

Atlas of the forest sector in Poland

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Working Papers of the Finnish Forest Research Institute publishes preliminary research results and conference proceedings.

The papers published in the series are not peer-reviewed.

<http://www.metla.fi/julkaisut/workingpapers/>
ISSN 1795-150X

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Publisher

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Authors Gerasimov, Yuri			
Title Atlas of the forest sector in Poland			
Year 2013	Pages 62	ISBN 978-951-40-2421-4 (PDF)	ISSN 1795-150X
Unit / Research programme / Projects Joensuu Unit / 7395 Central and Eastern European Forest Information Service / 3598 Topical follow-up of forest sectors in Russia, Central and Eastern European countries			
Accepted by Timo Karjalainen, Professor of International Forestry, 24.05.2013			
Abstract This atlas is a collection of maps with a short description of the current situation of the forest sector in Poland including the regions of Dolnośląskie, Kujawsko-pomorskie, Lubelskie, Lubuskie, Łódzkie, Małopolskie, Mazowieckie, Opolskie, Podkarpackie, Podlaskie, Pomorskie, Śląskie, Świętokrzyskie, Warmińsko-mazurskie, Wielkopolskie, and Zachodniopomorskie. The cartographic information covers forest resources, silviculture, wood harvesting, production and the most important producers of wood-based products (sawnwood, plywood, wood-based panels, pulp, paper, paperboard), potential of energy wood, producers of forest-related machinery, wood pellets and briquettes, forest education, and research institutions. This review serves the information needs of different stakeholders and those interested in the forest sector of Poland			
Keywords Forest resources, wood harvesting, forest industry, bioenergy, forest policy			
Available at http://www.metla.fi/julkaisut/workingpapers/2013/mwp268.htm			
Replaces			
Is replaced by			
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Other information Layout: Anne Siika/Metla			

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Preface

The report is a collection of maps with a short description of the current situation of the forest sector in different administrative regions in Poland. This review aims to provide a comprehensive picture of the situation of the forest sector in Poland, but in a very compact form by presenting information mainly on maps.

This publication was produced under the umbrella of the project “Central and Eastern European Forest Information Service”. The aim of the project is to create an information service for the Belarusian, Czech, Estonian, Latvian, Lithuanian, Polish, Romanian, Slovakian, and Ukrainian (hereafter CEE countries) forest sectors and to strengthen knowledge relating to them. The project collects information about the business environment of the forest sector, wood availability, forest sector enterprises, and bioenergy markets of CEE countries. The goal is also to find business opportunities and new markets in CEE countries for the Finnish forest sector enterprises and technology manufacturers. The project is funded by the European Social Fund and will be executed in 2010–2013. The co-ordinator of the project is the Finnish Forest Research Institute (Metla). Other partners are the Mikkeli Small Business Centre at the Aalto University School of Economics, School of Forest Sciences at the University of Eastern Finland, North Karelia University of Applied Sciences, and North Karelia College in Valtimo.

The project aims to provide a publication series about CEE countries in the same form. All publications can be downloaded from the Internet service of the CEE forestry: <http://www.metla.fi/metinfo/kie/>.

1 Introduction

Poland is the ninth largest country in Europe with a total area of 312,679 km², situated in the centre of Europe. Poland's population is over 38 million people, which makes it the sixth most populous member of the European Union. Administratively, Poland (Map 7.1) is divided into 16 provinces (*voivodeships*), which are subdivided into 379 counties (*powiats*) and 2,478 communes or municipalities (*gminas*) (GUS 2011e). Polish economy is on the healthy basis and it is one of the fastest growing within the EU. Poland is the only European economy to have avoided the late-2000s recession, owing to a strong domestic market, low private debt, flexible currency, and diverse exporting sectors (World Bank 2012, Wikipedia 2012).

Poland has relatively vast forest land areas and long traditions in the field of forestry as well as a high level of forest management and multiple use of forest resources. Poland contributes to the conservation of forests and environmental stability, and plays an important role in the CEE forest sector. In 2011, Poland produced 28% of the total industrial roundwood of CEE, 40% of its paper and cardboard, 29% of its plywood, and 15% of its sawnwood (UNECE 2012). By contrast, Poland has 18% of the forest land and 18% of the growing stock of the whole of CEE.

2 Forest sector policy

2.1 Forest ownership and administration

Forests in Poland are mostly publicly owned. The state owns 80% of forests, and 77% are under the management of the National Forest Holding "State Forests" (*Lasy Państwowe*). The share of privately owned forests is 19% (Table 2.1).

The forest administration is concentrated in the Ministry of the Environment of Poland. The Ministry is in charge of implementing national forest policy and enforcing forest legislation (Ministry of the Environment 2012).

Table 2.1. Forest ownership in 2011 (GUS 2012c).

Owner	Forests	
	1,000 ha	%
Poland	9,143	100
<i>Public</i>	7,438	81
State	7,354	80
National Forest Holding "State Forests"	7,077	77
National parks	184	2
Agricultural	34	0
Municipalities	84	1
<i>Private</i>	1,706	19
Individuals	1,606	18
Co-operatives, etc.	100	1

The management and local administration of state-owned forests are organised through the State Forests on behalf of the Polish State Treasury (PGL LP 2012). The organisation does not manage Poland's National Parks; however, the State Forests is involved in forest management in Landscape Parks, covering about 8% of the territory. The State Forests does not have a legal personality, but it is required to be financially self-sufficient with fixed assets of about PLN 3.6 billion. As of 2011, the State Forests comprised the following organisational units:

- Directorate-general;
- 17 regional directorates;
- 430 forest districts;
- Seven organisational units at the national level (the State Forest Information Centre, the Centre for Research and Implementation in Bedoń, the Forest Technology Centre in Jarocin, the State Forests Information Department in Bedoń, and the Environmental Project Co-ordination Centre in Warsaw).
- 17 organisational units at the regional level (transport and logistics, forest transport, forest services, service and production, storage complexes, fisheries, training and recreation centres);
- Two organisational units at the local level (the Kostrzyca Forest Gene Bank in Miłków and the Forest Culture Centre in Gołuchów).

The primary organisational unit of the State Forests is a forest district (*nadleśnictwo*), a list of which is presented in Table 2.2. The locations of forest districts can be downloaded from the official webpage of the State Forests (<http://zakazywstepu.lasy.gov.pl>). A district forest manager independently manages forests in his or her area according to the forest management plan, and he or she is responsible for their condition. In 2011, there were 431 forest districts with an average area of 17,500 hectares each. The State Forests employs about 24,700 people (PGL LP 2011). Each forest district is divided into several, more than a dozen, forestry units (*leśnictwo*) (Figure 2.1).

Table 2.2. Forest regions of the National Forest Holding “State Forests” in Poland (PGL LP 2012).

Forest region	Name of the Regional Directorates	Number	Official website
Białystok	Regionalna Dyrekcja Lasów Państwowych w Białymstoku	31	bialystok.lasy.gov.pl
Gdańsk	Regionalna Dyrekcja Lasów Państwowych w Gdańsku	15	gdansk.lasy.gov.pl
Katowice	Regionalna Dyrekcja Lasów Państwowych w Katowicach	37	katowice.lasy.gov.pl
Kraków	Regionalna Dyrekcja Lasów Państwowych w Krakowie	16	krakow.lasy.gov.pl
Krosno	Regionalna Dyrekcja Lasów Państwowych w Krośnie	26	krosno.lasy.gov.pl
Lublin	Regionalna Dyrekcja Lasów Państwowych w Lublinie	25	lublin.lasy.gov.pl
Łódź	Regionalna Dyrekcja Lasów Państwowych w Łodzi	19	lodz.lasy.gov.pl
Olsztyn	Regionalna Dyrekcja Lasów Państwowych w Olsztynie	33	olsztyn.lasy.gov.pl
Piła	Regionalna Dyrekcja Lasów Państwowych w Pile	20	pila.lasy.gov.pl
Poznań	Regionalna Dyrekcja Lasów Państwowych w Poznaniu	25	poznan.lasy.gov.pl
Radom	Regionalna Dyrekcja Lasów Państwowych w Radomiu	23	radom.lasy.gov.pl
Szczecin	Regionalna Dyrekcja Lasów Państwowych w Szczecinie	35	szczecin.lasy.gov.pl
Szczecinek	Regionalna Dyrekcja Lasów Państwowych w Szczecinku	30	szczecinek.lasy.gov.pl
Toruń	Regionalna Dyrekcja Lasów Państwowych w Toruniu	27	torun.lasy.gov.pl
Warszawa	Regionalna Dyrekcja Lasów Państwowych w Warszawie	14	warszawa.lasy.gov.pl
Wrocław	Regionalna Dyrekcja Lasów Państwowych w Wrocławiu	33	wroclaw.lasy.gov.pl
Zielona Góra	Regionalna Dyrekcja Lasów Państwowych w Zielonej Górze	20	zielonagora.lasy.gov.pl



Source: www.zielonagora.lasy.gov.pl/web/rdlp_zielonagora/struktura_organizacyjna

Figure 2.1. Map of the regional directorate (*Regionalna Dyrekcja Lasów Państwowych*) in Zielonej Górze including 20 forest districts (*nadleśnictw*) and 246 forestry units (*leśnictw*).

2.2 Forest policy

The National Forest Programme as such is still in preparation. Ongoing forest policy is based on the following forest legislation and programmes: Forest Law (1991, renev. 1997), State Forest Policy (1997), Regional Operational Programmes of State Forest Policy Implementation (2005), National Programme for Augmentation of Forest Cover (1995, renev. 2003), Rural Development Program (RDP) (2007), Polish National Biodiversity Strategy and Action Plan for 2007–2013, Pan-European Criteria & Indicators (2003), and EU Directives (especially related to Natura 2000, rural development and carbon sequestration).

Poland has a long-standing tradition in forestry and legislative frameworks to ensure high-level forest management approaches have been developed. The most important documents are the Act of Forests of Poland, adopted in 1991 and successfully implemented, as well as other legislative acts (Forest Law 1991). An extraordinarily high proportion of state forests in Poland are nature protected and the state forest sector is responding to international agreements and recommendations on the sustainable management of forest resources in an exemplary way. The private forest sector does not play a significant role in Poland (FAO 2012).

The Regional Operational Programmes of State Forest Policy Implementation formulate the goals and principles of the forest economy and its relations with other sectors and their beneficial influence on climate, water, soil, atmosphere, human health and environmental stability, and the production of wood and non-wood goods and services (FAO 2012).

The National Programme for the Augmentation of Forest Cover is the basis for afforestation works, assuming an increase in forest cover up to 30% in 2020 and up to 33% in 2050. Forest areas in Poland are constantly growing; in the first stage of the program (1995–2000), 111,300 ha were forested, 11% more than initially projected. In the second stage (2001–2005), only 79% of the project was completed with 95,400 ha of new forests. According to the project, in the third stage (2006–2010), 160,000 ha of new forests should have been created. However, from 2006 to 2009, only 27% of the project was completed, or about 43,800 ha were forested. In total, nearly 300,000 ha have been forested since the introduction of the program (PGL LP 2011). However, recent economic growth shows that this target will be difficult to achieve. Further, Polish forests face critical threats, such as insect and disease outbreaks, drought, and fires. According to the program, lands of low usefulness for agriculture and those susceptible to threats are excessively used in Poland. Considering the planned increase in the forest cover of the country, it is thus justified to support the process of forestation on private and municipal lands. The Measure covers the following forms of support: support for forestation, which covers the establishment costs and, if justified, costs of protection against game; maintenance premium to cover the maintenance costs of the new forest plantation and individual protection of tree seedlings against game; and forestation premium, which is an equivalent for the exclusion of land from agricultural cultivation. This support is not provided to land located within Natura 2000 areas (Kingsbury & Zochowska 2011).

The Ministry of Agriculture and Rural Development has introduced the RDP for 2007–2013 in line with European Commission standards (Ministry of Agriculture and Rural Development 2007). The RDP serves to implement in Poland EU policy concerning the development of rural areas. After the thorough analysis of Poland's socio-economic and environmental situation, the main priorities for the agricultural sector and, therefore, the National Strategic Plan for Rural Development for 2007–2013 have four directions, including the improvement of the environment and the countryside. The improvement of the environment and the countryside outlines four activities, among which two concern forests: "Forestation of agricultural and non-agricultural land" and "Restoring forestry production potential damaged by natural disasters and introducing appropriate prevention instruments". Financial plan of the RDP assumes for the whole period (2007–2013) for this direction a total public contribution of EUR 5.546 billion. Moreover, 80% of the total is granted by the European Agriculture Rural Development Fund and 20% from the country-level budget. The financial plan for forestation activities was settled at almost 12% of the total, and for restoring forestry production potential EUR 140 million (Kingsbury & Zochowska 2011).

2.3 Forest certification

Forest certifications provide information about the origin of the wood and inform that the wood comes from forests that are managed in an environmentally responsible way. All wood processing and trade companies need to have a forest certification system to be able to sell products with a forest certification label.

The certified representative of the Forest Stewardship Council (*FSC*) in Poland has been in place since 2001. In 2003, the *FSC* Poland registered as a non-governmental organisation, and since 2006, it has worked as a public utility organisation. There are two types of *FSC* certificates: the *FSC* Forest Management, which can be granted to forest owners and managers, and the *FSC*

Chain of Custody, which is awarded to wood processing companies, traders, and distributors. Certificates are granted for five-year periods; however, at least once a year, there is an audit to control whether forest management is in accordance with *FSC* standards. In 2010, 16 of the Regional Management units of the State Forests had the *FSC* certification system. In Poland, there are over seven million hectares of *FSC*-certified forests, which locates Poland in fifth place in the world. Moreover, recently, there has been a boom in *FSC* certificates among Polish enterprises (over 1,000 *FSC* Chain of Custody certificate holders in 2011). Poland belongs to the top countries regarding the number of companies using certified wood and managed in accordance with *FSC* standards (FSC 2012).

Since 2003, the Program for the Endorsement of Forest Certification Schemes (*PEFC*) has been in place, which is the largest certification system in Europe. The *PEFC* is a non-governmental organisation that is aimed at supporting sustainable forest management. It is responsible for the assessment and recognition of domestic forest certification systems, which should be based on intergovernmental rules concerning the promotion of sustainable forest management. Thus, the *PEFC* certification is issued in accordance with domestic standards and is accredited by the *PEFC* itself. To sell products marked as *PEFC*-certified, forest owners and managers have to hold the *PEFC* forest management certificate. Entrepreneurs that process or trade wood have to receive a certificate for the control of product origin. Moreover, all certified units should apply for the license to use the *PEFC* logo. The Regional Management units of the State Forests decides which of the certification systems they would prefer to implement. In 2011, 10 of the Regional Management units (Olsztyn, Radom, Szczecinek, Szczecin, Warsaw, Bialystok, Krakow, Torun, Lodz, and Zielona Gora) had the *PEFC* system (PEFC 2012, PGL LP 2012).

2.4 Forest industry policy

The National Development Strategy 2007–2015 (Ministry of Regional Development 2006) plays an imperative role and is the basic document defining the goals and priorities of the sustainable development of the country; social, economic, and territorial coherence (at a national, regional, or local scale) concerns the forest industry as well. Among the strategies directly connected with the forest industry are those developed by producers' associations: the Strategy for Wood-based Panel Industry Development in Poland until 2013 and the Strategy for Paper Industry Development in Poland until 2013.

Among the other documents, the Strategy for the Sustainable Development of Poland until 2025 and National Coherence Strategy, which sets priorities for using EU funds and describes the manner of their implementation, are the most important. Tools for the implementation of the National Coherence Strategy are Operational Programmes (relating to the fundamental issues of the country's development) and Regional Operational Programmes (concerning the development of particular regions).

A crucial trend also observed in the forest sector is the drive towards building a knowledge-based economy. One of the tools used to achieve this goal is Operational Programme Innovative Economy encompassing the period 2007–2013. This Programme aims to support innovativeness and facilitate the transfer of modern solutions from the science sector to the economy. Projects funded by this Programme are carried out in the forest industry as well.

Energy policy has had a growing impact on the forest industry (Ministry of Economy 2009, 2010). This policy assumes growth in the production of energy from renewable energy sources (15% in 2020 and 20% in 2030), a reduction in greenhouse gases emissions, and a reduction in energy consumption. An additional purpose of the broader use of renewable energy sources is the protection of forests against undue exploitation in order to obtain biomass as well as the sustainable use of rural areas. The effective provisions of the economic department assume that until 2015 wood biomass for energy purposes should be 100% replaced by agricultural biomass, i.e. biomass from special “energy plantations” (trees, shrubs, and plants of short growth rotation). This means that starting from 2015 the energy from waste and residues from wood harvesting as well as from the wood processing industry will not be considered to be “green energy”. Waste produced when wood is processed may be used for energy purposes only on sites where it is created and in production units of electric power less than 5 MW (Ministry of the Environment 2009).

2.5 Polish Technology Platform for the Forestry and Wood Sector

The Polish Technology Platform for the Forestry and Wood Sector (*PPTSL-D*) supports industry and research units active in the field of wood production by means of cooperation with economic chambers and associations of all branches of woodworking, furniture, and pulp and paper industries, the Association of Foresters and Wood Technologists, the Ministry of Economic Affairs and Labour, the Ministry of Science and Information Society Technologies, those ministries competent to deal with the economy, science, and the environment and other organisations interested in forest sector development. The Platform objectives include (FTP 2012):

- Joining the European Forest-Based Sector Technology Platform in realisation of its main activities:
 - preparation of a vision for sustainable forest sector development,
 - building a strategy for the development of modern technologies of forest resources utilisation,
 - creating policy and legislation that stimulates innovation,
 - stimulating the development of rural areas by means of the reasonable use of the raw material base and the local wood industry,
 - preparation of a strategic research agenda,
 - initiation and conduct of scientific and technical research;
- Enhancing the competitiveness of the Polish economy in the forest sector as an element of the European economy;
- Building a bridge between science and industry in the forest sector through the initiation and conduct of scientific and technical, pre-market and market research and the commercialisation of scientific solutions;
- Promoting innovation and scientific and technological development in the forest wood sector.

The Wood Technology Institute acts as a Coordinator of *PPTSL-D*. Members of *PPTSL-D* include forest sector companies, branch self-government units, associations, and research units.

3 Forest resources and their utilisation

3.1 Forest resources

In Poland, forest land covers 9.3 million ha, stocked forest land covers 9.1 million ha, and the volume of the growing stock is 2.3 billion m³ including 0.8 billion m³ in mature and over mature forests (PGL LP 2012, GUS 2011c). The average growing stock of forests is 257 m³ per ha. The mean annual increment is about 70 million m³. Since 1945, the growing stock has increased by 1.4 billion m³, and the growing stock of mature forests has increased by 0.6 billion m³. The largest forest areas are located in the Mazowieckie and Zachodniopomorskie provinces (over 0.8 million ha) and the smallest one in the Opolskie province (249,500 ha) (Table 3.1).

Forests are spread over the country's 16 regions with the average value of forest cover (ratio between the stocked forest land and total land) being 29%. The highest forest cover is in the Lubuskie province (49% of the total territory) and the lowest is in the Łódzkie province (21%) (GUS 2011c). The distribution of forest land by province is presented in Map 7.3. Forests once covered almost the whole territory of Poland. Even at the end of the 18th century, forests covered 40% of the territory within the Polish borders at that time, but this figure fell to just 21% by 1945. Deforestation and the associated depletion of the stand species structure resulted in a decrease of biological diversity in forests, degradation of the landscape, soil erosion, and disturbance of the water balance. A reversal of this process came about in the period 1945–1970, when Poland's forest cover increased to 27% because of afforestation (PGL LP 2011).

Forest land in Poland is distributed by forest habitat among three groups: 7.8 million ha belong to forests of lowland (*nizinne*), 0.5 million ha to forests of upland (*wyzynne*), and 0.8 million ha to mountain forests (*gorskie*) (Map 7.4). Forest terrain is flat, favouring the mechanisation of forest operations. About 9% of forests are in mountain terrain, which sometimes makes the extraction

Table 3.1. Distribution of forests (1,000 ha) by provinces and ownership on 31.12.2011 (PGL LP 2012).

Region	Total	Forest ownerships		
		State	Municipal	Private
Poland	9,143.6	7,353.7	83.8	1,706.1
Dolnośląskie	590.0	565.7	7.1	17.2
Kujawsko-pomorskie	420.2	368.5	3.6	48.1
Lubelskie	579.4	343.8	1.2	234.4
Lubuskie	686.0	673.6	2.1	10.3
Łódzkie	384.3	251.6	3.2	129.5
Małopolskie	434.7	233.2	11.7	189.8
Mazowieckie	810.2	453.2	2.3	354.7
Opolskie	249.5	236.3	1.5	11.7
Podkarpackie	671.6	529.7	28.4	113.5
Podlaskie	617.3	416.0	1.3	200.0
Pomorskie	663.4	585.8	3.4	74.2
Śląskie	392.1	309.7	3.7	78.7
Świętokrzyskie	327.8	234.5	0.9	92.4
Warmińsko-mazurskie	743.5	687.3	3.4	52.8
Wielkopolskie	765.3	677.6	5.6	82.1
Zachodniopomorskie	808.3	787.2	4.4	16.7

of roundwood and forest regeneration in these areas difficult. The exploitation of forests in mountains also raises ecological questions on appropriate use and sustainability.

The age distribution of forests in Poland is not good from a sustainable economic development point of view, with an unbalanced distribution in age classes. This is the result of intensive harvesting after the Second World War. Stands aged 41–60 years (class III) prevail in all ownership categories, while in private forests they occupy about 38% of the forest area. The stocked forest land, covered by middle aged stands, prevails over young, maturing, and mature stands (Table 3.2). The share of mature stands is 21% of the stocked forest land (GUS 2011c).

More than half of the stocked forest land (71% of the stocked forest area and 74% of growing stock) is covered by coniferous tree species such as pine (60% and 62%), spruce (6% and 7%), and fir (3% and 4%). A significant area is covered by small-leaf tree species such as birch (7% and 5%), alder (5% and 5%), aspen, and poplar. The share of broad-leaf species such as oak, beech, and hornbeam is about 13% of both the stocked forest land and the growing stock. The tree species distribution is presented in Table 3.3.

According to the National Forest Inventory, gross merchantable timber resources under all forms of forest ownership have doubled since the first inventory in 1967. The average growing stock of the forests managed by the State Forests has increased by 60%, from 150 m³/ha in 1967 to 250 m³/ha in 2010. The increase in timber resources is the result of harvesting in accordance with the principle of forest sustainability and the persistent augmentation of forest areas (PGL LP 2011). The distribution of forest resources by age class, tree species, area, and growing stock in Polish provinces is presented in Maps 7.5–7.10.

Table 3.2. Age structure of forest resources of Poland in 2010 (GUS 2011c).

Age class	Stocked forest land			
	Area	Share	Growing stock	Share
	1,000 ha	%	million m ³	%
1–20	1,273	14.0	22	0.9
21–40	1,456	16.0	239	10.3
41–60	2,463	27.1	679	29.0
61–80	1,668	18.3	551	23.6
over 81 yrs	1,894	20.9	18	35.1

Table 3.3. Tree species structure of forest resources of Poland in 2010 (GUS 2011c).

Species	Stocked forest land		Growing stock	
	1,000 ha	%	1,000 m ³	%
Pine	5,476	60.3	1,453	62.0
Spruce	582	6.4	159	6.8
Fir	267	2.9	85	3.6
Oak	636	7.0	142	6.1
Beech	505	5.6	158	6.8
Hornbeam	112	1.2	26	1.1
Birch	665	7.3	114	4.9
Alder	483	5.3	118	5.1
Aspen	65	0.7	14	0.6
Poplar	9	0.1	2	0.1

3.2 Utilisation of forest resources

Removals of roundwood in Poland have doubled since 1990 from 16 million m³ to 35 million m³ in 2011 due to increased cutting potential resulting from intensive forest regeneration in the past decades (Figure 3.1). In 2011, total removals were 37.2 million m³ including 34.9 million m³ of roundwood. The State Forests is a major supplier of wood on the Polish wood market; in 2011, it harvested 35.1 million m³ of wood, including 32.8 million m³ of roundwood. In private forests, removals were 1.6 million m³; in addition, 0.2 million m³ of roundwood were harvested from national parks and 0.1 from municipal forests (*gmina*). The share of final fellings in the State Forests was 48% and thinnings covered about half of the harvesting. A smaller amount of wood comes from sanitary fellings (due to wind disturbances, outbreaks of pest insects, weather anomalies, etc.). During the past five years, average roundwood removals from the State Forests have been about 4.5 m³/ha (PGL LP 2012). The actual cut in Poland is remarkably lower than the annual allowable cut; indeed, only 55% of the annual increment is utilised.

