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Atlas of the forest sector in Slovakia

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Abstract
This atlas is a review of the current situation of the forest sector in Slovakia with a collection of maps. The cartographic information is grouped in the following way: forest resources, silviculture, wood harvesting, production and the most important producers of wood-based products, forest education and research and potential of wood energy. This review serves the information needs of different stakeholders and those interested in the forest sector in Slovakia.

Keywords
Slovakia, forest resources, wood harvesting, forest industry, bioenergy, forest policy

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Preface

This work was carried out under the umbrella of the "Central and Eastern European Forest Information Service" project. The aim of this project is to create an information service for the Estonian, Latvian, Lithuanian, Polish, Czech, Belarusian, Ukrainian, Slovak and Romanian forest sectors, and to strengthen knowledge relating to these countries. The ultimate goal is to find business opportunities and new markets in CEE[1] countries.

The target groups of the project are Finnish forest sector enterprises and technology manufacturers, either planning to enter the sector or expand into CEE countries. The project is funded by the European Social Fund (ESF) and will be executed during the period 2010–2013. The coordinator of the project is the Finnish Forest Research Institute (Metla). Other partners include the Mikkeli Small Business Centre at the Aalto University School of Economics, the School of Forest Sciences at the University of Eastern Finland, North Karelia University of Applied Sciences, and North Karelia College Valtimo.

This atlas represents the sixth publication within the project. The report contains a description of the current situation regarding forestry in Slovakia, including a collection of maps. The cartographic information is grouped in terms of forest resources, silviculture, wood harvesting, production and the most important producers of wood-based products, forest education and research, and potential of wood energy. The review is based mainly on statistical data and several publications related to forest sector policy in Slovakia.

This review serves the information needs of different stakeholders and those interested in Slovak forestry. All maps can be downloaded from the Metla CEE forestry website (http://www.metla.fi/metinfo/kie/).

1 Belarus, Czech Republic, Estonia, Latvia, Lithuania, Poland, Romania, Slovakia, Ukraine

1 Introduction

Slovakia is a landlocked country in Central Europe with a total area of 49,035 km². Slovakia is bordered by the Czech Republic and Austria to the west, Poland to the north, Ukraine to the east and Hungary to the south.

Slovakia became an independent state on January 1, 1993. Since the political changes which took in place in 1989, the country's economy has transformed from being centrally-planned to being market-driven, with annual GDP growth one of the fastest in Europe. Slovakia joined NATO and the European Union in 2004.

Administratively, Slovakia is comprised of 8 krajov (regions): Bratislava (Bratislavský kraj), Trnava (Trnavský kraj), Trenčín (Trenčiansky kraj), Nitra (Nitriansky kraj), Žilina (Žilinský kraj), Banská Bystrica (Banskobystrický kraj), Prešov (Prešovský kraj) and Košice (Košický kraj). The country has 5.4 million inhabitants, 81 percent of whom are ethnic Slovaks; the largest minorities are Hungarians (9%) and Romani (2%). Slovak is the official language, although Hungarian is widely spoken in the south. The dominant religion is Roman Catholicism.

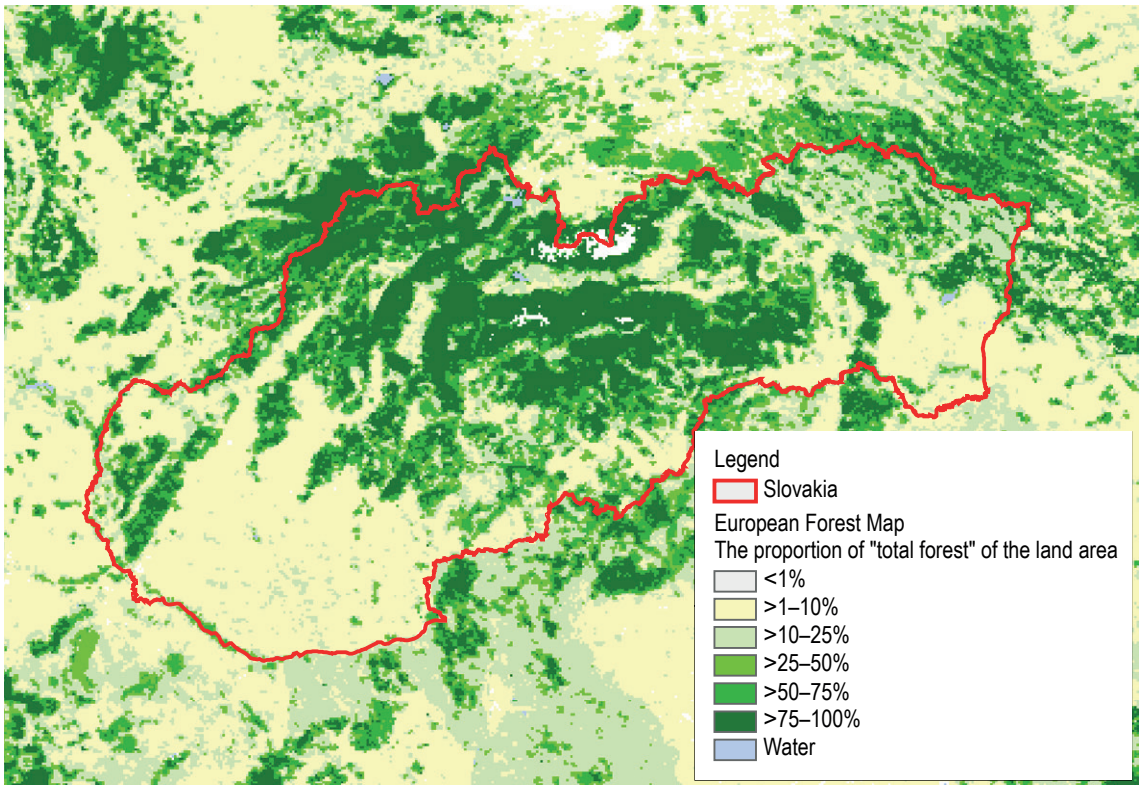
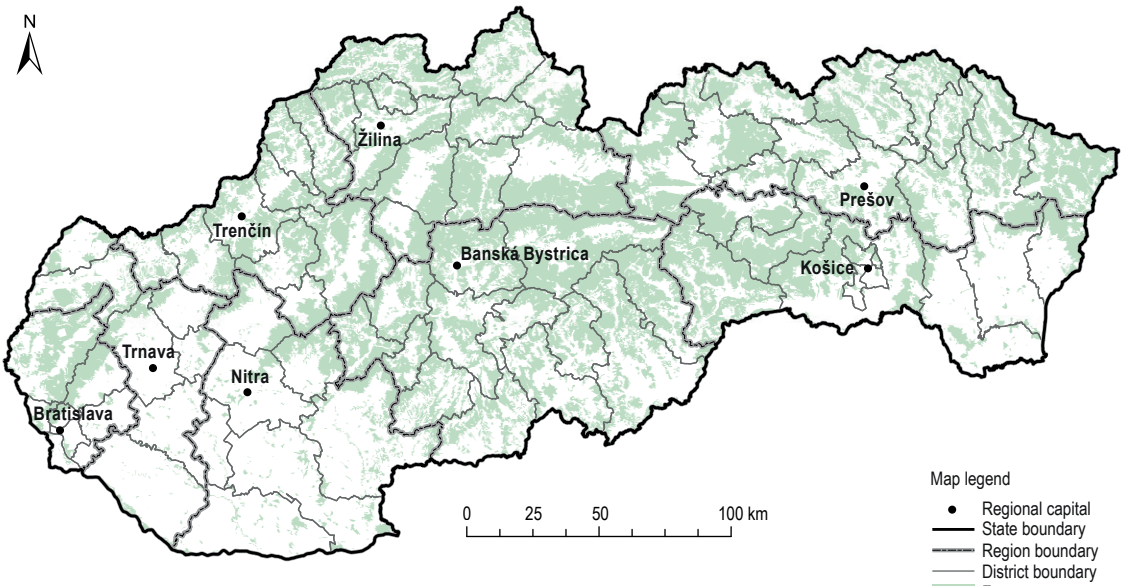


Figure 1.1. Slovakia on the European Forest Map[1] (Schuck et al. 2002).

[1] This information is based on output from the project "Forest tree groupings database of the EU-15 and pan-European area derived from NOAA-AVHRR data", which was awarded by the European Commission's Joint Research Centre (Institute for Environment and Sustainability) to a consortium of organisations under contract number 17223-2000-12 F1SCISPFI.



Source: Aggregate information about forests in the Slovak Republic (Súhrnné informácie... 2012)

Figure 1.2. Slovakia, its regions and regional capitals.

Slovak terrain is dominated by the Carpathian Mountains, especially their highest range the Tatra Mountains. The main rivers are the Danube, Váh and Hron.

Around half of the country's land area (49.3%) is devoted to agriculture. Notable natural resources include halite, coal, iron ore and copper.

The climate varies with geographical location; average annual temperatures are 9–10 °C in the warmest regions and less than 5 °C in the mountains.

Although the Slovak Republic covers a rather small area, the proportion of forest is relatively high compared to that of other countries in Central and Eastern Europe (CEE). In 2011, the area of forest land was 1.940 million hectares, or 40% of the total land area. Growing stock reached 466 million m³ in 2010, with the average growing stock per hectare around 241 m^3 (Green Report 2011).

The country contributes to the conservation of forests and environmental stability at both regional and global levels, as well as playing an important role in the CEE forestry sector. In 2010, Slovakia produced 9% of total CEE industrial roundwood, 23% of total pulp for paper, 11% of total paper and paperboard, 2% of total fibreboard, 5% of total particle board, 1% of total plywood and 10% of total sawnwood (FAOSTAT 2012).

2 Forest sector policy

2.1 Forest administration

The Slovak Ministry of Agriculture and Rural Development is the supreme national authority regarding both forest and game management, with practical aspects of state supervision carried out via a network of 8 regional and 40 district forest offices. The Military Forest and Estates office is the main authority for forests under the jurisdiction of the Slovak Ministry of Defence (Green Report 2011).

Currently, 51.9% of forests are managed by public organisations under the jurisdiction of the Ministry of Agriculture and Rural Development. A small proportion (3.5%) are managed by the Ministry of Defence (Table 2.1).

Through the work of the Department of Forestry and Wood Processing, the Ministry of Agriculture and Rural Development participates in the formulation and implementation of state forest policy, performs state administration of forestry, develops strategic concepts and documents for the forest sector, elaborates proposals regarding legal regulations and issues directives for their implementation. An important part of the Ministry's activities is the control and methodical guidance of local state forest administration. The Ministry cooperates with all stakeholders, both in the forest sector and in other sectors of the economy.

The regional offices of the State administration are responsible for carrying out the tasks ensuing from the present forestry legislation, including the approval of proposed regional plans, the control of forest management from the point of view of regional development, as well as the elaboration of forest management plans. The district offices of the State administration largely make decisions concerning law-keeping, but also those associated with the legal rights and duties of forest owners and users (Zákon 326/2005... 2005). A list of regional forest offices in Slovakia is presented in Table 2.2.

Table 2.1. Distribution of forest resources in terms of responsible Slovak agency in 2009–2010 (Green Report… 2010, 2011).

Agency	Forest area, ha				Number of legal entities performing forestry	
	2009	%	2010	%	2009	2010
Ministry of Agriculture	992,716	51.2	1,007,190	51.9	40	40
Ministry of Defence	67,224	3.6	67,088	3.5	1	1

Table 2.2. Regional forest offices in Slovakia (KLU = krajský lesný úrad) (Portál Lesných… 2013).

Region	Name of forest office	Number of district offices	Official website
Bratislava	KLÚ Bratislava	2	http://www.lesnyurad.sk
Trnava	KLÚ Trnava	3	”
Trenčín	KLÚ Trečín	4	”
Nitra	KLÚ Nitra	3	”
Žilina	KLÚ Žilina	7	”
Banská Bystrica	KLÚ Banská Bystrica	8	”
Prešov	KLÚ Prešov	8	”
Košice	KLÚ Košice	5	”

As a result of state-driven rationalisation, an organisational change in forest administration took place on January 1, 2013 with the closure of all 8 regional forest offices and the transfer of the latter's responsibilities to the district offices (Zákon 345/2012… 2012).

2.2 Ownership and management of forests

In 2010, Slovak state forest enterprises managed 55.4% of the country's total forest area, but held property rights to only 40.9%. State entities manage 14.5% of forests pending restoration of ownership rights, as well as those of unknown owners and those leased from non-state subjects.

Forests under state ownership are managed by the following enterprises: The Forests of the Slovak Republic s.e., Banská Bystrica; Ulič Forest-agricultural Estate s.e., and the TANAP (Tatra Mts. National Park) State Forests. Whereas the aforementioned subjects fall under the Ministry of Agriculture and Rural Development, the Military Forests and Estates of SR s.e., Pliešovce, are subordinated to the Ministry of Defence.

