


POLAND  The State Forests

# FORESTS IN POLAND

## 2014



State Forests



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# FORESTS IN POLAND

2014



State Forests



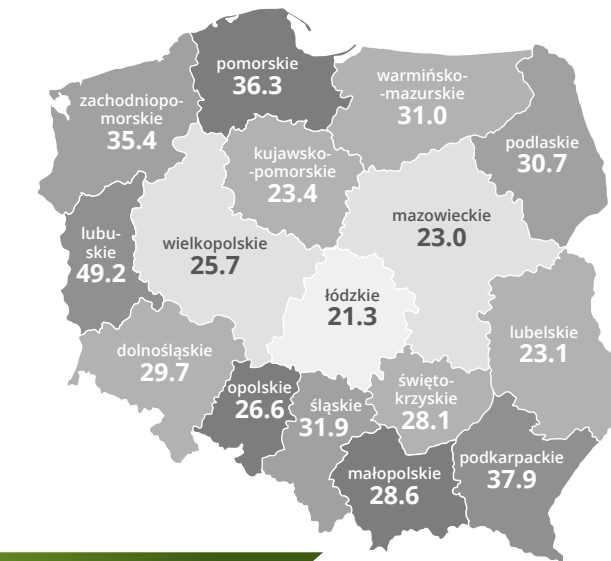


The Forest Act of 28 September 1991 states that the State Forests must publish an annual report on the condition of forests in Poland. This brochure is a shortened version of the report for the year 2013, which was commissioned by the Directorate-General of the State Forests and compiled by the Forest Research Institute. The report is based on materials provided by the Ministry of the Environment, the Directorate-General of the State Forests, the Forest Research Institute, the Forest Management and Geodesy Bureau, the Central Statistical Office and international statistics. The report describes the condition of Polish forests under all forms of ownership in 2013 in the context of the data from recent years and, where appropriate, refers to data from other countries whose natural conditions are comparable to those in Poland. The scope of the report covers three areas: forest resources in Poland, functions of forests and threats to the forest environment.

# FOREST RESOURCES IN POLAND

## Forest area and forest cover

In our climatic and geographical zone forests are the least distorted natural formation. They are a necessary element of ecological balance and, at the same time, a form of land use which ensures biological production with a market value. Forests are the common good and enhance the quality of human life.



FOREST COVER IN POLAND by province (Central Statistical Office)



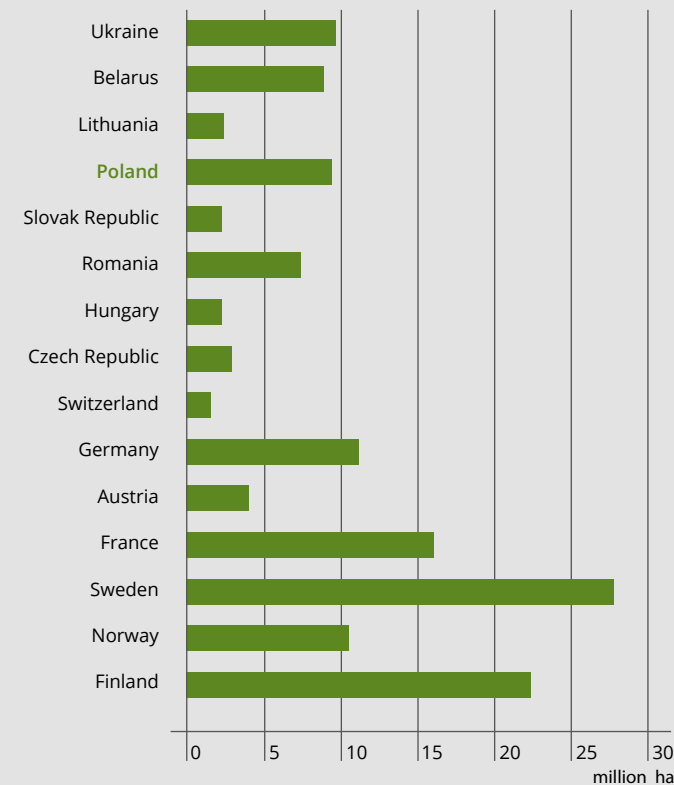
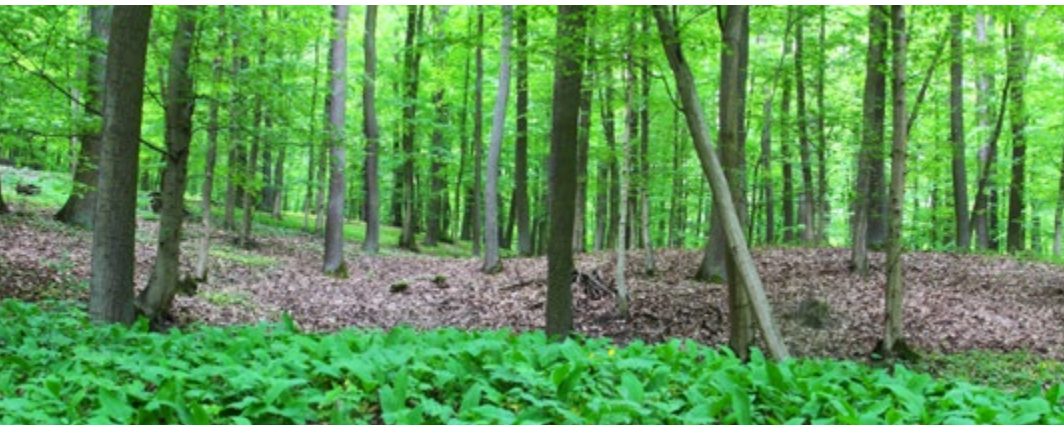
The total area of forests in Poland, as of 31 December 2013, is 9177.2 thousand hectares (Central Statistical Office), which puts forest cover at 29.4%. The lubuskie province has the highest level of forest cover (49.2%) and the łódzkie province has the lowest (21.3%).

29.4%  
forest cover  
in Poland

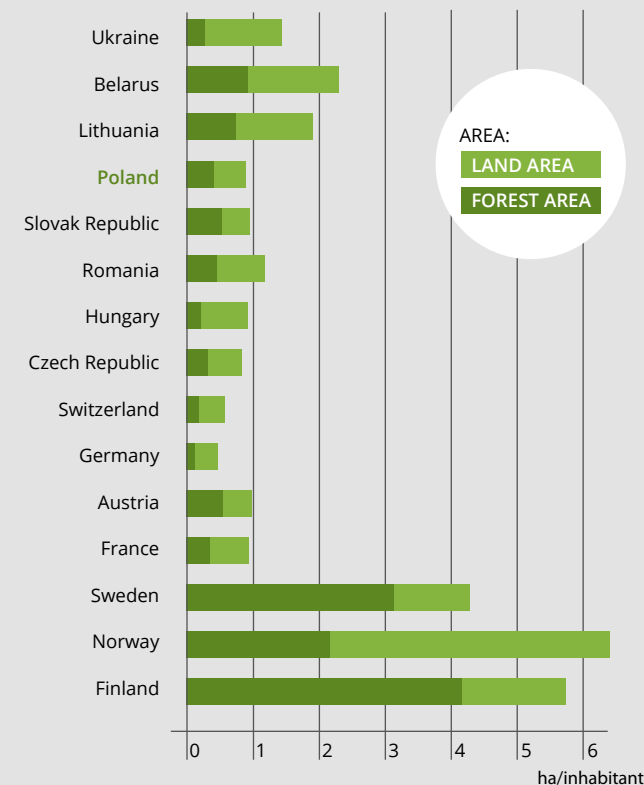
Measured by the international assessment standard, which takes into account the land associated with forestry, the forest area in Poland, as of 31 December 2013, was 9383 thousand hectares. Poland is among the countries with the largest forest area in the region, after France, Germany and Ukraine.

At the end of 2010, Poland's forest cover measured by the international assessment standard amounted to 30.4% and was lower than the European average (32.2%, exclusive of the Russian Federation). This figure, calculated in the same way at the end of 2013, was 30.6%.

A comparison of forest area *per capita* in Europe with an overall land area clearly shows that these values are higher in countries with low population density. The forest area per capita in Poland (0.24 ha) is one of the lowest in the region.



TOTAL FOREST AREA (SoEF 2011)

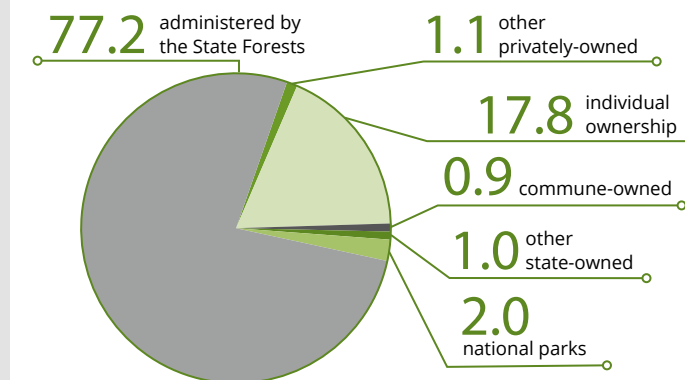


AREA OF FORESTS against the total land area, per inhabitant (SoEF 2011)

## Forest ownership in Poland

In the ownership structure of forests in Poland the majority, 81.2%, are publicly-owned, of which 77.2% are under the administration of the State Forests National Forest Holding (the State Forests).