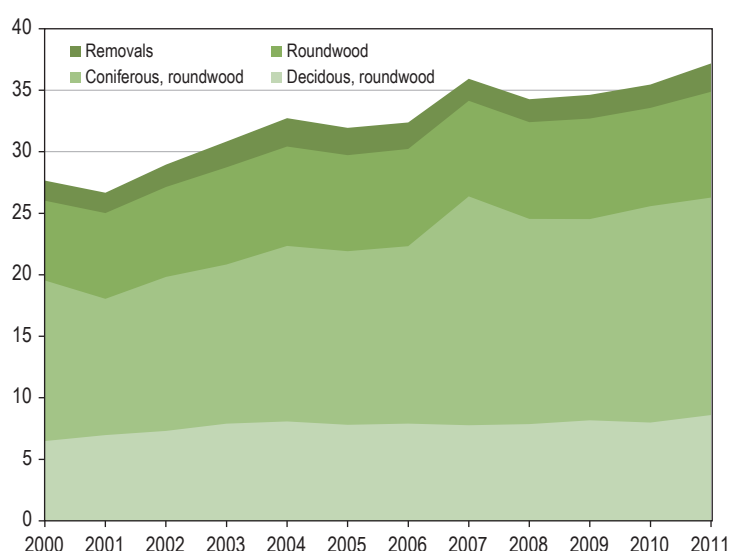


Figure 3.1. Development of forest use (million m³ per year) in Poland in 2000–2010 (GUS 2012).

In 2010, the clear-cutting area was 26 million ha and 6.1 million m³ of roundwood were harvested in clear-cuttings, i.e. 19% of the total harvesting carried out by the State Forests. The tendency is to decrease the clear-cutting area and change forest management closer to nature (Figure 3.2). Clear-cuttings are often used in the forests damaged by wind, drought, fungal infection, or insect outbreak (PGL LP 2011).

Wood harvesting intensity was highest in the Zachodniopomorskie province (12% of the total harvesting volume) and lowest in the Świętokrzyskie province (3%) (Table 3.4). The distribution of timber assortments of the total harvest of roundwood was as follows (GUS 2012):

- coniferous sawlogs – 32%
- coniferous pulpwood – 33%
- coniferous fuelwood – 7%;
- non-coniferous sawlogs – 7%
- non-coniferous pulpwood – 12%
- small-sized wood – 6%
- other tradable wood – 3%.

The share of pine was 43%, spruce 11%, birch 11%, beech 9%, and oak 9% (GUS 2012).

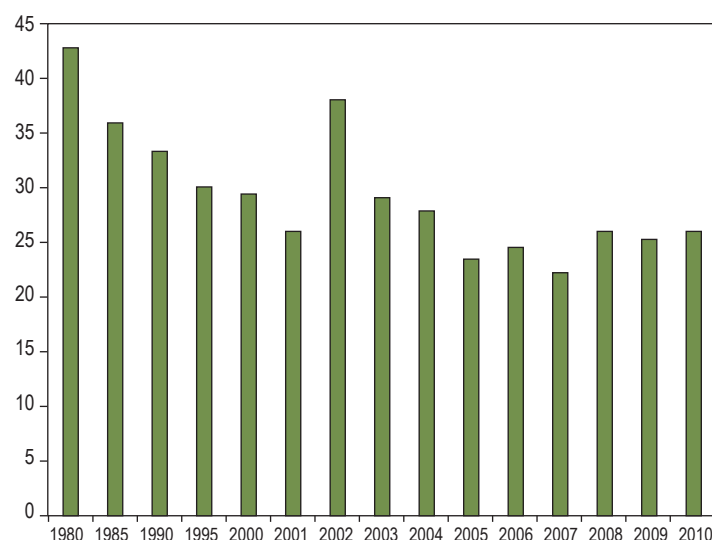


Figure 3.2. Development of clear-cutting area (million ha) in the State Forests in 1980–2010 (PGL LP 2011).

Table 3.4. Wood harvesting (1,000 m³) in Poland in 2011 (GUS 2012).

Region	Harvest	Roundwood	Slash	Stump wood
Poland	37,180	34,877	2,303	39
Łódzkie	1,226	1,157	70	8
Mazowieckie	2,145	2,059	86	0
Małopolskie	1,255	1,222	32	0
Śląskie	1,951	1,882	68	5
Lubelskie	1,707	1,652	54	0
Podkarpackie	2,471	2,409	62	0
Podlaskie	1,830	1,729	101	0
Świętokrzyskie	1,195	1,150	44	0
Lubuskie	3,247	2,894	353	3
Wielkopolskie	3,231	2,937	294	8
Zachodniopomorskie	4,282	3,930	352	0
Dolnośląskie	3,026	2,855	171	8
Opolskie	1,379	1,304	75	0
Kujawsko-pomorskie	1,655	1,515	140	7
Pomorskie	3,114	2,858	256	0
Warmińsko-mazurskie	3,466	3,322	143	0

Forestry service companies perform wood harvesting in Poland. They are usually small private businesses employing not more than 10 people. Currently, there are 4,200 such companies in Poland. Each year, they undergo progressive consolidation and transformation from small to medium-sized enterprises. In wood harvesting, the tree length (*TL*) and cut-to-length (*CTL*) methods are applied in Poland. These methods are different in relation to the technology utilised. The typical *TL* system employs chainsaws for felling and delimbing, and a cable wheeled skidder for extraction; the typical *CTL* system employs chainsaws for felling, delimbing, and crosscutting, and a forwarder for extraction. The fully mechanised *CTL* system “harvester and forwarder” is becoming common practice in Poland. Thinnings are usually carried out according to the *CTL* method and final fellings by the *TL* method. It is assumed that fully mechanical timber logging accounts for about 8% of the total harvest and logging with forwarders accounts for about 13%,

while mechanisation is ongoing. At present, there are about 250 harvesters and 400 forwarders on the Polish market. These are mostly machines produced by John Deere, Ponsse, Valmet, and Rottne, whose combined market share is over 80%, with the largest share John Deere (44%). Smaller and second-hand machines are most popular due to their lower prices. According to the data from the three largest importers, about 40% of harvesters are new machines and 60% used ones. On the other hand, 60% of the purchased forwarders are new and 40% second-hand (EcoLas 2012).

Polish roads are claimed to be of poor quality (little repaired, low bandwidth, unsuitable for heavy vehicles), and they are often crowded, as there are no urban bypasses (GUS 2011d, Geography NA6 2012). The density of the road network in Poland varies between regions depending on the industrial condensation, presence of the agricultural land, and population. The density of the roads accessing forests is about 9 m/ha, when the optimal forest road network in Poland should be 14.6–27.8 m/ha depending on the forest region (Ministry of Agricultural and Rural Development 2007). The utilisation of forest resources in Polish provinces is presented in Maps 7.11–7.13.

3.3 Silviculture

The dominant forest regeneration method in Poland is artificial regeneration (90% of the total forest regeneration area). Most of the artificially regenerated area has been planted. In 2010, 40,539 ha were artificially regenerated and 4,631 ha naturally regenerated (GUS 2011c). Forest-regenerated areas in Polish provinces are presented in Map 7.14. Pine dominates the artificial regeneration (17%) compared to spruce with 13%, larch 11%, fir 11%, black alder 12%, ash 10%, birch 10%, oak 8%, and beech 8%.

The thinning of middle-aged and maturing stands is quite common (Figure 3.3). The proportion of the thinning of the felled volume has been 51–60%. The reason why thinning has been even more common is mainly demand for pulpwood in many regions. The importance and benefits of thinnings are largely recognised, and it is expected that their amount will grow when the use of forest energy is intensified.

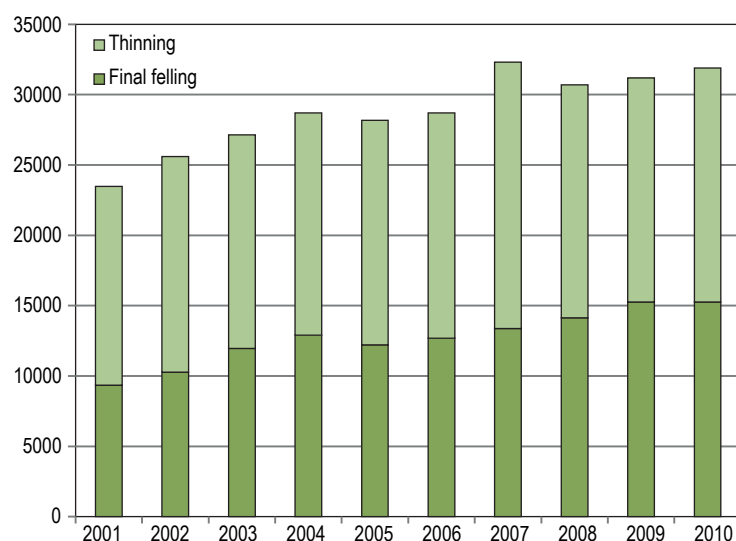


Figure 3.3. Removals (1,000 m³) in final fellings and thinnings in Poland in 2001–2010 (GUS 2011c).

4 Forest industry and machinery

The Polish forest sector plays an important role both internationally and domestically. Poland is the second largest producer of wood-based panels in the EU, the fifth in roundwood, the sixth in furniture and the seventh in sawnwood. The sector also has significant contribution to the national economy 6% share in the sold production. Wood-based products increase the positive foreign trade balance and furniture is one of the main export commodity groups in Poland. The forest industry employs 187,000 (143,000 in wood processing and 38,000 in pulp and paper) people. Thus, by taking into account the families of those employed, it provides a living for about one million people. Wood processing production dominates with 44% share of sold production. Furniture production provides 41% share of sold production. The pulp and paper industry is also important with 14% share (GUS 2011c, GUS 2012). Lately, the economic performance of the Polish forest industry has been relatively better than that of other processing sectors. The forest industry has achieved better financial and economic results, had a higher share of value added in production, and experienced high and growing exports. As far as foreign trade is concerned, roundwood and forest products account for over 5.2% of Polish exports and 3.6% of Polish imports. Furniture is one of the most important product groups in Polish exports, with 3.9% share. Contrary to the overall situation in Polish foreign trade, wood products generate a positive balance of exports and imports (Eurostat 2012, GUS 2011e).

According to the available data, about 3,000 business entities deal with wood processing. As many as 50% of them can be classified as handicraft enterprises processing less than 1,000 m³ per year. A further 45% are small manufacturing plants with a sawing capacity between 1,000 and 10,000 m³/a. Only 5% (150) exceed an output of 10,000 m³/a, sawing 50% of the sawn timber sold in Poland. Among them, as few as 12 entities (0.4% of the total number) process over 50,000 m³/a of roundwood per year (totally, about 20% of the total volume) can be classified as large enterprises. The wood-based panel and furniture industries in Poland feature a high concentration of production potential. The manufacturing of particleboards, fibreboards, and plywood is concentrated in a dozen or so bigger plants, which account for 98% of the total internal production of these goods. The dynamic development of the production of wood-based panels has been caused by growing demand in domestic and foreign markets. Those 12 largest Polish plants manufacture about 60% of Polish furniture (Niskanen et al. 2007, Zajac et al. 2005, GUS 2012).

Polish wood processing is characterised by low capital and creditworthiness. Moreover the lack of financial resources is a substantial obstacle hampering investments and innovation due to the dominance of SMEs. Companies with a significant share of foreign capital are the most competitive in the Polish wood sector but price competition still dominates over “quality-innovation” competition. Complicated and fast-changing legislation as well as bureaucracy and difficulties in obtaining EU funding are among the greatest obstacles. The lack of employees is another often-raised issue hindering the development of Polish companies in general. This is a noticeable problem in the forest industry, especially when it comes to finding skilled workers. The situation is also unsatisfactory when it comes to financial liquidity and financial resources for investments. In addition, competition from foreign companies, including Chinese, is perceived as a barrier to development (Pikul-Binieć & Wos 2008).

4.1 Use of roundwood

The Polish industry consumes annually about 34 million m³ of roundwood including 13 million m³ in the wood-based panel industry, 9 million m³ in sawmills, and 1 million m³ in plywood mills. About 1.3 million tonnes of roundwood was exported of which 54% to Germany, 20% to Czech Republic, and 12% to Austria in 2011. About 2.6 million tonnes of roundwood was imported and 66% came from Belarus and 13% from Lithuania in 2011 (GUS 2012b). The highest concentration of the forest industry is located in the Wielkopolskie province, with 1.2 million m³ of sawnwood and 1.1 million m³ of particleboards consumed in 2010, and in the Zachodniopomorskie province, with 0.7 million m³ of sawnwood and 0.8 million m³ of particleboards. The biggest wood consumers in Poland are presented on Maps 7.15–7.17 and in Appendix 1.

In Poland there is monopoly in roundwood supply, which has an adverse impact on roundwood price levels. The State Forests is the largest state-owned forest management company in Europe. The State Forests does not have a legal personality and it is not a company in the strict sense, but it occupies the top positions in the rankings of the largest Polish companies and employers. It employs about 25,000 people, often in regions having high unemployment. Roundwood supply in Poland is limited due to wood harvesting capabilities, as defined in the management plans, which are made for 10 years. Modern forest management conducted by the State Forests limits wood harvesting and increases the sustainability of forest resources that have led to difficulties in domestic roundwood supply in the Polish wood market. The deficit of roundwood is estimated to be about 5 million m³ (Pikul-Binieć & Wos 2008). As a result, competition for roundwood among companies, branches, and even sectors is growing. For many companies, especially in the sawmill industry, this deficit is a hindrance to the full use of capacity. The recent deficit has led in the short-term to an increase in roundwood prices in Poland and a plunge in the sawmill industry's profitability. On the other hand, the lack of roundwood on the market may to some extent encourage its more effective use. This could then stimulate the more balanced development of the Polish forest sector.

Sales of timber belonging to the State Forests mostly take place through electronic auctions, called e-wood (www.e-drewno.pl). Prices of roundwood are currently determined by a new system of wood sales based on the Internet, which is available for all clients on equal terms. This system has been designed with the aim of delivering benefits to suppliers as well as customers of wood in the short-term. However, the system does not represent the basis for long-term investment decisions. Polish national wood supply isn't self-sufficient, but only about 6% of roundwood is imported. Competition for wood between the forest and energy sectors in Poland exists because of the country's obligation towards the EU to increase the share of energy derived from renewables. The main source is biomass, as alternatives such as wind or water are not frequently used in Poland. In order to increase domestic raw material supply, an effective system of using logging and wood processing residues should be created (Pikul-Binieć & Wos 2008).

The roundwood sales system has been developing in Poland for a long time (Szostak 2001). It was introduced since 2007. It is based on three principles: 1) sales rules are the same for all buyers; 2) there is equal access to the raw materials; and 3) rules comply with the law (Kwiecień 2006).

This new roundwood sales system based on the e-wood portal (www.e-drewno.pl) provides equal opportunities to all its clients as well as allows common, simultaneous, and open examination of submitted demand and selection of the best offers and their proportional reduction based on

assessment criteria, which are known and accepted by certain bodies (Lis 2007). The system is still evolving and some of the criteria used by the portal need to be discussed, as they are more favourable to large customers, e.g. the production capacity criterion. The system aims to neutralise the supply monopoly of the State Forests, but it has not yet been successful at that and has not gained the full acceptance of the industry. Therefore, it might have to be modified in the future. Nevertheless, the introduction of the new system was pioneering for optimising the sales process and it also serves as one of the drivers of the sector facing raw material deficits (PGL LP 2012).

4.2 Production trends and foreign trade of the forest industry

During the post-communist years, the forest industry developed steadily in Poland. Particleboard and fibreboard production increased five-fold, while other branches of the forest industry tripled their production, excluding the sawmill industry, whose growth was more modest. The Polish forest industry is partly export-oriented, as half of its paper/paperboard and fibreboard and one third of its plywood are exported. The global economic crisis also hit the Polish forest sector, and production amounts started to decrease. According to the Polish Statistics Service (GUS 2012), the production of forest industry products, except pulp and paper, decreased considerably during 2008 and 2009 compared with 2007. In 2010, the production of forest industry products stabilised for plywood and particleboards, and even increased by 7% for fibreboards and 4% for sawnwood compared with 2007 (GUS 2012). The most important international markets for Polish forest products (roundwood, sawnwood, plywood, wood-based boards, paper and paperboard) are presented in Figure 4.1. The most important producers of forest products (sawnwood, plywood, wood-based boards, pulp, paper and paperboard) in Poland are presented in Maps 7.15–7.16 and in Appendix 1.

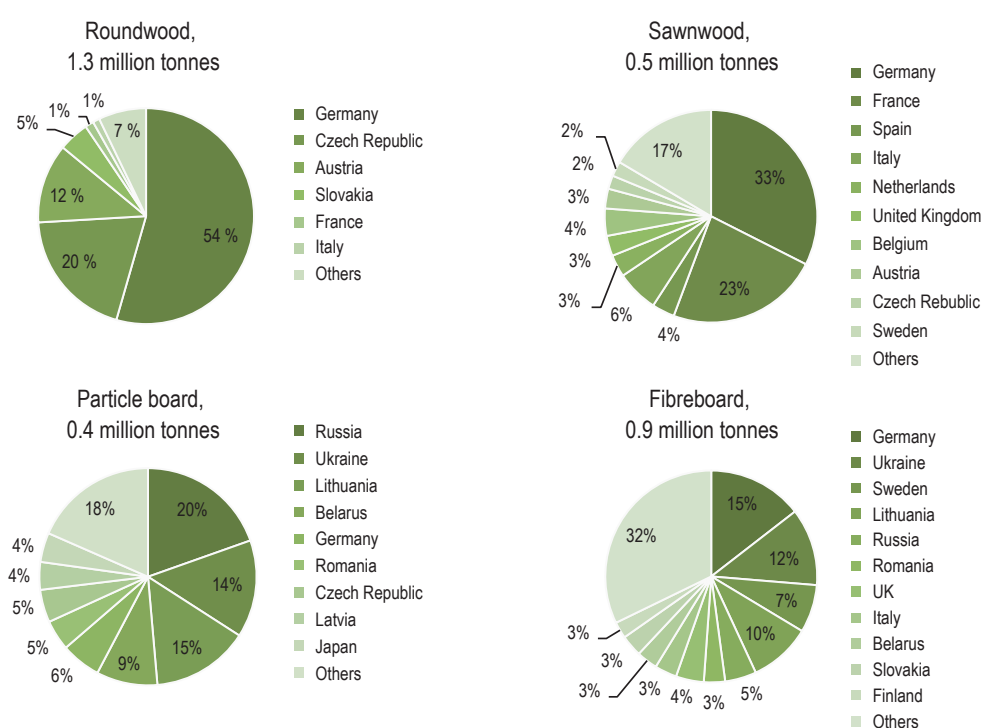


Figure 4.1. Forest product exports (in tonnes) according to country in 2011 (GUS 2012).

4.2.1. Sawnwood

Historically, sawmilling has been one of the main types of wood processing business in Poland. About 1,500 economic entities are registered in this business. The majority of the capacity of wood product industries in Poland is outdated, while only 20% of the capacity is relatively new (Niskanen et al. 2007). Most sawmills are small with an average annual output of 2,000 m³ and produce sawnwood products combined with sawmilling with mechanical woodworking (window sets, door sets, and frames for houses). The largest and advanced sawmills belong to global companies, such as Swedwood, Stora Enso, with an average annual output of about 100,000 m³. About 4.2 million m³ of sawnwood was produced of which 12% or 508,600 m³ was exported in 2010 (Figure 4.2). The most important markets were Germany (32% of the total export value), France (20%), and Italy (7%) in 2011.

The production of coniferous sawnwood (softwood) is dominant. In 2010, this production increased to 3.8 million m³. In relation to the previous year, this was an increase of 12%. Pine sawnwood dominates sawnwood exports. In 2010, the amount of produced deciduous sawnwood (hardwood) decreased in relation to the previous year by 3% to 455,000 m³. Mainly oak and beech sawnwood are exported from Poland.

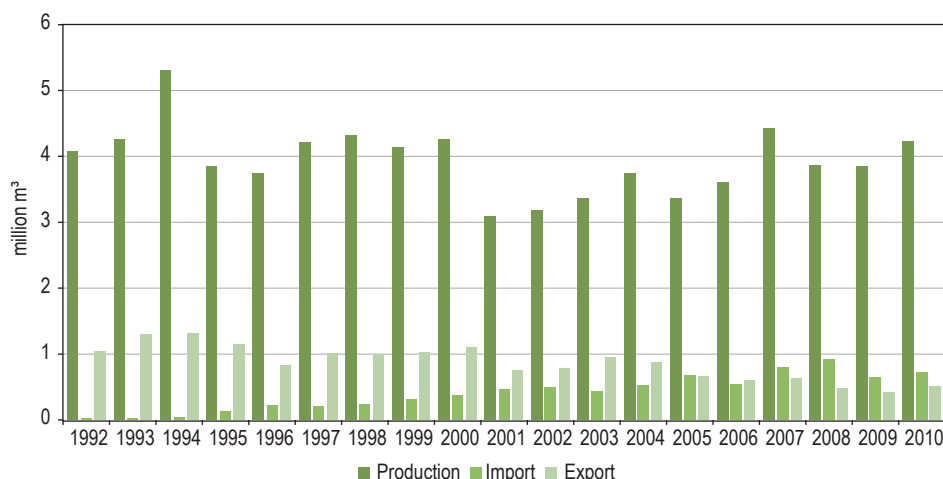


Figure 4.2. Production trends, imports and, exports of sawnwood (FAOSTAT 2012).

4.2.2. Wood-based panels

About 200 economic entities are registered in wood-based panel businesses in Poland (Eurostat 2012). Wood-based panel capacity is quite modern. In 2010, the production of wood-based panels was 8 million m³ (an increase of approximately 4% compared with 2009 and a decrease of 6% compared with 2008) (Figures 4.3–4.5). For many years, the assortment structure of wood-based panel production was dominated by particleboards whose share is still 60% (4.8 million m³). Second place belongs to fibreboards whose share is approximately 36% (2.9 million m³). Plywood represents around 5% of wood-based panel production (0.4 million m³). Approximately 12% of wood-based panel production is oriented strand board (OSB). Dry-process boards, high, medium and low-density fibreboard (HDF, MDF, and LDF) have a share of 69%, whereas the share of insulating boards is 23%.

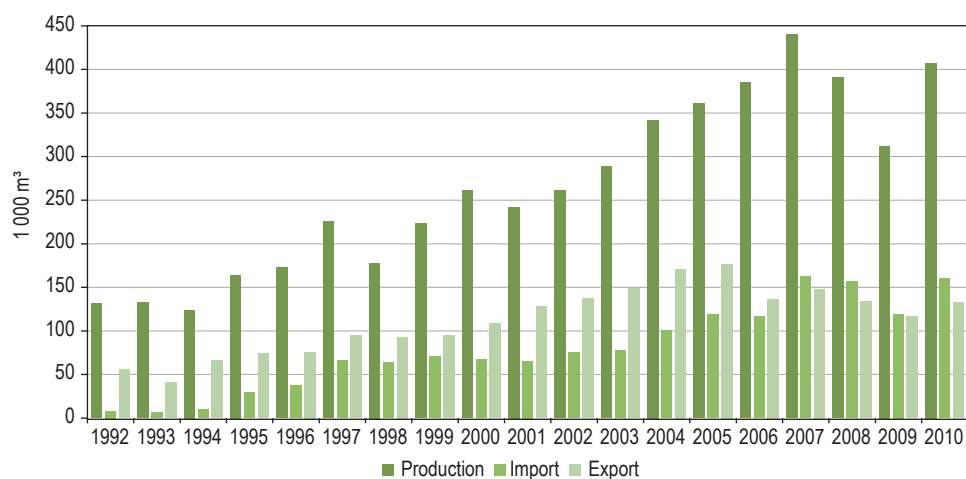


Figure 4.3. Production trends, imports, and exports of plywood (FAOSTAT 2012).

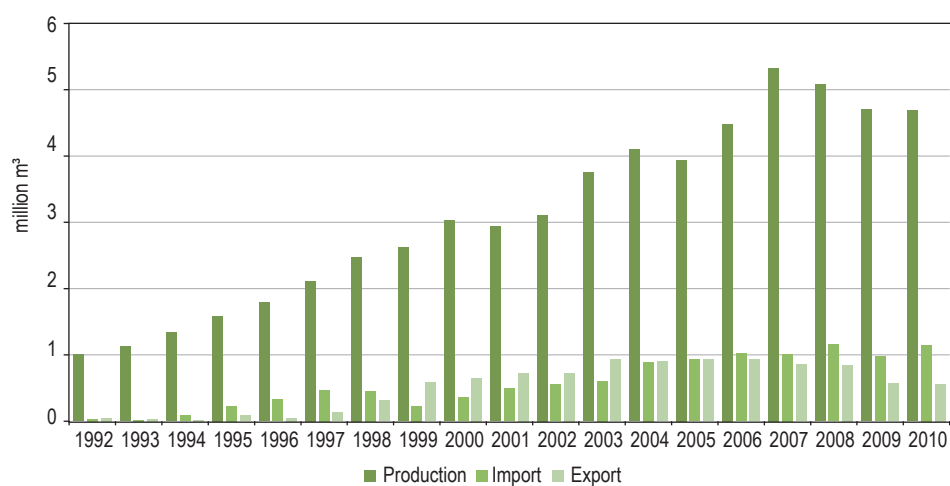


Figure 4.4. Production trends, imports, and exports of particleboards (FAOSTAT 2012).