Non-state forest owners (private and legal entities) who have legally settled their ownership rights own 49.9% of all forests in Slovakia. As state organisations also manage some of these forests, non-state entities are responsible for 45.6% of the total forest area in Slovakia (Green Report 2011).

The category of non-state forests includes private, community, church, agricultural co-op and municipal areas. The most common legal and organisational forms of ownership of non-state forests include land association companies, private persons and legal entities established by municipalities (Green Report 2011).

Table 2.3. Slovak forest ownership and tenure in 2010 (Green Report 2011).

Category		Ownership category						
		State	Municipal	Private	Community Forest land	Church	Agri co-op	Unknown
Ownership	ha	793,168	181,013	239,030	484,057	57,031	5,514	179,091
	%	40.9	9.3	12.3	25.0	2.9	0.3	9.2
Tenure	ha	1,074,278	175,645	124,167	531,301	27,969	5,544	–
	%	55.4	9.1	6.4	27.4	1.4	0.3	–

Forest tenure variation across the Slovak regions is shown in Map 6.1.

2.3 Forest policy

After a rather long period of changes and amendments to the old forest legislation (originating from the 1970s), the Slovak Republic finally adopted a new Forest Act considered to be the basis of all national forest legislation. The new Forest Act No. 326/2005 was adopted by the Slovak National Council in June 2005 (Zákon 326/2005... 2005).

New ideas regarding forest legislation and policy have been incorporated into the introductory articles of the new Forest Act, stating its purpose as follows (Šulek 2010):

- to preserve, improve and protect forests as a part of the environment and natural wealth,
- to provide differentiated professional sustainable management of forests,
- to harmonise the interests of society and forest owners, and
- to develop economic conditions for sustainable forest management.

A key document which defines the objectives and priorities of national forest policy, the National Forest Programme (NFP; National Forest... 2007) was designed with the aim of securing the sustainable management of Slovak forests.

The NFP was first drafted by the National Forest Centre in 2006, discussed and approved by the Ministry of Agriculture in March 2007, before being submitted for governmental adoption in April 2007. The Slovak Government adopted the NFP in June 2007, with the programme finally approved by parliament in September 2007 (National Forest... 2007).

The three main goals of the NFP are as follows (Šulek 2010):

1. Economic goal: to increase the long-term competitiveness of the forestry sector and improve the sustainable use of forest products and services.
2. Ecological goal: to maintain and improve the biodiversity, carbon sequestration, and integrity and resistance of forest ecosystems.
3. Social goal: to contribute to local quality of life through the preservation and improvement of the social and cultural dimensions of forests and forestry.

The NFP was approved for the period 2007–2020 by formulating the following five strategic goals for the sector (National Forest… 2007):

- to promote ecological forest management;
- to improve and protect the environment;
- to contribute to local quality of life;
- to improve long-term sector competitiveness;
- to foster co-operation, co-ordination and communication.

These strategic objectives were then further elaborated into 18 thematic priority areas and 56 framework goals, with the latter worked out in more detail on a regular basis and updated through measures formulated in the NFP Action Plan (The Slovak National… 2011).

Based on the NFP, the Ministry of Agriculture and Rural Development established an official Forestry Development Strategy. This document specifies and explains the objectives, intentions and development directions of the forestry sector in relation to the 18 thematic priorities of the NFP, in terms of the quantitative and qualitative outlook for 2025 contained within the document "Outlook and Visions of the Slovak Forest Sector". The Strategy also details the processes, instruments and implementation required to achieve the desired results.

The most important funding instrument currently available for the accomplishment of forest policy objectives and priorities is the Rural Development Programme of the Slovak Republic 2007–2013. This programme emphasises the importance of ecological forms of land management,

quality of life in rural areas, economic diversification and rural employment. Together with the Action Plan and the Forestry Development Strategy, the Rural Development Programme constitutes a key instrument of NFP implementation (Green Report 2009).

2.4 Forest industry policy

Responsibility for the wood-processing sector was transferred from the Ministry of Economy to the Ministry of Agriculture and Rural Development in 2009. However, since then no long-term policy regarding the development of the forest industry has been adopted. In November 2012 the Ministry of Agriculture and Rural Development drafted a document entitled "National Programme of Utilisation of Wood Potential in the Slovak Republic" (Národný program… 2012). This document contains an overview of international and national policy documents, international political initiatives, EU and national legislation related to the forest sector, as well as internal and external factors influencing the development of the forest sector. Growing stock, removals, trade and pricing policy in the timber trade are analysed, with the report also addressing the impact of the global financial crisis on the competitiveness of the forest sector in both domestic and international markets. The second part of the report analyses the tree species composition and assortment structure of growing stock, and makes prognoses of harvesting possibilities until 2035.

Based on the above-mentioned analysis, four strategic targets have been formulated:

1. To secure increasing requirements for timber removals under changing environmental and social conditions via active sustainable management.
2. To increase added value in the forest sector.
3. To increase domestic consumption of wood products whilst simultaneously respecting the principles of sustainable development.
4. To achieve increased utilisation of forest biomass as well as the by-products of timber processing for energy production.

3 Forest resources and their utilisation

3.1 Forest resources

The area of forest in Slovakia has increased steadily over the last few decades, with forest stands covering a total of 1.940 million hectares in 2011. In the same year, forest cover deducted from the area of forest stands was estimated at around 41% (Green Report 2011), with the total growing stock 466 million m³ and the mean volume per hectare 241 m³.

According to the same national statistics, the total area of forest land in Slovakia is slightly higher (2.010 million hectares), since this category also includes nurseries, forest roads, skidding tracks, landings and other land associated with forestry. In national surveys, growing stock is measured without bark and hence the total is lower than that found in UNECE statistics. Temporal variation in forest land area and total growing stock in Slovakia for the period 1950–2011 is illustrated in Fig. 3.1.

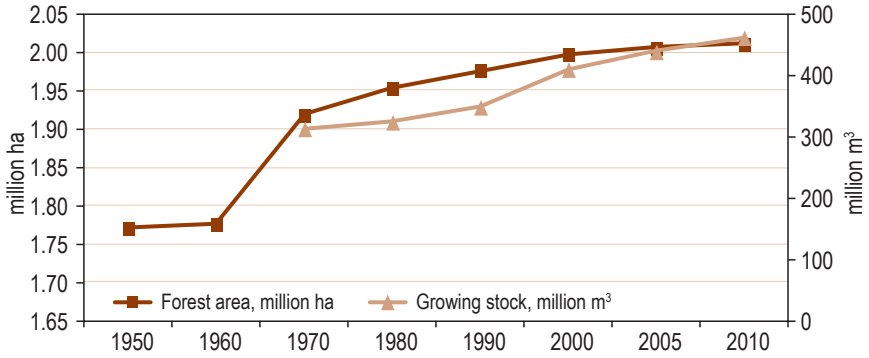


Figure 3.1. Dynamics of total forest land area and volume of growing stock in Slovak forests for the period 1950–2010 according to the national statistics (Green Report 2012).

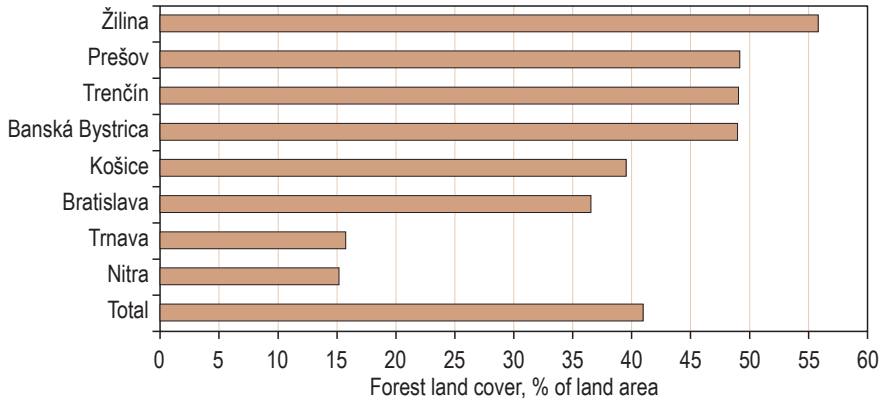


Figure 3.2. Area of forest cover in each Slovak region (Lesné hospodárstvo… 2011).

The forests of Slovakia are distributed unevenly across the country (Map 6.2), with both forest cover and growing stock varying significantly between regions (Figure 3.2, Map 6.3). The most densely forested region is Žilina, with forest cover representing almost 56% of the total area, followed by regions Trenčín, Banská Bystrica and Prešov, all of which are characterised by 49% forest cover. In contrast, the least forested regions are Trnava and Nitra, with forest cover of 15–16% (Lesné hospodárstvo… 2011).

In terms of tree species composition (Map 6.4), Slovak forests are characterised by high levels of diversity, with both coniferous and broadleaved species abundant. In the past, forest composition was heavily influenced by the drive for maximum timber production; spruce and pine were planted across large areas in order to meet this objective. However, from the 1950s onwards, forest planners gradually realised the importance of species composition based on the specific natural conditions of a particular site. At the same time, public demand for delivery of a multitude of forest functions, including non-productive forest benefits and services, started to grow (Green Report 2009).

At present, conifers cover 39.8% of Slovak forest land, with the remaining 60.2% covered by broadleaved species. However, the state has also adopted a long-term requirement for forest stand diversity, since the latter is considered to positively affect forest stability (National Forest… 2007). Current management preferences therefore focus on the establishment of more resistant, biodiversity-rich mixed-forest stands with greater ecological value. Forest division by main species groups is as follows: coniferous forest 31%, broadleaf forest 50% and mixed forest 19%.

Table 3.1. Main tree species composition of Slovak forests in 2011 (Súhrnné informácie... 2012).

Species	Area, 1,000 ha	Share, %
Slovakia	1,929.3	100.0
Coniferous	767.7	39.8
Spruce	487.7	25.3
Pine	135.0	7.0
Fir	77.4	4.0
Larch	46.2	2.4
Dwarf pine	21.0	1.1
Other	0.5	0.03
Broadleaf	1,161.6	60.2
Beech	613.2	31.8
Oak	206.7	10.7
Hornbeam	111.7	5.8
Maple	41.7	2.2
Robinia	33.3	1.7
Ash	29.4	1.5
Birch	27.9	1.4
Other	97.6	5.1

The most abundant tree species include beech (31.8%), spruce (25.3%) and oak (10.7%) (Table 3.1; Súhrnné informácie... 2012).

Broadleaved species predominate in the lowlands, as well as in the hilly terrain of the south-west and east of the country. In contrast, the central and northern mountain regions are characterised by the presence of mixed forests, in which coniferous species dominate. Other mountainous areas also contain mixed stands of spruce, fir and beech (Country Profile... 1997).

An even distribution of age classes is considered the best guarantee of sustainable and steady timber production, delivery of other forest-related benefits and services, and the stable development of the volume of forest operations. Table 3.2 displays the age structure of Slovak forests using a classification based on 10-year age classes. All age classes are typical for a higher presence of broadleaved species; this trend is most evident in 51–90 year old forests.

Table 3.2. Forested area by dominant species and age groups (Green Report 2010).

Age class	Total		Coniferous		Broadleaf	
years	ha	%	ha	%	ha	%
Non-stocked forest land	10,674	0.6	..	..	..	..
1–10	142,859	7.4	55,308	2.9	87,551	4.5
11–20	148,379	7.7	63,673	3.3	84,706	4.4
21–30	156,398	8.1	69,116	3.6	87,282	4.5
31–40	138,478	7.1	63,090	3.3	75,388	3.8
41–50	125,730	6.5	52,350	2.7	73,380	3.8
51–60	169,984	8.8	58,505	3.0	111,479	5.8
61–70	204,069	10.5	71,119	3.7	132,950	6.8
71–80	189,758	9.8	68,705	3.5	121,053	6.3
81–90	180,977	9.2	69,441	3.6	111,536	5.6
91–100	164,773	8.5	69,771	3.6	95,002	4.9
101–110	117,862	6.1	47,578	2.5	70,283	3.6
111–120	65,878	3.4	25,730	1.3	40,148	2.1
121–130	39,112	2.0	16,606	0.9	22,506	1.1
131–140	26,279	1.4	11,841	0.6	14,438	0.8
141–	56,474	2.9	29,030	1.5	27,444	1.4

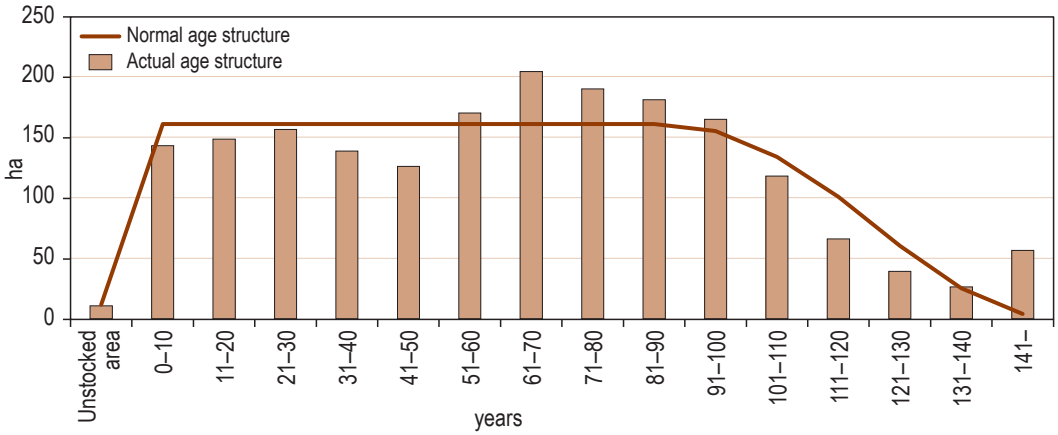


Figure 3.3. Age structure of commercial forests (Green Report 2010). Age class 1 refers to the class 1–10 years, age class 2 to 11–20 years etc.