However, in relation to the ownership structure, three groups of countries can be clearly distinguished: the Commonwealth of Independent States where almost 100% of forests are state-owned; the Scandinavian countries and France where a great majority of forests are privately-owned; the remaining countries which have diverse ownership structure with a predominance of publicly-owned forests.

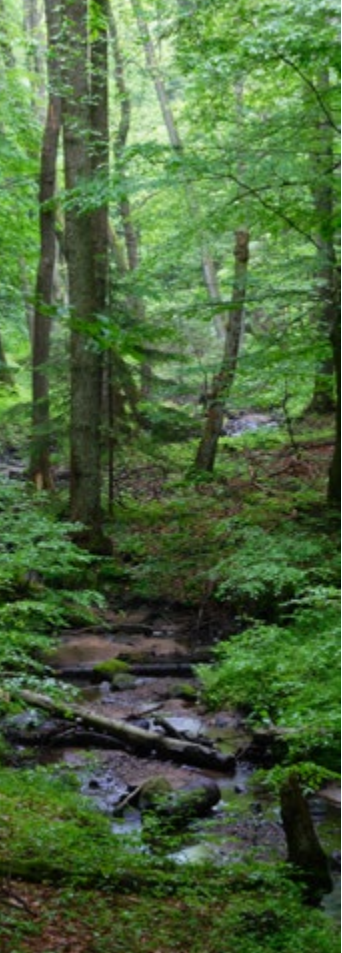


OWNERSHIP STRUCTURE OF FORESTS IN POLAND (Central Statistical Office)

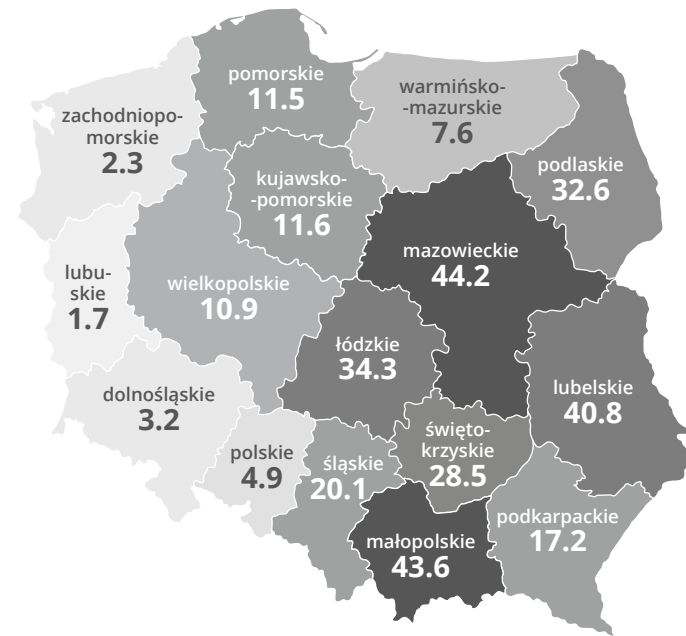


The ownership structure has not changed significantly in the whole post-war period.

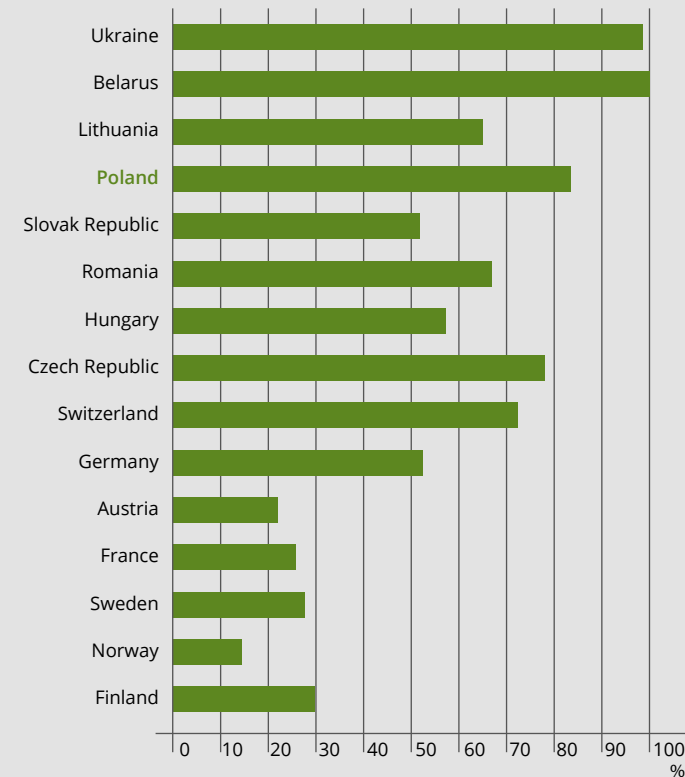




The share of privately-owned forests in Poland varies between the regions – the greatest is in the Mazowieckie province at 361.0 thousand hectares and the lowest in the Lubuskie province at 11.7 thousand hectares.



**SHARE OF PRIVATE FORESTS in the total forest area by province** (Central Statistical Office)

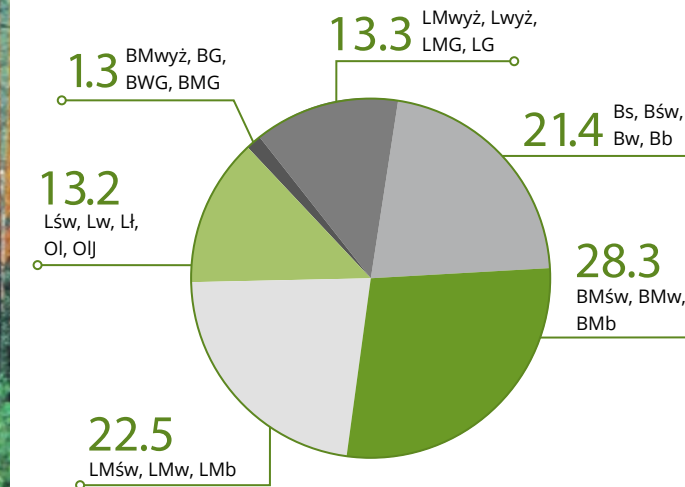


**SHARE OF PUBLIC FORESTS in the total forest area** (SoEF 2011)



## Habitat structure

Forests in Poland mainly occur in areas with the poorest soils, which in turn determines the structure of forest habitat types. Coniferous forest habitats predominate, accounting for 51% of the total forest area, while broadleaved forest habitats account for 49%.



**AREAL SHARE (in %) of forest habitat types in Poland** (Large-Scale Forest Inventory 2009–2013)



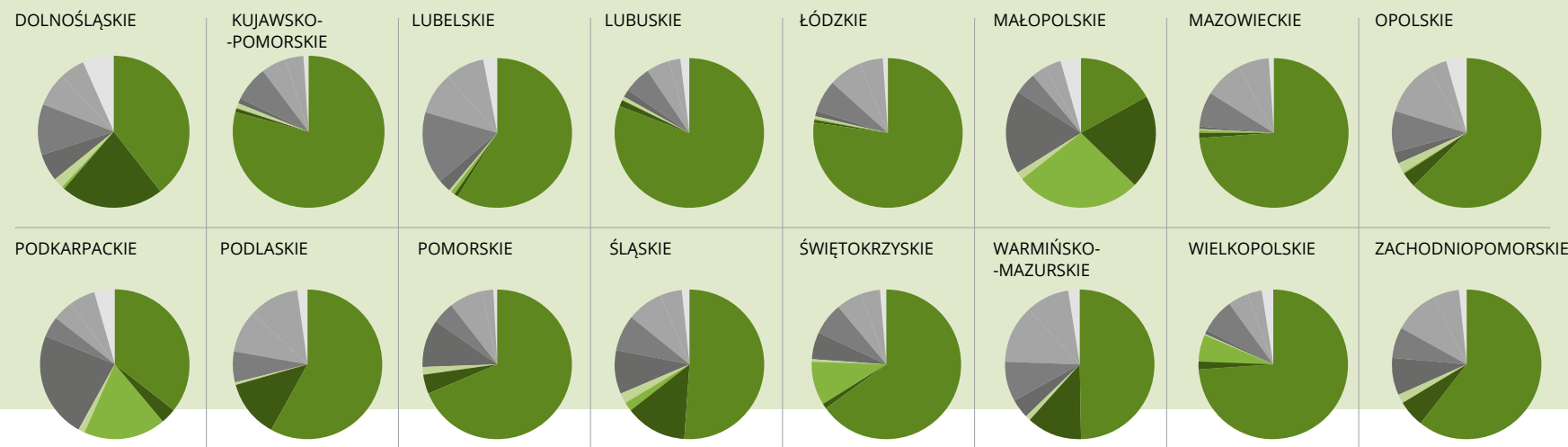
### LEGEND:

