a GB body.

Because the Forestry Commission fulfils both, a regulatory/policy function and a function as regards the management of forest land (approximately 30% of woodland in GB is owned by the FC), it has sustainable management at the core of its policies and working practices. These are set out in the UK Forestry Standard (FC, 2004a), supporting guidelines and other relevant publications (see for example: FC, 1990; FC, 1995).

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1. Forest characteristics

Forest area

The total area of woodland in the UK, as at the 31 March 2004, is 2.8 million hectares. Of this total, 1.3 million hectares (47%) is in Scotland, 1.1 million hectares (40%) is in England, 0.3 million hectares (10%) is in Wales, and the remaining 0.1 million hectares (3%) – in Northern Ireland (FC, 2004b; see Fig. 1). Fig. 2 shows the geographical distribution of all woodlands with area of at least 2 hectares for Great Britain.

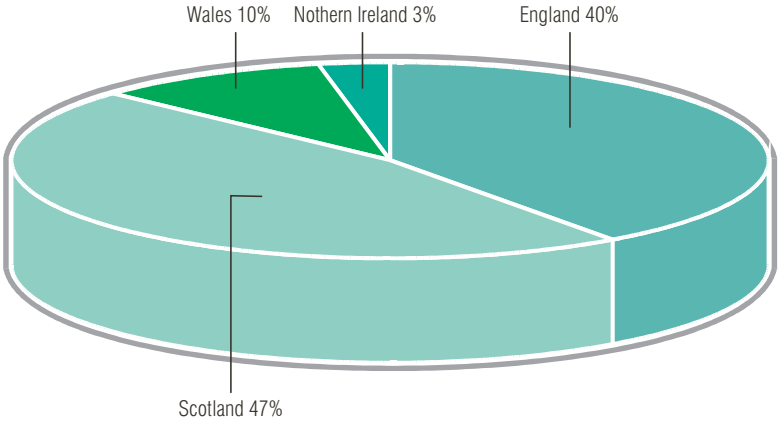

Fig.1. Percentage of UK total woodland area within each country (FC, 2004b)

Forest cover

Woodland area in the UK has increased significantly since the start of the 20th century. Historically, the UK was deforested due to agricultural and industrial development. Immediately following the First World War, the need for a strategic national supply of timber was identified by the 'Acland' Committee (Ministry of Reconstruction, 1918). In 1919, the Forestry Commission was set up with an initial mandate to plant and develop a state forest in order to secure timber supply.

From woodland cover of 4.7% of total land area in 1905, the percentage of woodland has increased steadily to the current 11.6% (see Fig. 3). Even with this doubling of forested area, the UK is still one of the least densely forested countries in Europe (FAO, 2003). There are large differences in the percentage woodland cover in each of the countries within the UK: England has 8.6%, Scotland 17.0%, Wales 13.8% and Northern Ireland 6.3% (FC, 2004b).

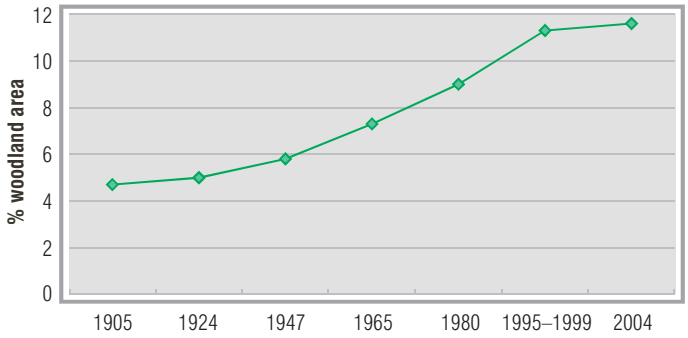

Fig. 2. Percentage increases in woodland area over time

Fig. 3. Geographical distribution of woodlands over 2 ha in area in Great Britain (FC, 2003)

Species composition

An estimated 53% of the woodland area in the UK comprises coniferous species, and 47% of the area – broadleaved species (FC, 2004b; see Table 1).

Table 1. Percentage of total forest area by species in the UK

Common name	Scientific name	Percentage of forest area
Conifers		
Scots pine	*Pinus sylvestris*	9
Corsican pine	*P. nigra* var. *laricio*	2
Lodgepole pine	*P. contorta*	5
Sitka spruce	*Picea sitchensis*	26
Norway spruce	*P. abies*	3
European larch	*Larix decidua*	1
Japanese larch	*L. kaempferi*	4
Douglas fir	*Pseudotsuga menziesii*	2
Other & mixed conifers	–	2
Total for conifers		**54**
Broadleaves		
Oak	*Quercus* spp.	8
Beech	*Fagus sylvatica*	3
Sycamore	*Acer pseudoplatanus*	3
Ash	*Fraxinus excelsior*	5
Birch	*Betula* spp.	6
Poplar	*Populus* spp.	0
Sweet chestnut	*Castanea sativa*	0
Elm	*Ulmus* spp.	0
Other & mixed broadleaves	–	11
Total for broadleaves		**36**
Felled, coppice and open space		11

Total standing volume and annual increment

Total growing stock of potential timber is around 301 million m^3, of which just under two-thirds is due to conifers (softwood). Growing stock of timber is increasing over time as annual increment exceeds the volume harvested (FC, 2002).

Table 2 shows the total standing volume and annual increment, on a per hectare basis, for the UK. The volumes and increments shown are based on those reported in FC (2002), which in turn are derived from the 1995–1999 National Inventory of Woodland and Trees (FC, 2003). The values relate only to the growing stock that is of adequate quality to harvest. The table indicates an average stem volume increment for conifers in the UK of 11 $m^3\ ha^{-1}\ yr^{-1}$ and an estimated increment of 6.5 $m^3\ ha^{-1}\ yr^{-1}$ for broadleaves.

Table 2. Areas, volumes and annual volume increment of growing stock in the UK for the year 2002

	Conifers			Broadleaves		
	area ('000s ha)	growing stock (m^3 ha^{-1})	annual increment (m^3 ha^{-1} yr^{-1})	area ('000s ha)	growing stock (m^3 ha^{-1})	annual increment (m^3 ha^{-1} yr^{-1})
England	434	115*	9.9	510	173	6.5
Scotland	891	120	11.3	109	156	6.4
Wales	145	145	12.4	61	197	6.6
N. Irleland	51	118	11.8	2	–	–
UK	**1,521**	**121***	**11.0**	**682**	**172**	**6.5**

* The areas and annual increments in the table are from UK Indicators of Sustainable Forestry (FC, 2002). However, there is an error in the original data for growing stock for England. The values shown are based on revised estimates from Global Forest Resources Assessment 2005: UK Report (FC, 2005a).

2. Harvesting and wood processing

The geographical location of the main wood processing sites in Great Britain (*c.* 1997) is given in Fig. 4.

Wood/timber production in the UK for 2003 was estimated to be 11.1 million m^3 overbark standing, 95% of which was softwood (FC, 2004b). This is an increase in 12.3% on the previous year. The increase arises from a non-uniform age class distribution in conifers due to the higher rates of planting between the 1950s and 1980s. Forecasts of potential softwood production for the UK predict further increases in production, up to a maximum annual average of 15.5 million m^3 overbark standing for the period 2017 to 2021. The majority of this is in the form of softwood from non-FC (mainly privately-owned) land (FC, 2004b).

As of 2003, there were 250 sawmills in the UK, 16 of which equal or exceed an annual production of 50,000 m^3 of sawnwood. Total consumption of roundwood by sawmills in 2003 was 4.5 million m^3 underbark and 2.7 million m^3 of sawnwood was produced. An estimated 97% of the timber consumed by sawmills in 2003 was softwood (FC, 2004b).

Several wood-based panel products are produced in the UK:

- Oriented strand board – OSB,
- Medium density fibreboard – MDF,
- Particle boards.

In 2003, wood-based panel producers consumed 4.3 million green tonnes of wood raw materials from four sources. The proportions coming from each of these sources are shown in Fig. 5. Due to market pressures, the use of recycled wood fibre in wood-based panel production has increased from zero in 1998 to almost 1 million green tonnes in 2003, or 23% of total input (FC, 2004b). Further information on the wood-based panel sector can be found at the Wood Panel Industries Federation website: www.wpif.org.uk

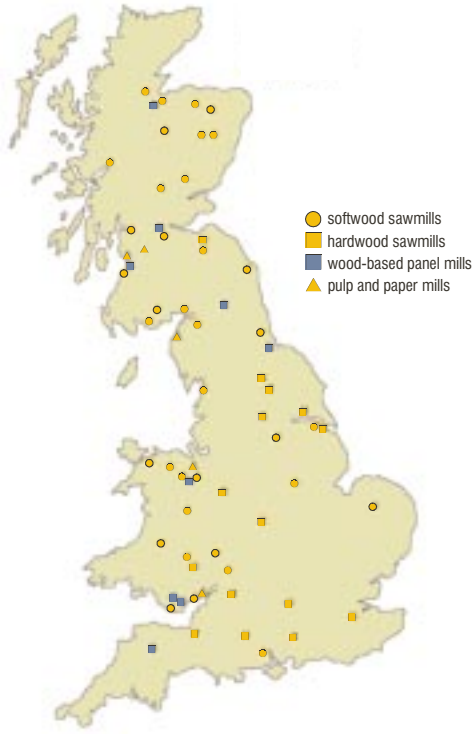

Fig. 4. Geographical location of major wood processors in Great Britain for the year 1997 (FICGB, 1998)

Fig. 5. Inputs to UK wood-based panel mills for the year 2003 (FC, 2004b)

Pulp and paper mills

The following information relates only to mills which use UK-grown roundwood in the production of paper (integrated pulp and paper mills). According to statistics reported in FICGB (1998) and FC (2004b), these mills also use recycled newsprint (200,000 tonnes in 1997) and recycled cardboard (50,000 tonnes in 1997). In 2003, integrated pulp and paper mills in the UK consumed 1.1 million green tonnes of wood material (excluding recycled wood fibre), of which 81% was softwood. Further information on the paper sector in the UK can be found at the Paper Federation of Great Britain website: www.paper.org.uk.