Table 3.3. Average age of selected tree species (Green Report 2010).

Year	Species								
	Spruce	Fir	Pine	Larch	Oak	Beech	Hornbeam	Maple	Ash
	Average age								
2000	66.2	76.1	60.8	44.9	72.1	70.1	62.5	51.7	51.8
2005	67.6	76.8	63.8	47.7	75.4	71.0	64.1	51.8	52.6
2009	68.2	77.6	65.6	49.4	77.5	71.5	64.4	51.8	54.3

Figure 3.3 assesses actual Slovak forest age structure against a so-called normal (optimal) age class distribution, which is depicted as a horizontal line with an end decline reflecting differences in rotation periods. At present, the majority of commercial forests in Slovakia are between 60 and 110 years old – well over the optimum level. Trees older than 140 years are mostly found in protected areas. Due to their protective function, these forests have generally longer rotation periods.

Table 3.3 below shows a clear gradual increase in the average age of the main tree species in Slovak forests taking place during the 2000s. However, this trend is likely only temporary since it reflects an uneven distribution of age classes. Due to a subsequently high volume of incidental felling in spruce forests, a decrease in the average age of this species is expected to manifest as early as the following decade (Green Report 2010).

3.2 Forest classification

Slovak forests are classified as belonging to one of three categories according to their most important function (Zákon 326/2005... 2005): commercial forest mainly producing timber, protective forest, and special-purpose forest serving largely non-productive, ecological and social functions, including soil conservation, watershed protection, biodiversity conservation and recreation (Map 6.5).

A primary objective in the management of commercial forests is the production of high quality timber without compromising other important ecological and social functions. At present,

commercial forests cover 1,370.2 thousand ha, which represents 70.7% of the total forest stand area in Slovakia.

Comprised of stands with a prevailing (protective) ecological function, protective forests are typically found on extraordinarily unfavourable sites, such as high altitude mountainous locations or the zone of dwarf pine designed to provide water and soil protection. Protective forests currently cover 331.06 thousand ha, or 17% of the total forest stand area (Green Report 2011).

Special-purpose forests are those with special functions associated with specifically important social needs. These forests are managed via the application of so-called functionally differentiated management systems, allowing for the purposeful reinforcement of one or more selected functions such as water purification, recreation, nature conservation, spas and other health treatments, education and research, etc. This category of forests currently covers 237.6 thousand ha, which accounts for 12.3% of the total forest stand area (Lesné hospodárstvo… 2011, Súhrnné informácie... 2012).

In the case of protective and special-purpose forests, although current Slovak legislation does not prohibit felling (with the exception of strictly protected nature reserves), the latter's extent and the methods involved are limited (Moravčík et al. 2011b).

Due to expanding requirements regarding the safeguarding of forest public functions, the relative proportion of commercial forests is currently in decline, while that of protective and special-purpose forests is increasing (Figure 3.4).

Forest ecosystems are a dominant and extremely valuable component of protected territories. Such territories are mostly designated in areas with a limited anthropogenic impact, such as those covered by forests or those largely unsuitable for agricultural production. For this reason, the average forest cover in protected areas is, at 72.6%, significantly higher than the national average (Green Report 2010).

The total of 1,114 protected areas in Slovakia comprises both large- and small-scale territories. While the former category includes 9 national parks and 14 protected landscape areas, the latter (1,091) includes state nature reserves, natural monuments and other protected territories

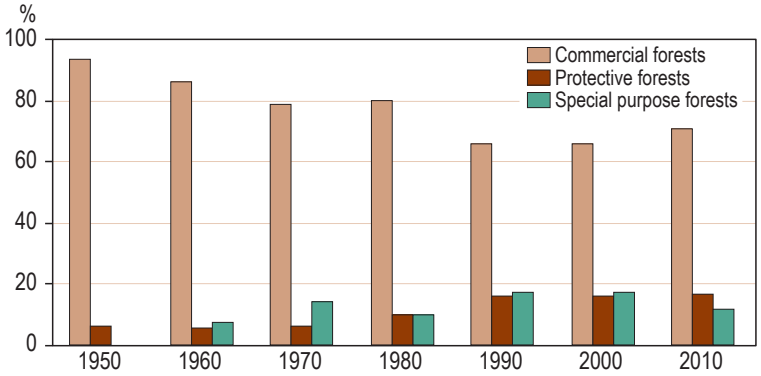


Figure 3.4. Development of forest categories according to prevailing functions between 1950–2010 in Slovakia (Forests in... 2009, Slovstat 2012).

(protected sites, protected parks and gardens, protected study areas and protected natural formations) (Klinda et al. 2011, Lesné hospodárstvo… 2011).

The total area of Slovakia currently designated as protected is 1,103,244 ha, which represents 57% of forest land and almost 25% of the entire national territory. NATURA 2000 protected areas comprise 48.8% of total forest land, which is the third highest proportion of all EU-27 member countries (Moravčík et al. 2011a).

3.3 Utilisation of forest resources

There is a growing trend for timber felling in Slovakia, with cutting increasing from 5–6 million m^3 in the 1980s and 1990s to 6–7 million m^3 after 2000 (Konôpka et al. 2010).

The annual volume of felled timber has also experienced a long-term increase; 9.4 million m^3 was felled in 2011 (Figure 3.5.), representing a rise of 75% with respect to 2000 levels. Of this volume, 58% was coniferous timber and 42% was timber of broadleaved species. Felling carried out by state forest organisations in 2011 totalled 4.9 million m^3 (52%), while the volume felled by the non-state sector was slightly lower at 4.5 million m^3 (48%) (Green Report 2012).

In the same year, accidental felling accounted for 53% of the total felling volume. Accidental felling can be caused by a variety of factors, including windstorms and insect outbreaks; the situation is particularly critical in the case of coniferous tree species, with the felling of these trees representing a staggering 73% of the total in 2011 (Green Report 2012).

A high rate of accidental felling (approximately one half of total annual felling) may cause planned timber harvests to be exceeded. Although such increased felling leads to a temporary rise in income, future felling potential may be reduced (Konôpka et al. 2010).

The actual wood harvest in each Slovak region is displayed in Figure 3.6. As this figure shows, in the regions of Žilina, Banská Bystrica and Prešov, the total harvested volume exceeded 1 million m^3. Regional data for total and accidental felling are presented in Maps 6.6 and 6.7, respectively.

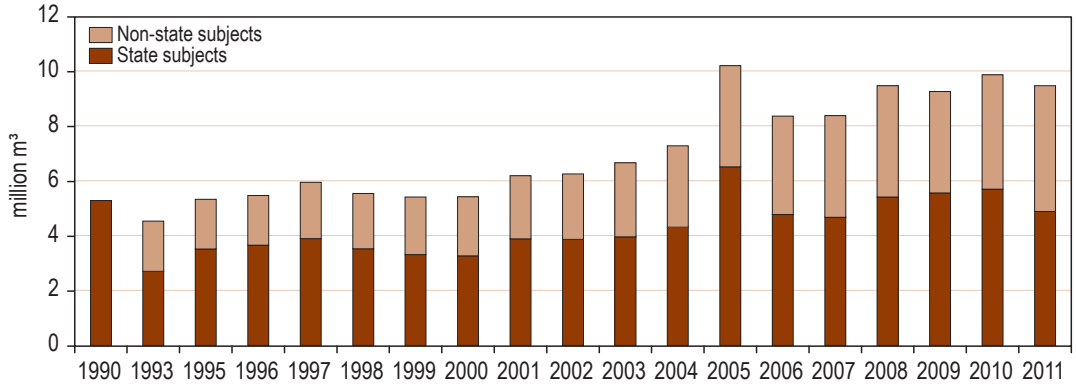


Figure 3.5. Wood harvested in Slovakia during the period 1990–2011 (Green Report 2012).

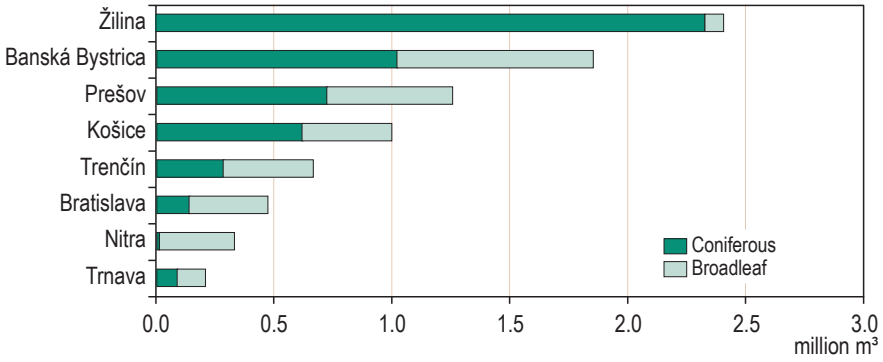


Figure 3.6. Actual wood harvest in the regions of Slovakia (Kunca et al. 2011).

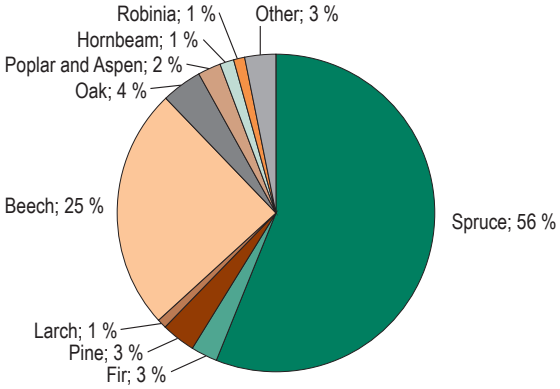


Figure 3.7. Tree species composition of harvested wood in 2011 (Slovstat 2012).

The distribution of harvested wood by tree species for the year 2011 is illustrated in Fig. 3.7. Analysis of this figure shows that spruce comprised more than half of harvested timber in this year, a situation largely due to the destructive windstorm events of 2004 and the following bark beetle outbreak in northern and central Slovakia. As the 2004 storms affected mainly national park forests, where the harvesting of damaged wood was prohibited by the Ministry of Environment, the outbreak of bark beetle subsequently spread to surrounding forests where it continues to this day.

The actual volume of growing stock accrued in a forest over a certain period of time (e.g. one year) is known as the total current increment (TCI). Maximum TCI values are observed in forests with a large proportion of high increment age classes (30–60 years). However, the TCI volume cannot be used as a felling indicator since it depends on forest age structure. In Slovakia, it is generally agreed that no more than 60% of TCI should be felled each year. The total TCI per ha of Slovak forests continues to grow, associated with actual forest age structure and development of growing stock. It is expected that owing to a gradual shift in growing stock towards higher classes with lower increment, the TCI will peak in around 2020 and fall thereafter (Green Report 2011).

Actual felling and TCI volumes for the period 1990–2011 are displayed in Figure 3.8 (Green Report 2012).

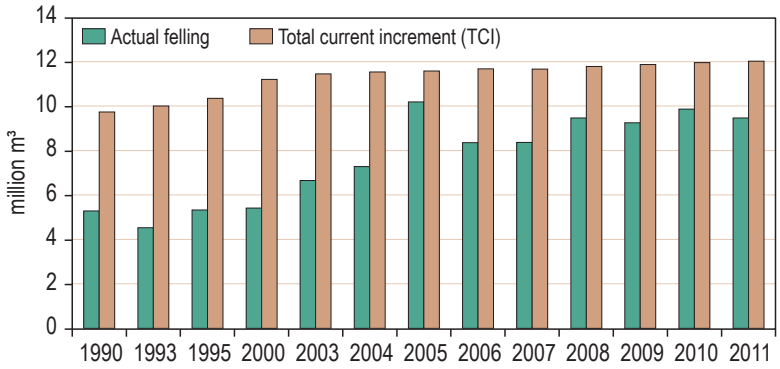


Figure 3.8. Development of actual felling and total current increment volumes in Slovakia for the period 1990–2011 (Green Report 2012).