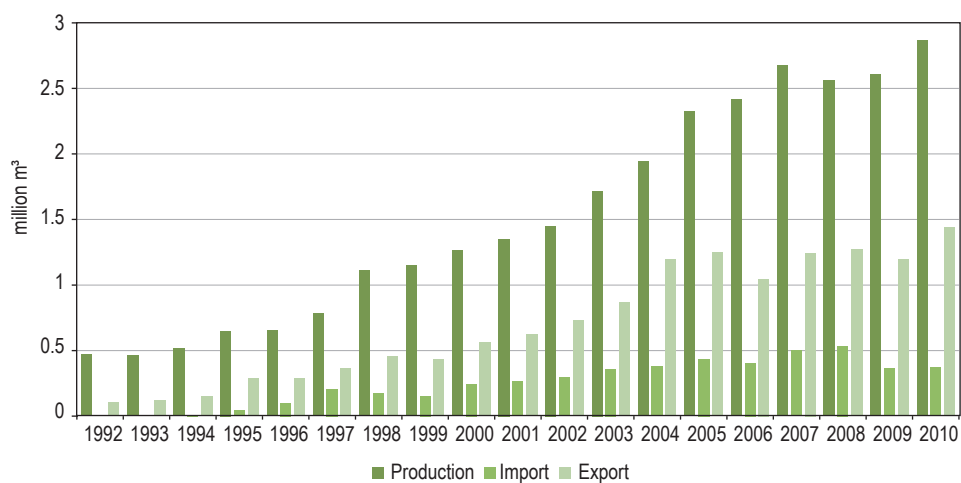


Figure 4.5. Production trends, imports, and exports of fibreboards (FAOSTAT 2012).

In 2010, the exports of wood-based panels amounted to 2.1 million m³ (the level was similar to that in 2007), which was 27% of the total volume of wood-based panels produced in Poland. Fibreboards were the main exports with 1.4 million m³, of which 41% were wet-process insulating boards and 37% dry-process boards (HDF, MDF, and LDF). In 2010, 0.56 million m³ of particleboards and 0.13 million m³ of plywood were exported. In 2010, imports of wood-based panels increased by 15% in relation to 2009 and reached 1.68 million m³. In relation to production, this is 21%. Deliveries to the Polish market are dominated by particleboards (1.2 million m³) and fibreboards (0.4 million m³). Poland also imported 0.2 million m³ of plywood.

4.2.3. Pulp and paper

About 120 economic entities are registered as paper and paperboard producers and 15 as pulp producers in Poland (Eurostat 2012). Pulp and paper capacity is modern. In 2010, about 1.2 million tonnes of wood pulp was produced in Poland, which was a similar level to previous years (Figure 4.6). The former assortment structure of production remained unchanged. The production of cellulose is dominant (0.8 million tonnes, i.e. 78% of total wood pulp production), while mechanical wood pulp is 5% of the volume of wood pulp production and the production of semi-chemical wood pulp is 17%. In 2008, the deficit of foreign trade in wood pulp grew, reaching 0.6 million tonnes. In 2010, in relation to 2009, imports increased by 5% to 58% of production. At the same time, the volume of exported wood pulp increased to 8,000 tonnes (by 35% in relation to 2009). In 2010, the share of exports in wood pulp production was only 3%.

Production, import and export of paper and paperboard have increased substantially during the past 10 years in Poland. In 2010, about 3.7 million tonnes of paper and paperboard was produced, 13% more than in 2009 (Figure 4.7). In 2010, approximately 49% of production was sold to foreign markets, and exports amounted to 1.9 million tonnes and were by 23% higher than in the previous year. The main exports were packaging and graphic paper. Imports of paper and paperboard increased by 12% to the level of 2009 and it amounted to 3.1 million tonnes. As in the case of exports, packaging and graphic paper dominate the structure of imports.

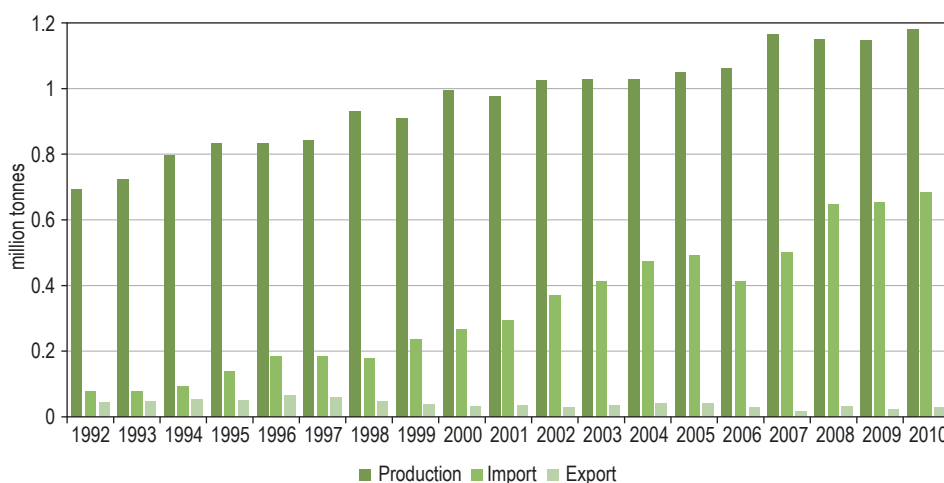


Figure 4.6. Production trends, imports, and exports of pulp (FAOSTAT 2012).

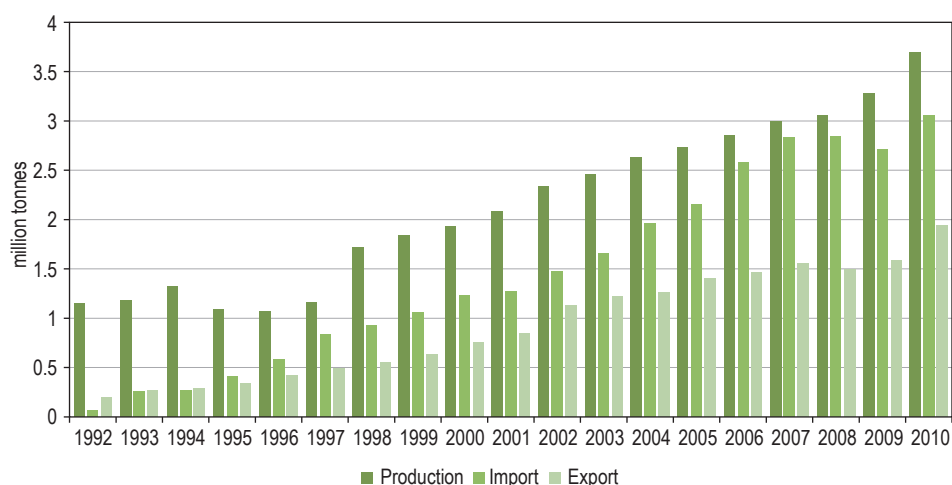


Figure 4.7. Production trends, imports, and exports of paper and paperboard (FAOSTAT 2012).

4.2.4. Pellets

Wood pellet production started in Poland in 2003 and since then pellets have been increasingly used for co-firing with coal in power plants and municipal heating (Table 4.2). More than 20 pellet-producing companies are operating; however, this number is changing due to the creation of new entities and profile changes in manufacturing activity. The production of mixed biomass pellets made of mixtures of raw materials (woody biomass, herbaceous biomass, fruit biomass) has also been constantly increasing. In 2009, about 80,000 tons of pellets were used for heating in individual houses (20 kW) and another 150,000 tons for co-firing with coal in power plants (Wach & Bastian 2010, Burczy et al. 2010). According to the volume of production, producers of pellets can be divided into three basic groups (Table 4.3).

The location of wood pellet plants and list of main players in the pellet market are presented in Map 7.17 and Annex 1.

Table 4.2. Production, consumption, and export of pellets in Poland in 2003–2009 (Wach & Bastian 2009, 2010, Eurostat 2012).

Year	2003	2004	2005	2006	2007	2008	2009	2010
Capacities, 1,000 t/a		255	300	415	545	665	640	
Production, 1,000 t/a	20	120	200	280	350	380	410	440
Consumption, 1,000 t/a	0	6	25	35	60	160	230	
Export, 1,000 t/a	20	114	175	245	290	220	180	

Table 4.3. Producers of pellets in Poland in 2008 (Wach & Bastian 2009, Burczy et al. 2010).

Plant scale	Capacity, 1,000 t/a	Production in 2008, 1,000 t	Number of producers	Value of capacity utilisation, %
Small (<30000 t/a)	140	123	14	76
Medium (30000–70000 t/a)	161	106	4	66
Large (>70000 t/a)	364	121	3	33

Most small and medium-scale producers have production capacities below 30,000 tons/a. However, they are characterised by a high capacity utilisation rate. They usually buy raw materials from industries close to their facilities. At present, three pellet producers with production capacities over 70,000 tons per year operate in the Polish market. Two of them use wood processing by-products, while the third prepares the wood material itself. Those large companies use only 33% of their production capacities. However, it should be expected that changes in the Polish power sector lead to an increase in demand for pellets. One should admit that the Polish pellet market is not well organised. Previous attempts to create a nationwide pellet producers association have failed. Existing companies also strongly compete with each other; they struggle for customers and – as a result – do not publish data about their production capacities, keeping them as business confidential.

A newly developing pellet market is pellets made of agricultural material. Many wood pellet production companies change their profiles and adapt their installations to suit agricultural pellet production. Estimates show that the energy potential of cereal straw residues is about 10 million tonnes. However, owing to the price instability of agricultural biomass, farmers do not want to enter into long-term biomass delivery contracts. This leads to high uncertainty about pellet supplies based on such input materials. Despite those difficulties, the agricultural pellet market is developing quite well. The main reason for this is the regulation of the Ministry of Economy of 2008 about the use of certain amounts of agricultural biomass (dedicated energy crops, cereal straw, food industry residues, agricultural waste) in power plants or CHP plants with an electrical output above 5 MW.

Before 2009 most of the pellets were exported. In 2009 180,000 tonnes were exported and the biggest export market were Denmark (79%), Sweden (12%), Italy (7%), and Germany (2%). Domestic prices of pellets sold in small bags and loosely delivered to houses were 130–150 €/ton (Burczy et al. 2010).

4.2.5. Value-added wood products

Poland recorded by far the largest trade surpluses of secondary wood products, such as wooden furniture, builder's joinery and wood carpentry, further processed sawnwood, wooden wrapping and packing equipment, and prefabricated buildings, in the EU27 at €3.93 billion in 2010 (Eurostat 2012). The value of exported secondary wood products reached €4.41 billion and the imports of these products was €480 million in 2010. This makes Poland the second largest exporter of secondary wood products in the EU27 (14% market share in 2010).

In Poland, furniture is the most important group of value-added wood products (Kalupa 2004, Kawonczyk 2009). About 14,700 economic entities are registered as furniture producers in Poland. In 2009, production amounted to €6.56 billion (Eurostat 2012). In relation to the previous year, this was a decrease by 12%. Wooden furniture was about 60% of it. Over 70% of the furniture produced in Poland is exported, of which wooden furniture is about 60% (€2.66 billion in 2009 and €3.03 billion in 2010). In 2009–2010, Poland imported wooden furniture to the value of €0.25 billion. Polish wood companies keep increasing their presence in foreign markets. This makes Poland the second largest exporter of wooden furniture in the EU27 (18% market share in 2010).

In 2008, the production of builder's joinery and carpentry products was €13.53 billion, higher by 9% than in 2007 (in fixed prices). Among other things, 13.2 million m² of wooden windows and doors were produced (an increase by 2% in relation to 2007). In 2009, production dropped to the level of 2007 (€10.72 billion). The value of exported products of builder's joinery and carpentry reached €654 million and the imports of these products €100 million in 2011 (Eurostat 2012, GUS 2012b). This makes Poland the third largest exporter of builder's joinery and carpentry products in the EU27 (12% market share in 2010).

Wooden packaging to the value of €585 million was produced in 2008 and €364 million in 2009. About 60% of these packaging products were exported and their value was almost €228 million, while the value of packaging imported into Poland was only €37 million in 2010 (Eurostat 2012). This makes Poland the second largest exporter of wooden wrapping and packing equipment in the EU27 (14% market share in 2010).

In 2008, the secondary processing of paper and paperboard products amounted to €3.66 billion and €3.11 billion in 2009. The value structure of this production is dominated by paper and corrugated paperboard as well as paper and paperboard packaging. About 60% of these packaging products were exported and their value was almost €2.3 billion; the value of packaging imported into Poland was about €1.3 million in 2010 (Eurostat 2012). This makes Poland the seventh largest exporter of wooden wrapping and packing in the EU27 (6% market share in 2010).

4.3. Producers of forest machinery

Production of forest machinery is not a significant branch of the heavy machinery industry in Poland. In recent years, a number of specific forest machines have been imported in Poland. The number of harvesters and forwarders in Poland, in the years 2000-2010 is presented in Figure 4.8 (Nowaska & Moskalik 2012). About 200 harvesters and 350 forwarders operated in Poland in 2008. According to Mercator, 176 harvesters operated in Poland (Drewno 2012) in 2009. The market share of John Deere, Ponsse, and Komatsu harvesters was over 84%, with the largest share John Deere (37%). According to data from the three largest importers, 41% of the harvesters sold in 2007 were brand new machines. The information provided by the Poland Forest (Polish representative of John Deere) shows that 80% of cases were type 1070D harvesters, and 20% higher, type 1270D. No one brought any type 1470D machines, characterised by even greater power, weight, and dimensions.

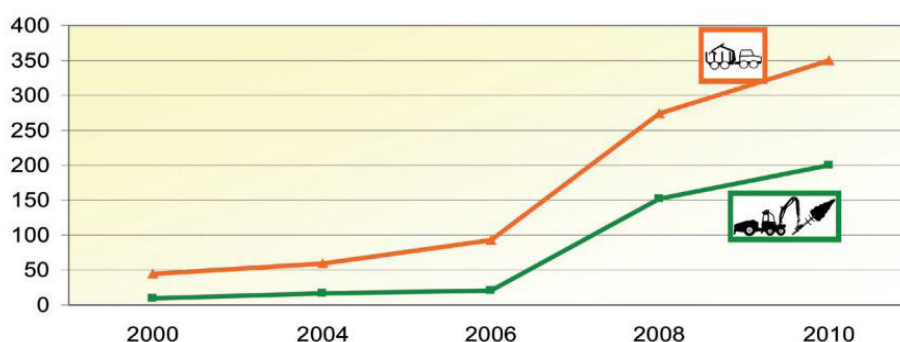


Figure 4.8. The number of harvesters and forwarders in Poland, in the years 2000-2010 (source: Nowaska & Moskalik 2012).

Compared with 2006, sales of harvesters and forwarders increased more than threefold. By using these types of machines, Polish forestry workers acquire 8% of wood, as calculated by Mercator, the Polish representative of the Windsor brand, which manufactures accessories for harvesting. A major problem with specialist forestry machinery in Poland is that most do not provide the necessary performance and quality. The barriers to the implementation of harvesting machines are lack of understanding of the need for new technological solutions and equipment, lack of unified assortment, measuring timber, lack of interest in woodlogs, shortcomings in the organisation of harvesting, and lack of stability in the service sector. According to many interviews, this last barrier is one of the biggest obstacles to the full mechanisation of harvesting and skidding. Simply put, it is not the use of annual contracts to perform economic tasks, preference for the tenders of contractors offering the lowest unit rate, or spasmodic and often limited agreements.

The Forest Technology Centre in Jarocin is one of six plants nationwide and the only plant producing forestry equipment. It is a separate structure from the State Forests. The department reports directly to the General Directorate of the State Forests. The Centre is the largest producer in the Polish market offering basic equipment for forestry activities (i.e. machines to clear the way to organise and protect the forest, soil preparation, harvesting, picking, and wood exports). The Centre is an intermediary in the sale of foreign harvesters, forwarders, mini forwarders, skidders, winches, chippers, tractors, and other forestry equipment. It manufactures a range of products domestically (Table 5.5), such as equipment for soil preparation and the maintenance of nurseries (14 models), machinery and equipment for soil preparation and afforestation (16 models), equipment for the care of crops (two models), wood harvesting (12 models), forest road construction and maintenance (11 models), splitters (two models), and containers (four models).

FAO-FAR is now the largest privately owned manufacturer of forestry machines in Poland. It was founded in 1992 as the first importer of forestry machines. Initially, machines were imported for the State Forests, but as the number of private forestry enterprises was growing, there were more and more private companies among its customers. Its business consisted of the importation of forestry machines at the beginning. As the needs of Polish forestry were increasing, it extended its product range. Since the company was developing its business, customers were gaining more and more confidence, and it started to manufacture machines of its own exclusively for Polish foresters that met Poland-specific requirements, such as heavy-duty use, hard ground conditions, rather weak tractors, and users' carelessness with machines. Different wood harvesting machines are produced by FAO-FAR in Cieszyn. These machines are designed for cut-to-length (Table 5.6).

Table 5.5. Forest machinery produced by the Forest Technology Centre in Jarocin (www.otljarocin.lasy.gov.pl).

Group of products	Model	Short description and technical data (web-site)
Nursery	SRS	Substratum sower
Nursery	AUL (U-779)	Forest cultivation unit
Nursery	BS	Szparownik nursery
Nursery	KUL	Forest cultivator
Nursery	PEĐRAK	Tractor attachment sprayer for the destruction of soil pests
Nursery	PS	Root cutter
Nursery	WS	Rooter
Nursery	WSA	Rooter (active)
Nursery	SPS	Point sowing seeder
Nursery	SPG	Seeder - drill points for seeding in the ground
Nursery	SN	Seeds separator
Nursery	SNS	Sieve seeds separator
Nursery	SOB	Nursery drum
Nursery	OS-1	Fertiliser sprayer
Soil preparation	GT (U-470)	Single deepener
Soil preparation	P1T	Active plough, 1-disc
Soil preparation	P1T	Active plough, 1-disc, hydraulic
Soil preparation	P2Tc	Double-disc plough
Soil preparation	LPz OTL	Double mould-board plough with deepener
Soil preparation	FL	Forestry cutter
Soil preparation	WT	Triple knife cultivation roller
Soil preparation	VLO	shaft presses
Soil preparation	WPG	Drill
Soil preparation	SAU	Seeder "Sobański"
Soil preparation	SZU	Seeder
Soil preparation	PS-G1	Seeder "Borysiewicz"
Soil preparation	PL	Plugofrezarka
Soil preparation	PLw2	Plugofrezarka
Soil preparation	LPz-P1T	Soil floor furrow exalt plough
Soil preparation	GNKp	Planter
Care of crops	BLN	Forest disc harrow "Niziński"
Care of crops	WPK	Nursing roller "Krokowski"
Wood harvesting	OB-218+OTL-40-32	Self-loading log trailer 3t with crane OTL-40-32
Wood harvesting	E5SD+Kesla	Self-loading log trailer 5t with crane Kesla 202
Wood harvesting	E5SD+OTL-40T	Self-loading log trailer 5t with crane OTL-40T
Wood harvesting	JAR-8+OTL-54T	Self-loading log trailer 8.4t with crane OTL-54T
Wood harvesting	JAR-6, 8, 10, 12	Self-loading log trailer with 6, 8, 10 and 12 t loads
Wood harvesting	PH-6, 10, 12	Forest hook set 6, 10 and 12 t loads
Wood harvesting	PR-01	Universal trailer 8t
Wood harvesting	OTL -40T	Log loader 16.8 kNm (netto)
Wood harvesting	OTL- 54T	Log loader 24.6 kNm (netto)
Wood harvesting	OTL- 54-50	Log loader 26.5 kNm (netto)
Forest biomass	LZB	The set for post-harvesting residue baling
Forest biomass	KIT CAP	The set for chipping includes trailer for chip production OTL-Jarocin, chipper, crane, tractor
Forest roads	RSD20	Universal roadside shredder
Forest roads	UDM	Road mixer device
Forest roads	V3-220	Road leveller, width 2.20 m
Forest roads	V4-240	Road leveller, width 2.4 m, under license from "VRETEEN" AB
Forest roads	V4000	Road leveller, width 2.2 m
Forest roads	WBR	Road vibrate roller
Forest roads	PR	Trencher for cleaning and maintenance of ditches along the forest roads
Forest roads	PR-H	Trencher for cleaning and maintenance of ditches along the forest roads
Forest roads	RBR	Roadside shredder
Forest roads	ZPL	Plough (winter mouldboard)
Forest roads	IG	Plough (winter rotary plough)
Containers	NRP and NEB	Waste containers
Containers	KS	Container for seedlings
Containers	KZ	The container for chips
Containers	PH - KMS	Forest hook set
Splitters	LD 5/40	Wood splitter (for firewood) 5t power
Splitters	LD 8/130	Wood splitter (for firewood) 8t power

Table 5.6. Forest machines by FAO-FAR (www.fao-far.pl).

Model	Short description and technical data (website)
PF 100	Plough-cutter for forest soil preparation
FV 4088, 4082 FU, FU 4077	Mills for forest soil preparation
842K, 942K, 1042K, 1142K, 1342K, 1442K	Forestry trailers - PROFI Series capacity 8 – 14t, with Nokka
ECO	Forest trailers with capacity 6 - 7 tons
FaoFar 61 2241, 61 2250, 71 2250	Forest trailers with capacity 6 - 9 tons
DT 2051, 2351, 2064, 2364	Pulverise milling machines

5 Forest education and research

5.1 Education

Formal forestry and forest industry education in Poland is conducted at:

- Two classical universities (98 forestry and 639 agricultural and forestry technology full-time students in 2010), six agricultural universities (4,238 and 2,286 students), and six technological universities (240 and 668 students) under the Ministry of Science and Higher Education of Poland as well as two private university colleges (118 students) (Table 5.1).
- Post-secondary schools (*szkoły policealne*). These schools open for the graduates of general and specialised secondary schools that will not enter higher education. The completion of these schools will enable them to acquire or extend their vocational qualifications on the technical secondary or equivalent level. Applicants are enrolled based on the certificate of the completion of education in the above-mentioned secondary schools. The education will vary in terms of curriculum and duration. It will also depend on the level of competencies acquired by pupils in general secondary schools. The school will provide educations of different duration, but no longer than 2.5 years. The education ends with a vocational examination set in accordance with the standards defined by the Central Examination Commission for the respective occupations. Graduates are awarded a certificate of the completion of education in the post-secondary school (*świadectwo ukończenia szkoły policealnej*) and having passed the vocational examination – the diploma of vocational title (*dyplom uzyskania tytułu zawodowego*)
- Secondary vocational schools with 2,448 graduates in forestry, wood technology, and environmental development in 2010 (Tables 5.2 and 5.3):
 - Three-year specialised secondary school (*liceum profilowane*) provides education in general vocational specialisations, enrolling gymnasium graduates. These types of schools provide education in a dozen general vocational education specialisations corresponding to the existing fields of economic and labour market needs, including forestry and wood technology. Graduates, having passed a maturity examination, are awarded the maturity certificate of the specialised secondary school (*świadectwo dojrzałości liceum profilowanego*). Holders of this maturity certificate may apply for admission to a higher education institution. Those graduates who do not take the above-mentioned examination

- are awarded a certificate of the completion of education in the specialised secondary school (*Świadectwo ukończenia liceum profilowanego*), which is a document confirming the secondary education and general vocational preparation of its holder. However, it does not entitle its holder to apply for admission to a higher education institution.
- Four-year technical secondary school (*technikum*). This school is open for gymnasium graduates interested in a vocational education, including forestry, wood technology, and papermaking. Graduates of technical secondary schools, who do not enter for the maturity examination, obtain a certificate of the completion of education in the technical secondary school (*świadectwo ukończenia technikum*), whereas graduates who have passed the maturity examination obtain a maturity certificate of the technical secondary school (*świadectwo dojrzałości technikum*), which entitles them to apply for admission to higher education institutions and having passed the vocational examination – the diploma of vocational title (*dypłom uzyskania tytułu zawodowego*).
 - Three-year supplementary technical secondary schools (*technikum uzupełniające*) are open for graduates of basic vocational schools. After the three-year education, its graduates may sit for the maturity examination and having passed it may be awarded the maturity certificate of the technical secondary school (*świadectwo dojrzałości technikum*), entitling them to apply for admission to a higher education institution and having passed the vocational examination – the diploma of vocational title (*dypłom uzyskania tytułu zawodowego*). Those who will not sit the maturity examination will obtain a certificate of the completion of education in the technical secondary school (*świadectwo ukończenia technikum*).
 - 11 secondary forest schools under the Ministry of the Environment of Poland, with about 217 graduates in 2010 (Table 5.3).
- Basic vocational schools offer general education and basic vocational education courses, and provide access to further education at a secondary school. The requirement for gaining access to the school is the certificate of the completion of education from primary school (*świadectwo ukończenia szkoły podstawowej*). Selection of applicants is carried out only when the number of applicants exceeds the number of places available in a school. Generally courses last two to three years. The timetable comprises a set of compulsory general and theoretical vocational subjects as well as practical training activities. Theoretical and practical vocational training courses account in the first year for ca. 30% of the total load, in the second year – for ca. 50%, and in the third year – for ca. 70%. The certificate of the completion of education from the basic vocational school (*świadectwo ukończenia zasadniczej szkoły zawodowej*) confirms that its holder has been awarded the title of skilled worker or worker with equivalent qualifications and the diploma of vocational title (*dypłom uzyskania tytułu zawodowego*) – a graduate having passed the vocational examination. This school also allows continuing the education at a three-year supplementary technical secondary school.

The above-mentioned educational institutions also play an important role in continuous education. The State Forests is active in forest education (5,500 objects, including the centres of forest education, education footpaths, education rooms, “education shelters” (green classes), parks and arboretums, educational points) (PGL LP 2012). The Research and Development Centre of State Forests in Będów provides information, education, and training materials. The State Forests run a forest education web portal for children and youths (<http://dzieci.erys.pl/>). It also organises many cultural events, partly at the Forest Culture Centre in Gołuchów (<http://www.okl.lasy.gov.pl/web/okl>). The locations of forest educational institutions in Poland are presented on Maps 7.18 and 7.19.