3. Categories of forest protection

The areas of protected forest in the UK and the forms of protection are given in Table 3.

Table 3. Protected forest areas in the United Kingdom (based on FC, 2005a)

Description of protection	Area in hectares (%*)	Interpretation
No active intervention	3,000 (0.1)	Sites of Special Scientific Interest (SSSIs) that either have • a management agreement to manage as a National Nature Reserve (NNR) with non-intervention and scientific monitoring as the main objective, or • a designation as a Special Area of Conservation and agreed management objectives for non-intervention.
Minimum intervention	7,000 (0.2)	NNRs and SSSIs that are subject to management agreements to manage, to retain and restore natural characteristics;
Conservation through active management	135,000 (4.8)	• Near-natural woodlands in National Parks (20,000 ha): estimated as half the area of semi-natural woodland in National Parks; • Habitat/Species Management areas (115,000 ha): estimated as Other Semi-Natural Woodland (OSNW) not on SSSIs, plus Planted Woods on Ancient Woodland Sites (PAWS) where the intention is to restore them towards a more semi-natural condition, plus some planted woodlands where the conservation of native species is the main objective.
Protection of landscapes and specific natural elements	646,000 (23)	• Near-natural semi-natural woodlands which are in SSSIs or protective ownership (400,000 ha): estimated from Ancient Woodland Inventories, National Inventory, grant scheme statistics and monitoring of management plans for state-owned forests, other public bodies and voluntary organisations; • Ancient Semi-Natural Woodland in protected landscapes (54,000 ha): includes PAWS and OSNW in National Parks, Royal Forests and Common Grazings; • Multi-purpose semi-natural woodland (192,000 ha): OSNW outside SSSIs and protected landscapes or protective ownerships.

* Percent of total UK woodland covering 2,817 million ha (FC, 2004b).

No statistics are available for forest areas in the UK with the primary function of protection of soil or water. However, there are notable examples where protection is the primary function on sandy soils, particularly in coastal areas and close to important public water supplies. It is estimated that the area of such forests could be in the region of 5,000 hectares (FC, 2005a).

There are many designations for woodland in the UK which confer some level of protected status. This protection may range from legal, as in the case of Sites of Special Scientific Interest (SSSIs), to certification of woodland under the UK Woodland Assurance Standard (UKWAS), which verifies that woodland has been managed to an internationally agreed level of sustainability (See UK Forestry Standard section).

4. Legal and organisational forms of forest holding

Ownership structure

National reports (FC, 2004b) divide UK national statistics on woodland areas into FC/NIFS-owned woodland (30%) and non-FC/NIFS-owned woodland (70%). A more detailed breakdown of ownership can be provided for GB as shown in Fig. 6.

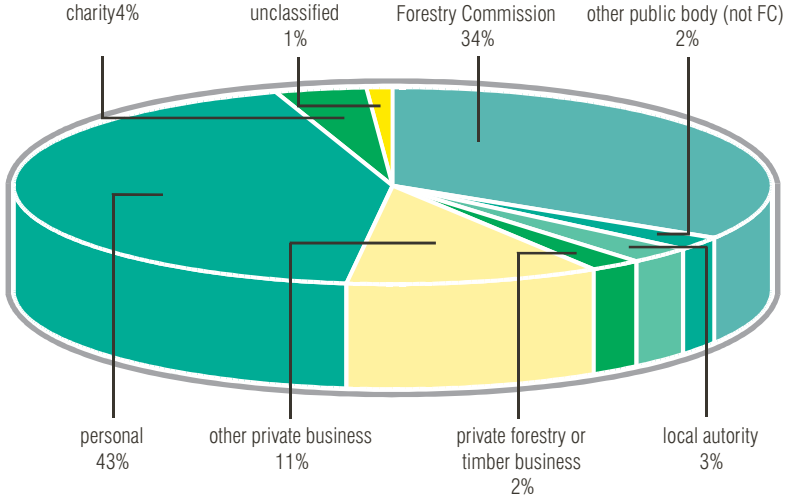

Fig. 6. Percentage area of woodland in Great Britain by ownership type (FC, 2004b)

Accessibility of forests to society

Most publicly owned forests, including those on FC/NIFS-owned land, apply a policy of 'freedom to roam' (FC, 2004a). Certain access rights to other lands are also conferred by statute. For example, the Countryside and Rights of Way Act 2000 extends the public's ability

to enjoy the countryside, whilst also providing safeguards for landowners and occupiers. In addition, it gives greater protection to SSSIs, provides better management arrangements for Areas of Outstanding Natural Beauty and strengthens wildlife enforcement legislation (http://www.defra.gov.uk/wildlifecountryside/cl/bill/factsheet/index.htm).

A range of grants available to non-FC woodland owners through the Forestry Commission in England, Scotland and Wales are outlined below. Supplementary to grants for new planting and management of existing woodlands, grants are also available towards the development of recreation, including path construction to improve access.

The 'Woods for People' project, co-ordinated by the Woodland Trust in the UK, has produced a UK-wide database of woodland accessible to the general public. The database is the result of interviews with organisations, such as local authorities and non-governmental organisations combined with data provided by FC and NIFS (FC, 2005a; see also www.woodland-trust.org.uk/woodsforpeople). Version 1 of the database indicates that 55% (1.5 million ha) of the 2.8 million ha of woodland considered by the survey is accessible to the public.

Forest regulation and governmental help for forestry

The Forestry Act 1967 is the main legal/governmental instrument relating to forestry in the UK. The act outlines the remit of the Forestry Commission, and gives a range of powers to it, including (EA, 2003) the power to:

- manage land placed at their disposal by (government) ministers,
- give assistance or advice to woodland owners,
- collect and publish statistics on forestry,
- promote and develop forestry training and education,
- control tree-felling in Britain and prosecute illegal felling.

UK Forestry Standard and certification of woodland

Sustainable management of forests is recognised as generating multiple social, environmental and economic benefits. Because all the benefits are generated to a greater or lesser extent by the same woodlands, the priorities given to delivery of particular benefits have to be reconciled with each other through long-term planning and positive management to achieve an appropriate balance. The achievement of a reasonable balance is a statutory duty for the FC. It is guided in this by the UK Forestry Standard, which is the Government's approach to sustainable forestry, setting out how the UK will meet its international commitments.

The purpose of the UK Forestry Standard is to set out standards for the sustainable management of forest and woodlands in the UK. It is the centrepiece of a system developed by the FC to guide and monitor forestry. The Standard takes into account the prime aspects of sustainable forest management: soils, water, air, production, biological diversity, workforce, communities, heritage and landscapes. It is used as the basis for the development of forest monitoring and is the foundation from which the UKWAS was developed (FC, 2004a).

The UKWAS is a voluntary certification standard for the independent certification of forest management in the UK. The standard was developed – and is managed by – a broad partnership of forestry-related, environmental and social organisations, in response to increasing demand that products be supplied from certified forests. Woodlands that satisfy the requirements of the UKWAS are being managed to a standard recognised and endorsed by UK and international forestry, environmental and social organisations (FC, 2004a).

UKWAS itself does not offer a product label; the labelling depends on the type of accreditation held by a certifying agency and the existence of an audited chain of custody for wood between the certified forest and point of sale for wood products. Both forest management audits and chain of custody audits have to be carried out by accredited certification agencies. UKWAS was recognised by the Forest Stewardship Council (FSC) in October 1999 and the FSC label is now used increasingly on UK-grown forest products (FC, 2004a). Around 1.2 million hectares of woodland in the UK are UKWAS certificated, including all FC woodlands.

The UK Forestry Standard is supported by a number of instruments. These include: the forestry/woodland grant schemes, Forest Plans, Forest Design Plans, Felling Licence regulations and Environmental Impact Assessment regulations. These instruments, the Standard itself, and its supporting publications are reviewed from time to time in the light of experience, or monitoring and research results.

Grants

Grants provided for non-FC woodland mainly go towards the costs of creating new woodlands (woodland expansion) and managing existing woodland (sustainability). Before devolution of the FC, provision of grants was through the woodland grant scheme (WGS). However, since power and responsibility were devolved to each of the countries, grant systems are being tailored towards fulfilling the particular national forest strategies in England, Scotland and Wales. The updated system for Scotland has already been launched as the Scottish Forestry Grants Scheme (SFGS). The systems in England: the England Woodland Grant Scheme (EWGS), and in Wales: Better Woodlands for Wales (BWW) are to have been launched in 2005.

To qualify for grants, the work proposed for planting, restocking or management must be set out in a 5-year plan for approval by FC/NIFS. Approval is based on the adoption of good (sustainable) practice, as set out in the published guidelines which deal with the aspects of management relating to aspects, such as forests and water, landscape design, soil conservation and archaeology. Implementation of approved plans is monitored and, if there is a serious departure from good practice, then the plan may be suspended. If the situation is not satisfactorily remediated, any grants paid may be reclaimed (FC, 2004a).