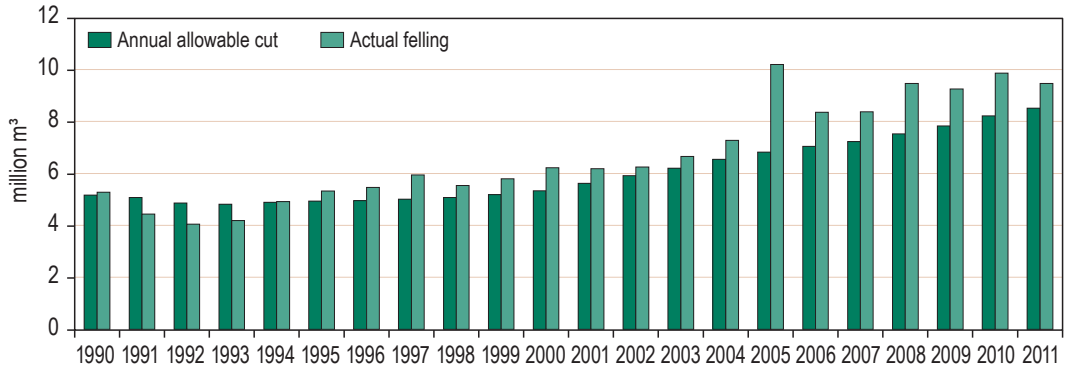


Figure 3.9. Development of annual allowable cut in Slovakia for the period 1990–2011 (Green Report 2012).

Figure 3.9 presents a comparison of annual allowable and actual felling volumes for 1990–2011. As this figure shows, the latter exceeded the former almost every year during this period due to the high rate of accidental felling (in 2011 by 11%).

Most timber harvesting (95–97%) is performed by forest contractors (Green Report 2011), typically with chain saws. The utilisation of harvester technologies is influenced by terrain conditions (primarily slope gradient); such methods are uncommon in Slovakia because around 45% of forest land is situated in areas with slopes greater than 40% (Suchomel & Gejdoš 2011).

An insufficient density and poor quality of forest road network has led to increased timber skidding distances between felling and hauling sites. As a result, the whole-stem felling method and tractor skidding of timber currently prevail in Slovakia. This limits possibilities regarding the effective use of multi-operation harvesting machinery, forest cableways and other opportunities for timber use. In addition, a high incidence of accidental timber felling, mainly due to weather and other abiotic factors, has also had a significant impact on the application of harvesting technology and timber skidding (National Forest... 2007).

3.4 Silviculture

According to Slovak law, felled forest sites must be reforested within two years after harvesting; in the case of expected natural regeneration, the state authority may approve the extension of this period by two further years. Within 2–10 years after reforestation, the forest must have an appropriate tree species composition adapted to the specific site conditions, with noticeable high growth and without the need for any additional reforestation.

Forest regeneration may take place either naturally or artificially. In Slovakia, artificial regeneration of forest has been gradually decreasing since 2000 due to the increase in implementation of the shelterwood system of silviculture. In contrast, the rate of natural forest regeneration has risen from 10% in 1995 to 40% in 2010 (Figure 3.10). Regional data regarding forest regeneration (natural and artificial) are presented in Map 6.8.

Only genetically appropriate seeds and seedlings approved by the Centre for Inspection of Forest Reproductive Material can be used for artificial afforestation.

Pre-commercial thinning has been performed on only 70% of planned forest in the last few years, largely as a result of the poor performance of non-state forest owners, by whom thinning was implemented on only 56% of the planned forest area.

An important part of silvicultural operations is the protection of forests against the main injurious factors. The current extent of protective measure implementation across the Slovak regions is shown in Map 6.9 (Forestportal o... 2012)

In 2009, 74% of the forest area in Slovakia was certified by either the Programme for the Endorsement of Forest Certification (PEFC) or the Forest Stewardship Council (FSC), with the former accounting for 64% of all certified forests. The Slovak Forest Certification Association (SFCS) is the National Governing Body associated with the PEFC (Fáber 2009).

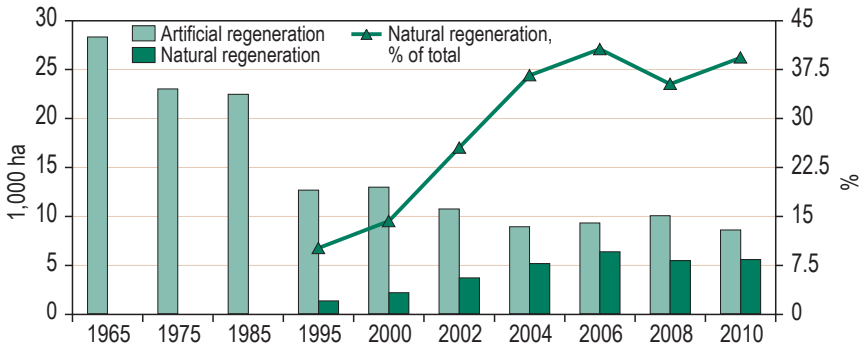


Figure 3.10. Development of forest regeneration in Slovakia during the period 1965–2010 (Green Report 2010).

Table 3.4. Forest certification in 2010 according to FSC statistics (Green Report 2011).

Certification scheme	PEFC	FSC	Total
Number of owners	296	6	302
Area in ha	1,262,505	140.105	1,402,610

3.5 Forest roads

According to available data, the current average density of the forest road network in Slovakia is 20.1 m/ha. In 2010, the total length of forest roads was 40,518 km (Table 3.5).

The optimal density of the forest road network in Slovakia, depending on the terrain, should be around 20–25 m/ha, meaning that approximately 6,000 km of new forest roads should be constructed. At present, an average of only 15–20 km is constructed annually.

The current state of the Slovak forest road network is in fact insufficient in terms of both density and quality, with class 1L roads representing only 23.1% of the total forest road network. More roads of this class must therefore be constructed, especially in Carpathian flysch areas.

Table 3.5. Forest road network in Slovakia (Green Report 2010, 2011).

Forest road category		2008		2009		2010	
		Length, km	Density, m/ha	Length, km	Density, m/ha	Length, km	Density, m/ha
1L	main paved roads	9,612	4.8	9,621	4.8	9,636	4.8
2L	main partially-paved forest roads	14,844	7.4	14,846	7.4	14,921	7.4
3L	main unpaved earth forest roads and permanent skidding roads	15,921	8.0	15,925	7.9	15,961	7.9
	Total	40,377	20.2	40,392	20.1	40,518	20.1

Note:
1L – year-round use
2L – seasonal use
3L – unpaved road sharing the parameters of main forest road that allow for timber haulage under favourable geological and weather conditions; permanent skidding (bare earth) road with maximum longitudinal gradient of 20%

3.6 Utilisation of biomass for energy

The potential of Slovak forest biomass for energy use is currently around 2.4 million tons, likely increasing to 3.2 million tons until 2050. Such biomass is typically procured in the form of traditional firewood and forest chips, with around 1 million tons currently delivered from forests to consumers in Slovakia each year. An overview of the amount of energy wood produced annually from Slovak forests is shown in Table 3.6.

Table 3.6. Production of energy wood from Slovak forests (Green Report 2010).

Year	Forest chips		Firewood		Total	
	1,000 tons	EJ	1,000 tons	EJ	1,000 tons	EJ
1990	2	0.02	368	3.50	370	3.52
2000	5	0.08	471	4.48	476	4.52
2005	120	1.14	640	6.08	760	7.22
2008	190	1.81	690	6.56	880	8.36
2009	220	2.09	695	6.60	915	8.69
2010	260	2.47	695	6.60	955	9.07

The current consumption of energy wood produced from forests, the wood-processing industry, agriculture and other sectors is close to 2 million tons. An overview of the main consumers with installed output greater than 0.2 MW_{th} is presented in Table 3.7 and Map 6.10.

Table 3.7. Consumption of biomass by heating and power plants with installed output greater than 0.2 MW_{th} (Jankovský 2012).

No.	Owner	Town	Installed output MW_e	Installed output MW_{th}	Consumption 1,000 tonnes 2010
1	SES Tlmače	Tlmače	0	2×16,5	18.2
2	Kysuca s.r.o.	Kys Nové Mesto	0	3×2,5	15.0
3	Tehos D. Kubín	Dolný Kubín	0	2×9,5	60.0
4	Bytreál Tlmače	Tlmače	0	1×0,2	0.7
5	Zvolenská teplárenská, a.s.	Zvolen	45	1×108, 1×65	67.0
6	KPT Bratislava	Bratislava	0	2×0,3	3.2
7	Bytterm Bánovce n/B.	Bánovce n/B.	0	2×0,5	6.3
8	TSM Partizánske	Partizánske	0	1×3	15.0
9	ILC distribution	Partizánske	0	1×3	15.3
10	Handlovská energetika	Handlová	0	3	6.4
11	Smrečina Hofatex	Banská Bystrica	2×6,5	2×11,5	70.0
12	Martinská teplárenská	Martin	1×7	1×40- SF	75.0
13	Spravbyt konfort Prešov	Prešov	0	8	25.0
14	MPB Vranov n/T.	Vranov n/T.	0	2×0,15	0.4
15	Bukocel, a.s. Vranov n/T.	Vranov n/T.	1×16,5	2×100	0.1
16	Sabyt Sabinov	Sabinov	0	2×0,6	3.0
17	Letecké opravovne Trenčín	Trenčín	0	2×0,2	0.7
18	Obec Zakamenné	Zakamenné	0	2×0,15	0.4
19	Sbsys Nižná	Nižná	0	2×0,5	5.7
20	Dalkia Slovakia Vráble	Vráble	0	1×1,9	4.0
21	Dalkia Slovakia Ziar/n.Hr.	Žiar n.Hronom	1×12	2×70	30.0
22	Intech Slovakia	Hriňová, Detva, Revúca	0	7×1	35.0
23	Chemes Humenné	Humenné	1×15,0	2×20	21.0
24	Energy Snina	Snina	1×5,0	2×9,5	56.0
25	SE, a.s. /Enel - Vojany	Vojany	1×110MW-FK		95.0
26	Bioenergy Bardejov	Bardejov	1×8,0	2×12	115.0
27	Bioenergy Topolčany	Topolčany	1×8,0	2×12	110.0
28	Rettenmeier Tatra Timber	L. Hrádok	1×4,0	2×14	50.0
29	Termonova Nová Dubnica	Nová Dubnica	1×2,2	4-16	40.0
30	Mondi SCP Ružomberok	Ružomberok	90	300	340.0
31	RWE - KA kontracting	Banská Bystgrica	0	2×6	30.0
32	Dalkia Slovakia Ziar/n.Hr.	Žiar n.Hronom	1×12	2×70	120.0
33	Bučina Zvolen	Zvolen	1×5	2×14	35.0
34	Energy Edge ZC, s.r.o.	Žarnovica	10,0	2×14	135.0
35	KOMPALA	Badín	2×11		30.0
36	Export				200.0
	Total				**1,840.5**

4 Forest industry

4.1 Development of the forest sector

The concept of 'wood-processing combinates' was developed in Slovakia during the former period of centrally-planned economy; factories and mills were constructed across the country with the aim of processing the assortment of timber available in each region. Some of these plants were specialised in terms of processing either broadleaved or coniferous tree species, depending on the prevailing tree species in the respective region. At the concept's height, Slovakia possessed more than 20 wood-processing factories and mills, each with over 500 employees.

After the political changes of the 1990s, the system was abandoned and the majority of factories were closed. New companies have since been oriented mainly toward the sawmilling of coniferous timber, most with very low production capacity and producing products with low added value. As a result, a very high proportion of removals are exported in the form of roundwood or sawn timber (Národný program…. 2012).

In 2010, removals totalled 8,916,000 m^3 of timber. According to the Customs Yearbook for the same year, Slovakia exported 2,564,000 m^3 of roundwood assortments worth around €187.5 million (Vins 2012).

In contrast, only 566,000 m^3 of timber (worth €21.6 million) was imported, of which 36.1% was coniferous timber, 53.5% non-coniferous timber and the remaining 10.4% fuelwood (Green Report 2011).

Figure 4.1 presents the development of total roundwood removals, as well as the export and import of timber in Slovakia for the period 1993–2011.

The future development of the forest products sector very much depends on the potential for harvesting opportunities in Slovak forests. Table 4.1 displays a strategic prognosis regarding future timber harvests according to the Slovak National Programme for the Utilisation of Wood Potential (Národný program… 2012). As this table reveals, a decrease of almost 1 million m^3 in total harvest volume is predicted for the next few decades. Conifer harvests are projected to decline substantially, while those of broadleaf tree species are set to increase. This fact must be accounted for in future planning of processing capacities and produced products.