Table 5.1. List of universities in the field of forestry and the forest industry in Poland (www.nauka.gov.pl).

Name	Field	Website
Warsaw University of Life Sciences Szkoła Główna Gospodarstwa Wiejskiego w Warszawie	Forestry (specialisations: multifunctional forestry, forest environment protection) Agricultural and forestry technology (engineering and information technology in forestry, renewable energy) Wood technology (mechanical wood technology, wood protection and modification, furniture manufacturing) Forest information technology	www.sggw.pl
University of Life Sciences in Poznań Uniwersytet Przyrodniczy w Poznaniu	Forestry (forest economy, forest environment protection, forest work contracting) Wood technology (mechanical wood technology, chemical wood technology, wood protection and modification, furniture manufacturing) Agricultural and forestry technology (biofuel sector engineering)	http://puls.edu.pl
Agricultural University of Cracow Uniwersytet Rolniczy im. Hugona Kołłątaja w Krakowie	Forestry (forest management, forest environment protection)	www.ur.krakow.pl
University of Lodz Uniwersytet Łódź	Forestry	www.uni.lodz.pl
University of Warmia and Mazury in Olsztyn Uniwersytet Warmia and Mazury in Olsztyn	Forestry (forest environment protection) Agricultural and forest technology (renewable energy)	www.uwm.edu.pl
Białystok University of Technology Politechnika Białostocka	Forestry (Management of valuable natural areas) Agriculture and forestry engineering (renewable energy)	www.pb.edu.pl
Warsaw University of Technology Politechnika Warszawska	Paper and printing technology (70 in 2012)	www.pw.edu.pl
Technical University of Łódź Politechnika Łódzka	Paper and printing technology	www.p.lodz.p
The Opole University of Technology Politechnika Opolska	Agricultural and forestry technology	www.po.opole.pl
Univeristy of Technology and Life Sciences in Bydgoszcz Uniwersytet Technologiczno- Przyrodniczy	Agricultural and forestry technology	www.utp.edu.pl
Koszalin University of Technology Politechnika	Agricultural and forestry technology (information technology in agriculture and forestry, renewable energy technologies)	www.tu.koszalin.pl
Wroclaw University of Environmental and Life Sciences Uniwersytet Przyrodniczy we Wrocławiu	Agricultural and forestry technology	www.up.wroc.pl
West Pomeranian University of Technology in Szczecin Zachodniopomorski Uniwersytet Technologiczny w Szczecinie	Agricultural and forestry technology (technology and services in forestry)	www.zut.edu.pl
University of Life Sciences in Lublin Uniwersytet Przyrodniczy w Lublinie	Agricultural and forestry technology (renewable energy)	www.ar.lublin.pl
Higher School of Management of the Environment in Tuchola Wyższa Szkoła Zarządzania Środowiskiem w Tucholi	Forestry Landscape architecture	www.wszs.tuchola.pl
Rzeszów School of Engineering and Economics Wyższa Szkoła Inżynieryjno - Ekonomiczna z siedzibą w Rzeszowie	Agricultural and forestry technology (development of green areas)	www.wsie.edu.pl

Table 5.2. List of secondary vocational schools in the field of forestry in Poland (www.cie.men.gov.pl, www.mos.gov.pl).

Name	Region	Website
Technikum Leśne Milicz*	Dolnośląskie	56-300 Milicz, http://zspmilicz.republika.pl
Technikum Nr 6 w Głogowie	Dolnośląskie	67-200 Głogów, www.przyrodnicza.glogow.pl
Technikum Przyrodniczo-Zywnościowych w Jeleniej Górze	Dolnośląskie	58-570 Jelenia Góra, www.zspz.jgora.pl
Technikum Leśne Tuchola*	Kujawsko-pomorskie	89-500 Tuchola, www.zsl.tuchola.pl
Technikum Leśne Biłgoraj*	Lubelskie	23-400 Biłgoraj, www.zslbilgoraj.internetdsl.pl
Technikum Leśne Starościn	Lubelskie	69-110 Starościn, http://zsl.republika.pl
Technikum Leśne Rogoziniec*	Lubelskie	66-210 Rogoziniec, www.zslrogoziniec.prv.pl
Niepubliczne Technikum Leśne Lublin	Lubelskie	20-009 Lublin, www.szansa.in.lublin.pl
Technikum Leśne w Starościnie*	Lubuskie	69-110 Rzepin, http://tlrzepin.pl
Technikum Leśne	Łódzkie	97-371 Wola Krzysztoporska
Technikum Leśne Stary Sącz	Małopolskie	33-340 Stary Sącz, www.zsz1starysacz.pl
Technikum Leśne Garbatka	Mazowieckie	26-930 Garbatka-Letnisko, www.zspwg.republika.pl
Technikum Leśne Kadzidło	Mazowieckie	07-420 Kadzidło, www.zsp-kadzidlo.pl
Publiczne Technikum Leśne	Opolskie	49-130 Tułowice, www.zsz-tulowice.pl
Zespół Szkół Leśnych w Lesku*	Podkarpackie	38-600 Lesko, www.zsl.lesko.info.pl
Zespół Szkół Ogrodniczych i Licealnych im. Zesłańców Sybiru	Podkarpackie	37-500 Jarosław, www.zsoilpawlosiow.edu.pl
Technikum Leśne Białowieża*	Podlaskie	17-230 Białowieża, www.bialowieza.lasy.pl
Technikum Leśne Warcino*	Pomorskie	77-230 Warcino, www.tlwarcino.pl
Technikum Leśne Brynek	Śląskie	42-690 Brynek, www.tlbrynek.edu.pl
Zespole Szkół Leśnych i Ekologicznych w Brynku*	Śląskie	42-690 Tworóg, www.tlbrynek.edu.pl
Zespół Szkół Drzewnych i Leśnych	Śląskie	34-300 Żywiec, http://zsdil-zywiec.w.interia.pl
Zespół Szkół Leśnych Zagnańsk*	Świętokrzyskie	26-050 Zagnańsk, http://tech-les.webpark.pl
Zespół Szkół w Bałtowie	Świętokrzyskie	27-423 Bałtów, www.zsbaltow.eu
Zespół Szkół Drzewnych i Leśnych im. Unii Europejskiej	Warmińsko-mazurskie	12-221 Ruciane-Nida, http://zsdil.webpark.pl
Technikum Iłowo Osada	Warmińsko-mazurskie	13-240 Iłowo Osada, www.zszilowo.edu.pl
Technikum Leśne Chodzież	Wielkopolskie	64-800 Chodzież, www.lion.netbiz.pl
Zaoczne Technikum Leśne*	Wielkopolskie	64-700 Góra nad Notecią, www.zsl-goraj.cil.pl
Zespół Szkół Ponadgimnazjalnych w Benicach	Zachodniopomorskie	72-400 Kamień Pomorski, www.zspbenice.pl

*) schools under the Ministry of the Environment of Poland

Table 5.3. List of secondary vocational schools in the field of the forest industry in Poland (www.cie.men.gov.pl, www.drewno.pl)

Name	Region	Website
Wood technology		
Zespole Szkół Rzemiosł Artystycznych w Jeleniej Górze	Dolnośląskie	58-560 Jelenia Góra, www.zsart.edu.pl
Technikum Drzewne dla Dorosłych MUR w Twardogórze	Dolnośląskie	56-416 Twardogóra, www.mur.com.pl
Technikum Drzewne w Twardogórze	Dolnośląskie	56-416 Twardogóra, http://zsp.twardogora.w.interia.pl
Liceum Profilowane - Leśnictwo i Technologia Drewna	Dolnośląskie	58-570 Jelenia Góra, www.sikorski.neostrada.pl
Zespół Szkół Drzewnych Bydgoszcz	Kujawsko-pomorskie	85-023 Bydgoszcz, www.zsd.bydgoszcz.pl
Technikum Uzupełniające Technologii Drewna w Nowem	Kujawsko-pomorskie	86-170 Nowe, http://zsp-nowe.go.pl
Technikum Drzewne dla Dorosłych Sępólno Krajeńskie	Kujawsko-pomorskie	89-400 Sępólno Krajeńskie, http://zspsepolno.republika.pl
Uzupełniające Technikum Technologii Drewna	Kujawsko-pomorskie	87-300 Brodnica, http://zszbrodnica.edupage.org
Technikum Drzewne, Zespół Szkół Budowlanych im. E. Kwiatkowskiego	Lubelskie	20-336 Lublin, http://www.zsb.lublin.pl
Technikum Przemysłu Drzewnego w Janowie Lubelskim	Lubelskie	23-300 Janów Lubelski, www.goose.friko.pl
Technikum Przemysłu Drzewnego w Zwierzyniec	Lubelskie	22-470 Zwierzyniec, http://www.zsdios.republika.pl
Technikum w Wschowa	Lubuskie	67-400 Wschowa, http://zswschowa.edu.pl
Technikum Nr 15	Łódzkie	90-242 Łódź, http://zsb2.lodz.pl
Technikum Drzewne i Ochrony Środowiska Radomsko	Łódzkie	97-500 Radomsko, www.drzewniak.friko.pl
Technikum Drzewne dla Dorosłych Piotrków Trybunalski	Łódzkie	97-300 Piotrków, www.zspnr3.w.pl
Zaoczne Technikum Uzupełniające Drzewne WZDZ w Łodzi z siedzibą w Zduńskiej Woli	Łódzkie	98-220 Zduńska Wola
Technikum Nr 5	Małopolskie	33-100 Tarnów, www.zso.tarnow.pl
Technikum Drzewne Towarzystwa Salezjańskiego w Oświęcimiu	Małopolskie	32-600 Oświęcim, www.salezianie.edu.pl
Niepubliczne Technikum Drzewne dla Dorosłych Kęty	Małopolskie	32-650 Kęty, http://ckd.edu.pl
Technikum w Maków Podhalański	Małopolskie	34-220 Maków Podhalański, www.zsmg.isg.pl
Zespół Szkół im. Komisji Edukacji Narodowej	Małopolskie	34-130 Kalwaria Zebrzydowska, http://zksen.edu.pl
Technikum Drzewne w Garbatce-Letnisko	Mazowieckie	26-930 Garbatka-Letnisko, www.zspwg.republika.pl
Technikum Uzupełniające - Drzewne TWP Przysucha	Mazowieckie	26-400 Przysucha, www.przysucha.pl
Niepubliczne Technikum Technologii Drewna dla Dorosłych w Pułtusk	Mazowieckie	06-100 Pułtusk, www.zntz.z.pl
Publiczne Technikum Nr 6. Zespół Szkół Budowlanych	Opolskie	45-761 Opole, www.zsb.opole.pl
Technikum Przemysłu Drzewnego Dobrodzień	Opolskie	46-380 Dobrodzień, www.zspdobrodzien.pl
Technikum Drzewne Kolbuszowa	Podkarpackie	36-100 Kolbuszowa, www.zst.kolbuszowa.pl
Technikum Drzewne na podbudowie ZSZ Miejsce Piastowe	Podkarpackie	38-430 Miejsce Piastowe, http://mzsp.otd.pl
Technikum Przemysłu Drzewnego ZS w Rudniku nad Sanem	Podkarpackie	37-420 Rudnik nad Sanem, www.zsrudnik.edu.pl
Technikum Drzewne Nr 2 w Lesku	Podkarpackie	38-600 Lesko, www.zsd.lesko.pl
Technikum Zawodowe Nr 9 w Białymstoku	Podlaskie	15-879 Białystok, http://zstbial.w.interia.pl
Technikum Uzupełniające dla Dorosłych Nr 4 w Białymstoku	Podlaskie	15-448 Białystok, http://www.ckubialystok.pl
Technikum Nr 2 w Suwałkach	Podlaskie	16-400 Suwałki, www.zs6.suwalki.pl
Technikum w Hajnówce	Podlaskie	17-200 Hajnówka, www.zshajnowka.republika.pl
Technikum Nr 3 w Słupsku	Pomorskie	76-200 Słupsk, http://drzewniak.prv.pl
Szkoła Policealna dla Dorosłych Nr 8 w Słupsku	Pomorskie	76-200 Słupsk, www.technik.slupsk.pl
Technikum Nr 3	Pomorskie	Kartuska 48, 83-400 Kościerzyna, http://pzs3koscierzyna.edupage.org
Technikum Uzupełniające dla Dorosłych	Pomorskie	84-240 Reda, www.zspreda.pl
Technikum Nr 2 w Starogardzie Gdańskim	Pomorskie	83-200 Starogard Gdański, www.zszstarogard.pl
Technikum Drzewne Żywiec	Śląskie	34-300 Żywiec, www.zsbd.edu.pl
Technikum Uzupełniające dla Dorosłych	Śląskie	42-200 Częstochowa, www.cku.czyst.pl
Prywatne Uzupełniające Technikum Drzewne dla Dorosłych Kielce	Świętokrzyskie	25-378 Kielce, www.ckb-zgoda.pl
Niepubliczne Technikum Uzupełniające dla Dorosłych w Staszowie ZDZ	Świętokrzyskie	28-200 Staszów, www.zdz.kielce.pl
Technikum Uzupełniające dla Dorosłych w Lubawie	Warmińsko-mazurskie	14-260 Lubawa, www.wkl.edu.pl
Technikum Drzewne po ZSZ w Reszel	Warmińsko-mazurskie	11-440 Reszel, www.rataj.reszel.pl
Technikum Technologii Drewna w Jagarzewie	Warmińsko-mazurskie	13-113 Janowo, www.zsriogagarzewo.republika.pl
Technikum Nr 1 w Morągu	Warmińsko-mazurskie	14-300 Morąg, www.zsziomorag.internetdsl.pl
Technikum Nr 4 w Olsztynie	Warmińsko-mazurskie	10-558 Olsztyn, www.zsb.internetdsl.pl
Technikum Drzewne na podbudowie ZSZ Lidzbark Warmiński	Warmińsko-mazurskie	11-100 Lidzbark Warmiński, www.zszlw.edu.pl
Technikum Budowlano-Drzewne	Wielkopolskie	60-135 Poznań, www.zsbd.pl
Technikum Nr 1 w Ostrzeszowie	Wielkopolskie	63-500 Ostrzeszów, http://zs1.ostrzeszow.pl
Technikum Uzupełniające dla Dorosłych w Kępnie	Wielkopolskie	63-600 Kępno, www.zsp2.kepno.pl

Table 5.3 continue

Technikum. Zespół Szkół Ponadgimnazjalnych w Zdunach	Wielkopolskie	63-760 Zduny, http://zspzduny.w.interia.pl
Technikum Uzupełniające w Czarnkowie	Wielkopolskie	64-700 Czarnków, http://www.zspczarnkow.edu.pl
Technikum Technologii Drewna Słupca	Wielkopolskie	62-400 Słupca
Zaoczne Technikum Technologii Drewna Oborniki	Wielkopolskie	564-600 Oborniki, www.zs.oborniki.info
Technikum Technologii Drewna dla Dorosłych	Wielkopolskie	62-045 Pniewy
Technikum Drzewne Czaplinek	Zachodnio-pomorskie	78-550 Czaplinek, www.zspczaplinek.pl
Technikum Zawodowe Nr 1	Zachodnio-pomorskie	73-110 Stargard Szczeciński, www.zs1.stargard.pl
Papermaking		
Technikum No. 2 w Kwidzynie	Pomorskie	82 - 500 Kwidzyn, www.zsp2.ckj.edu.pl

Table 5.4. List of basic forestry vocational schools in Poland (www.cie.men.gov.pl).

Name	Field	Website
School in Radłowie Zespół Szkół Ponadgimnazjalnych im.T.Kosciuszki w Radłowie	Forestry machinery operator	www.zspradlow.pl
Electro-Mechanical School in Złotów Zespół Szkół Elektro-Mechanicznych w Złotowie	Forestry machinery operator	www.zse-m.pl
School in Resko Zespół Szkół w Resku	Forestry machinery operator	www.zsresko.republika.pl
Forest School in Rogozińcu Zespół Szkół Leśnych w Rogozińcu	Forestry machinery operator	www.trogoziniec.pl

State-of-the-art forest management and governance based on the principles of sustainable development have caused the need to coordinate educational processes and curricula, while the Ministry of the Environment has also carried out the central governmental policy of vocational training human resources for forest management purposes. The Minister of the Environment launched an initiative to take over and provide surveillance of forest school complexes, for which before 1999 the Minister was the Founding Body, whereas now the County Offices have become the managing authorities for them. Under the current legal status (Ministry of the Environment 2012), public forest schools are back under Ministerial governance, by way of a Memorandum of Understanding to be concluded between the Minister of the Environment and the respective territorially competent self-governmental authority (i.e. County Office). In 2007, the relevant Memoranda of Understanding were signed between the Minister of the Environment and County offices on the conveyance of the governance title of the schools, and currently 11 Secondary Forest Schools in Poland are subordinated thereto.

Several elements of the curricula at these education and training institutions cover various aspects of forestry topics (e.g., economics and forest management), but there is no specific subject taught on forestry extension. The leadership of forestry faculties, forestry research institutes, and the directors of the Regional Directorates of the *State Forests* recently identified the need for the increased training of students in forestry extension. However, some officials do not place much importance in specific training in forestry extension. Traditional knowledge and skills in forest management were thought to be sufficient to carry out the supervision of private forests.

5.2. Research

The Polish Academy of Sciences (www.pan.pl) has established the Forestry Science and Wood Technology scientific committees with the purpose of representing Polish science in international scientific organisations and organising and coordinating the undertakings resulting from membership in those organisations. The composition of the committees secures the representation of the whole scientific community of the country. The Forestry Sciences Committee of the Polish Academy of Sciences (www.knl.pan.pl) was established in 1956. The scope of activities is all issues of forest sciences with regard to multilateral forest functions. The Committee serves as the National Committee for Cooperation with the International Union of Forestry Research Organisations. The Wood Technology Committee of the Polish Academy of Sciences (www.ktd.pan.pl) was established in 1961. The scope of activities is the science of wood, chemicals, and mechanical technology of wood and composite wood products, pulp and paper technology, mechanical wood processing, conservation and preservation of wood and wooden monuments, and the economics and organisation of the wood industry.

The Polish scientific community in the field of the forestry and forest industry includes several research organisations, such as:

- Forest Research Institute (*Instytut Badawczy Leśnictwa*)
- Institute of Dendrology (*Instytut Dendrologii*)
- Institute of Environmental Protection (*Instytut Ochrony Środowiska*)
- Research & Development Centre for Wood-based Panels (*Ośrodek Badawczo-Rozwojowego Przemysłu Płyt Drewnopochodnych*)
- Opole University of Technology - Department of Agriculture and Forest Technology (*Politechnika Opolska - Katedra Techniki Rolniczej i Leśnej*)
- Warsaw University of Life Sciences - Faculty of Forestry (*Szkoła Główna Gospodarstwa Wiejskiego (SGGW) - Wydział Leśny*)
- Poznań University of Life Sciences (*Uniwersytet Przyrodniczy w Poznaniu*)
- Agricultural University in Krakow - Faculty of Forestry (*Uniwersytet Rolniczy w Krakowie im. Hugona Kollątaja - Wydział Leśny*)
- other forest-related departments of Polish Universities (see Table 5.1).

The Forest Research Institute in Sękocin Stary (www.ibles.pl) was established in 1930. Since 1945, it has been acting as the Forest Research Institute, currently being subordinated to the Ministry of the Environment. The Institute consists of nine scientific departments:

- Departments of Forest Ecology (*Ekologii Lasu*), Silviculture and Genetics (*Hodowli Lasu i Genetyki Drzew Leśnych*), Scientific Information (*Informacji Naukowej*), Forest Protection (*Ochrony Lasu*), Forest Management (*Zarządzania Zasobami Leśnymi*), Chemical Analysis (*Pracownia Chemii Środowiska Leśnego*), Forest Fire Protection (*Pracownia Ochrony Przeciwpowodziowej Lasu*) in Sękocin Stary
- European Centre for Natural Forests (*Europejskie Centrum Lasów Naturalnych*) in Białowieża
- Department of Mountain Forestry (*Gospodarki Leśnej Regionów Górskich*) in Kraków.

The Forest Research Institute carries out scientific research and developmental work for the benefit of all forests, forest management, and forestry needs in the range of forest afforestation and reforestation, tending, utilisation and protection, ecology, genetics, forest economics and policy, and carbon sequestration in Poland. The Institute actively participates in formulating legislation and national forest policy and undertakes governmental activities. Information about

forest activities in Poland and daily fire danger is available via the webpages of the institute (<http://bazapozarow.ibles.pl/zagrozenie>). The institute also publishes the quarterly journal *Leśne Prace Badawcze* (www.lesne-prace-badawcze.pl) in Polish with English abstracts.

The Institute of Dendrology of the Polish Academy of Science in Kórnik (www.idpan.poznan.pl) is a Polish centre of multidisciplinary research on trees. The Institute was established in 1933 and carries out research in the areas of tree biology, especially in the fields of genetics, molecular biology, biochemistry, physiology, ecophysiology, ecology, systematic and geography, biology of seeds, mycorrhiza, and anthropopression hazards to forest ecosystems. Research is conducted in 13 laboratories. Their work is concerned with many aspects of tree biology. This is mainly basic research, involving the analysis and description of hitherto unknown processes and relationships. The scientists are also commissioned to solve current problems in forestry concerning seed plantations, biodiversity, the health of trees and forest stands, and so on. The Institute has at its disposal a wide range of laboratory equipment and plant material. This includes an invaluable collection of trees grows in the Kórnik Arboretum and the “Zwierzyniec” Experimental Forest as well as preserved specimens accumulated at the Institute’s herbarium for many years. Both the collections and the herbarium belong to the richest in Poland and they are well known around the world. The library is composed of about 26,000 books, 18,000 volumes of periodicals, and 1,500 special publications. The major directions of research conducted at the Institute are listed below:

- Systematics and chorology of trees and shrubs.
- Methods of vegetative propagation: modern methods of plant regeneration; in vitro propagation.
- Population genetics of forest trees.
- Biochemical genetics of forest trees.
- Physiopathology of trees and shrubs
- Seed biology of trees and shrubs
- Mycorrhizal symbioses of trees and shrubs
- Ecophysiological reactions of trees to environmental factors and human disturbance.
- Introduction and acclimatisation of trees and shrubs.

The Institute cooperates with about 50 foreign research centres in 30 countries. The Institute publishes an scientific journal *Dendrobiology* and popular scientific monograph *Our Forest Trees* (*Nasze drzewa leśne*). *Dendrobiology* is an international semi-annual journal, which includes original publications and review articles in the field of tree biology. *Our Forest Trees* is a book series that started in 1970 with a monograph on Scots pine (*Pinus sylvestris* L.).

The Institute for Environmental Protection in Warszawa (www.ios.edu.pl) was appointed by virtue of the Order of the Minister of Environmental Protection in 1986 and granted the status of a National Research Institute in 2010. The major activity area of the Institute is to develop scientific and technical bases for environmental protection and relevant national policies. The Institute is a ministerial/governmental institute, supervised by the Ministry of the Environment. The development of state policies at the national and international levels provides the Institute a special place among various other research and development institutions involved in environmental protection. Special areas of activity such as integrated environmental studies contribute significantly to the integration of work carried out under other research fields. The Institute is involved in the following research activity fields:

- Development of the principles of Polish environmental policy and strategies, and participation in international activities;

- Integrated environmental studies, especially on environmental processes and effects of degradation with particular consideration of industrial contaminated sites;
- Air protection against pollution;
- Climate protection;
- Abatement of noise and vibrations;
- Conservation of landscape and natural living resources;
- Protection and restoration of biologically active land surface;
- Protection and renewal of water resources;
- Protection of the Baltic Sea and its coastal zone;
- Waste management in the environment.

The scope of research under the above fields includes:

- Economic and legal basis for environmental protection, including Poland's international cooperation;
- Standards, levels, and indices of environmental quality and pollution emission;
- Environmental monitoring (assessment of the state of the environment and its changes);
- Methods and systems used in documenting and projecting changes in the environment;
- Documentation and databases on protected areas; designing protected areas and their management plans;
- Measurement and analytical methods in environmental pollution;
- The principles, concepts, and programmes used in environmental management;
- Environmental impact assessments of economic facilities and undertakings;
- Environmental impact assessments of substances, products and installations;
- Protection of the environment and nature resources in spatial planning;
- Methods and techniques used in environmental protection with the consideration of degraded land reclamation and evaluation of the effectiveness of protective measures;
- Integrated environmental monitoring.

The Institute is involved in international and national cooperation in the field of environmental protection, environmental education, granting technical approvals for facilities used in wastewater treatment and sewage sludge processing, providing opinions on plant protection products intended for registration in Poland with regard to their environmental safety, implementation and dissemination of the results of studies obtained at the Institute through its own publications, and by organising countrywide meetings, conferences, and seminars, and bibliographic and informative activity. The Institute manages two environmental monitoring stations: the Automatic Station for Measuring Air Pollution in Warsaw and Integrated Environmental Monitoring Station "Puszcza Borecka" in the Mazury Lake District.