- Bb – bog coniferous forest
- BG – montane coniferous forest
- BMb – bog mixed coniferous forest
- BMG – montane mixed coniferous forest
- BMśw – fresh mixed coniferous forest
- BMw – moist mixed coniferous forest
- BMwyz – upland mixed coniferous forest
- Bs – dry coniferous forest
- Bśw – fresh coniferous forest
- Bw – moist coniferous forest
- BWG – high-mountain coniferous forest
- LG – montane broadleaved forest
- Lt – riparian forest
- Lmb – bog mixed broadleaved forest
- LMG – montane mixed broadleaved forest
- LMśw – fresh mixed broadleaved forest
- LMw – moist mixed broadleaved forest
- LMwyz – upland mixed broadleaved forest
- Lśw – fresh broadleaved forest
- Lw – moist broadleaved forest
- Lwyz – upland broadleaved forest
- Ol – alder forest
- Olj – alder-ash forest

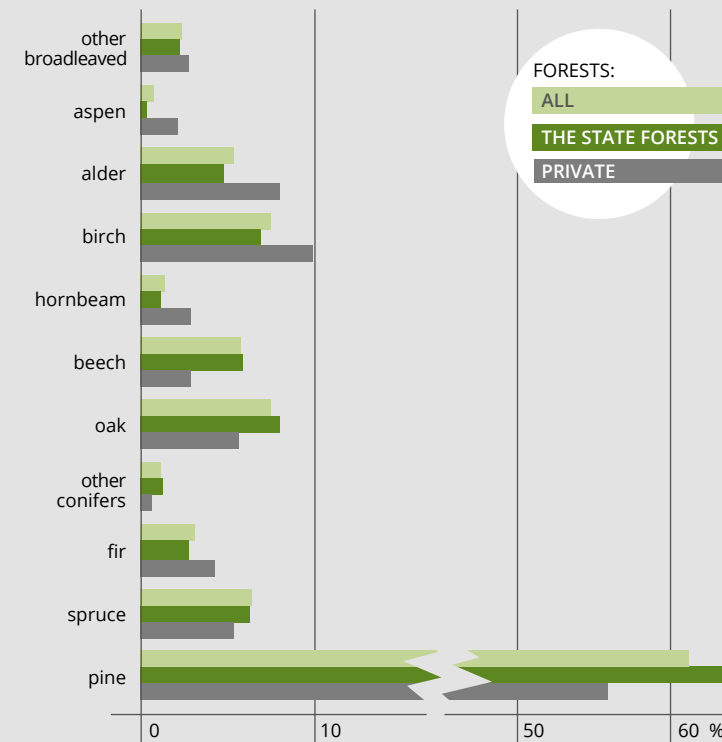


## Species composition

The geographical distribution of habitats is largely reflected in the spatial structure of dominant tree species. Apart from the mountain regions where spruce, fir and beech have a larger share in stand composition, in the rest of the country pine is the dominant species in the majority of stands.



AREAL DISTRIBUTION OF STANDS in the structure of dominant species (Large-Scale Forest Inventory 2009–2013)



AREAL SHARE OF DOMINANT SPECIES in forests in all ownership categories, in the State Forests and in private forests (Large-Scale Forest Inventory 2009–2013)

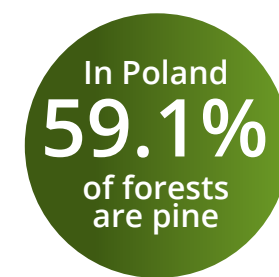
Coniferous species dominate in Polish forests, accounting for 69.6% of the total forest area. Pine, which in Poland has optimal climatic and site conditions within its Euro-Asiatic natural range, accounts for 59.1% of the area of forests in all ownership categories, 60.9% in the State Forests and 56.0% in the privately-owned forests (Large-Scale Forest Inventory).

In the period 1945–2013 the species structure of Poland's forests changed substantially, which is evident in the increased share of stands with the prevalence of broadleaved species. In the State Forests, where these changes are monitored annually, the increase was from 13% to 23.4%.

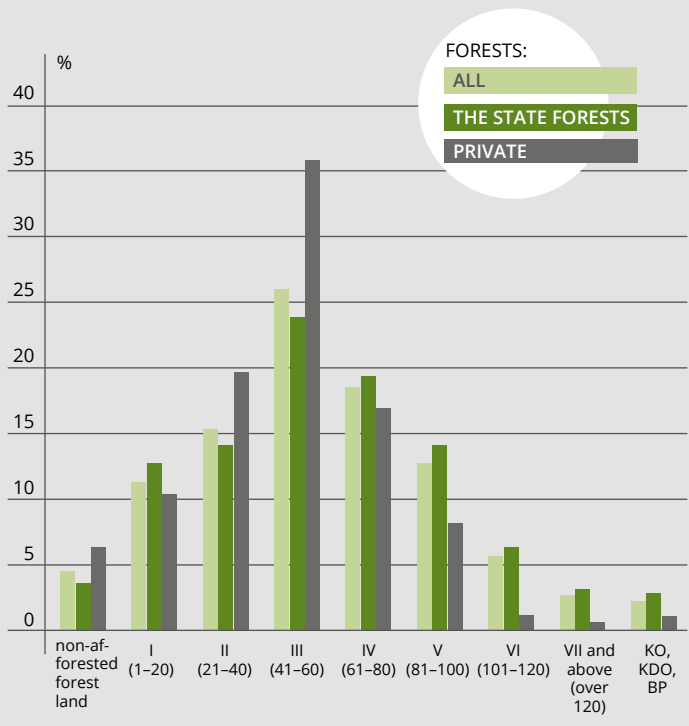
## Age structure

Stands aged 41–80 years, representing age classes III and IV, prevail in the forest age structure and cover 26.0% and 18.9% of the forest area respectively. Stands aged 41–60 years (class III) prevail in all ownership categories, while in private forests they occupy 36.1% of the area. Stands older than 100 years, including stands in classes KO, KDO and BP, account for 12.0% of the forest area managed by the State Forests while in private forests for only 2.6%. Non-afforested land in privately owned forests accounts for 6.7% of their total area and in the State Forests for 3.2%.

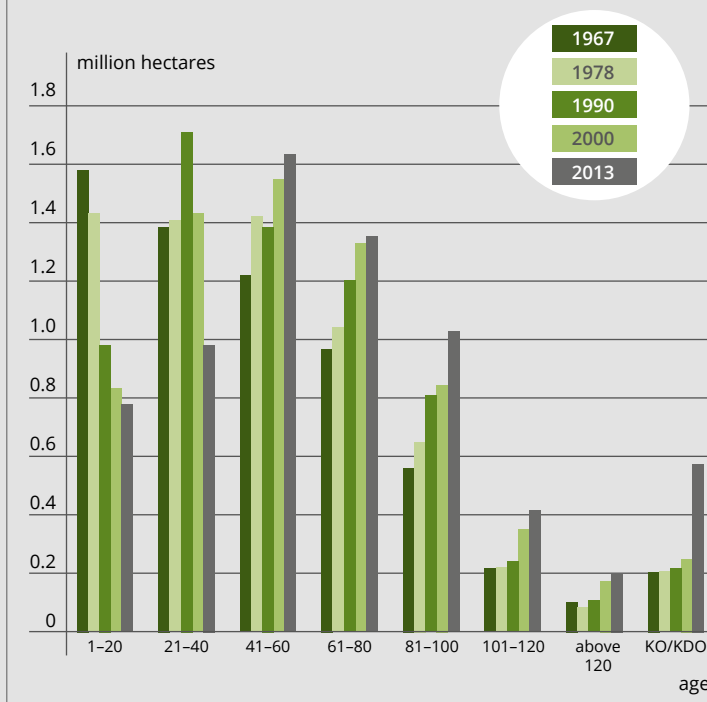
The direction of changes in the area structure of age classes can be seen in the example of forest resources administered by the State Forests.