Proposals for new planting, deforestation, forest road construction and the opening of quarries (*i.e.* developments that might have a significant environmental impact) require an Environmental Impact Assessment (EIA) to be carried out. The proposer must prepare an Environmental Statement which is made available to the public and environmental authorities. The statement and any comments received in relation to it are then taken into

account when FC/NIFS make their decision (FC, 2004a). Designated areas, such as National Nature Reserves and SSSIs, are protected by law, a fact that would influence the development and evaluation of any proposals made for planting or forest management.

Approximately 55,000 hectares of non-FC land is currently covered either by a grant for new woodland or management of the existing woodland. More than £ 31 million were paid under the FC-administered grant schemes to March 2004 (FC, 2004b).

Licences

With certain exceptions, it is illegal to fell trees in Great Britain without prior approval from the FC. The policy of the FC and NIFS is that areas felled should be replanted or naturally regenerated except where felling is allowed for environmental improvement or for development approved under planning regulations. Some flexibility is exercised to support the government's wider aims of sustainable land use, in line with the UK Forestry Standard.

Felling is permitted in private woodland through the granting of a felling licence or as part of approval of a long-term forest plan. The FC also approves tree-felling proposals on its own land by approval of Forest Design Plans submitted by those of its own agencies that are responsible for the management of FC land in England, Scotland and Wales.

Tree felling for approved development does not need FC approval and is controlled by local planning authorities. The planning authorities can also place tree preservation orders (TPOs) on trees or woodlands. In England and Wales, the FC decides whether trees or woodlands with a TPO can be felled. In Scotland, due to legal differences, applications for felling of trees or woodlands with a TPO are decided by the relevant local authority (FC, 2004a).

Forms of public holdings and public forests

The FC and NIFS manage the bulk of publicly-owned woodland. In the main, these are recently established forests in general planted in the 20th century in areas of low agricultural value, particularly in the uplands and involving mainly conifer species. A small number of woodlands are owned and managed by other public agencies (for example the Ministry of Defence), as well as local authorities (FC, 2004a).

Forestry Commission structure

The Forestry Commission is the Government Department responsible for forestry policy throughout Great Britain. It has a Board of Commissioners with duties and powers prescribed by statute, consisting of a Chairman and up to ten other Forestry Commissioners, including a Director-General, who are appointed by the Queen on the recommendation of Ministers.

While the role of the Forestry Commissioners remains significant, forestry is now a devolved matter. The Secretary of State for the Environment, Food and Rural Affairs has responsibility for forestry in England, as well as certain activities, such as international affairs and plant health, which remain reserved by the UK government based in Westminster. Scottish Ministers have responsibility for forestry in Scotland and the Welsh Assembly for forestry in Wales.

To reflect these arrangements, separate Forestry Commission structures in England, Scotland and Wales report directly to their appropriate Minister, providing advice on policy and implementing that policy within the relevant country. A Country Director, who is also a member of the GB Board of Commissioners, leads the work of the Forestry Commission in each country.

The Commission also has an Executive Board which assists the Director General and Country Directors in the effective management of the Commission, by providing leadership and setting direction for the Commission as an organisation.

This new, devolved FC structure, shown in Fig. 7, which came into effect on 1 April 2003, allows the Forestry Commission to focus more clearly on delivering the policies of the individual national governments, while still having the ability to take a GB-wide approach to 'cross-border' issues.

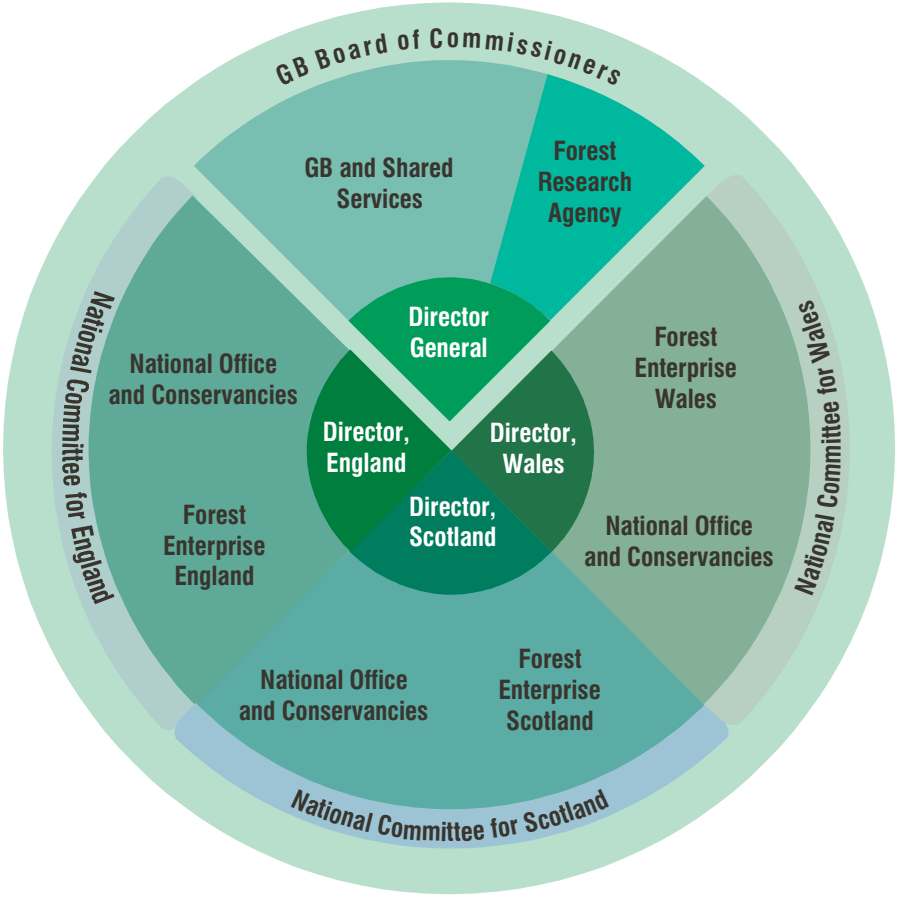

Fig. 7. Structure of the Forestry Commission showing the relationship between central and devolved departments and agencies (FC, 2005b)

The Commissioners receive external, independent advice on a range of key issues of interest to the forestry industry from the Forestry Commissioners Advisory Panel which operates on a GB level.

The mission of the Forestry Commission is to protect and expand Britain's forests and woodlands and increase their value to society and the environment.

The objective of the Forestry Commission GB is to take the lead, on behalf of all three administrations, in the development and promotion of sustainable forest management, and to support its achievement nationally.

Each of the countries has its own strategy and mission, and delivers the forestry policy of each through specific objectives drawn from the country strategies. Delivery of the policy and progress against the strategy and objectives are overseen and monitored in each country by the Commission's National Committees for England, Scotland and Wales.

The Forestry Commission also has four executive agencies which work to the targets set by Commissioners and Ministers.

Three of these agencies are charged with the management of public forests, woodlands and other land (one each in England, Scotland and Wales), on behalf of the Forestry Commission in that country. Together, the three agencies manage a total of more than 1,000,000 hectares of land. The fourth agency, Forest Research, is a GB-wide agency which aims to deliver high-quality scientific research and surveys to serve the development of forestry policies and practices, and promote high standards of sustainable forest management (see www.forestry.gov.uk).

Private forest ownership associations

Around two-thirds of the UK's total woodland resource is privately owned – by individuals, family trusts, charitable trusts or commercial companies. Typically, woodlands owned by private and family interests are a part of mixed estates, or are on farms. There are many thousands of small farm woodlands, but very few ownerships with more than 1,000 hectares of woodland (FC, 2004a).

There are several organisations in the UK whose aims are to promote the interests of forest owners, notably the Forestry and Timber association (www.forestryandtimber.org) and the Royal Forestry Society (www.rfs.org.uk). However, these organisations are not made up entirely of forest owners.

5. Education in forestry

The 'Acland' Committee (Ministry of Reconstruction, 1918) established the national forest policy and remit for the FC in 1919. By 1920, the Forestry Commissioners had developed a policy to underpin forest education. Relationships were established with the universities then awarding forestry degrees (three of these five universities still offer Forestry courses). Forester training schools were established in England (two), Scotland (one) and Ireland (one) to train the people who would manage the massive afforestation necessary to

achieve the establishment of the strategic supply of timber determined by the 'Acland' Committee (FC, 1994).

After the Second World War, the university forestry departments overflowed because of the large numbers of men returning from the armed forces. The need for additional Forester Training Schools was also recognised with three new schools being established by 1948. A Forest Worker's Training Scheme began in 1946. This led to increases in both, forester and forest worker numbers to continue the afforestation programme for the UK (FC, 2004).

By 1965, the Forestry Commissioners came to the view that due to changes in education trends, and in the interests of the public and private sector, responsibilities for forester training should be handed over to the public education system. In 1969, the Cumberland and Westmorland College of Agriculture and Forestry, at Newton Rigg in northern England, was selected to provide forestry education at supervisor level. As a result, by 1971, the three remaining Forester Training Schools had closed (FC, 1994).

At present, forestry is not taught formally at secondary level in the UK. Technical education in forestry is offered at approximately 30 colleges, while 10 institutions offer 36 higher education courses in the forestry sector (FC, 2004c).

Technical forestry skills are taught at colleges of further and higher education, or through 'on the job' vocational training, which may include attendance at college or training centres to study theory. The modern apprenticeships scheme follows this pattern, with the balance between practice and theory being determined for an individual and drawn up into a Training Agreement between the employer, local education authority and the individual. Lantra (the skills council for the environmental and land-based sector) provides support to forestry businesses requiring technical training.