The Wood Technology Institute in Poznan (www.itd.poznan.pl) was established in 1952. The Ministry of the Economy supervises the Institute. The subject and scope of activities defined in the Institute's Statutes encompass:

- Conduct of scientific research in the scope of:
 - structure, quality and properties of wood, composite wood products and other materials used in the wood processing and furniture industries, production of the following industries: sawmilling, wood-based panels, match-making, building woodwork, furniture making, wood chemical processing,
 - machine, tool and energy equipment,
 - wood industry organisation and economics,

- product quality,
- environmental protection and job security,
- Scientific, technical and economic information,
- Inventiveness and industrial and intellectual property rights,
- Standardisation and typification works.

Activity in the field of scientific research, stemming from the Statute, of the Institute encompasses scientific research and development works conducted in the following scope:

- structure, quality, and properties of wood, wood products and materials used in the woodworking and furniture industries and in products of these industries,
- production processes of sawmilling, wood-based panels, plywood, matches, builder's carpentry and joinery, furniture, chemical wood processing industries,
- machines, implements and energy supply of these branches,
- biotechnology,
- organisation and economics of the wood industry,
- roundwood, sawnwood, wood-based panels, furniture, and other wood products markets,
- product quality,
- environmental protection and safety at work.

The Institute employs 93 staff, of whom 19 have a DSc or PhD.

The Research and Development Centre for Wood-based Panels in Czarna Woda (www.obrppd.com.pl) is a research institute that has laboratories that are conducting research into various lignocelluloses raw materials including industrial waste, product testing, reducing the environmental effects of board manufacture, design and prototyping, and patents. The Centre is subordinate to the Treasury. It was brought into life by the merger of the Branch Laboratories of the plywood, fibreboard, and particleboard industries, and it continues the activity of the plants that formed it. The oldest of them, the Branch Laboratory of the Fiberboard Industry, was founded in 1957. The Centre's main aim is to inspire and stimulate technological progress in the wood-based panels industry, in detail by:

- development of new technologies for wood-based panels production,
- conducting of research works in the scope of technology, machines and equipment modernisation, including products properties upgrading and economical use of energy, material and water, and environmental protection,
- development of technological and technical expertise of machines and equipment production process,
- conducting works connected with determination and combating harmful effects of industry influences on the environment and work conditions,
- conducting products test and helping to obtain certificates, technical approvals, attestations and patents,
- development of forecasts for changes of production value of individual wood-based panels types and connected demand for resources and auxiliary material,
- conducting analysis of trends in production and use of particular wood-based panels types in Poland and Europe,
- taking part and helping in the popularisation of new technical and technological solutions for the wood-based panels industry, including the design and construction of atypical sets and installations,
- conducting activity in the area of science and technology, economic and patent information, and protection of industrial property.

6 Forest energy

The data presented in this report come from the recent and best available sources, which are used in the analyses by the Polish Ministry of the Economy (Burczy *et al.* 2010).

European Union subsidies and funds play a significant role in the promotion of renewable energy from biomass, including wood biomass. In the regulation sphere of obtaining biomass from agriculture, the Common Agricultural Policy (*CAP*) is imperative. Among other things, *CAP* establishes a direct payment system as well as supports the modernisation of agriculture and the enhancement of the benefits of agricultural and forest products. In Poland, mechanisms for support and the control of energy plantations were created based on the principles of the *CAP*. These mechanisms define the conditions for granting subsidies, verifying payment applications, controlling their feasibility. However, because of the health check of the *CAP* in 2008, it is planned to abolish currently functioning payments to “energy” plantations. Therefore, Community funds will be of growing importance. The Rural Areas Development Programme envisages support for projects connected with the production of energy materials from biomass (“Differentiation towards non-agricultural activity”, “Establishment and development of micro enterprises”). On the other hand, within the framework of the action entitled “Basic services for the economy and population in rural areas”, support is granted to initiatives connected with the production or distribution of energy from renewable sources, especially wind energy, water energy, geothermal energy, solar energy, and energy from biogas or biomass. Another programme offering subsidies for renewable energy sources (including biomass) is the Infrastructure and the Environment Operational Programme (action “Environmentally friendly energy infrastructure and energy efficiency”). This programme supports investments concerning the building or modernisation of electric energy production units using biomass, biogas, wind, and water energy and units producing electric energy and heat in combination with renewable energy sources (e.g. combined heat and power plants using biomass). At a regional level, there are also initiatives promoting biomass market. Support for these initiatives is envisaged in Regional Operational Programmes as well.

6.1. Biomass potential

In 2010, energy production from renewable energy sources (*RES*) in Poland reached 287,640 TJ and amounted to 10% of the total primary energy production. In comparison, 199,566 TJ (6%) was produced from *RES* in 2006. Solid biomass is a dominant source, 85.4% of total *RES* production, next come liquid biofuels with 6.7%, hydro (3.7%), biogas (1.7%), wind (2.1%), heat pumps (0.3%), geothermal energy (0.2%), solar energy (0.04%), and waste (0.03%) (GUS 2011a). It should be stressed that the dominant part of solid biomass originates from wood (the other part is composed of other biodegradable vegetable and animal substances such as straw and municipal waste).

Total solid biomass consumption was steadily expanding between 2001 and 2010. For instance, the biggest increase in consumption was observed in 2010 when 13% more solid biomass was acquired in comparison to the previous year, which constituted an increase by 53%. It is expected that this trend will continue over the forthcoming years. According to the data of the Energy Market Agency in 2009 (Flakowicz 2010), the biomass consumption of professional power and

CHP plants in Poland is about 56 PJ (about 4 million tons) per year. The other major consumers of biomass are the industrial CHP plants operating near the pulp and paper mills, furniture factories, and sawmills. According to the Energy Market Agency (GUS 2010), the biomass consumption of industrial CHP plants was about 1.7 million tons in 2009.

Biomass potential in Poland is available in three main segments:

- forest: wood, residues and by-products,
- agriculture: energy plants, short rotation coppice, residues,
- industry and households: organic waste stream.

The technical potential of solid biomass is estimated to be between 408 PJ/a and 755 PJ/a, depending on the sources. Among renewable energy sources, solid biomass is not only the most important in Poland today, but also is expected to be the fastest growing source in the future. However, the share of biomass from forestry will be significantly reduced. In 2008, electricity production from biomass amounted to 3,267 GWh (2,752 GWh in co-firing), which was equal to nearly 50% of total electricity production from *RES* compared with 44% in 2007, and this share is steadily increasing. About 0.96 million tons of biomass were used to produce electricity in 2007 in addition to about 4.5 million tons for heating purposes. Further estimates show that the minimum needs of the energy system and heating sector in Poland will amount to about 10 million tons by 2020 (Burczy et al. 2010).

Table 6.1. Solid biomass balance in 2001–2010, TJ (GUS, 2009, 2011).

Item	2001	2005	2006	2007	2008	2009	2010
Indigenous production	160406	174431	192097	197150	198401	217302	245543
Import							
Export							
Stock changes			-73	-924	500		
TPES	160406	174431	192024	196226	198902	217302	245543
Use for conversion	4886	17500	21180	25434	38251	55083	66119
Electricity and CHP plants	1181	9641	13430	17471	30428		
Heat plants	252	1412	1601	1529	1897		
Industrial electricity and CHP plants	3058	6194	5954	6266	5726		
Industrial heat plants	395	253	195	168	200		
Energy sector own use	39	2	11	57	20		
Power, CHP and heat	36	2	10	56	20		
Coal mining	3						
Oil and gas production			1	1			
TFC	155481	156929	170833	170735	160631	162085	179075
Industry sector	26185	30990	41752	44172	34088	33423	37186
Wood processing	8032	9641	7952	9925	11532	11718	15229
Pulp and paper	15138	18611	30368	30877	19729	19171	19054
Residential	104500	100700	104500	102000	102500	102500	112746
Agriculture and forestry	19043	19038	19977	19060	19024	19030	21088

6.2. Biomass from forests

Wood from forests is the largest resource of solid biomass and covers a wide range of different biomass with diverse characteristics (Table 6.2). *The State Forests* offers energy wood in different trading sorts (PGL LP 2012). The most popular energy sorts of wood are small fuel wood (M2), fuel wood (S4), and general purpose industrial wood (S2a/S2ac). Sales of wood belonging to *the State Forests* mostly take place through electronic auctions (www.e-drewno.pl). Small fuel wood (M2) is one of the cheapest types of wood offered by *the State Forests* (about 12.3 €/m³ in 2011). Therefore, it is of high interest to the energy sector that all forest production of that type of wood is immediately purchased (2.3 million m³ in 2011). A much more available type of energy wood is fuel wood (S4 *drewno opałowe*). There are two types of fuel wood (S4) on the market, differing by price and energy properties: coniferous (1.3 million m³ in 2011, 22.2 €/m³) and deciduous (1.5 million m³ in 2011, 27.8 €/m³). The yield of S4 fuel-wood is twice the level of the production of small fuel wood (M2). The most commonly available class of wood that can be used in the energy industry is a general purpose industrial wood (S2ac). The special subgroups of the general purpose industrial wood (S2ac), dedicated to the energy industry, are the so-called S2a_opal and S2a_ener. The remaining amount of the general purpose industrial wood (S2ac) is used by the paper industry and by furniture factories. Pulpwood and other types of general purpose industrial wood (S2a) are used sporadically by the energy sector. Based on estimates, about 10% of the general purpose industrial wood (S2a) can be used as biomass input in the energy industry (about 1.6 million m³ in 2011). Wood chips can be almost directly burned in boilers. However, due to a lack of adequate infrastructure, *the State Forests* is not able to deliver sufficient quantities of wood chips. It should be noted that, due to low availability and high prices, wood chips are not used in households as heating fuel (Burczy et al. 2010, PGL LP 2012).

Table 6.2. Energy wood production (1,000 m³) in Poland in 2005–2011 (GUS 2012).

Trading sort	2005	2006	2007	2008	2009	2010	2011
Small fuel wood	2,219	2,156	1,789	1,866	1,928	1,899	2,303
Deciduous fuel wood	1,085	1,201	1,125	1,264	1,387	1,352	1,627
Coniferous fuel wood	1,015	1,080	1,231	1,273	1,379	1,364	1,568
General purpose industrial deciduous wood	3,959	4,004	3,809	3,978	4,238	4,008	4,128
General purpose industrial coniferous wood	10,249	10,120	11,525	11,100	11,570	11,982	12,330

6.3. Biomass market

The biomass energy market in Poland is less developed than the fossil fuel market, and is restricted mainly to wood residues. However, it is continuously developing, mostly due to the recently dynamically developing use of biomass in co-firing with coal for electricity production and heating. Biomass is mostly traded to power plants via brokers. Brokers offer biomass with specific parameters, mostly in DDU (Delivered Duty Unpaid) contracts. The Delivered Duty Paid price includes the transport, duty, and insurance of biomass. Brokers buy biomass from several producers, and offer it to several power plants. In practice, the biomass is supplied to the power plant that offers the highest price. This leads to problems with the reliability of brokers, because they cannot guarantee sufficient amounts of biomass to all power plants.

Increasing demand for biomass has led to a boost in imports of this type of fuel to Poland. The main directions of imports are Ukraine and Belarus. The most popular type of imported biomass is sunflower husk pellets and woody biomass. Waybills mostly settle transaction. Woody biomass is mostly traded by electronic auctions (www.e-drewno.pl). Brokers process woody biomass at specific parameters, and offer a final product (wood chips, pellets) to power plants at a higher price. In order to boost the significance of biomass economy and create professional biomass market, it is planned to open a dedicated biomass section at the Polish Power Exchange (*Towarowa Gielda Energii S.A.*). It is believed that this move would enable the domestic market to gain optimal results in solid fuel trade, including biomass trade as well as the physical exchange and transport logistics, which is a vital question. The projected trading volume of the TGE Biomass Market is 400,000 tons per year, which is about 10% of the consumption of biomass for energy needs. Another helpful initiative in this respect is establishing the Polish Chamber of Commerce Energy and Environmental Protection (*Izba Gospodarcza Energetyki i Ochrony Środowiska*). The forecasts are that the biomass turnover on this market should reach 15 million tonnes per year (PPEX 2010). Currently, the Internet biomass market (BIOTrade.pl) is a helpful tool to establish business relations.

The basic legal document regulating biomass consumption in Polish power plants is the ordinance of the Minister of the Economy from 14 August 2008 (changed in February 2010) on green certificates, paying a substitute fee, the purchase of electricity and heat produced from renewable energy sources and the obligation to validate the data about the amount of electricity generated from renewable energy sources (Burczy et al. 2010). This regulation defines biomass as the liquid or solid substances of plant or animal origin, agricultural, food industry or timber production waste, biodegradable waste, and low quality cereal grains not covered by the State intervention purchase. In addition, it defines which kind of biomass can be used in Polish power plants. Power plants are obligated to use certain amount of agricultural biomass in their overall fuel balance. This amount is dependent on biomass combustion technology (co-firing, hybrid combustion or biomass dedicated boilers). The purpose of this regulation is to stabilise the use of wood resources in Poland at a certain level. In 2009, the share of woody biomass in biomass fuel structure was about 51% (Flakowicz 2010).

In the period 2006–2009, average DDU biomass prices increased by about 10% per year. Woody biomass delivered to power plants costs about 6 €/GJ (Burczy et al. 2010). The reasons for this growth were increasing competition between the power plants and increasing distances of biomass transportation. A very important issue is the effect of scale in the biomass market. The biggest consumers pay 10% to 20% more than power plants using less than 100,000 tonnes. The reason behind this mechanism is the distance of biomass transportation to power plants. Smaller consumers can explore local biomass potential, while big power plants have to transport biomass from long distances at a higher price. The average auction prices by energy wood achieved by the State Forests in 2011 are shown in Table 6.3 (PGL LP 2012).

Table 6.3. Auction prices for firewood achieved by the State Forests in 2011 (PGL LP 2012)

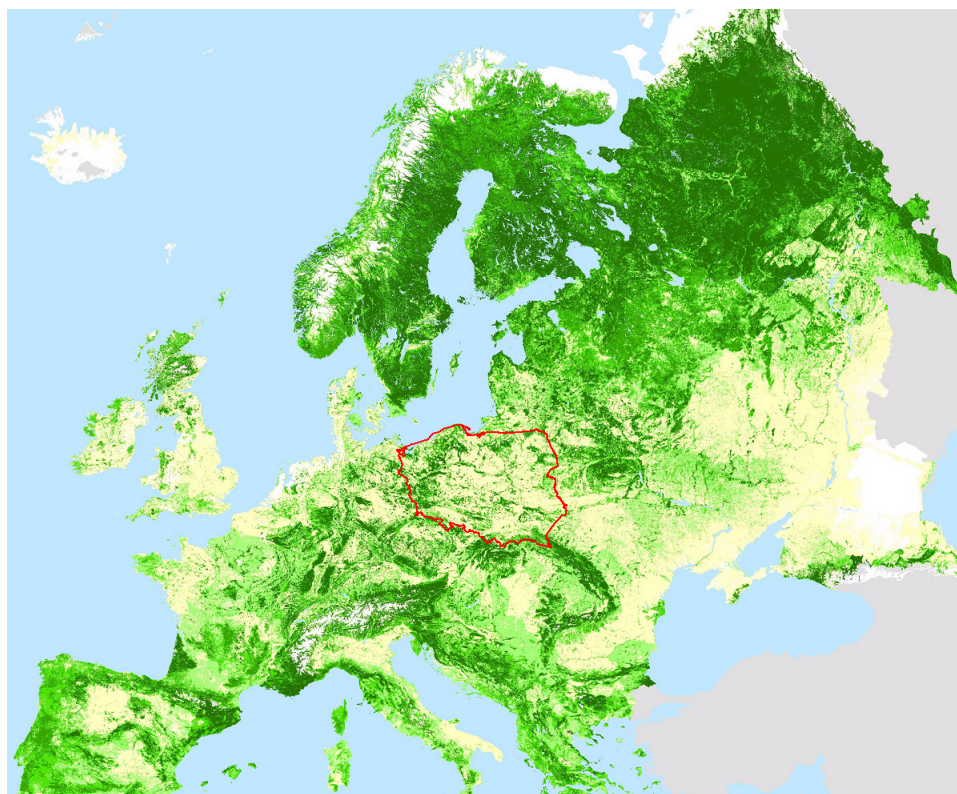
Item	M1 M2	S4 coniferous	S4 deciduous	S2 coniferous	S2 deciduous
PLN/m ³	50.7	91.8	114.9	170.2	152.0
PLN/t dm	169.1	306.3	383.2	567.4	506.7
PLN/GJ	9.4	17.0	21.3	31.5	28.1
Euro/GJ	2.3	4.1	5.1	7.6	6.8

6.4. Biomass plants

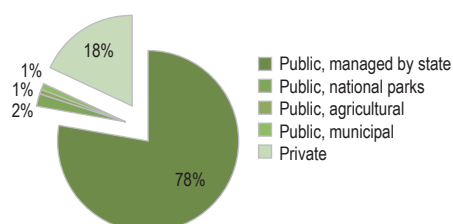
According to the data collected by the Energy Regulatory Office (<http://www.ure.gov.pl>), there are 15 power plants or their add-on power generation units in Poland using biomass only. Their total capacity is 356 MW. Many other coal power plants in Poland are co-firing biomass with coal (Map 7.19). The basic form of burned biomass is biomass from wood and paper production waste, about 88% of renewable energy produced by Polish power plants. In CHP plants, biomass is used mostly in co-firing. The share of co-firing technology in biomass consumption was about 95% in 2009. The exact structure of biomass consumed in the Polish power sector is hard to estimate. The total number of units using biomass in the Polish power sector was 43 in 2009. Most power plants prefer biomass transport by tippers. Assuming that the average yearly biomass consumption of a power plant is 100,000 tonnes, the daily delivery of biomass must be secured at the level of about 274 tonnes. Compared with a standard tipper capacity of about 30 tonnes, this represents 10 trucks per day. However, on the narrow roads that are typical in rural areas, smaller tippers are often used, which increases the number of journeys, and those may even total several thousand kilometres per day. The biggest biomass consumers (with a yearly consumption above 200,000 tonnes) cannot rely on truck transport alone. The coordination of road transport at this scale is very difficult. Biomass is then rather transported by both trains and trucks. It is very difficult to estimate how biomass is exactly transported to each particular power plant. For example, some power plants (*Dolna Odra*, *EC Wybrzeze*) have the possibility to transport biomass by barges. Based on biomass auction data (transport specifications), it can be concluded that about 80% of biomass in Poland is transported to power plants by trucks, 19% is transported by rail, and less than 1% of biomass is transported by waterways (Burczy et al. 2010). The energy wood potential in Polish provinces is presented on Map 7.20. The largest power plants using wood as well as wood pellets and briquette producers are shown on Map 7.19.

7 Maps

7.1 The Republic of Poland on the European Forest Map¹



Total forest area is 9.1 million ha

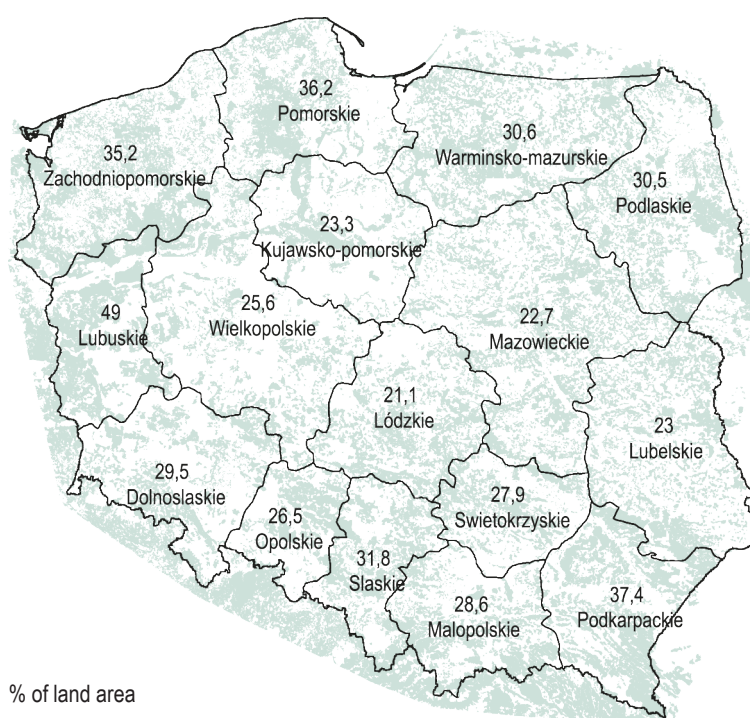


¹ This information is based on outputs from the project “Forest tree groupings database of the EU-15 and pan-European area derived from NOAA-AVHRR data”, which was awarded by the European Commission, Joint Research Centre (Institute for Environment and Sustainability), to a consortium of organisations under the contract number: 17223-2000-12 F1SCISPF1.