Stands aged  
**41–80**  
years  
dominate in Polish  
forests



AREAL SHARE OF STANDS IN ALL FORMS OF OWNERSHIP, in the State Forests and in private forests, by age class (Large-Scale Forest Inventory 2009–2013)



CHANGES IN AREA STRUCTURE OF AGE CLASSES in forests administered by the State Forests (Forest Management and Geodesy Bureau)

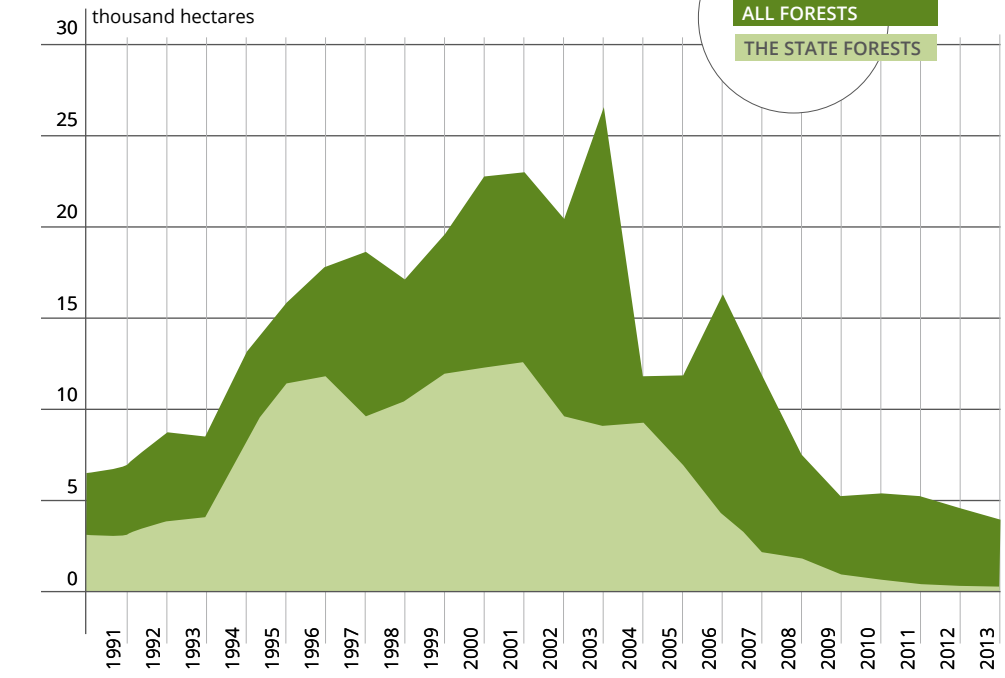
## Changes in forest area

Compared with the previous year Poland’s forest area increased by 13 thousand hectares in 2013. According to the land records the forest area has increased by 483 thousand hectares since 1991.

The basis for all afforestation in Poland is the “National programme for the augmentation of forest cover”, which was prepared by the Forest Research Institute and recommended for implementation by the Council of Ministers in 1995 (the programme was modified in 2002). The main aims of the programme are to increase forest cover to 30% by 2020 and to 33% by 2050 and to ensure an optimal spatial and temporal distribution of afforestation.

Afforestation (artificial) carried out in 2013 covered 4078 hectares of land in all ownership categories. The drastic decline in afforestation (76% decrease, from 16 933 hectares in 2006) is largely a result of the change to the criteria for designating privately owned agricultural land for afforestation under the “Programme for the development of rural areas” (PROW) 2007–2013.

A similar decrease in the size of afforested areas was observed in the State Forests where in 2013 only 384 hectares were artificially afforested, as compared with 9.7 thousand hectares in 2004. This was a result of a sharp decline in the size of post-agricultural land and wasteland being designated for afforestation by the Agricultural Property Agency.



AREA OF AFFORESTATION (artificial) in Poland in 1991–2013 (Central Statistical Office)





## Structure of timber resources by volume

Over half (52.3%) of the timber resources are in stands in the age classes III and IV (41–80 years). The volume of timber resources in the stands over 100 years old, including classes KO, KDO and BP, stands at 18.4% in the State Forests and 4.2% in private forests.

The main source of information about the volume of timber resources in Poland is the Large-Scale Forest Inventory. According to the data collected in the years 2009–2013, and based on the forest area as it stood at the end of 2012, the timber resources amounted to 2440 million m<sup>3</sup> of gross merchantable timber, including 1929 million m<sup>3</sup> in the State Forests and 393 million m<sup>3</sup> in private forests.

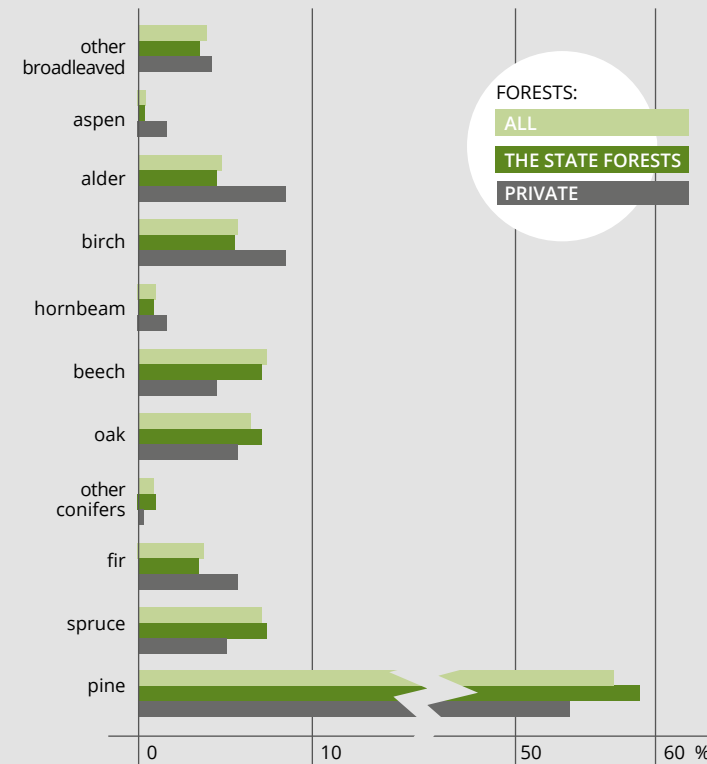
According to the Large-Scale Forest Inventory 2009–2013 calculations, the average standing volume of forests in Poland is 266 m<sup>3</sup>/ha, in the State Forests 272 m<sup>3</sup>/ha and in private and commune-owned forests 228 m<sup>3</sup>/ha.

Pine accounts for 56.9% of the volume of timber resources in all categories of forest ownership, 58.7% in the State Forests and 54.2% in private forests.

In privately-owned forests the proportion of the volume of broadleaved species is larger than in the State Forests, especially species such as birch, alder and aspen, while oak and beech have a smaller proportion.



**VOLUME OF TIMBER RESOURCES in different age classes in forests in all ownership categories, in the State Forests and in privately-owned forests** (Large-Scale Forest Inventory 2009–2013)



**VOLUME OF TIMBER resources by tree species in forests in all ownership categories, in the State Forests and in privately-owned forests** (Large-Scale Forest Inventory)

Polish forests rank high in Europe with regard to standing volume. The SoEF figures for 2011 demonstrate that the average for Poland, amounting to 247 m<sup>3</sup>/ha, is more than double of the European average (112 m<sup>3</sup>/ha, or 155 m<sup>3</sup>/ha excluding the Russian Federation).

Poland, with a relatively large absolute area of forests and with standing volume exceeding the European average, has significant timber resources which amount to more than 2.3 billion m<sup>3</sup>, according to SoEF 2011.

Timber resources in Poland  
**2.3**  
billion m<sup>3</sup>

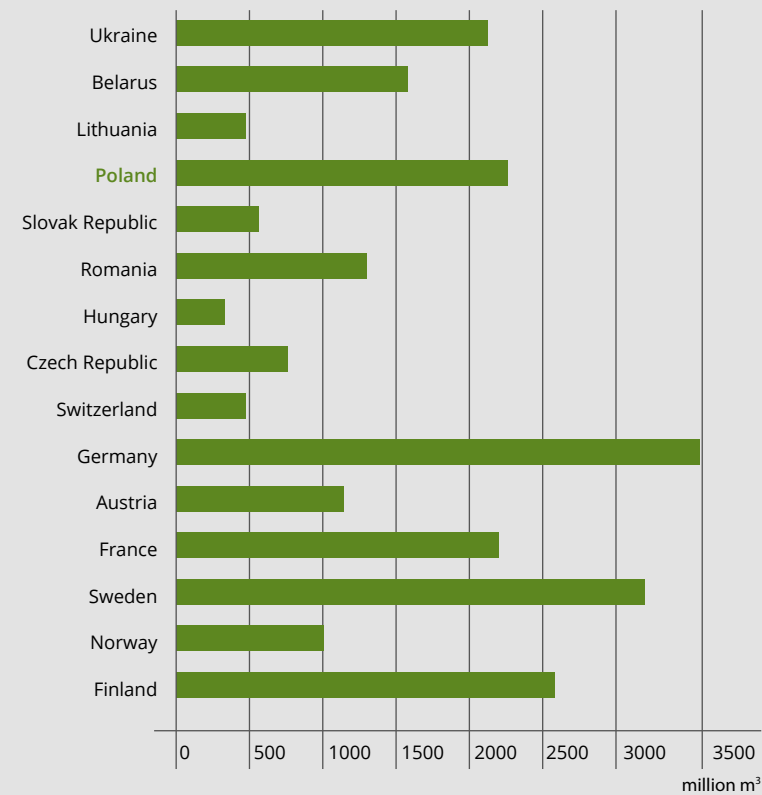




STANDING VOLUME in selected countries (SoEF 2011)

STANDING VOLUME (m³/ha):

251–346	101–150
201–250	51–100
151–200	0–50



TIMBER RESOURCES in selected countries (SoEF 2011)



## Changes in timber resources

There has been a steady growth of timber resources since the first inventory in the State Forests took place in 1967. A reliable source of data in the last few years has been the Large-Scale Forest Inventory which also includes information on resources in privately-owned forests. In relation to the State Forests the statistics produced by the Large-Scale Forest Inventory give a slightly higher figure (by 6%) for forest resources, than the annually updated data concerning forest area and timber resources from the Forest Management and Geodesy Bureau. According to the Large-Scale Forest Inventory for the periods 2006–2010 and 2009–2013, the total timber resources in Poland have been increasing annually by an average of 35 million m³.