Training, independent assessment and Certification are required for certain forest operations and workers. For example, chainsaw operators are expected to obtain a National Proficiency Test Council certificate of competence, and forest machine operators (Forest Machine Operators Certification Scheme) may require certificates before contracts for work can be agreed. These are contractual requirements as part of the work carried out on the land owned by the FC.

There has been a decline in the number of students studying forestry at degree level in the UK over the past 7 years – from 560 full time undergraduates in 1996 to 325 in 2003, a 42% reduction (FC, 2004c).

6. Forest research

Number of employees

Forest Research (the research agency of the Forestry Commission) employs *c*. 300 people (FR, 2005). At present these employees comprise scientists (35%), foresters in research divisions (5%), administrative and support staff (26%) and field workers, including foresters (34%).

Sources of research funding

In 2003–2004, Forest Research income amounted to £12.8 million. The sources of this income are shown in Fig. 8.

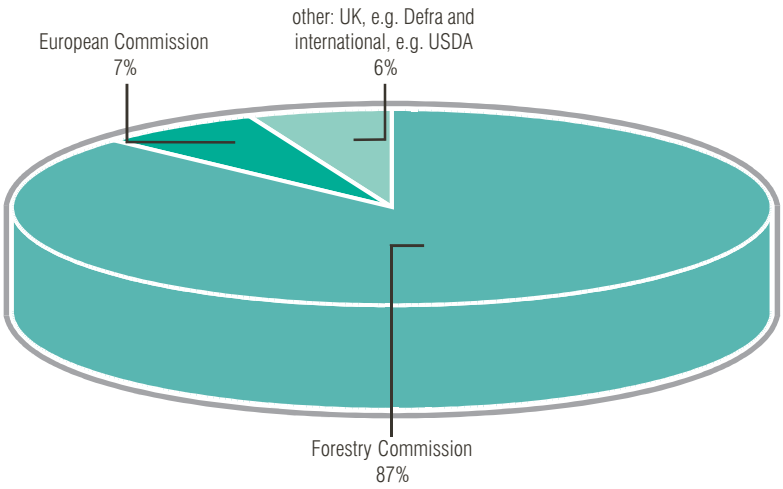

Fig. 8. Income received by Forest Research by source for the year 2003–2004 (FR, 2005)

Research directions: present and future

As outlined previously, the function of the Forestry Commission has been devolved to England, Scotland and Wales. In response to this, a new Forestry Commission Research Strategy for Great Britain is currently being drawn up to reflect the different priorities and directions each country has for its research. Balanced with these needs are the overall requirements of the UK for research into forestry issues that affect all of the countries, along with international research commitments. The strategy aims to provide the direction for much of the work carried out by Forest Research in the coming years.

Forest Research is organised into five science discipline-based divisions and four technical and administrative support groups. However, specific research areas being pursued by the agency are organised into 'themes' with the aim of focusing research efforts onto key priorities and encouraging work and co-operation between scientific disciplines. There are eight themes:

- **Evaluating woodland resources.** Determining the potential of Britain's resources. Including mensuration and modelling (of trees and forests), remote sensing and timber quality evaluation.
- **Land reclamation and urban greening.** Establishing woodlands on brownfield sites and contaminated land. Researching the technical assessment of site suitability and techniques to develop safe, multifunctional urban greenspaces.

- **People, trees and woods**. Developing an understanding of the ways trees benefit society. Ensuring both urban and rural needs are understood, that the social dimension is seen as integral to sustainability and developing an interest in tools for measuring the economics of sustainability.
- **Protecting trees**. Preventing and controlling damage to woodlands. The problems posed by exotic pests and diseases are accelerating. Move towards reducing the use of chemicals for control – research into alternatives. Developing a better understanding of population modelling of damaging organisms.
- **Sustainable woodland management**. Improving silvicultural and operational methods for sustainable management. Research into restoration of ancient woodland. Contributing to the creation of thriving rural economies. Developing targets for delivery of public benefits from woodlands.
- **Tree improvement and forest genetics.** Exploring genetic variation and breeding better trees. Increasing the 'quality' of commercial tree species through breeding. Research into the genetics of native populations using DNA markers. Developing the use of biotechnology for tree improvement.
- **Woodland biodiversity.** Conserving all forest ecosystems. Researching UK priority habitats and species. Focusing on landscape-wide ecosystem evaluation.
- **Woodlands and the environment.** Understanding the impact of the environment on trees. Investigating the influence of climate change. Reconciling forestry with wider land-use planning and land management.

Forest Research has identified three critical research areas it considers to be important future directions for the strategic development of the institute:

- **Innovative research**. Examples include: transport fuels from biomass and the development of hydrogen fuel cells; charcoal for cleaning contaminated land; developing the role of forests in improving cardiovascular health.
- **Integrated land management tools**. Creating a centralised database for land reclamation sites; developing a Biological and Environmental Evaluation Tool for Landscape Ecology (BEETLE); bringing definition to, and developing standards for, the measurement of sustainability.
- **More anticipation, less fire-fighting.** Acting on confident early disease diagnoses; exploiting Forest Research's modelling capability; improving the organisation's ability to 'horizon scan'.

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Useful sources of information:

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II. Forestry in EU agricultural and environmental policy

The EU Forestry Strategy and Rural Development

Mariuz Lazdinis

The EU Forestry Strategy

On 15 December 1998, the European Council adopted a Resolution on a Forestry Strategy for the European Union[1]. This was the outcome of a process initiated in 1996 with a call from the European Parliament[2] requesting that the Commission put forward a legislative proposal on a European Forestry Strategy, in response to which the Commission presented a corresponding Communication to the Council and the European Parliament[3]. The growing concern about the coherence between the forest policies of the Member States and the forest-related activities at EU level, as well as the rising profile of forests in international policy debates and initiatives in the area of sustainable development, were the main driving forces behind the adoption of the EU Forestry Strategy.

The Strategy provides a framework for forest-related actions in the EU, with consideration being given to the existing Community legislation concerning the forest sector as well as the commitments made by the European Union and its Member States in all relevant international processes, in particular the UN Conference on the Environment and Development of 1992 and its follow-up, as well as the Ministerial Conferences on the Protection of Forests in Europe (MCPFE). The Strategy emphasises the importance of the multifunctional role of forests and sustainable forest management and identifies a series of key elements upon which its implementation is to be based. These include:

- A recognition that forest policy is mainly the competence of a Member State, while the EU can contribute to the implementation of sustainable forest management through common policies, on the basis of the principle of subsidiarity and the concept of shared responsibility;
- Implementation of international commitments, principles and recommendations through the national or sub-national forest programmes developed by the Member States, as well as active participation in all forest-related international processes;
- The need to improve co-ordination, communication and co-operation in all policy areas of relevance to the forest sector, both within the Commission and with the Member States, as well as among the Member States.

The EU Forestry Strategy also indicates a number of focus areas at Community level, rural development being the most important one.

Mariuz Lazdinis – European Commission, DG Agriculture and rural development, Unit F1 – Environment and Forestry. Disclaimer: This article represents solely the views of its author and can not in any circumstances be regarded as the official position of the Commission.

[1] OJ C56, 26.2.1999.
[2] A4-0414/96, OJ C55, 24.2.1997, p. 22.
[3] COM (1998) 649 final, 18.11.1998, "Communication from the Commission to the Council and the European Parliament on a Forestry Strategy for the EU".

The Strategy and rural development

With over half the population of the 25 Member States of the European Union (EU) living in rural areas (which covers 90% of its territory), rural development is a vitally important sphere of policy. Farming and forestry remain crucial for land use and the management of natural resources in rural areas, and provide a platform for economic diversification in rural communities.

The EU Forestry Strategy emphasises the contribution made by forests to the promotion of employment, the well-being of the rural population and the quality of our environment. It stresses the role of forestry in the context of rural development, in particular the added value that the Community's actions can provide through forestry measures within the framework of the rural development policy. The Strategy also recognises that the existing forestry measures in rural development and the chapter dedicated to forestry in Agenda 2000 (the action programme adopted by the Berlin European Council in 1999 on the reform of the CAP) could provide a basis upon which guidelines outlined in the Strategy might be implemented.

The EU rural development policy under Agenda 2000 seeks to establish a coherent and sustainable framework for the future of rural areas on the basis of the following main principles:

- The multifunctionality of agriculture and forestry, i.e. its varied role over and above the production of foodstuffs and raw materials. This implies the recognition and encouragement of the range of services provided to society by farmers and foresters;
- A multisectoral and integrated approach to rural economy in order to diversify activities, create new sources of income and employment, and protect rural heritage;
- An important degree of subsidiarity allowing Member States to draw up their own rural development programmes.

The Rural Development Regulation

The core instrument underpinning the achievement of rural development objectives is Council Regulation No 1257/1999[4] – the Rural Development Regulation. The overall principles of the EU Forestry Strategy, e.g. multifunctionality and sustainability, are reflected in the rural development policy, which brings together economic, social and environmental objectives and transforms them into a coherent package of measures, thus giving added value to the implementation of the national and regional forest programmes of the Member States. The forestry measures of the rural development programmes are, at the same time, seeking to contribute to global agreements, such as those on climate change mitigation and biodiversity. It must be noted that all rural development measures are voluntary in nature, proposed by the Member States, adopted by the Commission and then implemented by the Member States.

* [4] Council Regulation (EC) No 1257/1999 of 17 May 1999 (OJ L 160, 26.06.1999).

This Regulation thus emerges as an important vehicle for the implementing of the EU Forestry Strategy. In broad terms, the integration of forestry aspects into the rural development policy follows three pathways, in particular for privately- and municipality-owned forests:

- Investments to improve the multifunctional role of forests (Article 30),
- Afforestation of agricultural land (Article 31) and
- Improvement of environmental forest functions (Article 32).