7.2 Administrative map of Poland



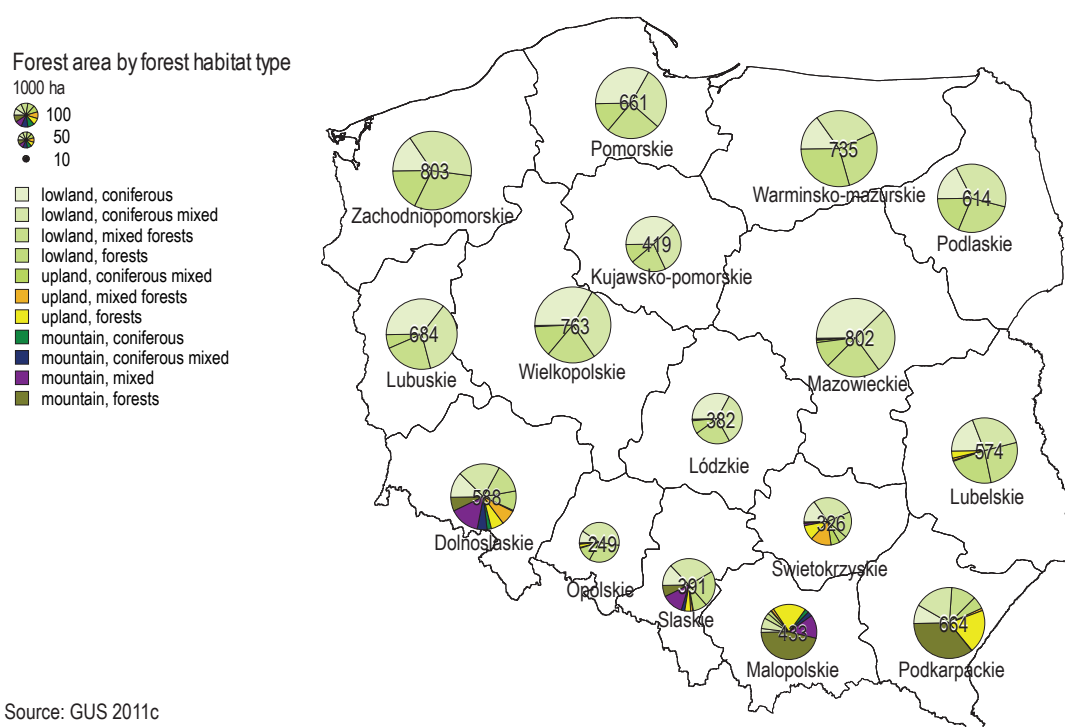
7.3 Forest cover by province



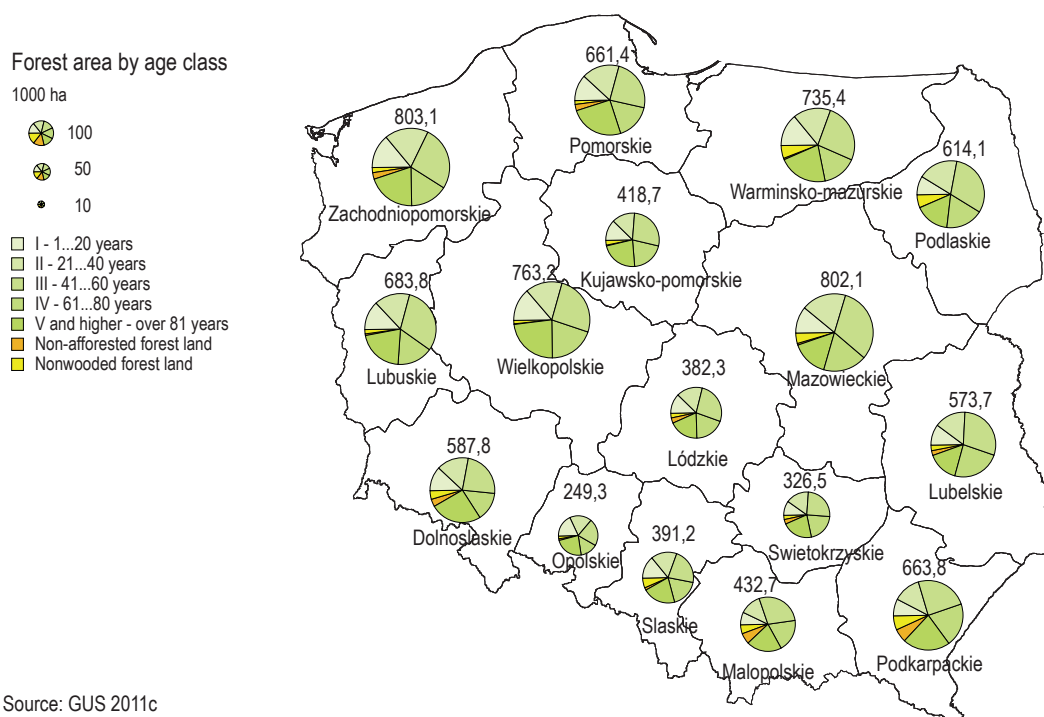
% of land area

Source: Emaps Online 2010

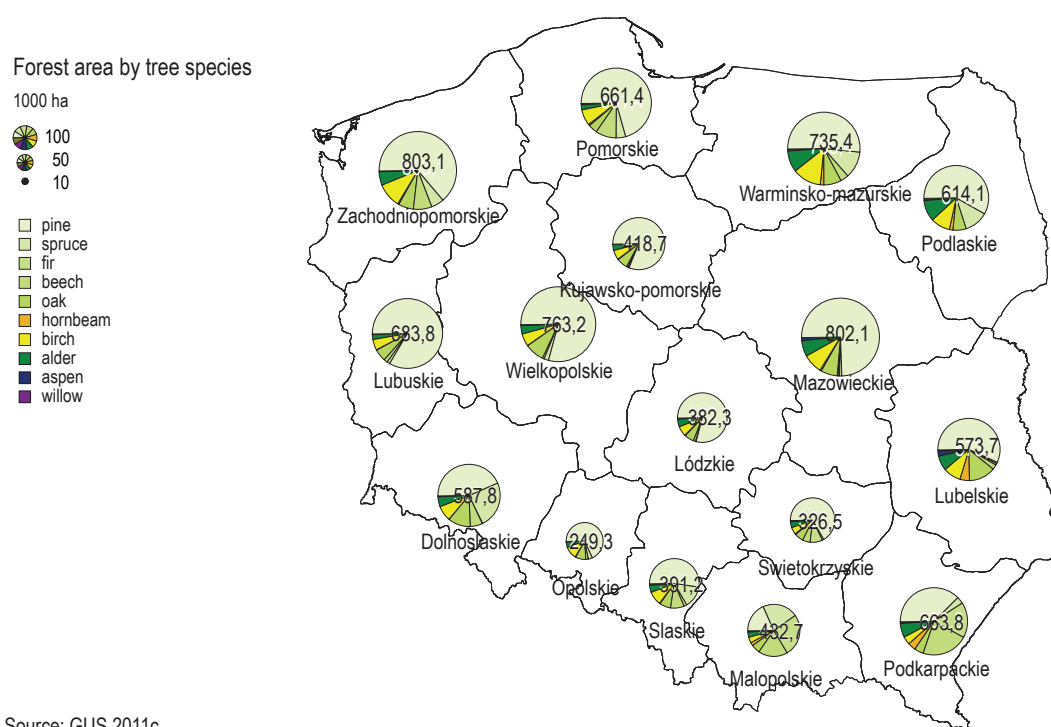
7.4 Forest area by habitat type



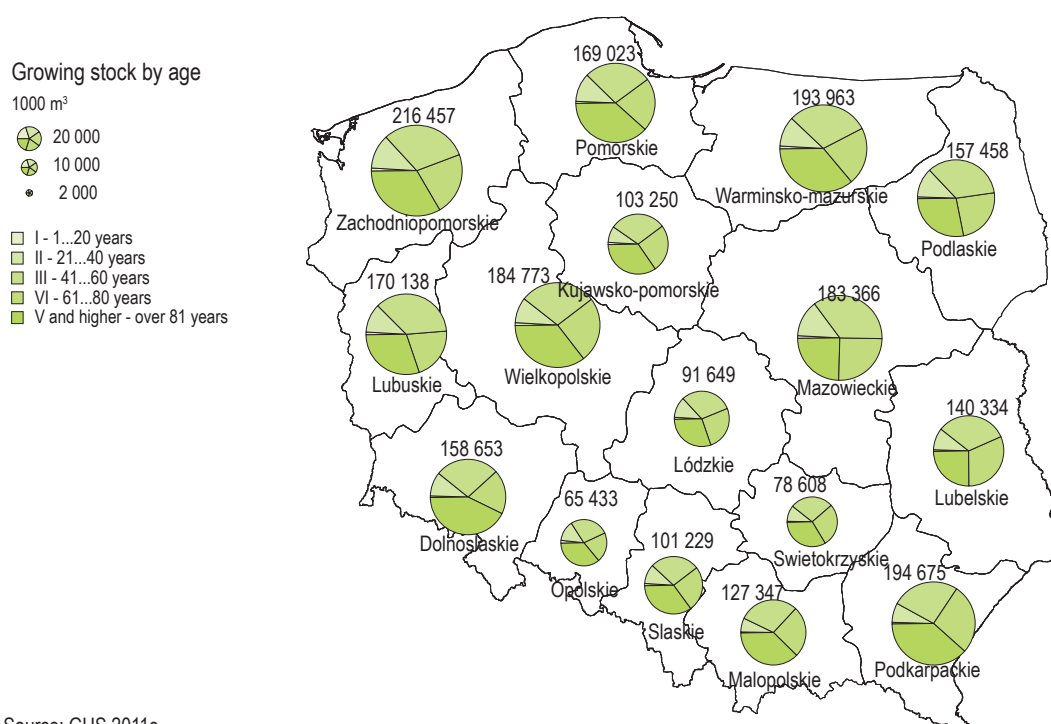
7.5 Forest area by age class



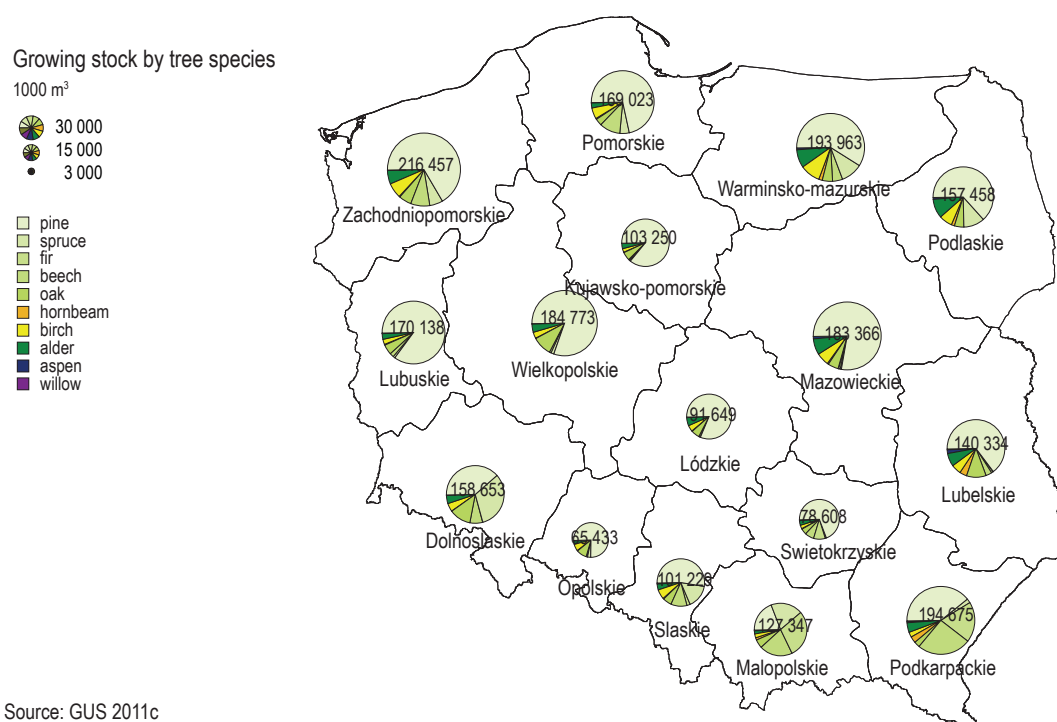
7.6 Forest area by tree species



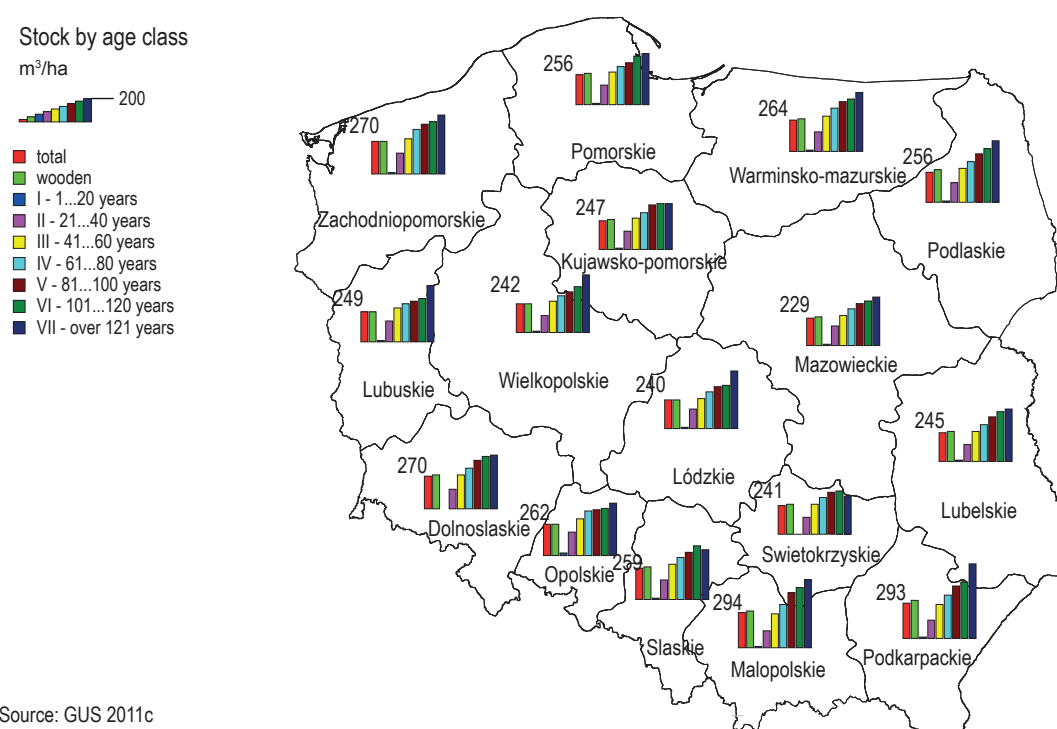
7.7 Growing stock by age class



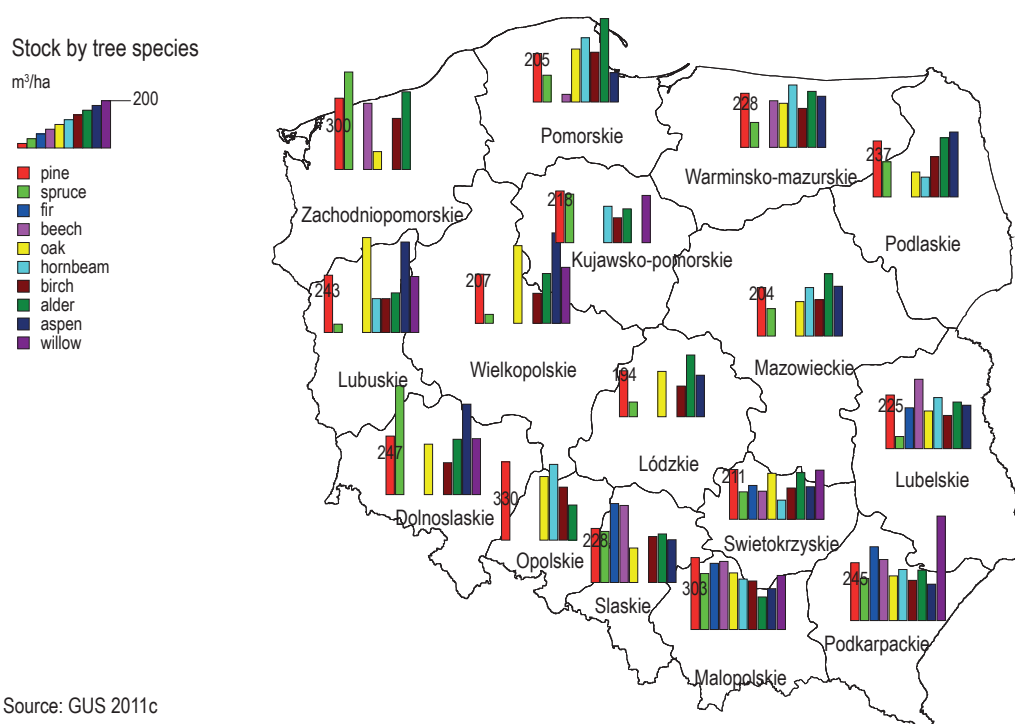
7.8 Growing stock by tree species



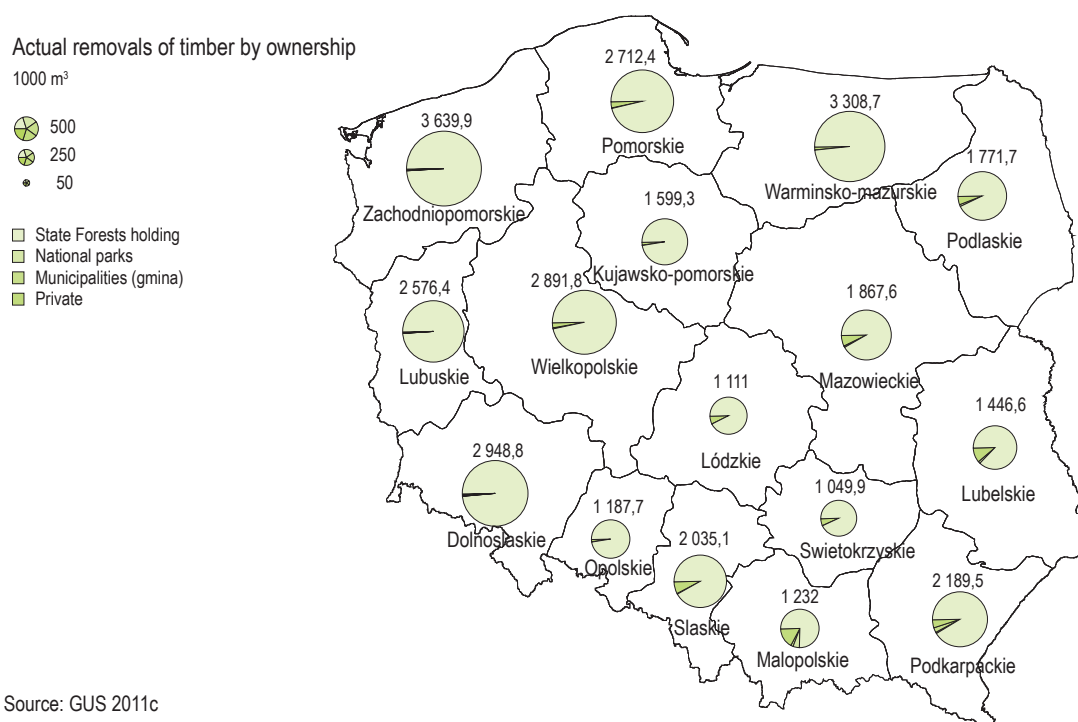
7.9 Average growing stock per ha by age class



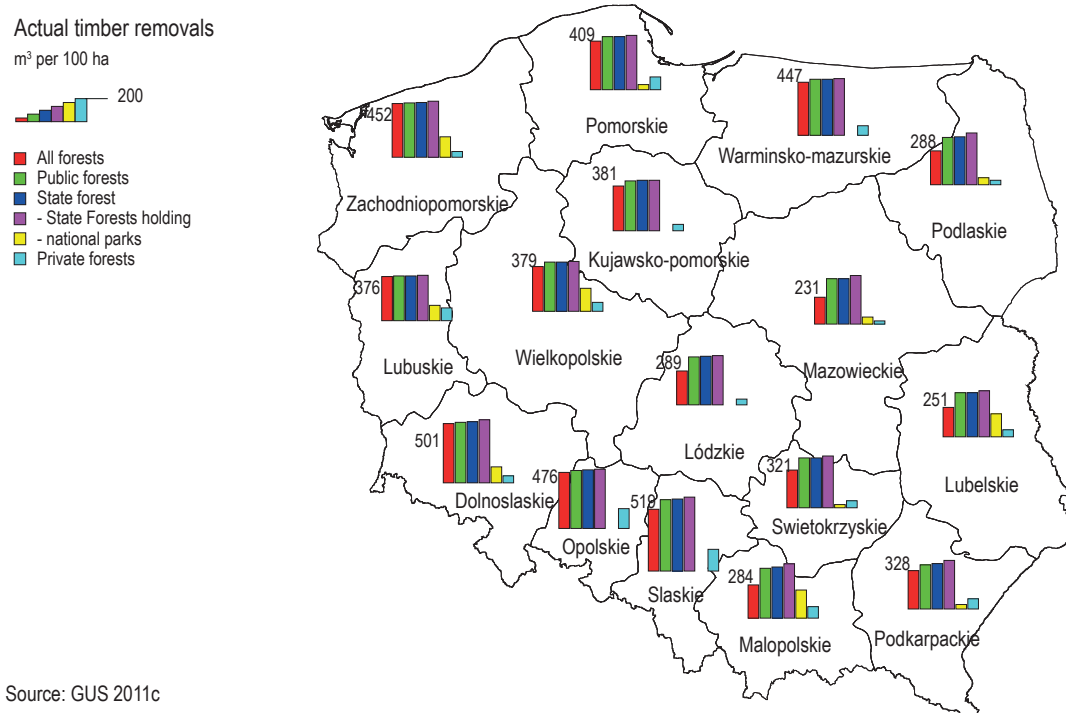
7.10 Average growing stock per ha by tree species