In the last 20 years, from January 1993 to January 2013, the volume increment in forests administered by the State Forests amounted to 1167 million m³ of gross merchantable timber. During that period 645 million m³ of merchantable timber was harvested, which means that 522 million m³ of gross merchantable timber, representing 45% of the total increment, remained to augment standing timber resources.

The increase in timber resources is not only a result of the increase in the overall forest area. There has also been a steady increase in standing volume (measured as volume per hectare) in every age class except KO/KDO. The increase in timber resources within the State Forests is a result of harvesting in accordance with the principle of forest sustainability and of the continuing augmentation of the forest area. To some extent it may also be due to more accurate inventory methods.



Timber resources in Polish forests increase by

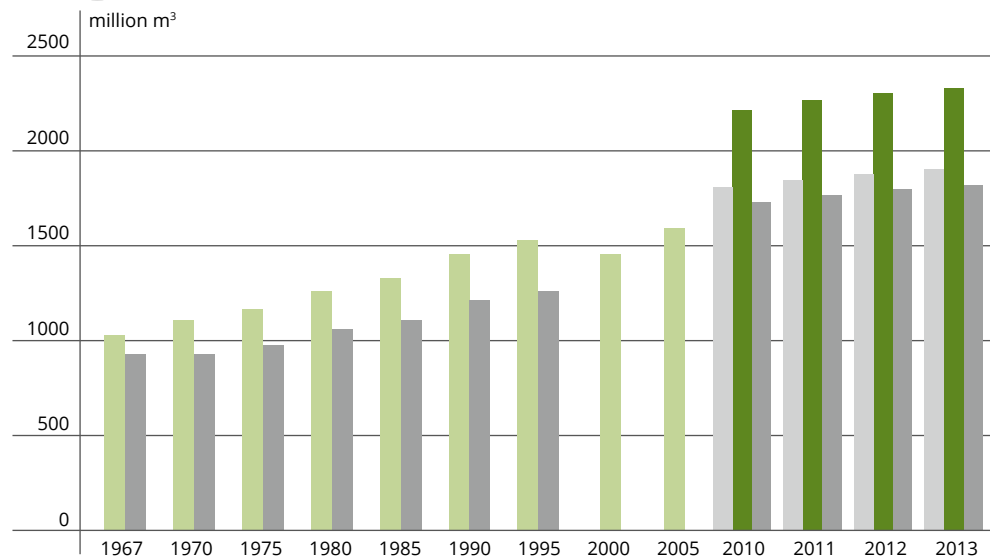
**35**  
million m³  
annually



LEGEND:

ALL FORESTS (Central Statistical Office)	THE STATE FORESTS (Large-Scale Forest Inventory*)
ALL FORESTS (Large-Scale Forest Inventory*)	THE STATE FORESTS (Forest Management and Geodesy Bureau)

\* Large-Scale Forest Inventory data for periods 2006–2010, 2007–2011, 2008–2012, 2009–2013



**TIMBER RESOURCES** in Polish forests in the period 1967–2013 (as of 1 January), in million m<sup>3</sup> of gross merchantable timber (Central Statistical Office, Forest Management and Geodesy Bureau, Large-Scale Forest Inventory)

# FOREST FUNCTIONS

Forests fulfil diverse functions, either naturally or as a result of human activities:

## ENVIRONMENTAL (PROTECTIVE) FUNCTIONS

favourable impact on shaping of the local and global climate, regulation of water cycle in nature, prevention of floods, avalanches and landslides, protection of soil against erosion and landscape against steppeisation;

## SOCIAL FUNCTIONS

providing health-enhancing and recreational conditions for society, contributing to the labour market and helping to develop environmental education of society;

## PRODUCTIVE (ECONOMIC) FUNCTIONS

primarily production of renewable biomass, including timber and non-timber products and effective management of hunting.

Forests provide employment for nearly 50 thousand people directly involved in their utilisation and protection. Forests also stimulate other industries and support many jobs in other sectors of the economy, such as timber, pulp-and-paper and energy industries.



The State Forests National Forest Holding is legally bound to practise sustainable forest management with the objective of ensuring continuity of forests and increasing their resources.



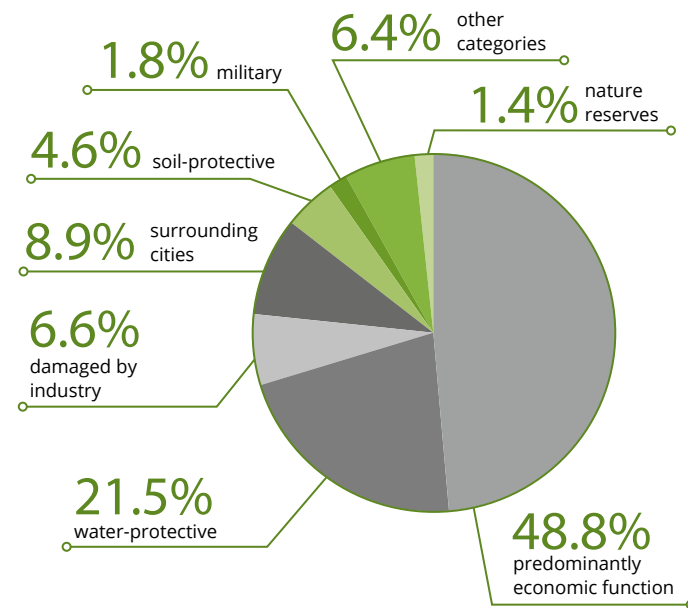
## Environmental functions of forests

Environmental and social functions of forests, often referred to as nonproductive functions, have long been recognised in forest management which begun to distinguish a category of protective forests as early as in 1957. By the year 1975, a total of 1485 thousand hectares of forests were designated as protective, which amounted to 22.5% of the forest area administered at that time by the State Forests. At present, as of 1 January 2013, the total area of protective forests stands at 3527 thousand hectares, which represents 49.8% of the total forest area, or 51.2% including 101 thousand hectares of nature reserves. The majority of protective forests are located in the mountain regions (Kraków RDSF 90.3%, Krosno RDSF 84.1%) and in areas affected by industry (Katowice RDSF 83.7%).

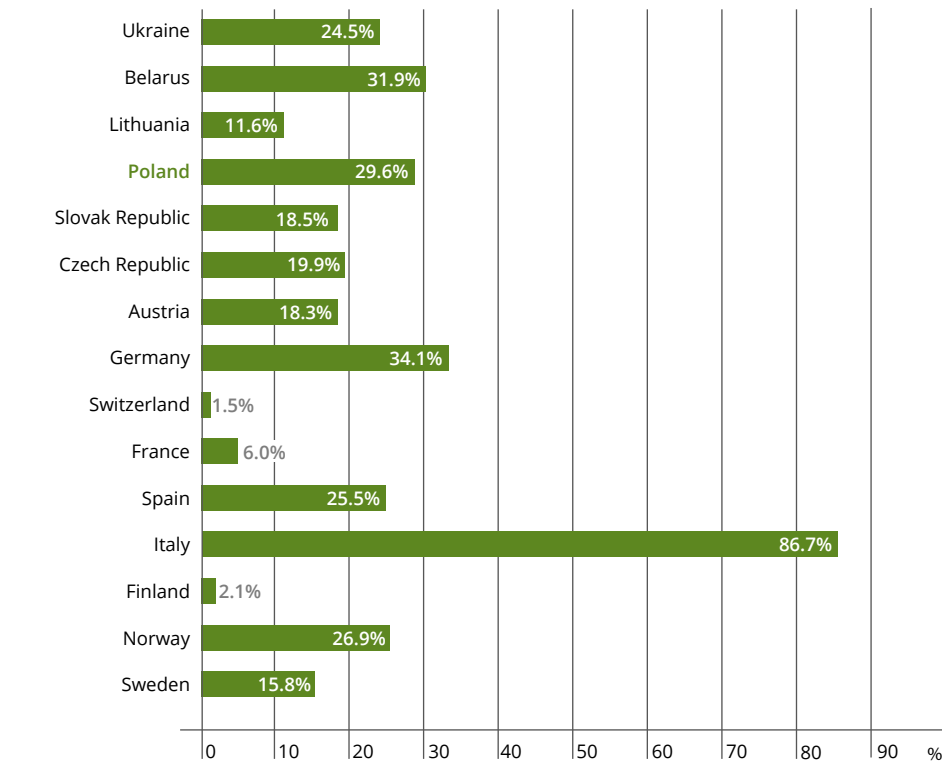
The area of private forests recognised as protective is estimated at 64.5 thousand hectares, or 3.7% of their total area. Protective forests owned by communes cover an area of 23.7 thousand hectares (27.7% of their total area). The share of protective forests in all ownership categories in the total forest area in Poland currently stands at 40.5%.