The integrated rural development approach puts great emphasis on linkages with other policy areas and land uses, as well as on the consideration of specific socio-economic and ecological factors, in line with the following basic principles:

- Interdependence of different sectoral and horizontal policy areas – the need to accommodate different interests and to achieve economic, social and environmental objectives in a coherent way;
- Regional diversity – an acknowledgement of locally distinctive characteristics and priorities, problems and opportunities;
- A bottom-up approach – whereby the active involvement and participation of local communities is emphasised, along with self-help rather than reliance on external action.

The implementation of the Regulation is discussed below, the focus being on the application of forestry measures in the EU-15 Member States.

Implementation of rural development programmes in the EU-15 Member States for the period 2000–2006

A total of EUR 4.8 billion has been allocated to forestry measures proposed by the EU-15 Member States under the EAGGF (European Agricultural Guidance and Guarantee Fund) budget for the period 2000–2006. This amount represents almost 10% of the total budget allocated for rural development over that period. Table 1 provides the breakdown of financial commitments between EU-15 countries. Portugal (19.3%), Spain (17.5%), Ireland (14.9%), UK (14.6%), Denmark (12.4%) and Italy (12%) are the countries with the highest proportion of the budget allocated to forestry measures within their rural development programmes.

Table 1. Financial forecast regarding the rural development programmes and forestry measures therein, for the period 2000–2006: EU contribution under the EAGGF

Country	EAGGF budget for rural development (EUR)	EAGGF budget for forestry measures (EUR)			% of total RD budget
		afforestation	other forestry measures	total	
1	2	3	4	5	6
Austria	3,249,445,471	8,080,000	78,619,783	86,699,783	2.6%
Belgium	401,767,048	6,153,000	18,068,182	24,221,182	6.0%
Denmark	336,420,000	35,330,000	6,600,000	41,930,000	12.4%

Table 1. continued from page 469

1	2	3	4	5	6
Finland	2,393,294,000	23,330,000	40,731,000	64,061,000	2.6%
France	5,762,531,788	37,605,789	238,268,240	275,874,029	4.7%
Germany	8,661,786,733	110,012,000	299,378,594	409,390,594	4.7%
Greece	3,253,700,000	57,800,000	129,966,503	187,766,503	5.7%
Ireland	2,558,291,000	350,800,000	31,500,000	382,300,000	14.9%
Italy	7,493,685,000	560,123,000	341,189,000	901,312,000	12.0%
Luxembourg	91,000,000	14,000	1,101,250	1,115,250	1.2%
The Netherlands	427,000,000	12,210,000	5,450,000	17,660,000	4.1%
Portugal	3,552,483,178	345,864,791	341,115,503	686,980,294	19.3%
Spain	8,515,946,848	663,539,423	832,792,843	1,496,332,266	17.5%
Sweden	1,232,268,999		3,620,999	3,620,999	0.3%
United Kingdom	1,555,509,000	175,910,000	51,452,000	227,362,000	14.6%
Total	**49,485,129,064**	**2,386,772,003**	**2,419,853,896**	**4,806,625,899**	**9.7%**

Overview of individual forestry measures

This section provides information on individual forestry measures based on the responses to a questionnaire that was sent out by the European Commission to the EU-15 Member States in 2003, in the context of reporting on the implementation of the EU Forestry Strategy.

Article 30 – Investments to improve the multifunctional role of forests

Article 30 of the Rural Development Regulation encompasses a number of measures aimed at enhancing the multifunctional role of forests and their sustainable management. This article includes six main types of measure:

- Afforestation of non-agricultural land;
- Investments in forests aimed at improving their economic, ecological or social value;
- Investments to improve and rationalise the harvesting, processing and marketing of forestry products (investment as regards the use of wood as a raw material is limited to working operations prior to industrial processing);
- Promotion of new outlets for the use and marketing of forest products;
- The establishment of associations of forest holders with a view to their members being helped to improve the sustainability and efficiency with which their forests are managed;
- Restoring the forestry production potential damaged by natural disasters and fire, and introducing appropriate prevention instruments.

Where the afforestation of non-agricultural land is concerned, only Austria, Belgium, France, Greece, Portugal and the UK reported using this measure, though the level of implementation is rather moderate in those countries also. Austria indicated that about 1,500 hectares per year were afforested during the period 2000–2003; Belgium reported the afforestation of some 80 hectares in the first half of 2004; in France around 600 hectares were afforested annually; and the UK reported that about 900 hectares per year were planted during the period 2000–2002.

The bulk of the actions in the Member States fall under the "other measures" included in Article 30. Silvicultural measures to enhance the overall quality of forest stands, forest protection measures, such as liming, investments to improve the ecological value of forests, investments to improve forestry operations, the setting-up of associations of forest holders, protection against fire, and the restoring of the forestry production potential damaged by natural disasters and fire, are all examples of the actions implemented in different countries.

Article 31 – Afforestation of agricultural land

This measure follows up on the scheme established in 1992 by Council Regulation (EEC) N° 2080/1992 as a measure accompanying the CAP reform. This Regulation introduced a system of EU aid for forestry measures in the context of the CAP, of which the 4 main objectives were:

- to accompany the changes to be introduced under market organisation rules;
- to contribute to an eventual improvement in forest resources;
- to contribute to the forms of countryside management more compatible with environmental balance;
- to combat the greenhouse effect and absorb carbon dioxide.

In the context of Regulation N° 2080/92, about one million hectares of agricultural land were afforested in the EU Member States during the period 1994–1999. In terms of forest composition, broadleaved species accounted for 56.8% of the planted area (particularly cork oak and evergreen oak stands). Conifers accounted for 32.1% of the area, while about 4% was planted with fast-growing tree species.

In 2001, the Commission presented an evaluation report[5] of this Regulation which analyses the economic, social and environmental impacts of measures being implemented across the EU. Where economic and social aspects are concerned, the report indicates benefits accruing to all countries from the favourable effects of activity to diversify agriculture and promote afforestation. It is estimated that 150,000 full-time equivalent jobs were created temporarily owing to afforestation operations. The frequent planting of mixed stands in certain countries and the use of autochthonous tree species, in particular in Germany, Finland and Austria, has contributed to a greater diversity of forest composition, whereas in Spain and Portugal, it has allowed for specific interventions connected with fire protection, as well as improvements in cork oak stands.

* 5 "Evaluation of the Community aid scheme for forestry measures in agriculture of Regulation N° 2080/92", AGRI/2001/33002-00-00-EN.

Under the current Rural Development Regulation, this measure is being implemented in 13 of the EU-15 Member States (all except Finland and Sweden). The information provided by the 15 shows that countries are placing ever greater emphasis on the use of native broadleaved tree species. For instance, Denmark indicates that afforestation with indigenous broadleaved tree species represents 94% of the total area planted. In Germany, 96% of planted forests are mixed broadleaved stands; France indicates a rate of 70% for broadleaved tree species, and the UK has about 77% broadleaved species in the new plantations. Where afforestation strategies are concerned, seven countries indicate that these have been established at national level, while the others have strategies at regional level.

Article 32 – Improvement of forest protection values

The measures under Article 32 are aimed at maintaining and improving the ecological stability of forests where the protective and ecological role of forests are of public interest, and where the costs of maintenance and improvement measures for forests exceed the income from classical forestry operations. Support is granted, provided that the valuable protective and ecological features of these forests are ensured in a sustainable manner, the measures to be carried out being laid down by contract, and their costs specified.

Table 2. Article 32, EAGGF-Guarantee (87 rural development programmes) – 2001

Country	N° of applications approved	Area supported, '000s ha	Total eligible cost, EUR '000s	Total public expenditure, EUR '000s	Of which EAGGF, EUR '000s	Total costs borne by beneficiaries, EUR '000s	Average area supported per application, ha
Austria	92	333	142	133	67	142	3,633
Belgium	0	0	0	0	0	0	–
Denmark	0	0	0	0	0	0	–
Finland	0	0	0	0	0	0	–
France	0	0	0	0	0	0	–
Germany	4,821	156	7,313	5,812	2,906	1,502	32
Greece	NP	NP	NP	NP	NP	NP	–
Ireland	NP	NP	NP	NP	NP	NP	–
Italy	21	4	570	570	238	0	213
Luxembourg	0	0	0	0	0	0	–
Netherlands	NI	NI	NI	NI	NI	NI	–
Portugal	NP	NP	NP	NP	NP	NP	–
Spain	41	8	245	245	98	0	190
Sweden	NI	NI	NI	NI	NI	NI	–
UK	0	0	0	0	0	0	–
Total	**4,975**	**501**	**8,270**	**6,760**	**3,309**	**1,644**	**101**

NI – not implemented in 2001; NP – no programme under EAGGF-Guarantee.
Source: European Commission.

The responses to the questionnaire indicate that this measure is being applied in a limited number of countries. Austria, Belgium, Germany, Ireland, Italy, The Netherlands and Spain reported using this measure. In Austria, it has mainly been applied to the conservation of special forest types, while in some German Länder, it is largely used in protective forests (in avalanche control), or for contract-based, ecological, forest management in ecologically-sensitive regions (e.g. NATURA 2000 areas). Ireland has indicated that the new Native Woodland Scheme provides financial support for the landowners working to protect and enhance native woodlands. Belgium (Flemish Region) indicated that the measure has been applied since 2004, a grant for the development of a forest management plan being provided in line with the criteria of sustainable forestry.