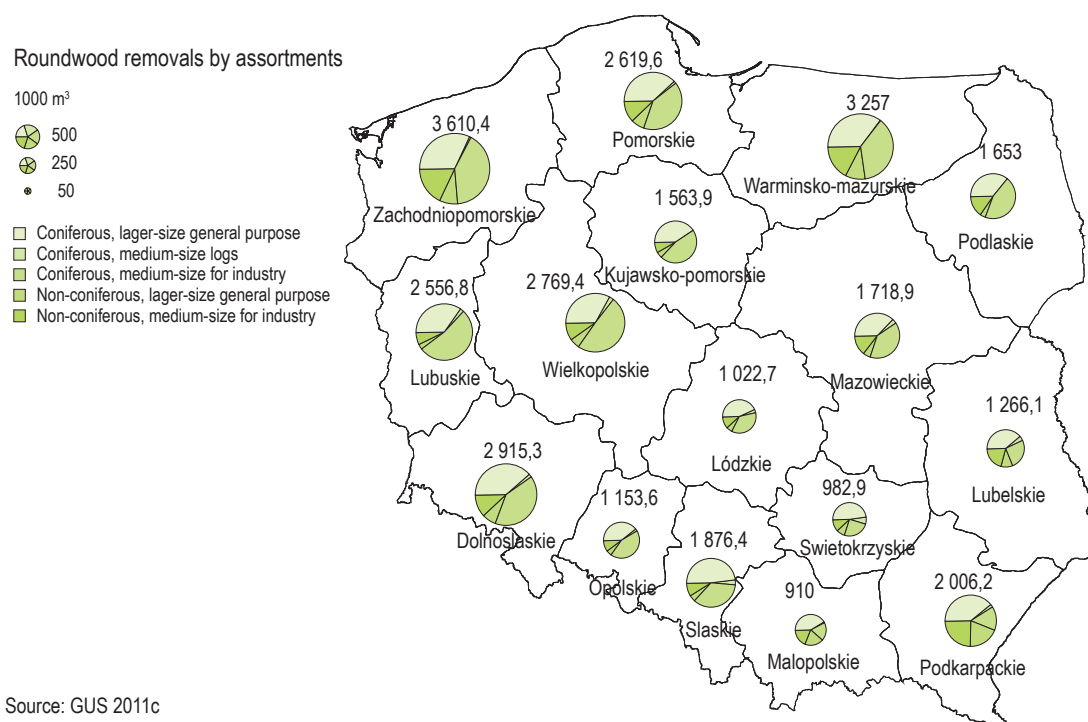
7.11 Wood removals by ownership



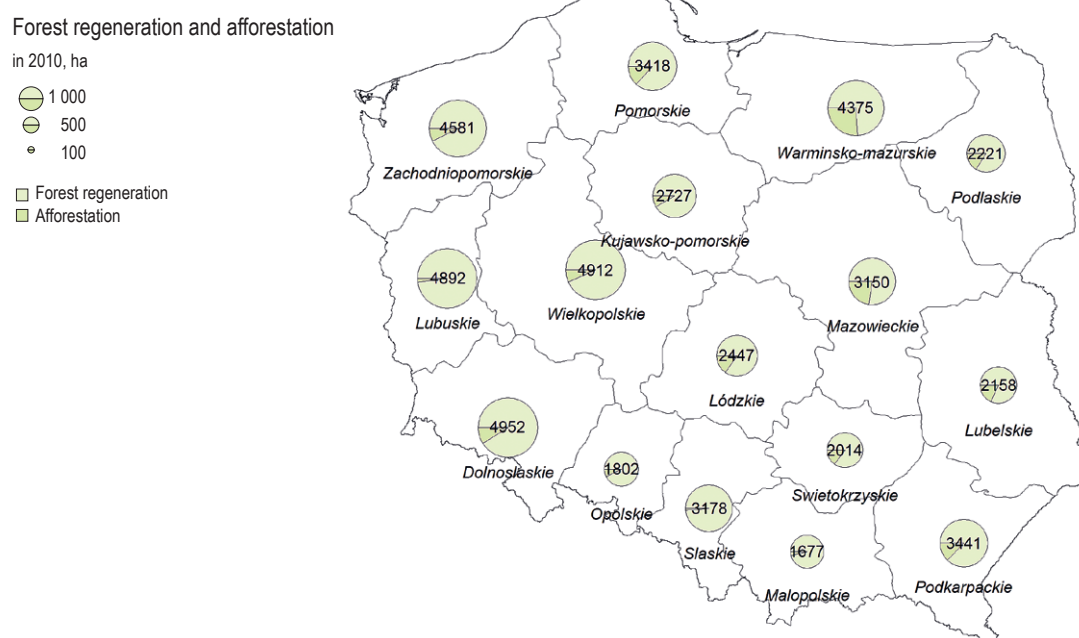
7.12 Wood removals by ownership



7.13 Roundwood removals by assortments

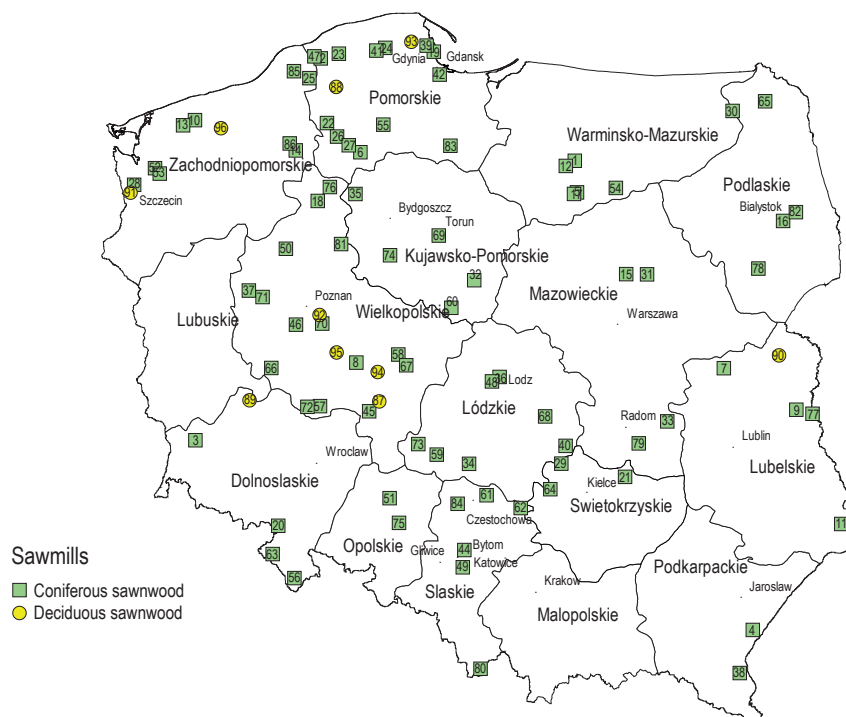


7.14 Forest regeneration



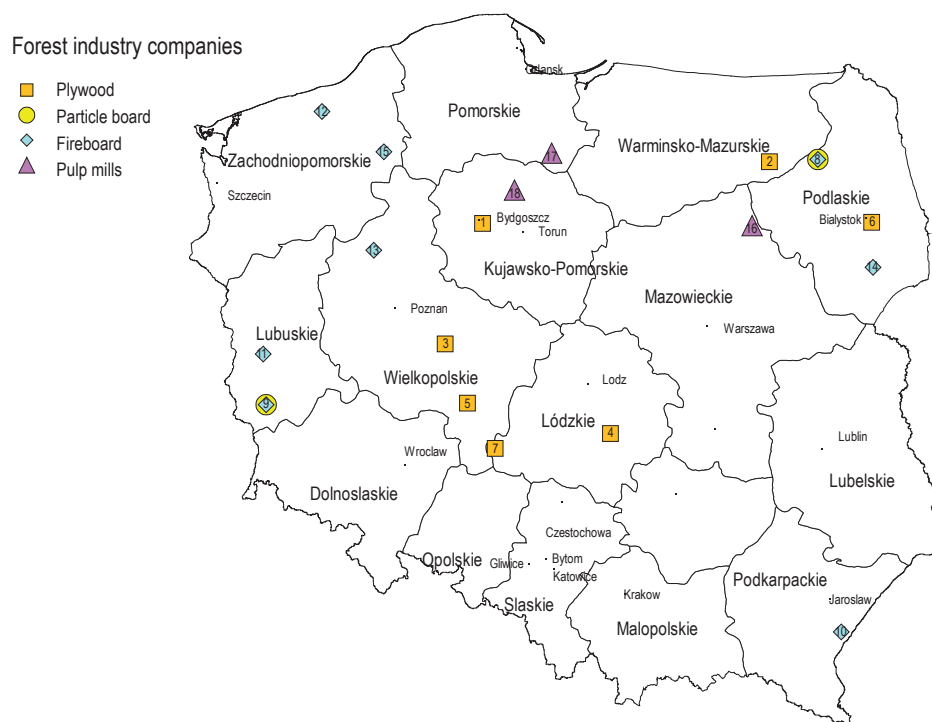
Source: GUS 2011c

7.15 Users of sawlogs



- | | | |
|--|---|--|
| 1 ANDREW | 33 PPUH TRAK | 65 TARTAK PŁOCICZNO |
| 2 AROCO Barbara Treczyńska | 34 PPUH UK-POL | 66 Tartak Stefan Spółka Jawna Piotr Cieślak |
| 3 ARTIMBER | 35 PPUH WEMAR Marek Wegner | 67 TARTAK ZBIERSK |
| 4 CHESTER | 36 Przedsiębiorstwo "BARTEK" Lech Witman | 68 TARTOM Zakład Przemysłu Drzewnego |
| 5 DREHABUD | 37 PRZEDSIĘBIORSTWO PRODUKCYJNO-BUDOWLANE Zetbeer | 69 Toruńskie Przedsiębiorstwo Przemysłu Drzewnego |
| 6 DREWKOM | 38 Przedsiębiorstwo Produkcyjno-Handlowe DANKROS | 70 WAMAR - SOSENKA |
| 7 DREWMARK Marek Woliński | 39 Przedsiębiorstwo Produkcyjno-Handlowe KASZUB | 71 WITAR Tartak Pniewy |
| 8 DREWNO-JAROCIN - Piotr Kubiak | 40 Przedsiębiorstwo Przemysłu Drzewnego PETRYKOZY | 72 WITAR TARTAK Rawicz |
| 9 FIRMA HANDLOWO-USŁUGOWA Jan Chudaś | 41 Przedsiębiorstwo Przemysłu Drzewnego POLTAREX | 73 WITAR Tartak Tyble |
| 10 FIRMA KORBUTOWICZ Bogdan Korbutowicz | 42 PRZEDSIĘBIORSTWO USŁUGOWO-PRODUKCYJNE COMPLEX | 74 Z.P.D. TARTAK KROTOSZYN Leszek i Dariusz Wiland |
| 11 FOREST - Marek Wiatrzyk | 43 Przedsiębiorstwo Wielobranżowe DREWNOMAL | 75 ZAKŁAD DRZEWNY Józef Chmiel |
| 12 INTERLAS s.c. Stanisław Wnuk, Danuta Wnuk i Elżbieta Back | 44 PRZESIEBIORSTWO PRODUKCYJNO-USŁUGOWO-HANDLOWE SANDEX | 76 Zakład Drzewny KUJAN |
| 13 JACK-DREW | 45 PUPH TARTAK Marek Burkietowicz | 77 ZAKŁAD DRZEWNY |
| 14 Koszalińskie Przedsiębiorstwo Przemysłu Drzewnego | 46 RSC BIS Skrzynki | 78 Zakład Produkcyjno-Handlowo-Usługowy Piotr Radziszewski |
| 15 MARDOM | 47 SILVA Zakład Drzewny w Słupsku | 79 Zakład Produkcyjno-Usługowy TARKOS |
| 16 N.E.T. WOOD | 48 SOPEXIM | 80 ZAKŁAD PRODUKCYJNY S.J. Tartaczniwo i wyroby z drewna |
| 17 NAPIWODA Zakład Drzewny | 49 SOR-DREW PPUH R. Sorowski | 81 Zakład Przemysłu Drzewnego ROMA |
| 18 P.H.U.S. EXPORT IMPORT "TRANSPIL-SPEDITION" | 50 STEICO S. A. | 82 Zakład Przemysłu Drzewnego TARTAK SUPRAŚL |
| 19 P.P.H.U. TARTAK Stanisław Szymerkowski | 51 STORA ENSO Wood Products | 83 Zakład Przerobu Drewna RAKOWIEC s.c. E. W. Lewandowscy |
| 20 P.P.U.H. DREWBAR Adam Barwiński | 52 Swedwood Poland, Golblat | 84 ZAKŁAD STOLARSKO-TARTACZNY Ryszard Winecki i Wspólnicy Sp. J. |
| 21 PERFECT Sp. z o.o. Przedsiębiorstwo Wielobranżowe ZPCh | 53 Swedwood Poland, Tartaki | 85 ZAKŁADY DRZEWNE POLDAN Eksport Import Zygmunt Kroplewski |
| 22 POLTAREX, Bielsko | 54 Swedwood Poland, Wielbark | 86 Zielony Dąb |
| 23 POLTAREX, Dąbnica | 55 SYLVA | 87 ZPD TARTAK Marian Leonhard Gorzyce Wielkie |
| 24 POLTAREX, Godetowo | 56 TARTAK DOMASZKÓW Tadeusz Farbotko | 88 ŁĄCCY-KOŁCZYŹŁOWY |
| 25 POLTAREX, Korzybie | 57 Tartak Chojno SOMAPOL Sławomir Sobota | 89 Parkiet - Serby Juliusz Łunkiewicz |
| 26 POLTAREX, Nowa Wieś Czulchowska | 58 TARTAK GRODZIEC | 90 POL-KRES EDWOOD Daniel Tomaszuk |
| 27 POLTAREX, Polnica | 59 Tartak i Zakład Stolarski Janina i Wacław Witkowsy | 91 Pomeranian Timber Inc. |
| 28 Pomeranian Timber Inc. | 60 TARTAK IZBICA | 92 PPHU PROMIS Joanna Pankowska |
| 29 PPHU "JARPOL" Jarosław Kalita | 61 TARTAK Jolanta Gula | 93 Przedsiębiorstwo Przemysłu Drzewnego FORNITEX |
| 30 PPHU "LIMBA" R. Majewski i T. Szerel | 62 TARTAK KARON Grzegorz Karoń | 94 TARTAK Krystyna Dwornik-Świągł i Tomasz Świągł s.c. |
| 31 PPHU Tartak Import-Export Jerzy Abramczyk Wólka | 63 TARTAK ŁĘŻYCE Janusz Pocięcha | 95 WALCZAK |
| 32 PPUH HAMAR A.M.Benedykciński Spółka Jawna | 64 Tartak OLCZYK | 96 ZAKŁAD PRODUKCJI DRZEWNEJ TARTAK Józef Nowakowski |

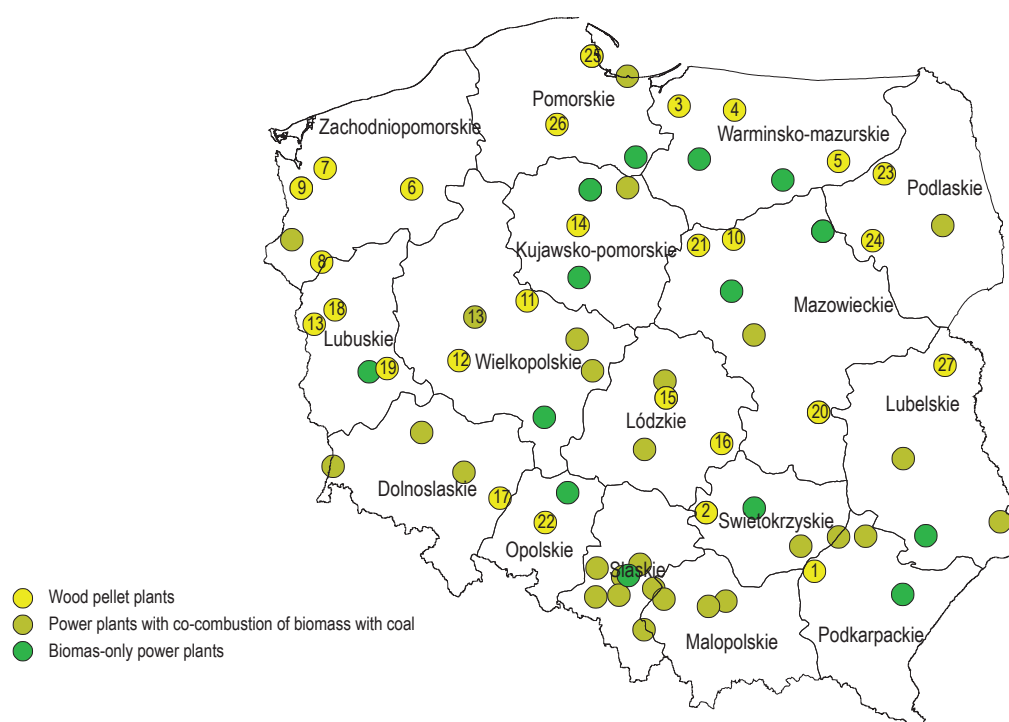
7.16 Users of pulpwood



Source: Polish Economic Chamber of Wood Industry 2012, company information

- 1 Plywood Plant in Bydgoszcz-MULTI SA
- 2 "Plywood-WRITE" SA
- 3 Orzechowski Plywood Industry Plant
- 4 Houses the Plywood Industry Plant Sp. of o.o.
- 5 Plywood - EKO SA
- 6 BIAFORM PLYWOOD PLANTS INDUSTRY SA
- 7 Pfeleiderer Prospan SA
- 8 Pfeleiderer Grajewo SA
- 9 KRONOPOL Sp. of o.o.
- 10 Fibris S.A.
- 11 HARDEX S.A.
- 12 HOMANIT POLAND Sp z. Ltd. and Company
- 13 STEICO S.A.
- 14 Swedspan Polska Sp. z o.o.,
- 15 Kronospan Szczecinek Sp. of o.o.
- 16 STORA ENSO POLAND S.A.
- 17 INTERNATIONAL PAPER - KWIDZYN SP. Z O.O.
- 18 MONDI ŚWIECIE S.A.

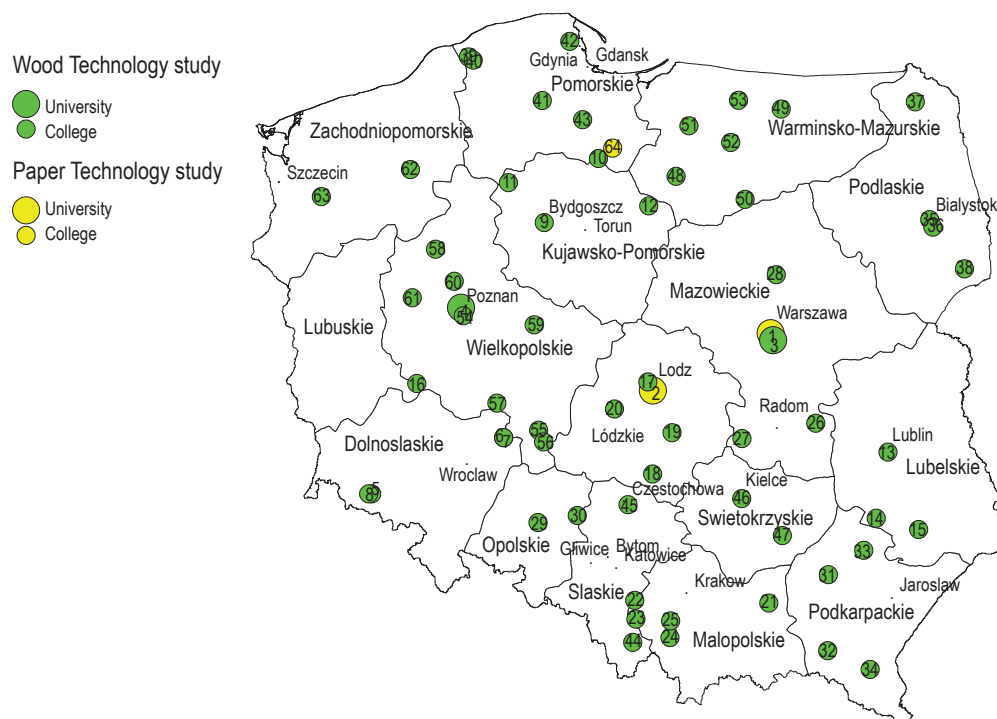
7.17 Largest wood pellet producers and power plants using energy wood



Source: Burczy et al. 2010, Pellets Atlas 2010

- | | | |
|------------------------------------|--|--|
| 1 Motowerk Zbigniew Misiarz | 12 Radmar Ekoenergia | 23 Mirosław Kaminski PPHU |
| 2 Tartak Olczyk, 20 Kt/a | 13 Vapo, 80 Kt/a | 24 E.M.G. sp. z o.o., 50 Kt/a |
| 3 FU-WI sp. z o.o. | 14 Vapo, 10 Kt/a | 25 PPHU FU-WI export-import sp. z o.o. |
| 4 Eko-Orneta, 30 Kt/a | 15 Furel sp. z o.o., 24 Kt/a | 26 Sylva sp. z o. o., 12 Kt/a |
| 5 EKOPAL | 16 BRYTPOL s.c. Jadwiga Teda Monika Teda | 27 Serhej |
| 6 PPHU Fabic | 17 PBH Żalubski, 36 Kt/a | |
| 7 BIOPAL | 18 Pellet-Art sp. z o.o. , 60 Kt/a | |
| 8 Barlinek, 80 Kt/a | 19 Stelmet, 140 Kt/a | |
| 9 Arno-Eko, 60 Kt/a | 20 Pellety Kozienice, 12 Kt/a | |
| 10 Libero F.H.U., 18 Kt/a | 21 Max-Parkiet Sp. z o.o. | |
| 11 Task Marek Tasiemski, , 20 Kt/a | 22 Regionalna Agencja Poszanowania Energii | |

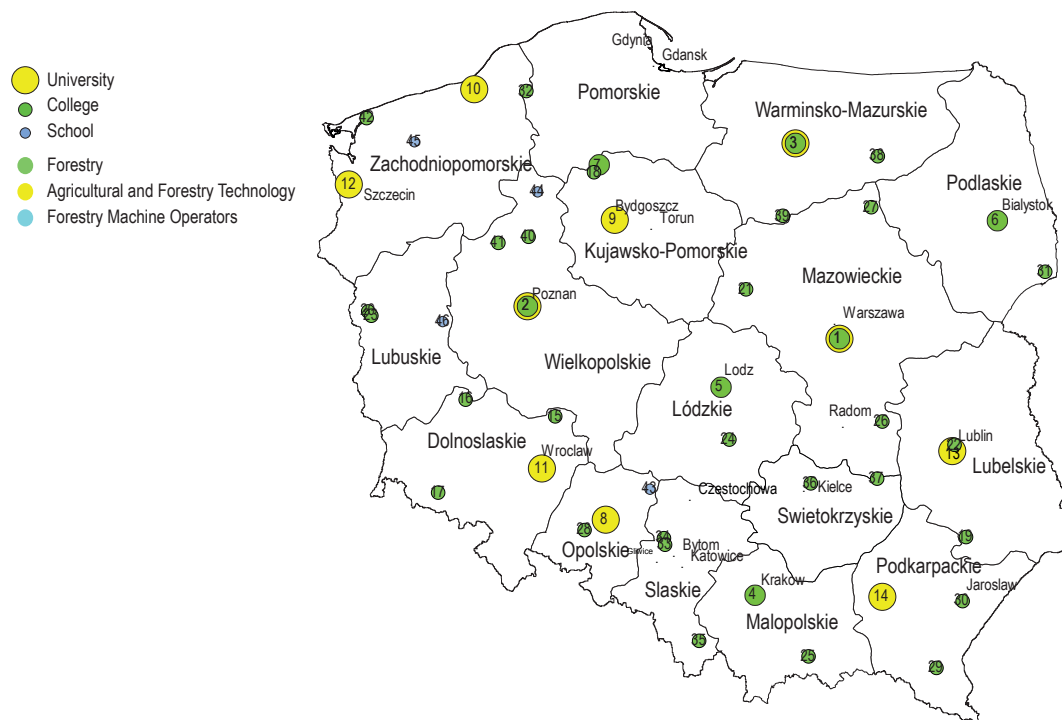
7.18 Education institutions in forest industries



Source: www.cie.men.gov.pl, www.drewno.pl, www.mos.gov.pl, www.nauka.gov.pl, institution information

- | | | |
|---|--|---|
| 1 Warsaw University of Technology | 23 Niepubliczne Technikum Drzewne dla Dorosłych Kęty | 45 Technikum Uzupełniające dla Dorosłych |
| 2 Technical University of Łódź | 24 Technikum w Maków Podhalański | 46 Prywatne Uzupełniające Technikum Drzewne dla Dorosłych Kielce |
| 3 Warsaw University of Life Sciences | 25 Zespół Szkół im. Komisji Edukacji Narodowej | 47 Niepubliczne Technikum Uzupełniające dla Dorosłych w Staszowie ZDZ |
| 4 University of Life Sciences in Poznań | 26 Technikum Drzewne w Garbatce-Letnisko | 48 Technikum Uzupełniające dla Dorosłych w Lubawie |
| 5 Zespole Szkół Rzemiosł Artystycznych w Jeleniej Górze | 27 Technikum Uzupełniające - Drzewne TWP Przysucha | 49 Technikum Drzewne po ZSZ w Reszelie |
| 6 Technikum Drzewne dla Dorosłych MUR w Twardogórze | 28 Niepubliczne Technikum Technologii Drewna dla Dorosłych w Pułtusk | 50 Technikum Technologii Drewna w Jagarzewie |
| 7 Technikum Drzewne w Twardogórze | 29 Publiczne Technikum Nr 6. Zespół Szkół Budowlanych | 51 Technikum Nr 1 w Morągu |
| 8 Liceum Profilowane - Leśnictwo i Technologia Drewna | 30 Technikum Przemysłu Drzewnego Dobrodzień | 52 Technikum Nr 4 w Olsztynie |
| 9 Zespół Szkół Drzewnych Bydgoszcz | 31 Technikum Drzewne Kolbuszowa | 53 Technikum Drzewne na podbudowie ZSZ Lidzbark Warmiński |
| 10 Technikum Uzupełniające Technologii Drewna w Nowem | 32 Technikum Drzewne na podbudowie ZSZ Miejsce Piastowe | 54 Technikum Budowlano-Drzewne |
| 11 Technikum Drzewne dla Dorosłych Sępólno Krajeńskie | 33 Technikum Przemysłu Drzewnego ZS w Rudniku nad Sanem | 55 Technikum Nr 1 w Ostrzeszowie |
| 12 Uzupełniające Technikum Technologii Drewna | 34 Technikum Drzewne Nr 2 w Lesku | 56 Technikum Uzupełniające dla Dorosłych w Kępnie |
| 13 Technikum Drzewne, Zespół Szkół Budowlanych im. E. Kwiatkowskiego | 35 Technikum Zawodowe Nr 9 w Białymstoku | 57 Technikum, Zespół Szkół Ponadgimnazjalnych w Zdunach |
| 14 Technikum Przemysłu Drzewnego w Janowie Lubelskim | 36 Technikum Uzupełniające dla Dorosłych Nr 4 w Białymstoku | 58 Technikum Uzupełniające w Czarnkowie |
| 15 Technikum Przemysłu Drzewnego w Zwierzyniec | 37 Technikum Nr 2 w Suwałkach | 59 Technikum Technologii Drewna Słupca |
| 16 Technikum w Wschowa | 38 Technikum w Hajnówce | 60 Zaoczne Technikum Technologii Drewna Oborniki |
| 17 Technikum Nr 15 | 39 Technikum Nr 3 w Słupsku | 61 Technikum Technologii Drewna dla Dorosłych |
| 18 Technikum Drzewne i Ochrony Środowiska Radomsko | 40 Szkoła Policealna dla Dorosłych Nr 8 w Słupsku | 62 Technikum Drzewne Czaplinek |
| 19 Technikum Drzewne dla Dorosłych Piotrków Trybunalski | 41 Technikum Nr 3 | 63 Technikum Zawodowe Nr 1 |
| 20 Zaoczne Technikum Uzupełniające Drzewne WZDZ w Łodzi z siedzibą w Zdunskiej Woli | 42 Technikum Uzupełniające dla Dorosłych | 64 Technikum No. 2 w Kwidzyn |
| 21 Technikum Nr 5 | 43 Technikum Nr 2 w Starogardzie Gdańskim | |
| 22 Technikum Drzewne Towarzystwa Salezjańskiego w Oświęcimiu | 44 Technikum Drzewne Żywiec | |

7.19 Education institutions in forestry

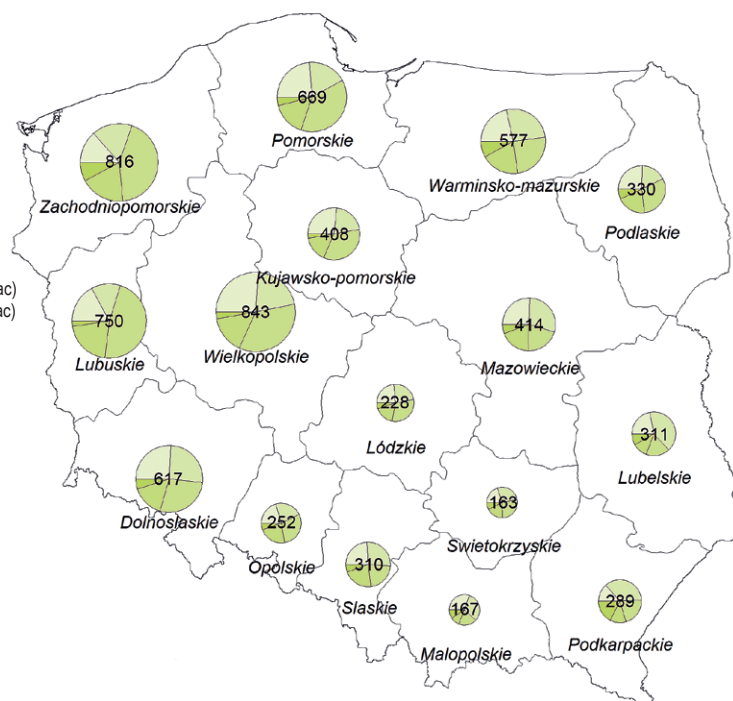
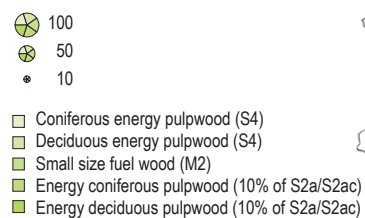


- | | |
|---|--|
| 1 Warsaw University of Life Sciences | 24 Technikum Leśne |
| 2 University of Life Sciences in Poznań | 25 Technikum Leśne Stary Sącz |
| 3 University of Warmia and Mazury in Olsztyn | 26 Technikum Leśne Garbatka |
| 4 Agricultural University of Cracow | 27 Technikum Leśne Kadzidło |
| 5 University of Lodz | 28 Publiczne Technikum Leśne |
| 6 Białystok University of Technology | 29 Zespół Szkół Leśnych w Lesku* |
| 7 Higher School of Management of the Environment in Tuchola | 30 Zespół Szkół Ogrodniczych i Licealnych im. Zesłańców Sybiru |
| 8 The Opole University of Technology | 31 Technikum Leśne Białowieża* |
| 9 University of Technology and Life Sciences in Bydgoszcz | 32 Technikum Leśne Warcino* |
| 10 Koszalin University of Technology | 33 Technikum Leśne Brynek |
| 11 Wrocław University of Environmental and Life Sciences | 34 Zespoły Szkół Leśnych i Ekologicznych w Brynku* |
| 12 West Pomeranian University of Technology in Szczecin | 35 Zespół Szkół Drzewnych i Leśnych |
| 13 University of Life Sciences in Lublin | 36 Zespół Szkół Leśnych Zagnańsk* |
| 14 Rzeszów School of Engineering and Economics | 37 Zespół Szkół w Bałtowie |
| 15 Technikum Leśne Milicz* | 38 Zespół Szkół Drzewnych i Leśnych im. Unii Europejskiej |
| 16 Technikum Nr 6 w Głogowie | 39 Technikum Iłowo Osada |
| 17 Technikum Przyrodniczo-Zywnościowe w Jeleniej Górze | 40 Technikum Leśne Chodzież |
| 18 Technikum Leśne Tuchola* | 41 Zaoczne Technikum Leśne* |
| 19 Technikum Leśne Biłgoraj* | 42 Zespół Szkół Ponadgimnazjalnych w Benicach |
| 20 Technikum Leśne Staroścín | 43 School in Radłowie |
| 21 Technikum Leśne Rogoźnicz* | 44 Electro-Mechanical School in Złotów |
| 22 Niepubliczne Technikum Leśne Lublin | 45 School in Resko |
| 23 Technikum Leśne w Staroścínie* | 46 Forest School in Rogoźniku |