In comparison with other countries in the region, Poland has a relatively high proportion of protective forests (almost 30%, SoEF 2011). Slightly ahead of Poland are Germany (34%) and Belarus (32%) but the largest proportion of protective forests occurs in Italy (about 87%) due to large areas of soil- and water-protective forests.

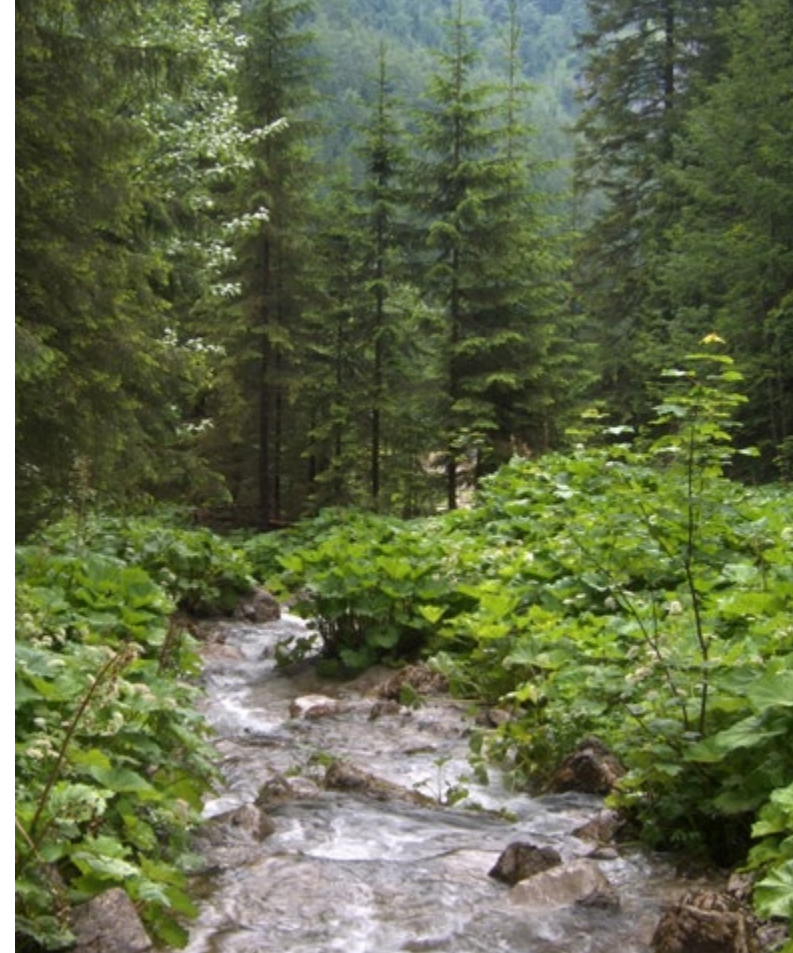
Protective forests are subject to different management practices, depending on their main function. They may include limits on clear-cutting, raising the age of trees for cutting, matching the species composition with the function or creating recreational facilities.



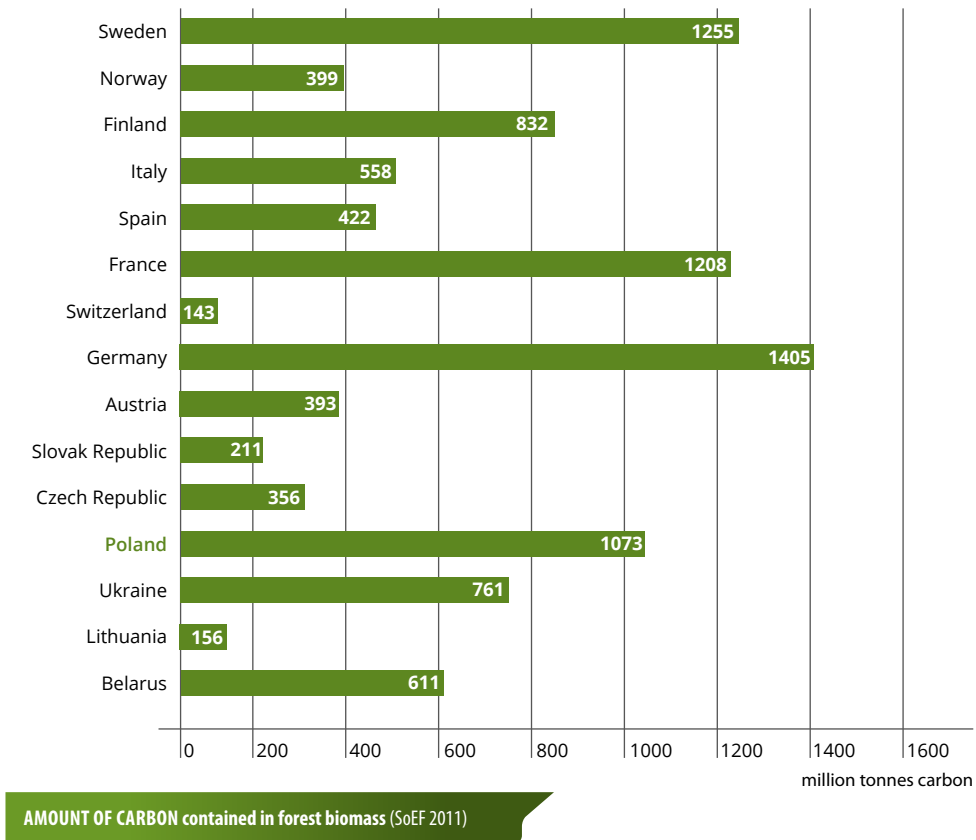
SHARE OF PROTECTIVE FORESTS in the State Forests in 2013  
(Directorate-General of the State Forests)



SHARE OF PROTECTIVE FORESTS in the total area of forests (SoEF 2011)







## Carbon sequestration

Assessment of the amount of carbon absorbed by ecosystems (including forests) was, until recently, of almost exclusively scientific interest. The growing threat of climate warming caused by the increased concentration of atmospheric CO<sub>2</sub> and the social awareness of this threat, have brought about a more practical approach which was expressed in the Kyoto Protocol (in force since 16 February 2005).

According to the estimates based on the available data on timber resources in Poland, the forest biomass contains 1099 million tonnes of carbon, of which 26 million tonnes occur in deadwood (SoEF 2011). The diagram compares the amount of carbon contained in forest biomass of several countries in the region. It also shows the size of timber resources in those countries. The amount of CO<sub>2</sub> absorbed every year by forests (including soil and taking into account utilisation) is estimated at 39.5 million tonnes, which roughly equals 10.8 million tonnes of carbon.

The reduction in greenhouse gas emissions can be achieved by implementing appropriate methods in forestry, such as increasing forest area by afforestation of post- agricultural land, using fast growing species in forest renewal, employing silvicultural methods aimed at increasing standing volume and extending the life of wood products and their recycling.



## Social functions of forests

### Forest education

Forests are a natural place for recreation and leisure, particularly for the inhabitants of large conurbations. Forests are a popular destination for excursions, mainly organised by schools, which gives young people an opportunity for direct contact with nature and provides grounding in forest education.