Member States reported that the generally low level of implementation of Article 32 measures is related to the lack of tradition in the establishing of contracts between forest owners and administrations, the heavy administrative procedures and some lack of clarity concerning eligibility, as well as the limited financial resources within the RD budget. As an indication, Table 2 provides the data for the year 2001 concerning the implementation of this measure under the rural development programmes of the Member States.

Article 9 – Training of forest holders

The education and training of farmers and forest holders are crucial if sustainable land management is to be developed and applied. Responding to this need, the Rural Development Regulation provides support for vocational training aimed at improving the occupational skills and competences of forest holders and other persons involved in forestry activities, notably in regard to the application of forest management plans to enhance the economic, ecological or social functions of forests. This measure is horizontal in nature, coexisting with and complementing the objectives of other RD measures.

Austria, Denmark, Finland, France, Ireland, Portugal and Sweden have pointed to the implementation of several activities in the context of this measure, though the actions are in some cases taken within schemes covering both agriculture and forestry, making it difficult to provide quantitative data on the application of the measure.

Recent policy developments and the rural development policy post-2006

As the CAP's second pillar, the rural development policy follows the overall orientations for a sustainable agriculture in line with the conclusions of the European Councils held at Lisbon (March 2000) and Gothenburg (June 2001). At the former, EU leaders stated their objective of making the EU "the most competitive and knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion" by 2010. The Gothenburg conclusions added to the Lisbon objectives an emphasis on protecting the environment and achieving a more sustainable pattern of development. The reform of the CAP in 2003 gave a further impulse to this objective through

the introduction of a series of new measures to the Rural Development Regulation. With regard to forestry, the 2003 CAP reform introduced the possibility of support being extended to state-owned forests for the investments aimed at enhancing the ecologically and socially valuable features[6].

In July 2004, the Commission adopted a proposal to rework the EU rural development policy for the period 2007–2013, and to greatly simplify its implementation[7]. Reflecting citizens' demands, the Commission wants the EU rural development policy to play a more important role in a new, reformed CAP. The proposal will increase EU rural development funding to EUR 13.7 billion per year for 2007–2013. By introducing a single funding and programming instrument, the new policy will be much simpler to manage and control. Coherence, transparency and visibility will be increased. The Member States and regions will have more freedom as to how to draw up and implement their rural development programmes.

To achieve a more strategic approach to rural development, a first step in the programming phase will be the preparation by the Commission of a strategy document setting out the EU priorities around the three major objectives for RD policy, detailed in the Communication on the Financial Perspectives for the period 2007–2013, namely:

- Improving the competitiveness of the agricultural and forestry sectors;
- Enhancing the environmental quality in the countryside through support for land management;
- Enhancing the quality of life in rural areas and promoting diversification of economic activities through measures targeting the farm sector and other rural actors.

An EU rural development strategy was adopted by the Council in 2005, to form the basis for the national rural development strategies of the Member States. The latter strategies will translate the EU priorities to the national level following stakeholder consultation, set core result indicators and demonstrate the complementarity of rural development programming with other EU policies, in particular the cohesion policy and standing environmental objectives.

Concluding remarks

The consolidation of all forestry measures within Rural Development Regulation 1257/99 has contributed to the integration of forestry into sustainable rural development. The new rural development proposal for the period 2007–2013 continues this trend and acknowledges the important role that forestry plays in rural development. It includes a number of measures across the three priority axes, aiming at enhancing protection and sustainable forest management and promoting the multifunctional role of forests in the EU, as well as a better integration of forestry within rural development programmes. It is expected that the Rural Development Regulation will continue as the main instrument for implementing the EU Forestry Strategy. With this in mind, the EU Member States should make all efforts to utilise this instrument to its full extent.

* [6] Council Regulation (EC) No 1783/2003 of 29.9.2003, OJ L 270, 21.10.2003.

[7] Commission proposal for a Council Regulation on support for rural development by the European Agricultural Fund for Rural Development (EAFRD); COM (2004) 409 final.

Forestry and the environment, marriage of convenience or true romance?

Joost Van de Velde

Background

Forest use and forest functions, past and present

Europeans have traditionally attached multiple values to forests. For centuries, they have managed woodland, mainly for the provisioning of material and fuel to industries and households, while simultaneously maintaining forest cover to protect arable soils from erosion and to ensure stable freshwater supplies. More recently, forests have had attributed to them important roles as public amenities, reservoirs of biodiversity and regulators of global climate and local weather.

Forest cover in Europe has been very variable down the years, with an all time low being reached at the end of the 18th century and a continuous expansion over the last 150 years. The forest utilisation rate, expressed as the ratio of reported timber output to measured volume increment, has been declining steadily in Europe over the past 50 years, resulting in what is now an exceptionally large volume of standing timber. At the same time, recent decades has seen the EU forest sector facing a decline in profitability, while imports of timber and forest products have continued to grow.

The many faces of European forests

While forest habitats dominate the potential natural vegetation of Europe, forests in fact cover 1/3 of EU territory, or roughly the same amount of land as is utilised in agriculture.

In terms of their extensiveness, structure and composition, Europe's forests have varied markedly over both time and space.

- Primary differentiation in terms of climatic and soil-related factors occurred in the course of the last postglacial recovery by forest-building species, starting approximately 10,000 years ago. This means that northern Europe's forests are of more recent origin and have fewer plant species, because their establishment followed the regression of the icecap during the Holocene period. Southern Europe's forests are much older, with some formations already existing for over 15,000 years. As southern forests have been less influenced by the glaciations, they host a higher number of species and greater species diversity. In addition, the W-E climatic gradient from the oceanic to the continental influence also implies a decrease in the richness of species and habitats towards the Atlantic.
- Different degrees of human influence have modified forest cover and structure since Neolithic times. The history of the impacts exerted on forests by human settlement is reflected in a N-S gradient, with the oldest colonisation taking place in the South-East

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about 8,000 years ago and reaching Fennoscandia as recently as 500 BC. Human influence first resulted in fragmentation of forest cover in the plains, and has expanded gradually to conquer space for agriculture, to open up pastures and to meet energy needs. The older the colonisation process, the more its consequences are visible in the present-day landscape. As a result, the high level of forest cover in Fennoscandia and today's large forest complexes in Central Europe contrast with the treeless landscapes of the South-West.

Naturalness or biodiversity or continuity of forest management?

Biological diversity and the naturalness of European forests have been influenced to varying degrees by human activities for a very long time now. If all possible degrees of primary and human-induced differentiation of forest composition and structure were put together in a matrix-like grid of crossing influences, this would result in an infinite number of possible situations. Forests on fertile soils underwent the most intense change, being more interesting from the point of view of human settlement, while natural forests are now almost exclusively limited to locations of marginal agricultural value. This means that very little untouched forest is left. Equally, totally artificial forest is not really abundant. Europe's forests now consist largely of naturally regenerated stands and plantations of indigenous species on abandoned agricultural land. In many natural forests, the authentic herbaceous layer was nearly completely degraded by grazing and the export of litter, while others have been 'enriched' with exotic species regenerating spontaneously.

This great diversity in terms of forest composition and structure may lead to confusion between naturalness, meaning an absence of human influence, and biodiversity, meaning species and structural richness. Interchangeable use of these concepts has sometimes led to theoretical visions of what could or should be the characteristics of 'virgin', 'ancient' or 'primeval' forests. In practice, however, it is not possible to determine with any reasonable degree of confidence what the original forest cover at any given spot in Europe may have looked like. As this is the case for other formations, the continuation of human intervention may even be essential to assure forest habitat conservation.

State of the world's forests

About 45% of the Earth's original forest cover has now disappeared, cleared mostly during the 20th century. With forests currently covering around 30% of the world's land area, loss of natural forests has continued at a rate of c. 13 M ha per year (1990–2000), with no signs of change in this trend. This forest decline results from non-sustainable logging and conversion to other land uses, mainly in tropical regions, but also in the boreal zone. In the EU, there is a small net extension of the forest area, resulting from plantations and natural regrowth on the land being abandoned by both cultivation and grazing.

Notwithstanding the process of global deforestation, the world's forests remain an important rural resource, providing livelihoods for local communities and forest-based enterprises. Alas, the greater part of forest use is not globally sustainable, in the sense that it tends to deplete the resources on which it depends, rather than renewing them. While

natural forests in the Tropics are converted to other land uses, or are at best replaced by monofunctional forestry[1] operations for timber or fibre production, the industrialised countries show a general trend towards a lowering in the rate of utilisation of their domestic forest resources. This appears to fit with the current trend towards a shift in primary production and raw-material provision to emerging economies whose social and environmental framework conditions are less demanding. The process can thus be called into question from an environmental point of view.

In the global picture, EU forestry is exceptional in its maintaining of one of the largest single reservoirs of biodiversity and carbon, while playing an important social role and functioning as a source of raw materials for economic activities. However, the continued reconciling of the objectives that natural heritage be protected, while other ecological forest functions are assured and economic use is made of wood as a climate-neutral energy and raw material provider is tending to become a real challenge in a globally-interconnected economic environment driven by specialisation and open markets.

Is our forest policy keeping a grip on events?

All EU Member States and the Community have participated in the UN dialog on forests and in the MCPFE process that started 15 years ago. These processes, whose prime objective has been to strive for the multifunctional and sustainable management of all forests have involved EU Member States in the developing of proposals for action, work programmes, definitions, criteria and indicators, and policy resolutions. But at no time since the structured international dialog on forests started have its participants gone as far as to adopt a single system to implement their commitments. Indeed, the Forestry Strategy for the EU of 1998 advanced the National Forest Programme as one of its substantial elements, while formulating neither binding targets, nor an agenda for implementation, nor reporting obligations. MSs have justified this absence of common Forest Policy objectives in terms of the application of the principle of subsidiarity because the EU Treaties make no reference to forests or forestry, and because wood is not listed among products covered by the common market organisation.