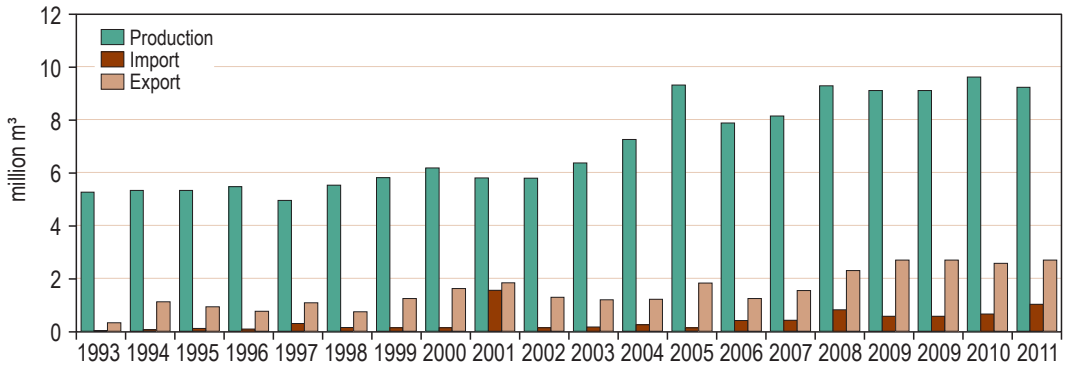


Figure 4.1. Roundwood removals and foreign trade in Slovakia (FAOSTAT 2012).

Table 4.1. Strategic prognosis for Slovak timber harvesting (Národný program… 2012).

Timber harvesting	Current	Predicted timber harvest				
	2010	2015	2020	2025	2030	2035
	million m³					
Total	9.86	8.83	8.90	8.96	9.00	8.99
Final felling	7.91	7.38	7.55	7.65	7.73	7.74
Thinnings	1.94	1.46	1.35	1.31	1.27	1.24
Conifers	6.24	4.64	4.50	4.37	4.25	4.11
Broadleafs	3.63	4.19	4.40	4.59	4.75	4.88

4.2 Use of roundwood and location of industry

The processing of coniferous roundwood in Slovakia is largely carried out in sawmills. Eight of the country's sawmills have an annual processing capacity greater than 50,000 m^3 (Table 4.2.), with a further 15 ranging between 20,000 m^3 and 50,000 m^3. The remaining sawmills are of very low capacity.

Capacities for the processing of hardwood sawlogs were closed during the 1990s, with the current national annual volume of less than 500,000 m^3 processed by small entrepreneurs. The production of wood products with higher added value, such as plywood, particle boards and MDF, is completely absent (Národný program… 2012).

The Mondi SCP a.s. mill located in Ružomberok is the most important Slovak manufacturer of pulp and paper, producing 474,000 tons of sulfate pulp and 510,000 tons of paper in 2010. The second most important pulpmill is that of Bukóza Holding a.s., Hencovce, with 126,000 tons of sulfate pulp produced in 2010. In 2011, overall paper production dropped by 4.1% compared to 2010 levels (Národný program… 2012).

The locations of the main sawmill capacities and most important pulpmills in Slovakia are displayed in Map 6.11.

Table 4.2. Main sawmill capacities (Národný program… 2012, Vins 2012).

Sawmill	Location	Capacity, 1,000 m^3
Rettenmeier Tatra Timber	Liptovský Hrádok	800
PRP	Veľký Krtíš	300
Amico drevo	Oravský Podzámok	120
P.F.A	Lozorno	90
Pilex Slovakia	Podolínec	84
Kamwood	Lučenec	60
Drevopal	Ladce	50
ProPopulo PP	Levoča	50

4.3 Production trends, exports and imports of timber and timber products.

The Slovak forestry industry is still recovering from its destruction at the beginning of the 1990s. A net exporter of roundwood (Fig. 4.1) and sawnwood (Fig. 4.2), Slovakia also annually produces less than 1 million m³ of wood-based panels (Fig. 4.3–4.5).

During the 2000s, domestic annual pulp production was around 600,000–700,000 tons, with paper production slightly less than 1 million tons. Slovakia is the only CEE country in which the production of printing and writing paper accounts for more than half of total paper and paperboard.

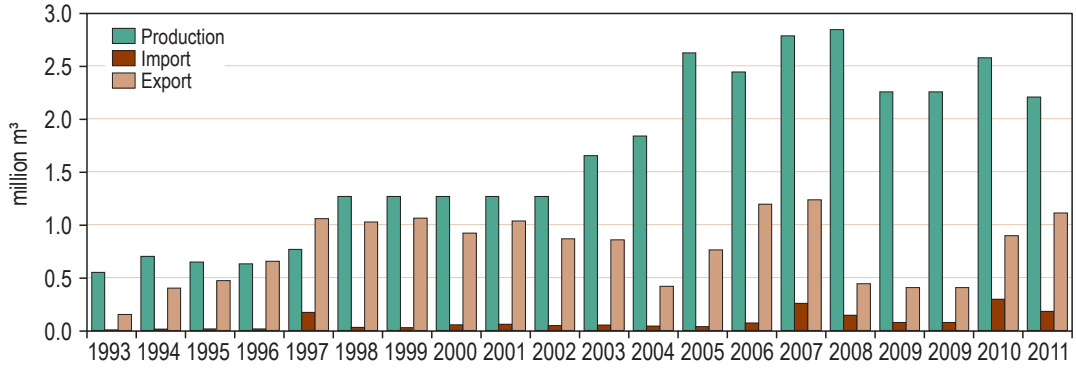


Figure 4.2. Production trends, imports and exports of sawnwood (FAOSTAT 2012).

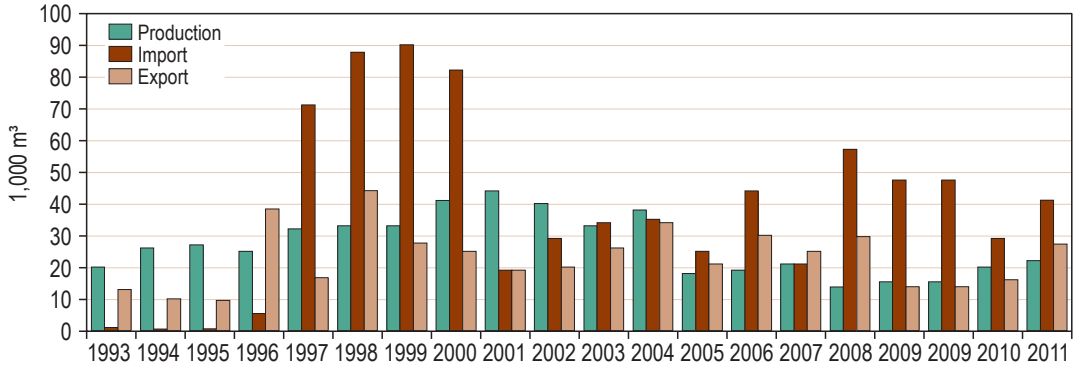


Figure 4.3. Production trends, imports and exports of plywood (FAOSTAT 2012).

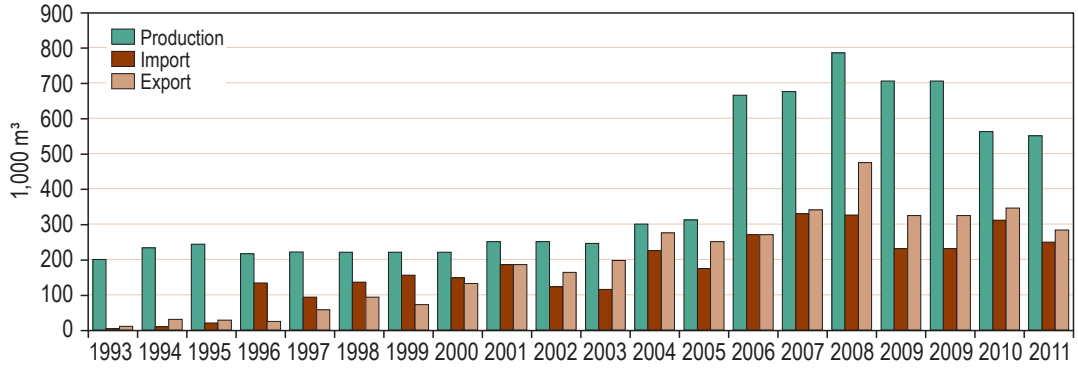


Figure 4.4 Production trends, imports and exports of particle boards (including OSB) (FAOSTAT 2012).

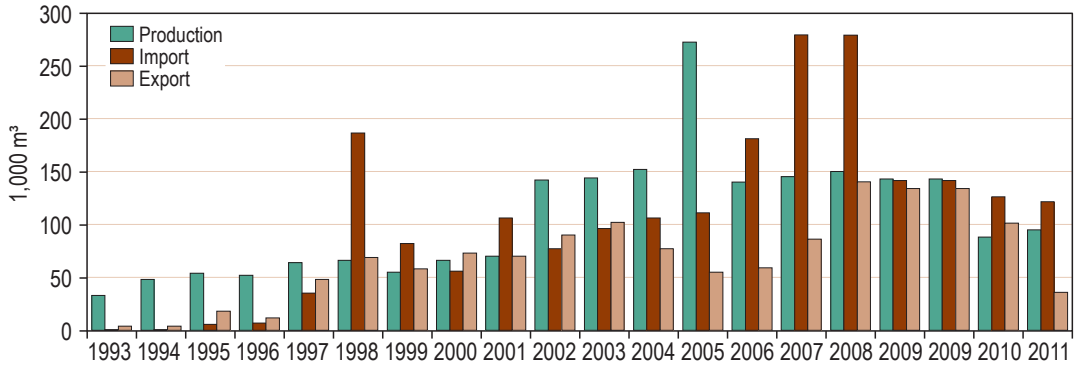


Figure 4.5. Production trends, imports and exports of fibreboard (FAOSTAT 2012).

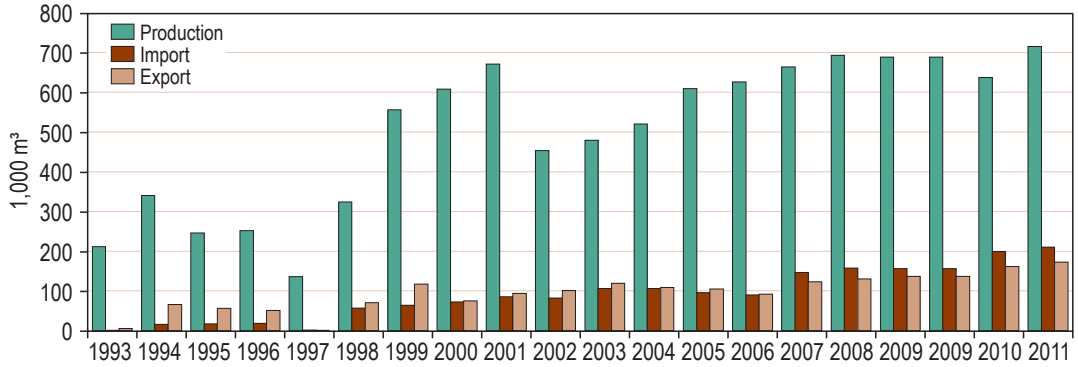


Figure 4.6. Production trends, imports and exports of pulp (FAOSTAT 2012).

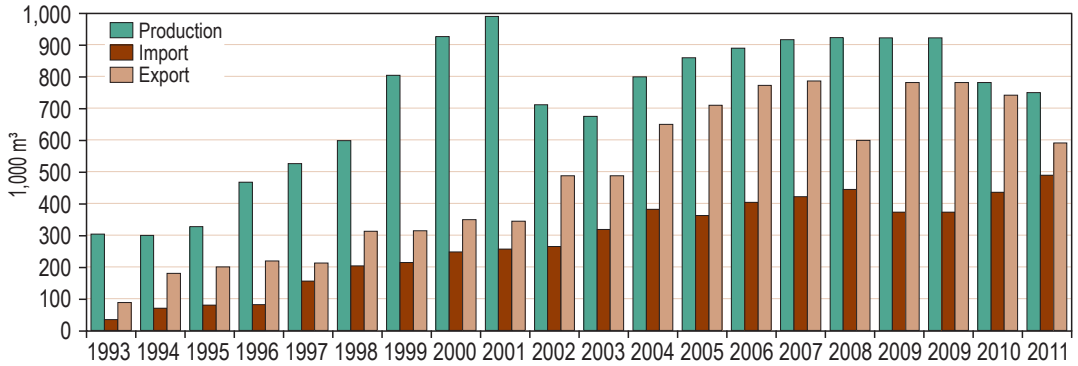


Figure 4.7. Production trends, imports and exports of paper and paperboard (FAOSTAT 2012).

The structure of Slovak timber-product exports is presented in Fig. 4.8–4.13.

The most important export destinations for Slovak roundwood in 2010 were Austria, the Czech Republic and Poland (Fig. 4.8) (FAOSTAT 2012). In 2011, almost half of exported roundwood was comprised of coniferous roundwood (1.3 mill. m^3), with the main export markets being the Czech Republic (687,000 m^3), Austria (297,000 m^3), and Poland (263,000 m^3) (Vins 2012).

The most important export countries for sawnwood in 2010 were Hungary and Italy (Figure 4.9), and for wood-based panels and paper: Poland, Italy and Germany (Fig. 4.10–4.12).