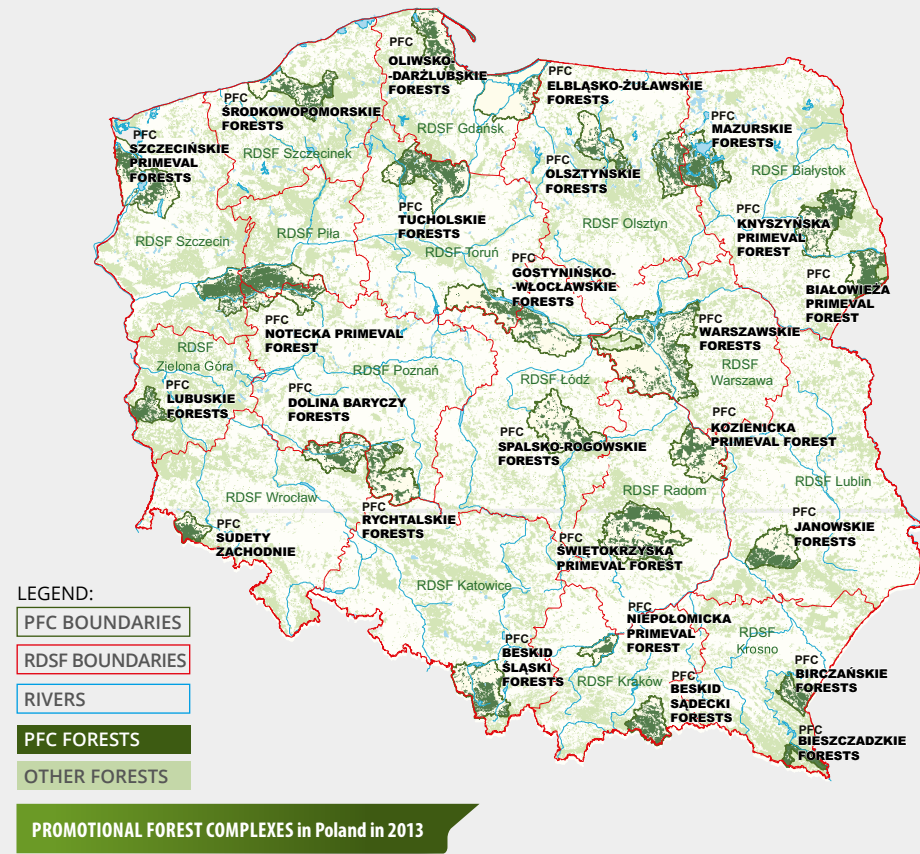
The aim of forest education is to spread the knowledge about the forest environment and sustainable forest management, to raise the awareness of the rational and responsible utilisation of all forest functions and to build society's trust with regard to the professional work of foresters. Forest education is delivered by qualified teams who continually improve their skills by attending professional training events which instruct them about teaching methodology and designing, preparing and delivering educational multimedia presentations aimed at audiences of varying ages.

Various educational programmes organised by the State Forests attracted over 3 million participants in 2013. Among the events offered were outdoor lessons and guided tours, classes held in centres for forest education, meetings with foresters in and outside schools, exhibitions, competitions, sporting events and many others.



**3**  
million  
participants  
in educational  
programmes





These diverse educational activities are supported by an appropriate infrastructure which includes: forest education centres (58), classrooms (263), teaching shelters for use as “green classes” (532), educational trails (981), educational stops (1937), a “green school”, other facilities (2504) and also overnight accommodation.

A leading role in forest education is unquestionably played by the promotional forest complexes which attract about 30% of participants in the educational programmes organised by foresters.

There are 25 promotional forest complexes located across all 17 regional directorates of the State Forests. Their total area is 1225 thousand hectares, of which almost 1200 thousand hectares are administered by the State Forests (nearly 17% of its territory). The PFCs have been established as part of the State Forests policy on promoting ecological forest management.

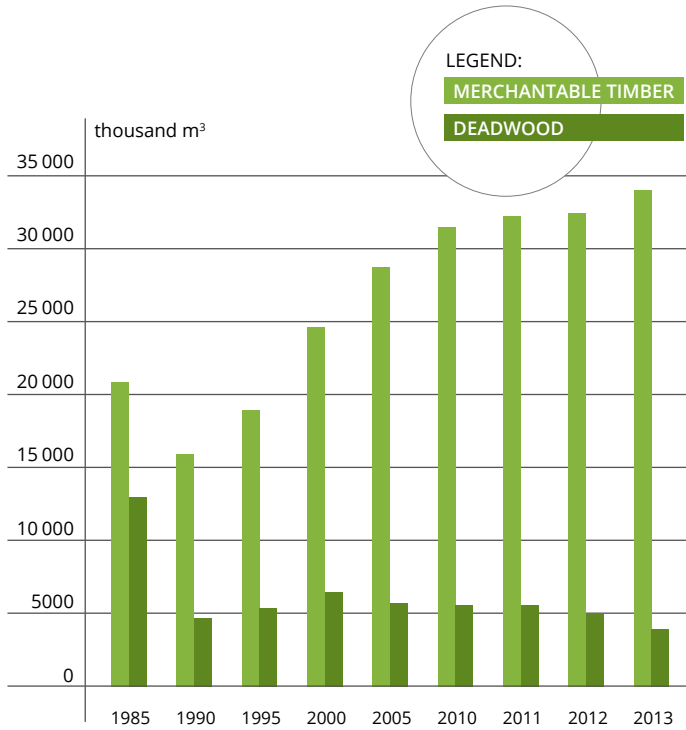


The level of utilisation of forests is determined by natural conditions, silvicultural and protective needs and, above all, by the principle of sustainability of forests and augmentation of their resources.

The volume of net merchantable timber harvested in Poland in 2013 amounted to 35 796 thousand m<sup>3</sup> (818 thousand m<sup>3</sup> more than in 2012), including 1246 thousand m<sup>3</sup> from private forests and 159 thousand m<sup>3</sup> from national parks. The State Forests harvested 36 286 thousand m<sup>3</sup> of raw timber, including 34 152 thousand m<sup>3</sup> of net merchantable timber (nearly 100% of the approximate prescribed cut), of which 16 671 thousand m<sup>3</sup> (93.7% of prescribed cut) was obtained from final felling and 17 478 thousand m<sup>3</sup> (106.7% of prescribed cut) from intermediate felling.



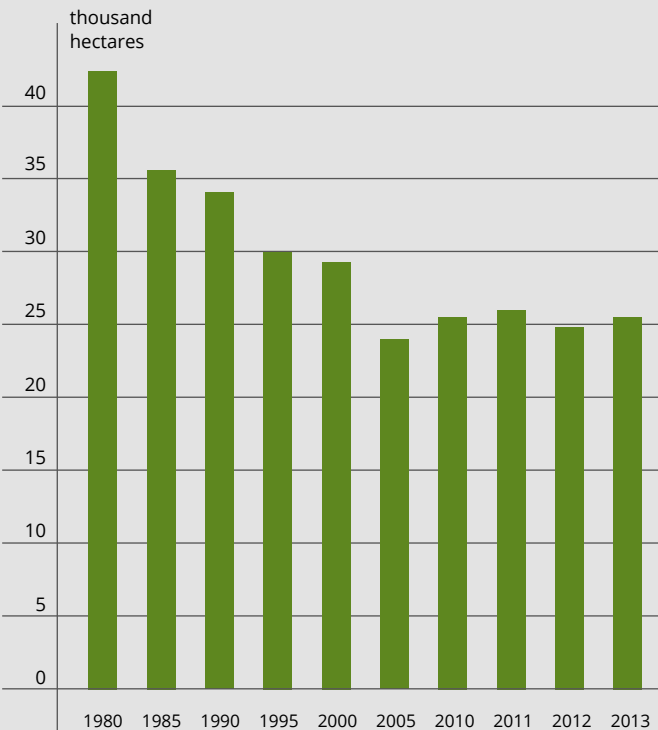
Timber harvest in Poland is  
**60%**  
of volume increment



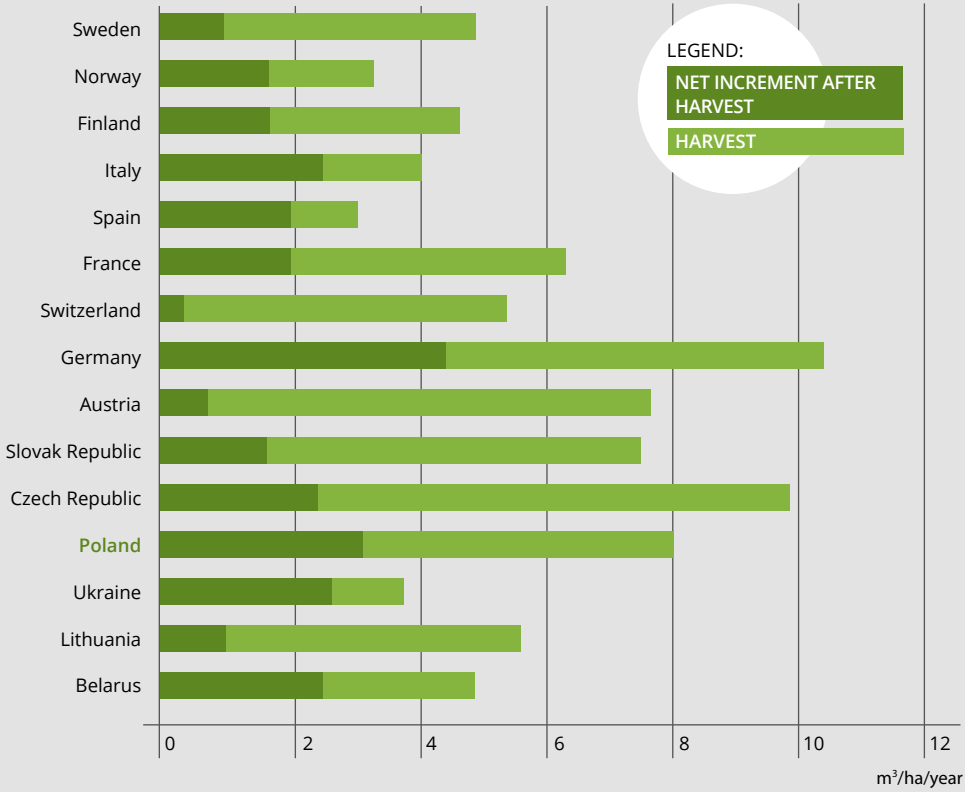
SHARE OF DEADWOOD in the total utilisation in the State Forests in 1985–2013, in thousand m³ of net merchantable timber (Directorate-General of the State Forests)