At the same time, the 'Rio momentum' of the 1990s generated environmentally-based agreements and processes, at global, pan-European and EU levels[2]. These processes have gradually filled the voids left open by forest policymakers, extending their supranational objectives to address forests and forestry. This has ultimately resulted in the formula-

* [1] Throughout this article, a distinction is being made between 'forests' and 'forestry'. The term 'forests' covers all aspects related to the physical composition, ecological processes and functions of vegetation types dominated by trees, classified as such according to the criteria defined by FAO. The terms 'forestry' and 'the forest sector' are used in a much more narrow sense, only relating to activities concerning the economic use of forests to serve productive functions.

[2] UN Framework Convention on Climate Change (+ Kyoto Protocol)/Convention on Biological Diversity/ Convention to Combat Desertification/Pan-European Biological and Landscape Diversity Strategy/EU Energy Directives/EU Water Framework Directive.

tion of (national) forest policy being guided to an ever greater extent by supranational environmental objectives. As a result, forest managers are now seen increasingly as providers of a series of ecosystem services, rather than as responding to the classical objectives of forestry like timber production. Nevertheless, forest owners, both public and private, continue to rely almost exclusively on wood sales for revenue from their property, even though increased environmental and social constraints on both levels of production and forestry practices affect the profitability of their holdings. Conversely, the obligation to stay profitable may limit the ability of forest owners to bear the costs of providing the social and ecological services forests have to offer. Worse still, today's globalised economy sees the prices of forest products set largely by those producers who operate under less--stringent environmental and social framework conditions than are in place in the EU.

It therefore comes as no surprise that EU Member States use their national forest policies to operate support systems[3] for the forest sector, these capable of being seen as compensation for those environmental and social services of a non-economic nature provided by forests. Currently, it is hard to obtain a clear view of the existing level of public support assigned to forestry in the EU, primarily because many national intervention mechanisms exist, but also because dedicated, centralised records analogous to the bookkeeping on Community agricultural spending do not exist. Nevertheless, it can be safely assumed that, combining all grants, incentives, subsidies and other preferential conditions over a complete rotation, inputs of several 100 €/ha/yr are not uncommon in Western Europe.

Environmental objectives and forestry, antagonism or synergy?

At the Rio conference in 1992, environmental concerns about the effects of tropical deforestation dominated the discussions intended to result in a global forest convention. Ultimately, though, the relevant legally-binding agreement on forests was not arrived at by the UNCED, while comparable instruments concerning Climate Change, Biological Diversity and Desertification did become the subject of conventions in international law. This disparity reflects the facts that:

- developing countries refused to accept the prevalence of global environmental concerns over national sovereignty where natural resources, in this case forests, were concerned;
- the industrialised world refused to mobilise the kind of financial resources that would have permitted the establishment of a mechanism (providing support comparable to their own subsidies and incentives) for the development of SFM in tropical forests.

While the global status of forests and forestry is still being negotiated[4], the Rio MEAs have helped major environmental issues to find their way into mainstream societal

[3] See results of the EFFE research project at http://www.efi.fi/events/2004/effe_conference/programme.html
[4] Intergovernmental Panel on Forests (1995-97), Intergovernmental Forum on Forests (1998-2002), UN Forum on Forests (present).

discussions, leading forests and forestry to become a secondary issue in the implementation of other agreements and policies, such as those concerning climate change, biodiversity, protected areas, energy, water, etc. At the same time, the ever more urbanised European citizen has started to perceive forests more as an environmental than an economic asset, supporting a growing trend towards conservative forest management and the prioritising of non-material forest functions in many EU countries.

However, the societal process that has changed the public perceptions of forests from uninviting wilderness to be conquered to an increasingly valuable, limited resource providing ecosystem services as its most important product, seems to have ignored almost completely the fact that forests can be managed for the provision of materials with low-energy content and climate-neutral fuel, whose large-scale use could substantially contribute to the reaching of the Kyoto targets, without endangering other environmental functions. Surprisingly, the less-efficient carbon sink function seems to have attracted more attention, although, apart from the CDM[5] rules, no specific modalities have yet been worked out by EU Member States. Paradoxically, many developed economies are struggling to maintain economic growth and reduce greenhouse gas (GHG) emissions from fossil-fuel and material production, while classical forest production functions continue to be sidelined, with holders in many cases being 'compensated' by way of grants and subsidies with non-productive purposes. This may seem surprising, as ample experience from the past shows that productive forest management need not be contrary to environmental objectives, if multifunctionality is addressed properly.

Thus, in order to gain full public acceptance of its *modus operandi*, the forest sector has no other choice but to engage in affirmative action, with a view to fulfilling, not only the climate-related objectives of reducing GHG emissions and sequestering ambient CO_2, but also its other environmental services. This means that all agreements, policies and plans concerning forests and forestry, be these at global, regional, national or local levels, should not see environmental issues as a burden on profitability, but as opportunities to inject new dynamics into a sector that has too long chosen to go on the defensive against its most natural ally, the environmentally-aware citizen.

Environmental issues that forestry can address

Climate-change mitigation

Living forests can contribute to climate-change mitigation by sequestering carbon in their biomass, while active forestry provides renewable fuel and material with low energy content.

The Kyoto Protocol set objectives and ushered in accounting principles for GHG emissions from land use and **carbon sequestration** by terrestrial sinks, such as forests. This allows for partial reliance on forest extension and other forestry measures as

* [5] Clean Development Mechanism, Art. 12 of the Kyoto Protocol to the UN FCCC.

environmentally-friendly and cost-effective ways of meeting the binding targets for reducing greenhouse gas emissions. In addition, more dynamic but climate-conscious forestry can have positive effects on forest biodiversity and may be supported by EC rural development measures. An effective way to reach the goal of 'de-carbonising the economy' could be to increase the use of forest products, ultimately leading to more production requirements in respect of the existing forests, and the demand for new ones. The ECCP[6] Working Group on Forest-Related Sinks identified a number of promising forestry practices, and assessed their carbon sequestration potential, together with other environmental and socio-economic effects. These measures are afforestation programmes, managing the natural expansion of forests, short rotation tree plantations on formerly agricultural land, preventing deforestation, the establishment of forest reserve areas, the restoration of forest wetlands, continuous-cover forest management, the prevention of forest fires, and improved management of fast-growing plantations in S. Europe.

Rising **energy consumption** is the main cause of climate change, and the influence of energy policy on other sectors, notably on all forms of land use, will increase. Since the Commission's White Paper on renewable energy (1997) proposed to raise the share of renewable energy sources (RESs) from 6% (1995) to 12% of total EU (15) primary energy production by 2010, a framework of community legislation has further detailed this objective, covering electricity, transport, building and co-generation. Studies have indicated that, among the different RESs currently available, biomass and wind power have the highest growth potential. Alongside annual energetic crops, forests can become a major source of biomass for energy, if the tendency for a declining rate of utilisation of forest increment[7] can be reversed. Stepping into the energy business may bring new life at the level of the individual property or management unit.

Preservation of biodiversity (CBD-1992/EU Biodiv. Strategy & BAP's[8]/NATURA 2000)

Forests harbour the majority of the world's terrestrial biodiversity. The effective conservation and sustainable use of European forests is therefore a vital contribution to the achievement of the target that the loss of biodiversity be reduced (globally) or halted (in the EU and Europe-wide) by 2010, as adopted by the Gotenborg European Council in 2001.

NATURA 2000, the community-wide network of Special Areas of Conservation (SACs) to assure the long-term survival of Europe's most valuable and threatened species and habitats is expected to contain about 30% forest. As the implementation of NATURA 2000 is a legal obligation for MSs, certain forms of land use will have to be adapted accordingly, following designation.

* [6] European Climate Change Programme, see http://europa.eu.int/comm/environment/climat/eccp.htm.
[7] A comparison of the net annual increment in EU15 forests available for wood supply (460 M m^3) and the corresponding annual removals (265 M m^3) shows barely 60% of growth is being reported as production, with the greatest disparities occurring in Germany, France and Italy (TBFRA 2000 – UN/ECE).
[8] European Community Biodiversity Strategy, COM(98)42fin. and 4 Biodiversity Action Plans.

In 2002, the El Teide Ministerial Declaration[9] made clear commitments in regard to the future involvement of stakeholders, management of the network and the targeting of resources. In order to address the funding issue in a comprehensive and effective way, the financing of NATURA 2000 management has been integrated into the discussions on the use of Community financial instruments during the next budgetary period 2007–2013. Specific requirements to support the achievement of EU environmental legislation and, in particular, the proper management of the NATURA 2000 network, are expected to become part of all major EU funding instruments, such as EARDF, ERDF and ESF[10].

The **Community Biodiversity Strategy**, adopted by the Commission in 1998, has led to 4 Community Biodiversity Action Plans (BAPs) pertaining to natural resources (NR), agriculture, fisheries, and development cooperation. Forests and forestry are covered by the NR BAP, which sets out a series of objectives for landscape-level biodiversity conservation in EU forests. After the Gotenborg Council adopted the objective that biodiversity loss in the EU be halted by 2010, the Malahide stakeholders conference in 2004 proposed that delivery mechanisms be reinforced. Forest biodiversity at landscape level (beyond protected areas) will no doubt play an important role in the upcoming Roadmap to 2010 that the Commission will present this year.