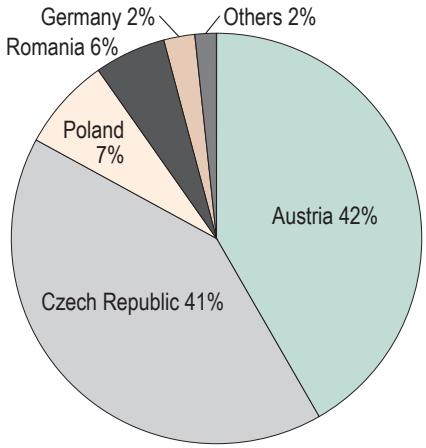


Figure 4.8. Industrial roundwood exports according to country in 2010 (FAOSTAT 2012).

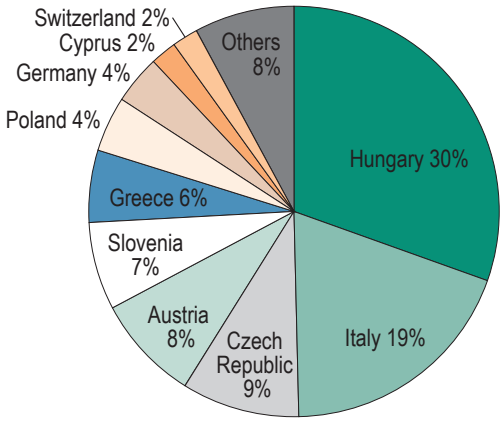


Figure 4.9. Sawnwood exports according to country in 2010 (FAOSTAT 2012).

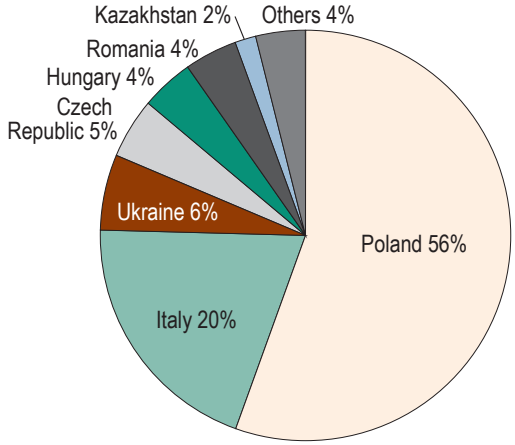


Figure 4.10. Particle board exports according to country in 2010 (FAOSTAT 2012).

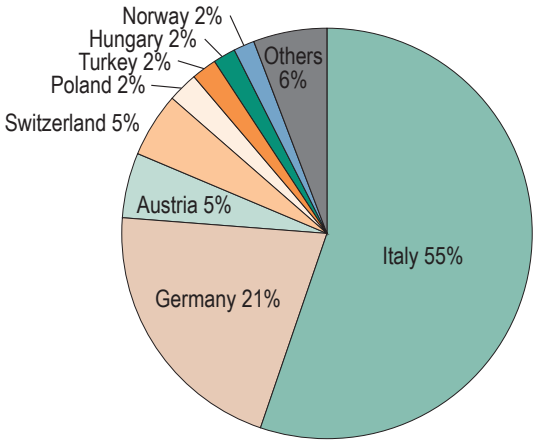


Figure 4.11. Plywood exports according to country in 2010 (FAOSTAT 2012).

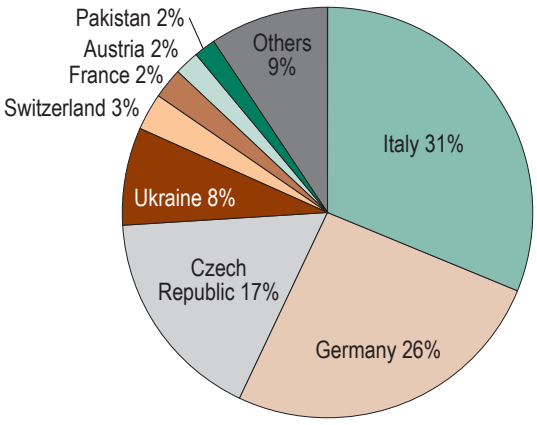


Figure 4.12. Fibreboard exports according to country in 2010 (FAOSTAT 2012).

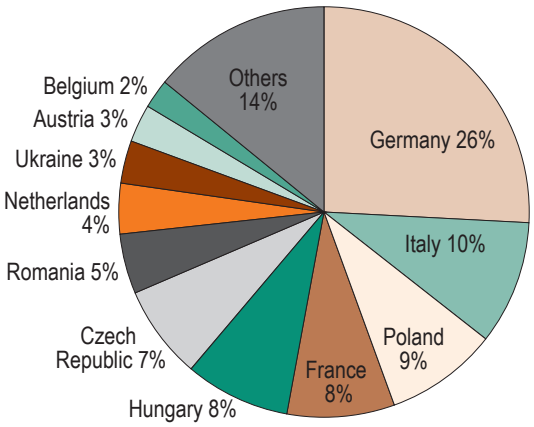


Figure 4.13. Paper and paperboard exports according to country in 2010 (FAOSTAT 2012).

5 Forest education and research

5.1 Forest education

The education of a new generation of forest management staff is currently provided by 9 institutions:

- Faculty of Forestry at the Technical University in Zvolen
- Three Secondary Forestry Schools in Banská Štiavnica, Liptovský Hrádok and Prešov
- Two Vocational Forestry Schools in Bijacovce and Tvrdošín
- Three Joint Vocational Schools in which forestry is one of the available specialisations.

All of the above institutions fall under the Ministry of Education, Science, Research and Sport of the Slovak Republic.

The Faculty of Forestry at TU Zvolen provides degrees at three different levels of study: BSc, MSc and PhD (Table 5.1). During the 2011/2012 academic year, a total of 134 bachelors, 123 masters and 18 PhD students graduated from both full time and part-time degrees.

In the same period, the secondary and vocational schools jointly produced 375 students who went on to employment in forestry practice, as well as in technical and administrative positions (Green Report 2011).

Further training of forestry professionals is provided through accredited courses organised by the National Forest Centre at the Institute of Forest Consulting and Education in Zvolen. The courses are available for a wide range of forestry professionals from both state and non-state forest sectors.

Established by TU Zvolen in 2004, the Centre of Continual Education is aimed at the development and provision of further education in compliance with the professional orientation of the University's faculties.

Table 5.1. Accredited forestry study programmes available at TU Zvolen (Technical University… 2013).

Faculty	Accredited study programmes		
	BSc	MSc	PhD
Faculty of Forestry	Forestry	Forestry	Forest Management
	Applied Zoology and Game Management	Forest Ecology	Forest Phytology
		Applied Zoology and Game Management	Silviculture and Forest Protection
		Geoinformatics and Mapping Technologies in Forestry	Technique and Technologies of Forestry Production
			Applied Zoology and Game Management
			Forestry Ameliorations
Whole University Study Programme*	Economy and Management of Natural Resources	Management and Financing of Forest Enterprises	

*falls under the University Rectorate

Table 5.2. Secondary forestry schools in Slovakia (Stredná odborná… 2013a, 2013b, 2013c).

Name	Field	Website
Banská Štiavnica Secondary Forestry School	Forestry Bioenergetics	http://www.soslbs.edupage.org
Jozef Dekret Matejovie Secondary Forestry School, Liptovský Hrádok	Forestry Economics Rural development	http://www.slslhr.sk
Prešov Secondary Forestry School	Forestry	http://www.slspo.sk

Table 5.3. Vocational forestry schools in Slovakia (Súhrnné informácie... 2012).

Name	Field	Website
Bijacovce Vocational Forestry School	Forestry Forest machinery	http://www.sosbijac.edupage.org
Tvrdošín Vocational Forestry School	Forestry Forest machinery Forest and landscape keeper	http://www.soultv.sk
Banská Štiavnica Joint Vocational School	Forestry Forest machinery	http://www.soulesbb.edu.sk
Ivanka pri Dunaji Vocational School of Agriculture	Forestry Forest machinery Forest and landscape keeper	http://www.spojsivanka.sk
Sigord Vocational School	Forestry Forest production	http://www.slspo.sk

5.2 Forest research

There are several research institutions in Slovakia which focus solely on forestry issues. Among these is the National Forest Centre (NFC), a semi-budgetary forestry agency established in Zvolen by the Ministry of Agriculture and Rural Development (MARD). Reporting directly to the Department of Forestry and Wood-processing within the MARD, the NFC is an umbrella organisation for four specialised institutes:

- NFC – Forest Research Institute (FRI);
- NFC – Institute for Forest Consulting and Education (IFCE);
- NFC – Institute for Forest Resources and Information (IFRI);
- NFC – Forest Management Institute (FMI).

The NFC strives to both enhance the management of national forest resources and to promote the role of forests in sustainable development. In order to achieve these aims, the Centre covers a wide range of forest-related topics, from high-quality research through forest planning, forest inventorisation and monitoring, forest informatics and thematic forest mapping, to consulting, public education and further training of forestry professionals (Green Report 2010, National Forest… 2012).

The main objective of the Forest Research Institute is to obtain new scientific knowledge regarding forest ecosystems and their management, doing so by undertaking research activities

in the fields of biology, forest management, forest technology and economics, among others. Additional important activities covered by the Institute include forest protection services, seed production control, elaboration of forestry standards and scientific information services (FAO Forestry… 2012).

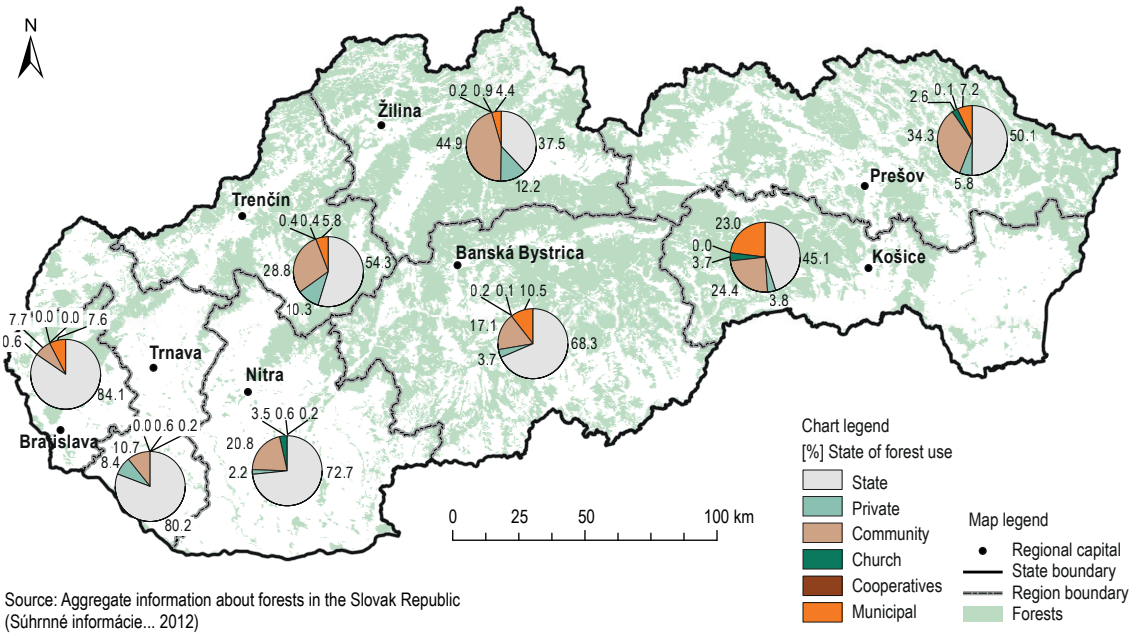
Research examining the specific issues facing mountain forests is conducted by the Research Station & Museum established by the Forests of Tatra National Park public enterprise.

Other research bodies include the Faculty of Forestry at TU Zvolen and the Institute of Forest Ecology of the Slovak Academy of Sciences Zvolen. Both deal mainly with basic research and fall under the Ministry of Education, Science, Research and Sport.

All of the above bodies are involved in a number of international cooperation programmes through the European Forest Institute (EFI) and the International Union of Forest Research Organisations (IUFRO).