7.20 Energy wood production

Energy wood

1 000 m³ harvested in 2011



Source: GUS 2012

Annex 1. Companies on the maps

Sawmills, softwood	Location	Web
ANDREW Sp. z o.o.	11-034 Stawiguda	www.andrew-tartak.pl
AROCO Barbara Treczyńska	76-200 Słupsk	
ARTIMBER Sp. z o.o.	59-724 Osiecznica	
CHESTER sp. z o.o.	37-700 Przemyśl	www.tartakchester.pl
DREHABUD sp. J. ruszlińska	13-100 Nidzica	www.drehabud.pl
DREWKOM Joanna Domagała i Marek Dalecki	89-604 Chojnice	www.drewkom.com
DREWMARK Marek Woliński	21-400 Łuków	www.drewmark.com.pl
DREWNO-JAROCIN Sp. z o.o. - Piotr Kubiak	63-200 Jarocin	
FIRMA HANDLOWO-USŁUGOWA Jan Chudaś	22-205 Wyrki	
FIRMA KORBUTOWICZ Bogdan Korbutowicz	72-304 Brojce	www.firmakorbutowicz.pl
FOREST - Marek Wiatrzyk	22-530 Mircze	www.firmaforest.pl
INTERLAS s.c. Stanisław Wnuk, Danuta Wnuk i Elżbieta Back	11-015 Olsztynek	
JACK-DREW PPD IMPORT-EKSPORT	72-300 Gryfice	
Koszalińskie Przedsiębiorstwo Przemysłu Drzewnego S.A.	78-400 Szczecinek	www.kppd.pl
MARDOM Sp. z o.o.	06-100 Pultusk	www.mardom.com.pl
N.E.T. WOOD Sp. z o.o.	15-267 Białystok	www.netwood.pl
NAPIWODA Zakład Drzewny Sp. z o.o.	13-100 Nidzica	www.tartak-napiwoda.com
P.H.U.S. EXPORT IMPORT "TRANSPIL-SPEDITION" Waldemar Bocheński ODDZIAŁ ZAKŁAD PRZEMYSŁU DRZEWNEGO w Krajenka	77-430 Krajenka	
P.P.H.U. TARTAK Stanisław Szymerkowski	81-094 Gdynia	www.tartak.com.pl
P.P.U.H. DREWBAR Adam Barwiński	57-450 Ludwikowice Kłodzkie	
PERFECT Sp. z o.o. Przedsiębiorstwo Wielobranżowe ZPCh	27-200 Starachowice	www.klejonka.pl
POLTAREX Sp. z o.o. Sawmill Bielsko	77-220 Koczała	www.poltarex.pl
POLTAREX Sp. z o.o. Sawmill Damnica	76-231 Damnica	www.poltarex.pl
POLTAREX Sp. z o.o. Sawmill Godetowo	84-218 Łęczyce	www.poltarex.pl
POLTAREX Sp. z o.o. Sawmill Korzybie	77-231 Korzybie	www.poltarex.pl
POLTAREX Sp. z o.o. Sawmill Nowa Wieś Czulchowska	77-320 Przechlewo	www.poltarex.pl
POLTAREX Sp. z o.o. Sawmill Polnica	77-323 Polnica	www.poltarex.pl
Pomeranian Timber Inc. (25000 m3/a)	71-333 Szczecin	www.pomeraniantimber.com.pl
PPHU "JARPOL" Jarosław Kalita	26-242 Ruda Maleniecka	www.tartak-jarpol.com.pl
PPHU "LIMBA" R. Majewski i T. Szerel	19-400 Olecko	
PPHU Tartak Import-Export Jerzy Abramczyk Wólka	07-205 Rząśnik	www.tartak-abramczyk.pl
PPUH HAMAR A.M.Benedykciński Spółka Jawna	87-810 Włocławek	www.hamar.pl
PPUH TRAK Sp. z o.o.	26-930 Garbatka	www.trak-garbatka.pl
PPUH UK-POL Sp. z o.o.	98-330 Pajęczno	
PPUH WEMAR Marek Wegner	89-410 Więcbork	
Przedsiębiorstwo "BARTEK" Lech Witman	95-100 Zgierz	www.tartak-bartek.pl
PRZEDSIĘBIORSTWO PRODUKCYJNO-BUDOWLANE Zetbeer Sp. z o.o.	64-420 Kwilcz	www.zetbeer.pl
Przedsiębiorstwo Produkcyjno-Handlowe DANKROS Sp. z o.o.	38-700 Ustrzyki Dolne	www.dankros.com
Przedsiębiorstwo Produkcyjno-Handlowe KASZUB Spółka z o.o.	81-236 Gdynia	
Przedsiębiorstwo Przemysłu Drzewnego PETRYKOZY A. Górski Sp. j. Zakład Pracy Chronionej	26-307 Białaczów	www.petrykozy.prv.pl
Przedsiębiorstwo Przemysłu Drzewnego POLTAREX Sp. z o.o.	84-300 Łębork	www.poltarex.pl
PRZEDSIĘBIORSTWO USŁUGOWO-PRODUKCYJNE COMPLEX Sp. z o.o.	80-451 Gdańsk	www.complex.gda.pl
Przedsiębiorstwo Wielobranżowe DREWNO-MAL Sp. z o.o.	96-323 Osuchów	www.drewno-mal.pl
PRZESIEBIORSTWO PRODUKCYJNO-USŁUGOWO-HANDLOWE SANDEX Sp. z o.o.	42-622 Nowe Chechło	
PUPH TARTAK Marek Burkietowicz	63-420 Odolanów	www.burkietowicz.pl
RSC BIS Sp. z o.o. Skrzynki	62-060 Stęszew	www.rscbis.com.pl
SILVA Zakład Drzewny w Słupsku Sp. z o.o.	76-200 Słupsk	www.silva.slupsk.pl
SOPEXIM Sp. z o.o.	95-070 Aleksandrów Łódzki	www.sopexim.pl
SOR-DREW PPUH R. Sorowski	41-608 Świętochłowice	www.sorowski.com.pl
STEICO S. A.	64-700 Czarnków	www.steico.com
STORA ENSO Wood Products Sp. z o.o. (70000 m3/a)	46-030 Murów	www.storaenso.com
Swedwood Poland Sp. z o.o. Golblat sawmill (50 Km3/a)	72-100 GOLENIOW	www.swedwood.com
Swedwood Poland Sp. z o.o. Tartaki sawmill (100 Km3/a)	72-100 GOLENIOW	www.swedwood.com
Swedwood Poland Sp. z o.o. Wielbark sawmill (150 Km3/a)	12-160 WIELBARK	www.swedwood.com
SYLVA Sp. z o.o.	83-441 WIELE k/Kościerzyny	www.sylvadrewno.com
TARTAK DOMASZKÓW Tadeusz Farbotko	57-522 Domaszków	

Tartak Chojno SOMAPOL Sławomir Sobota	63-921 Chojno	www.somapol.prv.pl
TARTAK GRODZIEC Sp. z o.o.	62-580 Grodziec	
Tartak i Zakład Stolarski Janina i Wacław Witkowsky sp. j.	98-300 Wieluń	www.tartakjww.com.pl
TARTAK IZBICA	87-865 Izbica Kujawska	www.tartakizbica.pl
TARTAK Jolanta Gula	42-240 Rudniki	
TARTAK KAROŃ Grzegorz Karoń	42-230 Koniecpol	www.tartak.bigduo.pl
TARTAK ŁĘŻYCE Janusz Pocięcha	57-340 Duszniki Zdrój	
Tartak OLCZYK Sp. z o.o.	29-105 Krasocin	www.tartakolczyk.com.pl
TARTAK PŁOCICZNO Sp. z o.o.	16-402 Suwałki 4	www.tartakplociczno.pl
Tartak Stefan Spółka Jawna Piotr Cieślak, Jarosław Cieślak	64-140 Włoszakowice	www.tartakstefan.pl
TARTAK ZBIERSK Sp. z o.o.	62-830 Zbiersk	
TARTOM Zakład Przemysłu Drzewnego Sp. z o.o.	97-200 Tomaszów Mazowiecki	www.tartom.com.pl
Toruńskie Przedsiębiorstwo Przemysłu Drzewnego S.A.	87-100 Toruń	www.tppd.pl
WAMAR - SOSENKA s.c.	62-023 Gądko k. Poznania	www.wamar-sosenka.pl
WITAR Tartak Pniewy sp. z o.o.	62-045 Pniewy	www.witar.pl
WITAR TARTAK Rawicz Sp. z o.o.	63-900 Rawicz	www.witar.pl
WITAR Tartak Tyble sp. z o.o.	98-420 Sokolniki k/Wielunia	www.tyble.pl
Z.P.D. TARTAK KROTOSZYN Leszek i Dariusz Wiland s.c.	88-190 Barcin	www.wiland.republika.pl
ZAKŁAD DRZEWNY Józef Chmiel	46-053 Suchy Bór	www.tartak-chmiel.slask.com.pl
Zakład Drzewny KUJAN Spółka z o.o.	77-424 Zakrzewo	
ZAKŁAD DRZEWNY Sp. z o.o.	22-200 Włodawa	
Zakład Produkcyjno-Handlowo-Usługowy Piotr Radziszewski	17-120 Brańsk	
Zakład Produkcyjno-Usługowy TARKOS Sp.J. Jerzy Kostrzewa, Błażej Kostrzewa	26-640 Skaryszew	www.tarkos.pl
ZAKŁAD PRODUKCYJNY S.J. Tartaczniactwo i wyroby z drewna	34-371 Ujsoły	www.tartaczniactwo.biz.pl
Zakład Przemysłu Drzewnego ROMA Sp. z o.o.	62-130 Golańcz	www.tartak-roma.pl
Zakład Przemysłu Drzewnego TARTAK SUPRAŚL Sp. z o.o.	16-030 Supraśl	
Zakład Przerobu Drewna RAKOWIEC s.c. E. W. Lewandowscy	83-135 Mała Karczma	
ZAKŁAD STOLARSKO-TARTACZNY Ryszard Winecki i Wspólnicy Sp. J.	42-133 Węglowice	www.winecki.pl
ZAKŁADY DRZEWNE POLDAN Eksport Import Zygmunt Kroplewski	76-100 Sławno	www.poldan.pl
Zielony Dąb	78-400 Szczecinek	www.wood.pl
ZPD TARTAK Marian Leonhard	63-410 Ostrów Wielkopolski	www.leonhard-tartak.osw.pl
Gorzyce Wielkie		

Sawmills, hardwood

ŁĄCCY-KOŁCZYGŁOWY Sp. z o.o.	77-140 Kołczygłowy	www.laccy.pl
Parkiet - Serby Juliusz Łunkiewicz	67-200 Głogów	www.parkiet-serby.com.pl
POL-KRES EDWOOD Daniel Tomaszuk	21-500 Biała Podlaska	www.edwood.pl
Pomeranian Timber Inc. (25000 m3/a)	71-333 Szczecin	www.pomeraniantimber.com.pl
PPHU PROMIS Joanna Pankowska	60-638 Poznań	www.promis.conswood.pl
Przedsiębiorstwo Przemysłu Drzewnego FORNITEX Sp. z o.o.	84-200 Wejherowo	www.fornitex.com.pl
TARTAK Krystyna Dwornik-Świgoń i Tomasz Świgoń s.c.	63-300 Pleszew	
WALCZAK sp. j.	63-130 Książ Wlkp.	www.walczakparkiety.pl
ZAKŁAD PRODUKCJI DRZEWNEJ TARTAK Józef Nowakowski	78-314 Sławoborze	

Plywood producers

Plywood Plant in Bydgoszcz-MULTI SA	85-752 Bydgoszcz	www.sklejka.pl
"Plywood-WRITE" SA	12-200 Pisz	www.sklejka-pisz.com.pl
Orzechowski Plywood Industry Plant	62-322 Orzechowo	www.ozps.com.pl
Houses the Plywood Industry Plant Sp. of o.o.	97-300 Piotrków Trybunalski	www.sklejkapiotrkow.pl
Plywood - EKO SA	63-400 Ostrow Wielkopolski	www.sklejkaeko.pl
BIAFORM PLYWOOD PLANTS INDUSTRY SA	15-566 Białystok	www.biaform.com.pl
Pfleiderer Prospan SA	98-400 Wieruszów	www.pfleiderer.pl

Particleboard producers

Pfleiderer Grajewo SA	19-203 Grajewo	www.pfleiderer.pl
KRONOPOL Sp. of o.o.	68-200 Żary	www.kronopol.com.pl

Fibreboard producers

Fibris S.A.	37-700 Przemyśl	www.fibris.pl
HARDEX S.A.	66-600 Krosno Odrzańskie	www.hardex.pl
HOMANIT POLAND Sp z. Ltd. and Company	78-230 Karlino	www.homanit.pl
STEICO S.A.	64-700 Czarnków	www.steico.com
Swedspan Polska Sp. z o.o.,	17-100 Bielsk Podlask	www.swedspan.com

KRONOPOL Sp. of o.o.	68-200 Żary	www.kronopol.com.pl
Kronospan Szczecinek Sp. of o.o.	78-400 Szczecinek	www.kronospan.pl
Pfleiderer MDF Sp. z o.o.	19-203 Grajewo	www.pfleiderer.pl

Pulp producers

STORA ENSO POLAND S.A.	07-401 Ostrołęka	www.storaenso.com
INTERNATIONAL PAPER - KWIDZYN SP. Z O.O.	82-500 Kwidzyn	www.ipaper.com.pl
MONDI ŚWIECIE S.A.	86-100 Świecie n. Wisłą	www.mondigroup.pl

Paper and paperboard producers

ARCTIC PAPER KOSTRZYN S.A.	66-470 Kostrzyn n. Odrą	www.arcticpaper.com
DELITISSUE SP. Z O.O.	06-400 Ciechanów	
HANKE TISSUE SP. Z O.O.	66-470 Kostrzyn n.Odrą	www.hanketissue.pl
ICT POLAND SP. Z O.O.	66-470 Kostrzyn n.Odrą	www.ictpoland.pl
INTERNATIONAL PAPER - KWIDZYN SP. Z O.O.	82-500 Kwidzyn	www.ipaper.com.pl
KIMBERLY - CLARK SP. Z O.O.	32-310 Klucze	www.kimberly-clark.com
METSÄ TISSUE POLAND SP. Z O.O.	05-520 Konstancin-Jeziorna	
MONDI ŚWIECIE S.A.	Świecie n. Wisłą	www.mondigroup.pl
PACKPROFIL SP. Z O.O.	46-057 Kolonowskie	www.packprofil.pl
STORA ENSO POLAND S.A.	07-401 Ostrołęka	www.storaenso.com
WEPA PROFESSIONAL PIECHOWICE S.A.	58-573 Piechowice	www.wepro.com.pl

Wooden houses

Centrum Dystrybucji i Obróbki Drewna Sp. z o.o.	12-140 Świątajno	www.cdod.pl
STOWARZYSZENIE DOM DREWNIANY	80-264 Gdańsk	www.domydrewniane.org

Wood pellet and briquette producers

Arno-Eko	70-893 Szczecin	www.arnoeko.pl
Barlinek	74-320 Barlinek	www.barlinek.com.pl
BIOPAL	70-130 Maszewo	www.biopal.com.pl
BRYTPOL s.c. Jadwiga Teda Monika Teda	26-341 Mniszków	
EKO-ORNETA	11-130 Orneta	www.eko-orneta.pl
EKOPAL	12-200 Pisz (Jagodnie)	www.ekopal.pl
EMG Sp. z o.o.	18-210 Szepietowo	www.emg.com.pl
Libero F.H.U.	09-311 Kuczbork	www.pelet.eu
FUREL sp. z o.o.	91-863 Łódź	www.pellet.furel.pl
FU-WI Sp. z o.o.	82-300 Elbląg	www.fuwi.pl
Max-Parkiet Sp. z o.o.	09-300 Żuromin	www.maxparkiet.com.pl
Mirosław Kaminski PPHU	19-200 Grajewo	
Motowerk Zbigniew Misiarz	39-300 Mielec	
PBH Zalubski	55-221 Jelcz-Laskowice	
Pellet-Art sp. z o.o.	66-235 Torzym	www.pellet-art.pl
Pellety Kozienice	26-900 Kozienice	www.pelletykozienice.pl
PPHU Fabic	78-500 Drawsko Pomorskie	
PPHU FU-WI export-import sp. z o.o.	81-036 Gdynia	www.ekomir.com.pl
Radmar Ekoenergia	64-020 Czempin	
Regionalna Agencja Poszaniowania Energii	45-158 Kup	
Serhej	21-532 Łomazy	www.serhej.pl
Stelmet	65-127 Zielona Góra	www.stelmet.com
SYLVA Sp. z o. o	83-441 Wiele k. Kościerzyny	www.sylvaderwno.com
Tartak "OLCZYK" Ludwik Olczyk	29-105 Krasocin	www.tartakolczyk.com.pl
TASK Marek Tasiemski, Mateusz Tasiemski	62-280 Kiszewo	www.pelet.pl
Vapo	85-022 Bydgoszcz	www.vapo-poland.pl
Vapo	69-100 Słubice	www.vapo-poland.pl

References

- Forest Law 1991. Act on Forests. Journal of Laws of the Republic of Poland - Dz.U. 1991.101.444, with amendments
- Burczy H., Mirowski T., Kalawa W., Sajdak W. 2010. Study on Biomass Trade in Poland. 32 p.
- Drewno. 2012. Forestry equipment in Poland. Retrieved 29 August 2012 from http://www.drzewnictwo.com.pl/pl_PL/news/4225/maszyny-lesne-w-polsce
- EcoLas 2012. Polish market analysis. Retrieved 29 August 2012 from http://ekolas.mtp.pl/en/gastro-trendy_in_a_nutshell/polish_market_analysis.pdf
- Emaps Online 2010. Retrieved 7 April 2010 from www.emaps-online.com.
- Eurostat 2012. Employment in forestry and forest-based industry. Retrieved 29 August 2012 from <http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home>
- FAO 2012. Policy – Poland. Retrieved 29 August 2012 from <http://www.fao.org/forestry/country/61838/en/pol/>.
- FAOSTAT 2012. Data from the statistical database of the FAOSTAT. Retrieved 29 August 2012 from <http://faostat.fao.org>.
- Flakowicz M. 2010. Biomass consumption in Polish power sector. Green Power 2010. Warsaw.
- FSC 2012. Official website of the Forest Stewardship Council in Poland. Retrieved 29 August 2012 from <http://pl.fsc.org>.
- FTP 2012. Strategic Research Agenda (SRA) for the Forest-based Sector Technology Platform (FTP). Retrieved 29 August 2012 from www.forestplatform.org.
- Geography NA6 2012. Transport in Poland. Retrieved 29 August 2012 from <http://geografia.na6.pl/transport-w-polsce>
- GUS 2011a. Energia ze źródeł odnawialnych w 2010 roku [Energy from renewable sources in 2010]. Warszawa, Central Statistical Office. 66 p.
- GUS 2011b. Financial results of economic entities in 2010. Retrieved 29 August 2012 http://www.stat.gov.pl/gus/5840_817_ENG_HTML.htm
- GUS 2011c. Forestry 2011. Warsaw, Central Statistical Office. 311 p.
- GUS 2011d. Road Transport in Poland in the Years 2005-2009. Retrieved 29 August 2012 from: http://www.stat.gov.pl/gus/5840_11868_ENG_HTML.htm.
- GUS 2011e. Statistical Yearbook of the Republic of Poland 2011. Warsaw, Central Statistical Office. 910 p.
- GUS 2012. Official website of the Polish Statistics Service. Retrieved 29 August 2012 from <http://www.stat.gov.pl>.
- Kalupa, Ł. 2004. Meblarstwo w Polsce. Kondycja. Podstawy sukcesu. Perspektywy (Furniture industry in Poland. Condition. Motors of success. Perspectives.) Wydawnictwo Eint Sp. z o. o., Toruń.
- Kawonczyk, A. 2009. Forestry situation in Poland and Baltics. GAIN Report Number PL9009. Warsaw. 5 p.
- Kingsbury, A., Zochowska M. 2011. Forestry situation and solid wood products in Poland. GAIN Report PL 1124. Warsaw, USDA Foreign Agricultural Service. 16 p.
- Kwiecień, E. 2006. Wkrótce nowe zasady sprzedaży drewna [New wood sale rules soon]. Głos Lasu (4): 35–38.
- Lis, W. 2007. Zarządzanie obrotem drewnem okrągłym w Polsce [Management of roundwood trade in Poland]. Annual Scientific Bulletin of Plant Economic Department of the European Wood Technology University Studies, Poznań, 23, p. 9.
- Ministry of Agriculture and Rural Development. 2007. National Strategic Plan for 2007-2013 Rural Development.
- Ministry of Economy 2009. Energy Policy of Poland until 2030. Warsaw, Ministry of Economy. 27 p. Retrieved 21 May 2012 from http://www.mg.gov.pl/files/upload/8134/Polityka%20energetyczna%20ost_en.pdf

- Ministry of Economy 2010. Krajowy Plan Działania w Zakresie Energii ze Źródeł Odnawialnych [National action plan on renewable energy]. Warszawa: Ministerstwo Gospodarki. 148 p. Retrieved 21 May 2012 from http://www.mg.gov.pl/files/upload/12326/KPD_KE.pdf
- Ministry of the Environment 2009. Polish Statement of the wood market review and prospects. Economic Commission for Europe Timber Committee, 67th Session, October 2009. 12 p.
- Ministry of the Environment 2012. Official website of the Ministry of the Environment of the Republic of Poland. Retrieved 21 May 2012 from <http://www.mos.gov.pl>.
- Ministry of Regional Development 2006. National Development Strategy 2007-2015. Warsaw, Ministry of the Regional Development. 179 p.
- Niskanen, A., Slee, B., Ollonqvist, P., Pettenella, D., Bouriaud, L. and Rametsteiner, E. 2007. Entrepreneurship in the forest sector in Europe. University of Joensuu, Faculty of Forestry, Silva Carelica 52. 127 p.
- Nowacka, W. Ł., Moskalik, T. 2012. Las miejscem pracy – nowy zawód, nowe możliwości [Forestry as a place of work-new profession, new possibilities]. Proceedings of the Center for Nature and Forestry Education 32(3): 215-221.
- PEFC 2012. Official website of the Program for Endorsement of Forest Certification Schemes. Retrieved 29 August 2012 from www.pefc.org
- Pikul, J., Ratajczak, E. 2006. Czy zamiana złotego na euro będzie korzystna dla przemysłu drzewnego i meblarskiego [Will Poland's adoption of the euro be beneficial for the wood and furniture industry]. Gazeta Drzewna-Polski Holz-Zentralblatt, no 4, pp. 30–31.
- Pikul-Biniak, J., Wos, A. 2008. Drivers of the Polish forestry-wood sector. In: Cost Action E44 Final Conference in Milan on a European wood processing strategy: future resources matching products and innovations. Pp. 73–82.
- Polish Economic Chamber of Wood Industry 2012. Retrieved 21 May 2012 from <http://www.przemysldrzewny.pl>.
- Portalmaszynowy 2008. Najazd harwesterów i forwarderów na polskie lasy [Invasion harvesters and forwarder sto Polish forests]. Retrieved 21 May 2012 from http://www.portalmaszynowy.pl/pl_PL/artukul/4280/najazd-harwesterow-i-forwarderow-na-polskie-lasy
- PPEX. 2010. Towarowa Giełda Energii SA (Polish Power Exchange). Retrieved 21 May 2012 from <http://www.polpx.pl/>.
- PGL LP 2011. Forests in Poland 2011. Warszawa, State Forests. 51 p.
- 2012. Official website of the National Forest Holding “State Forests”. Retrieved 20 May 2012 from <http://www.lasy.gov.pl>.
- Schuck, A., Van Brusselen, J., Päivinen, R., Häme, T., Kennedy, P. and Folving, S. 2002. Compilation of a calibrated European forest map derived from NOAA-AVHRR data. European Forest Institute. EFI Internal Report 13, 44 p. plus Annexes
- Szostak, A. 2001. Ewolucja systemu sprzedaży surowca drzewnego w Polsce [Evolution of wood raw material sales system in Poland]. Gospodarka Materiałowa i Logistyka (4): 14–15.
- UNECE 2012. Trade and Timber Division. Forest Products Statistics 2005–2009. Retrieved 29 August 2012 from <http://timber.unece.org>.
- Wach, E., Bastian, M. 2009. Development and promotion of a transparent European Pellets Market Creation of a European real-time Pellets Atlas. Pellet market country report Poland. Baltic Energy Conservation Agency, Intelligent Energy. 19 p.
- , Bastian M. 2010. Rynek pelet w Polsce i w Europie. Czysta energia.
- Wikipedia 2012. Poland. Retrieved 29 August 2012 from <http://en.wikipedia.org/wiki/Poland>.
- World Bank 2012. Poland. Retrieved 29 August 2012 from <http://www.worldbank.org/en/country/poland>.
- Zajac, S., Golos, P., Laskowska, K., Adamczyk, W., Czemko, B., Jodlowski, K., Kalinowski, M., Lis, W., Staniszewski, P., Zastocki, D. & Janeczko, E. 2005. Poland. Acta. Silv. Ling. Hung. Special Edition: 509–554.