The pan-European process Environment for Europe has produced the Pan-European Biological and Landscape Diversity Strategy (PEBLDS). At the Vienna MCPFE in 2003, a framework for future cooperation between the MCPFE and PEBLDS was adopted, with a view to the Ecosystem Approach of the CBD being integrated with the SFM concept defined by the MCPFE. In this context, it is important to note that protected areas and well-managed landscapes should not always be seen as an objective *per se*, but can be played out as an asset for the development of tourism in rural areas. This is already a very important economic activity in S. Europe, and has ample potential in many of the new MSs.

European Water Policy

The increasing demand citizens impose for cleaner rivers and lakes, safe groundwater and coastal beaches is evident.

The EU Water Framework Directive[11] (WFD) entered into force on 22 December 2000. Its main objective is to enable all waters in the EU to achieve a 'good status' rating by 2015. This Directive sets ecological criteria for defining water quality, and outlines an integrated approach to river-basin management, rather than a management system based on administrative borders.

The main objectives of the Water Framework Directive are:

- expanding the scope of water protection to all waters,
- achieving 'good status' for all waters by a set deadline,

* [9] http://europa.eu.int/comm/environment/nature/nature_conservation/natura_2000_network/communicating _natura_2000/el_teide_declar/index_en.htm.

[10] European Agricultural Rural Development Fund (EARDF) / European Regional Development Fund (ERDF) / European Social Funds (ESF).

[11] Directive 2000/60/EC – «WFD».

- water management at river-basin level,
- ensuring that water prices cover the real costs of quality and quantity,
- ensuring that citizens become more closely involved in water management,
- streamlining water legislation.

It is clear that the importance of forests for the protection of upper catchments and the adoption of the 'catchment approach' to water management (the core principle of the WFD), will have consequences for forest management. Forests and water are connected by a thousand links. Most importantly, forest often forms the first link in the water cycle, because most of the headwaters of Europe's major rivers are located in important forest areas. This means, that forestry practices affect quality, quantity and the dynamics of runoff. Forestry can help to improve hydrological conditions, but can also have adverse impacts on water resources. This may imply reconsideration of the past hydrological arrangements in forestry, such as through the restoration of forest wetlands to improve the water-rentention capacity. Fair water prices may prove to be an opportunity for the recognition of the ecological services supplied by forests.

Forests, the environment and Community trade policy

Following the increasing pressure to act against the imports of illegally-harvested timber, the Commission proposed an Action Plan on Forest Law Enforcement, Governance and Trade (FLEGT) in May 2003. An important element of this plan is the establishment of bilateral agreements with producer countries, allowing EU consumers to discriminate the illegally-harvested timber in favour of that harvested legally. In response to the calls from the Council and EP, the Commission is currently preparing legislation to work out a voluntary licensing scheme for timber imports. The first operational agreements under this scheme are expected to be concluded in 2005.

As international exchanges of products and services continue to grow, there is increasing pressure from civil society for standards and/or references to be adopted where the certification of forest products is concerned. The area of certified forest has grown markedly in Europe, and because certification schemes from third countries have started to request recognition in the EU, baseline rules to integrate certification into Community instruments, such as the ECOLABEL and EMAS may become necessary.

The Thematic Strategy on use of Natural Resources

The 6th Community Environmental Action Plan[12] foresees the elaboration of a Community strategy for the use of natural resources. The overarching goal of this strategy is to show possibilities for economic growth to be decoupled from resource use. With a view to this being achieved, the life cycle of our natural resources are to be examined, and solutions for non-sustainable forms of their use indicated (these including cleaner technologies, environmentally less-problematic processes, and the environmental impact of the production processes of imported commodities).

[12] Decision 1600/2002/EC of the European Parliament and the Council – OJ L242/1 of 10.09.2002.

In the overall picture of resource-use, forests are exceptional, because they are both, a renewable and an extinguishable resource. While their judicious use can bring long-term benefits, their over-exploitation or monofunctional management can lead to a permanent loss of productivity and ecosystem services. Forests also play a crucial role in the protection of other natural resources, such as water, soil, and biodiversity. A comprehensive, natural resources strategy will therefore have to devote attention to forests, and could *i.a.* weigh against one another the use of forests or other resources for different purposes.

Should there be environmental concern about EU forests and forestry?

Several reports by the EEA[13] on general environmental conditions in Europe have mentioned a tendency towards uniformisation of forest structures, a reduction in the variety of tree species, as well as loss of forest biodiversity. The combined effects of intensification of silvicultural practices, increased uniformity, the use of exotic species and forest fires have been mentioned as leading to a decline in the environmental quality of forest ecosystems. However, more recent reports[14] show some positive changes. Currently, there is an overall trend, especially in Western and Central Europe, to let broadleaved trees re-occupy some of the areas that had been converted to conifer stands in the past. In this way, the use of natural regrowth has gained considerably in importance as a planned regeneration technique, resulting, especially in public forests, in an increase in the area of mixed forest stands.

Meanwhile, timber, pulp, panels and forest biomass fuel have become commodities traded all over the globe at prices set by supply and demand, the result being that those producers having the lowest environmental and social standards are favoured. As a result, EU forest owners (public or private, small or large), who effectively observe SFM principles and multifunctionality, are being pushed out of the market, because the value of their environmental services, such as protection of soil, nature, watersheds and climate regulation is not considered in economic terms. Moreover, prices can be expected to remain depressed, as large-scale plantations in the S. hemisphere, based on complete separation of productive and environmental functions, will soon come on stream. Some major forest countries effectively use rationalisation and uniformisation (as in the agricultural sector) to conquer markets. In Europe, discussion and competition have developed between interest groups defending different forest functions, holding diametrically opposed views on priorities in forest management, from hyper-protective to ultra-productive. But Europe should reflect on whether it is to continue shifting the ecological footprint of its lifestyle to other parts of the world. If we want to be credible in the international forest dialog, we should recognise that enjoying nice landscapes and a clean environment at home, while at the same time

* [13] The Dobris Report, 1995, Europe's Environment, the Second Assessment (Dobris +3), EEA-1998, and Environment in the EU at the turn of the Century, EEA-1999.
[14] Europe's Environment: the third assessment, 2003.

consuming imports which have been produced unsustainably elsewhere, cannot be upheld as an example of the global equity that should serve as the foundation for an international forest regime.

Can environmental functions bring new dynamics to the forest sector?

Evolution towards intensification in certain areas and the leaving of important areas 'set aside' in other regions brings to mind comparisons with the CAP. However, the attainment of environmental objectives, such as energy generation from biomass, biodiversity preservation, water protection and the judicious use of natural resources could all bring new dynamics to the EU forest sector. This can make possible new economic developments in rural areas where jobs are scarce. If opportunities to mobilize inactive forest owners and underused forest resources can be found, the benefits in terms of maintaining rural social structures and jobs may be important.

A few points of departure:

Large forest countries, such as Germany, Italy and France currently present the widest gap between measured forest increment and reported production. It is striking that the areas with the highest intrinsic production potential in line with soil and climatic conditions seem to be those in which market problems are most acute and public preferences for 'conservation only' forestry most outspoken.

The total area of forests and other wooded land in the 5 Mediterranean MSs almost equals that of Scandinavian forests, but production is much lower in the South. However, potential increment per hectare is almost equally low in the far North as in the deep South. A particular feature of the South is, thus, that a substantial part of its forest area consists of a wooded land, with sparse vegetation dominated by trees or shrubs. It is mostly a degraded high forest capable of being restored in conditions of adequate investment in planting or of managed natural recolonisation. Climate and biodiversity functions of forests might, in this way, be made compatible, through a careful tradeoff between seemingly contradictory management requirements, or a reverting to the tried and tested multifunctional management practices, such as coppicing or grazing.

The recent expansion of the EU has made the situation of the forest sector more complex, but also has led to positive developments. In the continental new Member States, the restitution and/or privatisation of forestland and the reattribution of the previously public functions in forest management to the private sector has provoked a whole sequence of market and governance changes. In most new MSs, the production-related and administrative functions of state forest administrations are being separated. Several new Member States and candidate countries have established publicly-owned commercial companies for the management of their state-owned forests, while harvesting and silvicultural operations are now mostly carried out by private contractors. Services like the preparation

of forest management plans have also been shifted to private operators. But such reforms do not only concern timber, as they can, just as well, be applied to the development of an enormous potential of eco-tourism and sustainable hunting, with a promise of substantial forest revenue. This evolution is very much in line with the EU economic-reform objectives of the Lisbon Agenda, and could been seen as exemplary by the 'old' MSs of the ex--EU15, among which the profitability of forest holdings has become problematic.

The 2004 enlargement has the potential to further reinforce the EU's position as a net exporter of forest products. Confirming a process that has already started 15 years ago, forest products originating from the continental new Member States continue to gain market share in the EU, because of the differences in the processing costs and product prices between the EU-15 and the EU-10. The new Member States offer attractive investment opportunities for forest industry operators from the EU-15 and elsewhere.

Although a great deal of public support has existed in the past and continues to be available to the forest sector, there is an urgent need for better information about the socio-economics of forest use in the EU. As mentioned above, a large quantity of scattered information would have to be collected, compared, and summarized. This is necessary if a better insight into the current material and financial streams is to be obtained, and if informed decisions on how to redirect policy work towards improved economic and environmental performance are to be made. In this field, there would certainly be an added value in Community instruments, as the current fragmented approach is totally unfit to play today's global markets.

To conclude, the combining of economic-development and environmental objectives should not be seen as a problem, but rather as an opportunity for lasting synergies to be created. However, the enormous diversity of EU forests should not be forgotten as new dynamics or developments in the sector are conceived of. Indeed, so many different situations result from the crossing influences of biogeograhical and human factors that no 'across-the-board' solutions to satisfy all expectations can be found.

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