6 Maps

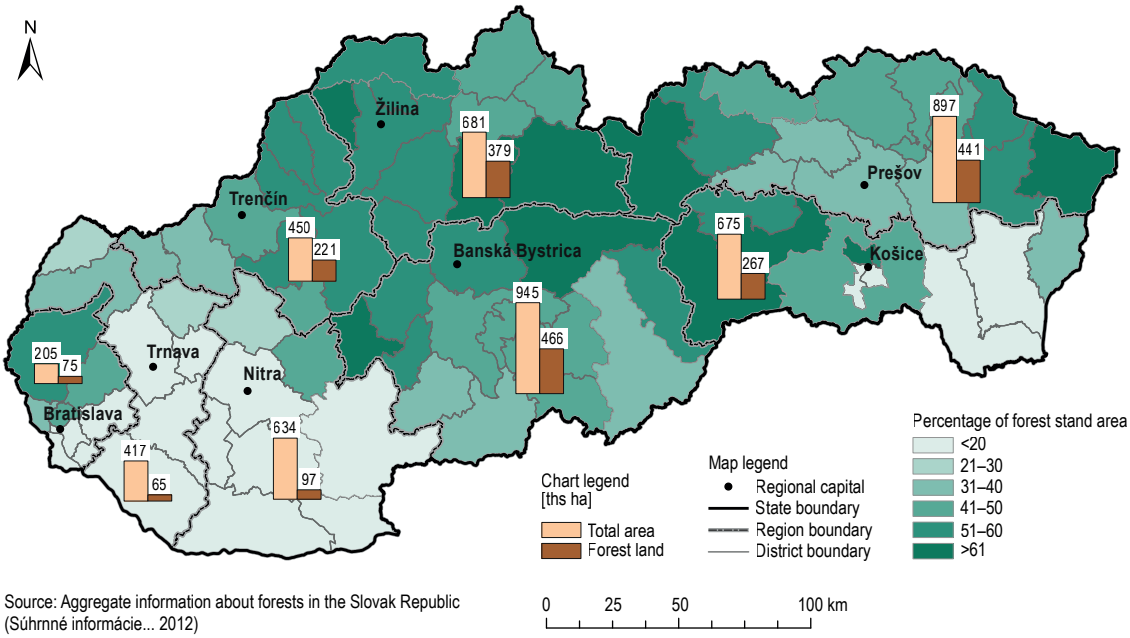
6.1 State of forest use in the Slovak regions



Source: Aggregate information about forests in the Slovak Republic (Súhrnné informácie... 2012)

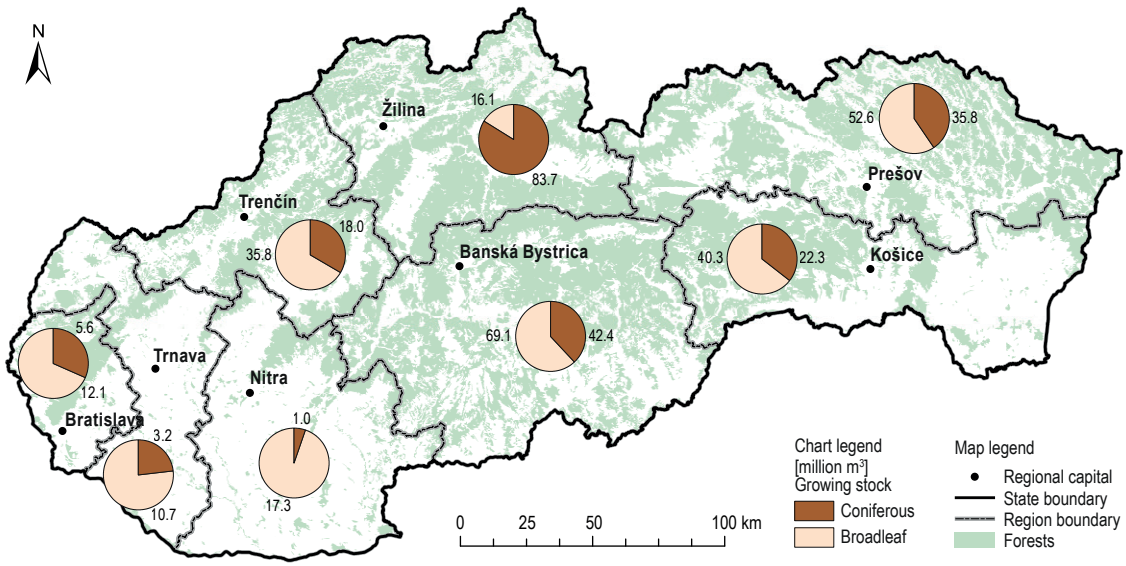
Region	Forest Owner						Total
	State	Private	Community	Church	Cooperatives	Municipal	
				ha			
Bratislava	61,266	417	5,634	14	6	5,509	72,846
Trnava	50,005	5,230	6,673	3	345	104	62,360
Trenčín	116,868	22,157	62,051	808	776	12,518	215,178
Nitra	67,290	1,994	19,235	3,235	527	225	92,506
Žilina	136,679	44,514	163,451	596	3,102	16,087	364,429
Banská Bystrica	310,155	16,749	77,762	885	487	47,777	453,815
Prešov	210,343	24,185	143,904	10,911	537	30,129	420,009
Košice	116,679	9,925	63,060	9,692	0	59,611	258,967
Total	1,069,285	125,171	541,770	26,144	5,780	171,960	1 940,110

6.2 Area of forest land in the Slovak regions



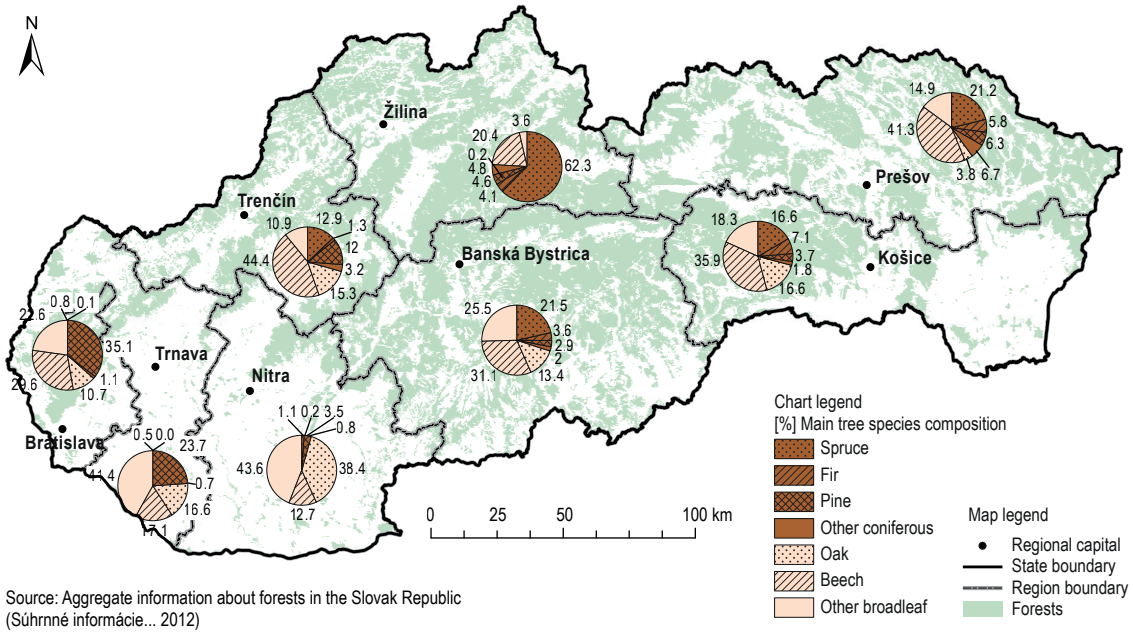
Source: Aggregate information about forests in the Slovak Republic (Súhrnné informácie... 2012)

6.3 Growing stock in the Slovak regions



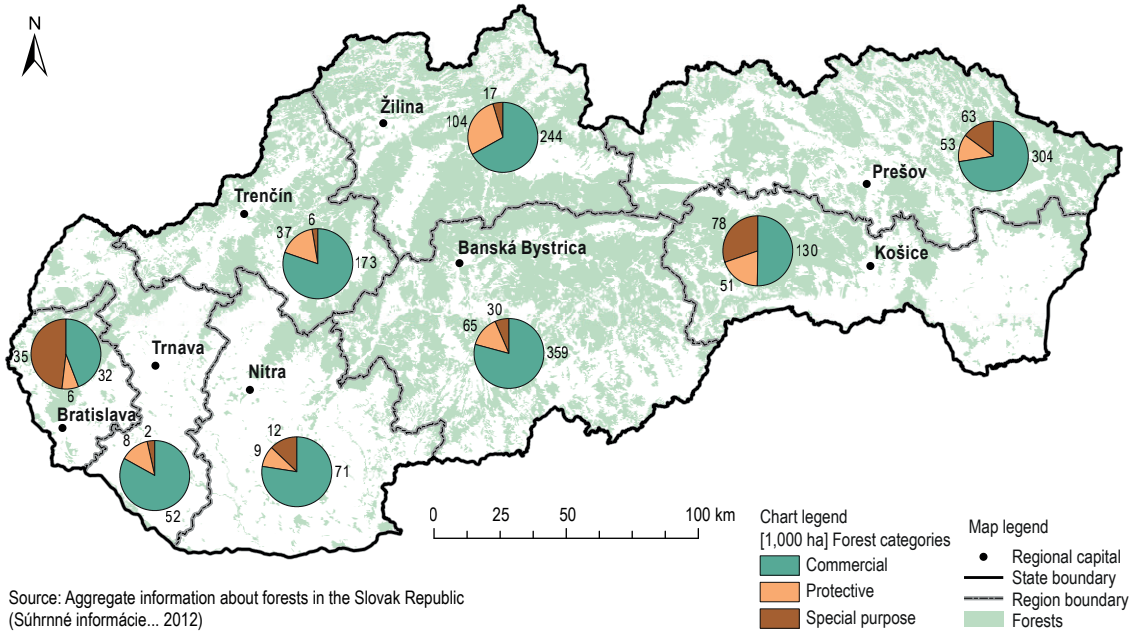
Source: Aggregate information about forests in the Slovak Republic (Súhrnné informácie... 2012)

6.4 Main tree species composition in the Slovak regions



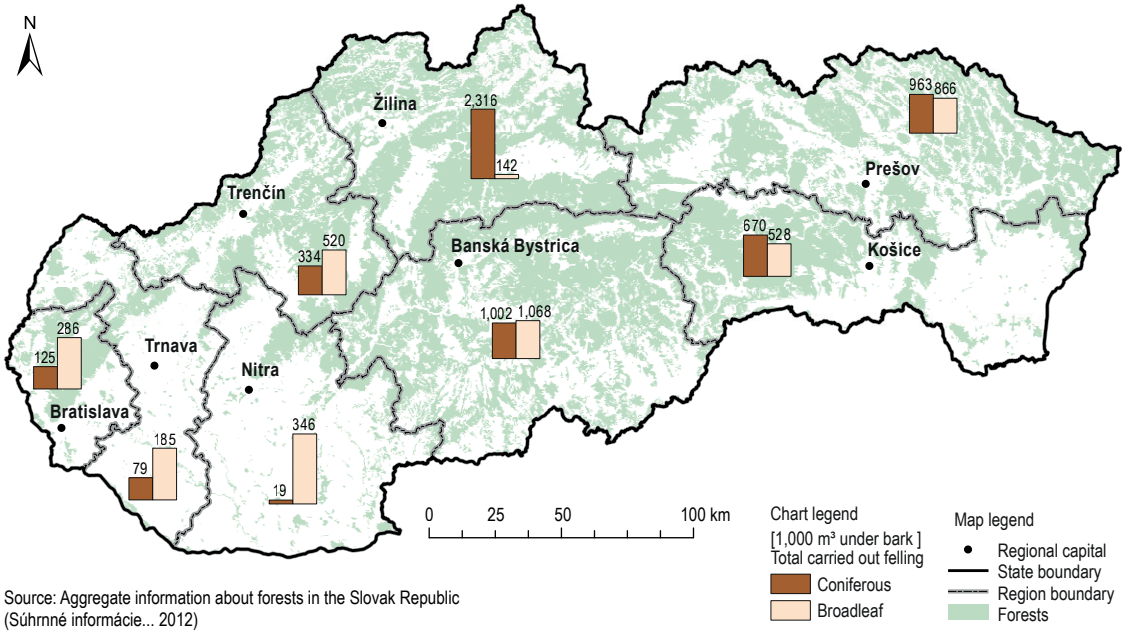
Source: Aggregate information about forests in the Slovak Republic (Súhrnné informácie... 2012)

6.5 Distribution of forest categories in the Slovak regions



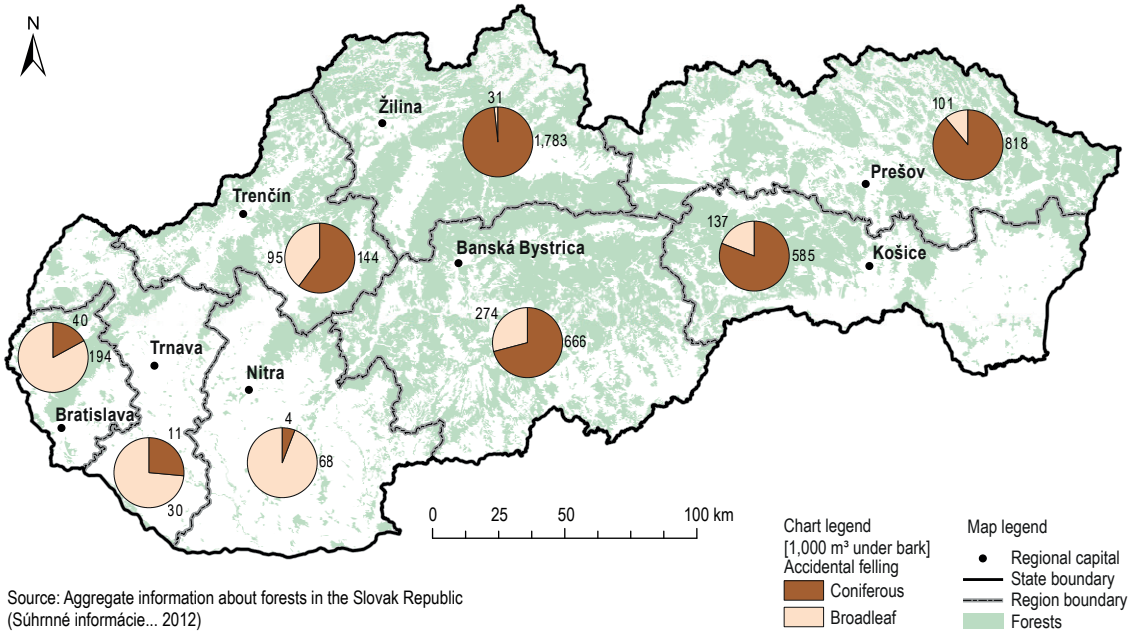
Source: Aggregate information about forests in the Slovak Republic (Súhrnné informácie... 2012)

6.6 Total felling in the Slovak regions



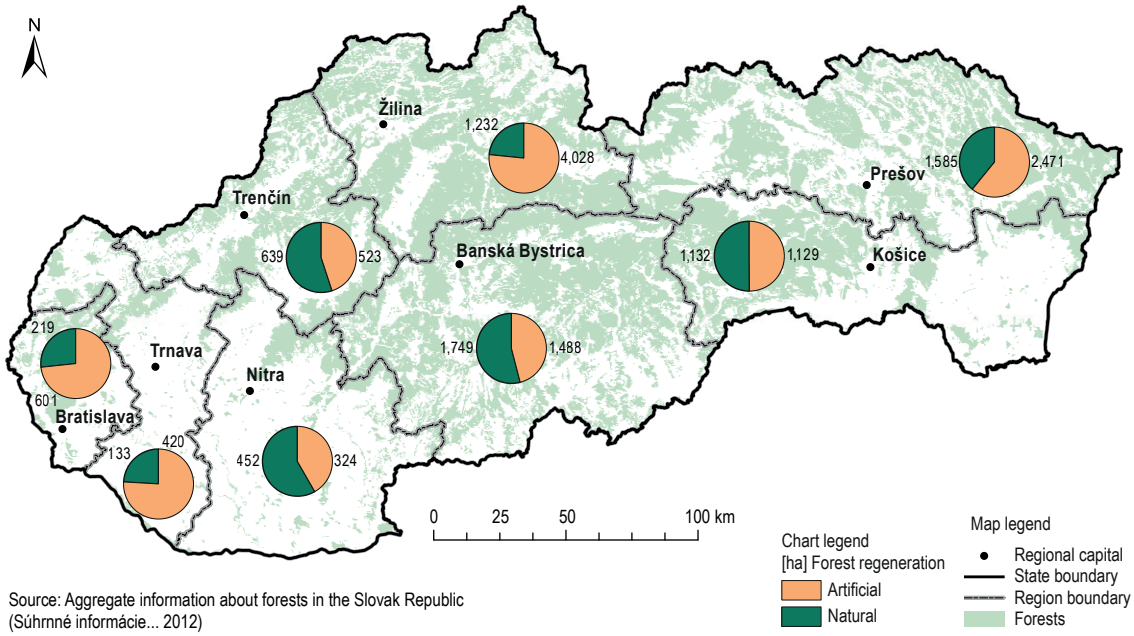
Source: Aggregate information about forests in the Slovak Republic (Súhrnné informácie... 2012)

6.7 Accidental felling in the Slovak regions



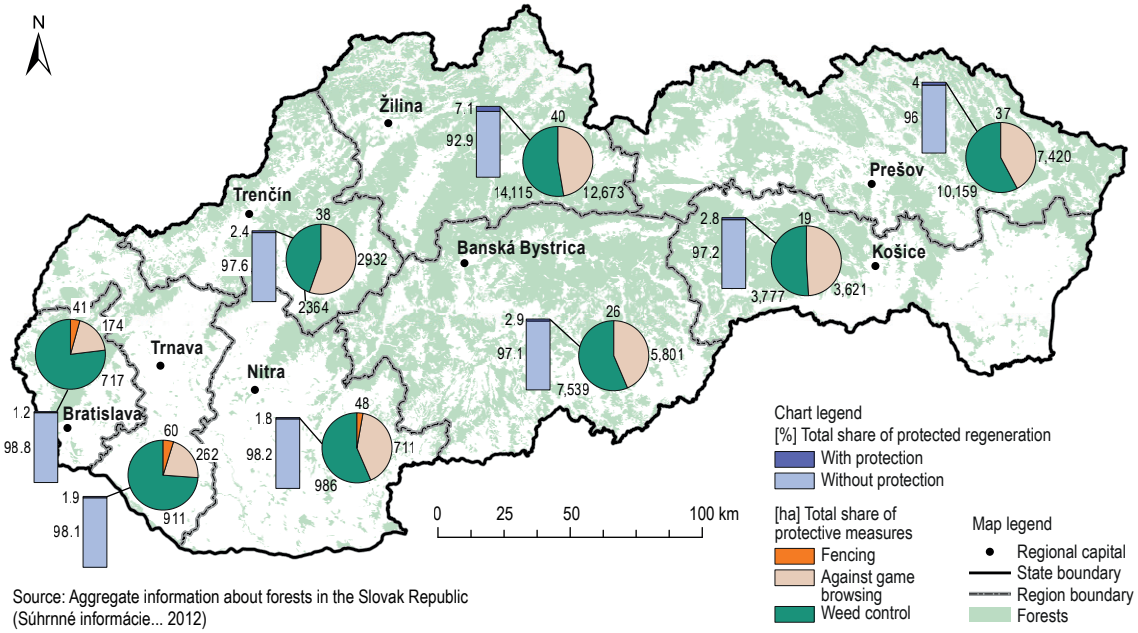
Source: Aggregate information about forests in the Slovak Republic (Súhrnné informácie... 2012)

6.8 Area of forest regeneration in the Slovak regions



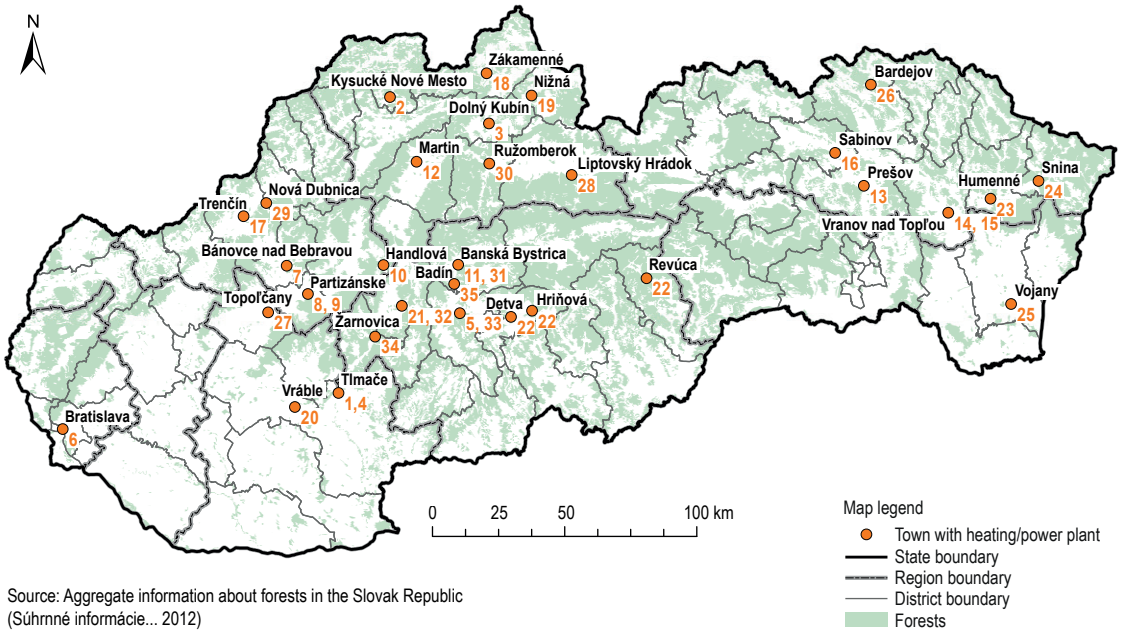
Source: Aggregate information about forests in the Slovak Republic (Súhrnné informácie... 2012)

6.9 Forest protection in the Slovak regions



Source: Aggregate information about forests in the Slovak Republic (Súhrnné informácie... 2012)

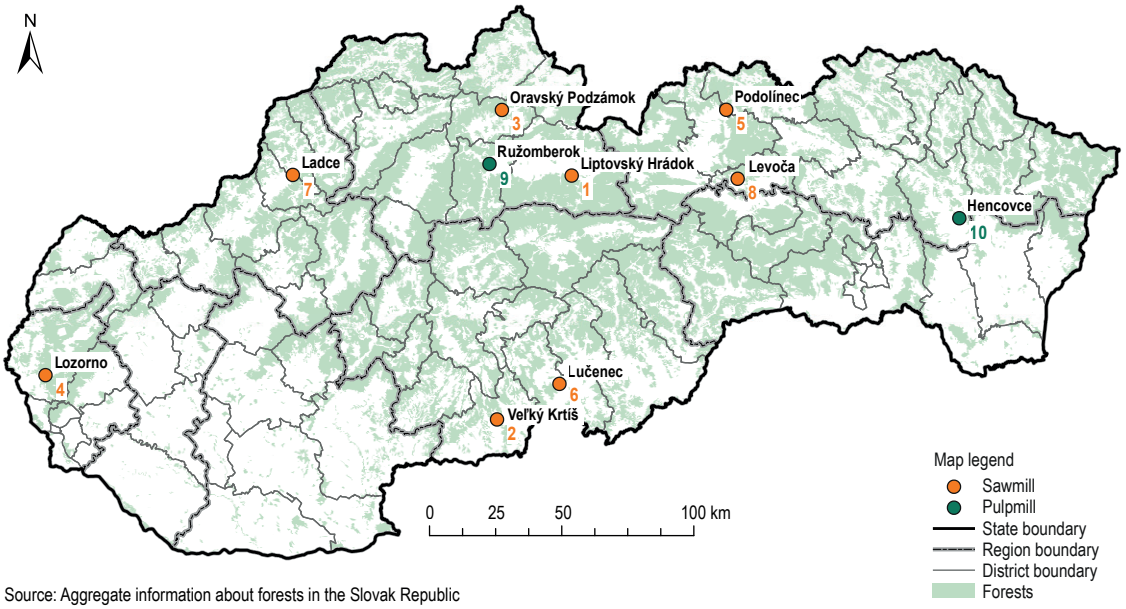
6.10 Heating and power plants with installed output greater than 0.2 MW_{th} in the towns of the Slovak republic



Source: Aggregate information about forests in the Slovak Republic (Súhrnné informácie... 2012)

No.	Town	No.	Town
1	Tlmače	19	Nižná
2	Kys. Nové Mesto	20	Vráble
3	Dolný Kubín	21	Žiar n.Hronom
4	Tlmače	22	Hriňová, Detva, Revúca
5	Zvolen	23	Humenné
6	Bratislava	24	Snina
7	Bánovce n/B.	25	Vojany
8	Partizánske	26	Bardejov
9	Partizánske	27	Topolčany
10	Handlová	28	L. Hrádok
11	Banská Bystrica	29	Nová Dubnica
12	Martin	30	Ružomberok
13	Prešov	31	Banská Bystrica
14	Vranov n/T.	32	Žiar n.Hronom
15	Vranov n/T.	33	Zvolen
16	Sabinov	34	Žarnovica
17	Trenčín	35	Badín
18	Zákamenné		

6.11 Main sawmill capacities and the most important pulpmills in the Slovak republic



Source: Aggregate information about forests in the Slovak Republic (Súhrnné informácie... 2012)

No.	Sawmill	Location	Annual processing capacity [m^3]
1	Rettenmeier Tatra Timber	Liptovský Hrádok	800,000
2	PRP	Veľký Krtíš	300,000
3	Amico drevo	Oravský Podzámok	120,000
4	P.F.A	Lozorno	90,000
5	Pilex Slovakia	Podolínec	84,000
6	Kamwood	Lučenec	60,000
7	Drevopal	Ladce	50,000
8	ProPopulo PP	Levoča	50,000
No.	**Pulpmill**	**Location**	**Sulfate pulp production in 2010 [tons]**
9	Mondi SCP	Ružomberok	474,000
10	Bukóza Holding	Hencovce	126,000

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