In 2013, under the clear-cut system, 6166 thousand m³ of merchantable timber was harvested in the State Forests, which accounts for 18.1% of total harvest. The clear-cut area totalled 25.7 thousand hectares and was slightly larger than the average for the past decade at 25.2 thousand hectares. The gradual reduction in size of the clear-cut area is indicative of the progress in sustainability of forest management.

A comparison of the respective indicators for a group of countries with similar geographic conditions is indicative of the intensity of forest utilisation in Poland. The majority of countries in the region harvest over 50% of the annual increment (60% in Poland), with the exception of Ukraine (33%) and Belarus (47%).



CLEAR-CUT AREA in the State Forests in the years 1980–2013, in thousand hectares (Directorate-General of the State Forests)



PROPORTION OF HARVESTED TIMBER in the volume of annual increment (SoEF 2011)





## Forests in nature and landscape conservation

Forests in Poland are one of the most valuable elements of our environment and are protected by a variety of nature and landscape conservation measures. The highest level of protection is given to national parks, which currently number 23 and cover an area of 314.6 thousand hectares, of which 195.0 thousand hectares (62%) are forests.

The 1480 nature reserves cover an area of 165.7 thousand hectares, of which 95.6 thousand hectares are forests (incomplete figure due to on-going geodesy work in two regions). The vast majority of nature reserves (1271) are administered by the State Forests. Local authorities have so far created 122 landscape parks. They cover a total area of 2610.8 thousand hectares, including 1315.5 thousand hectares (50.4%) of forests.

The areas of protected landscape include 385 nature sites with a total area of 7107.4 thousand hectares, of which 2197.7 thousand hectares (30.9%) are forests. Both forms of nature conservation account for 51% of the total area administered by the State Forests.

Within Natura 2000 network, at the end of 2013, there were 145 Special Protection Areas for birds, with a total land and sea area of 5559 thousand hectares, and 845 Sites of Community Importance (awaiting to be designated as special areas of conservation of habitats), with a

total area of 3816 thousand hectares. Currently Natura 2000 sites cover 6827 thousand hectares, which is about 20% of the country's total area. Within the State Forests they cover 38.1% of the total territory.

The State Forests, in compliance with the Forest Act and the national policy on forests, has been maintaining an inventory of all forms of nature protection, which is kept up to date with the data provided annually by forest districts.

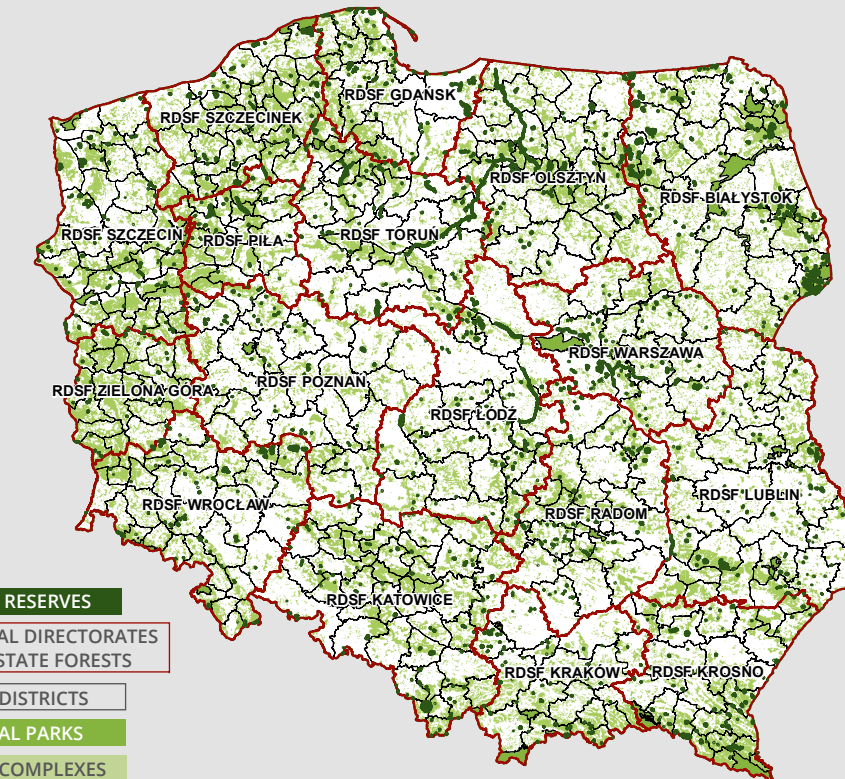


As of 31 December 2013, the State Forests inventory included:

- 1 271 nature reserves with an area of 121.7 thousand hectares;
- Natura 2000 sites with a total area of 2880 thousand hectares (38.1% of the State Forests territory). They include: 131 areas for protection of birds (SPAs) covering 2205 thousand hectares (29.1%) and 726 sites of Community importance (SCIs) with a total area of 1640 thousand hectares (21.7%);
- 10 873 natural monuments, including 8416 single trees, 1481 groups of trees, 126 tree avenues, 466 erratic boulders, 183 rocks and caves, 201 areas under monument protection (345 hectares);
- 8969 areas of ecological utility with a total area of 28 087 hectares;
- 135 documentation sites with a total area of 1068 hectares;
- 135 nature-and-landscape complexes with a total area of 47 501 hectares.

Additionally, 3201 protective zones have been created within the State Forests, with a total area of 141 403 hectares, in order to protect refuges of rare birds, mammals, reptiles, insects and lichens.

In the total area of forest stands under special protection over 204 279 hectares of stands are designated as the seed base which supplies material for maintaining native ecotypes of forest-forming species in our forests.



LEGEND:

**NATURE RESERVES**

**REGIONAL DIRECTORATES OF THE STATE FORESTS**

**FOREST DISTRICTS**

**NATIONAL PARKS**

**FOREST COMPLEXES**

**NATURE RESERVES in Poland within the territory administered by the State Forests (Directorate-General of the State Forests)**

The population of elk has increased by **486%** in the last decade

The State Forests also initiate their own programmes aimed at maintaining biological diversity and protecting and restoring endangered species of flora and fauna. Among them are “Programme for the preservation of forest genetic resources”, “Programme for the restitution of fir in Western Sudety”, “Programme for the restitution of yew” and numerous projects focusing on reintroduction of wood grouse, black grouse, peregrine falcon, lynx, edible dormouse and bison. There are 9 animal rehabilitation centres run by forest districts, 6 botanical gardens and 5 arboreta.

The State Forests, in order to carry out projects aimed at protecting valuable elements of ecosystems, obtain additional government and EU funding, eg. from the Life+ programme or Priority Axis 5.

Game animals, whose number in Poland is one of the highest in Europe, are indicative of the richness of species of the forest fauna. In 2013 there was a small increase in the size of populations of most game animals, as compared with 2012. In the last decade, however, this increase has been significant, most notably in the population of elk (486%). The reverse trend was observed only in the population of partridge (decrease of 20%).

The State Forests initiate various actions aiming at increasing the numbers of game animals, their restitution and widening of the gene pool (eg. fallow deer). In the last 10 years, for example, there was a 30% increase in the population of hare, which was previously in decline.

## THREATS TO THE FOREST ENVIRONMENT

Forests in Poland are among the most threatened in Europe due to a constant and simultaneous impact of a number of factors which have detrimental effect on the health of forests. The negative phenomena, often called stress factors, can be classified with respect to their origin as **abiotic, biotic and anthropogenic**.

### Abiotic threats

Several abiotic factors had devastating effect on forests in 2013, with most damage caused by heavy snow fall and ice accretion, disturbances in water relations (both flooding and draught) and hurricane-force winds. The amount of wood from fallen and broken trees, which was harvested in 2013, reached 1 924 347 m<sup>3</sup> and was 41% less than in 2012.

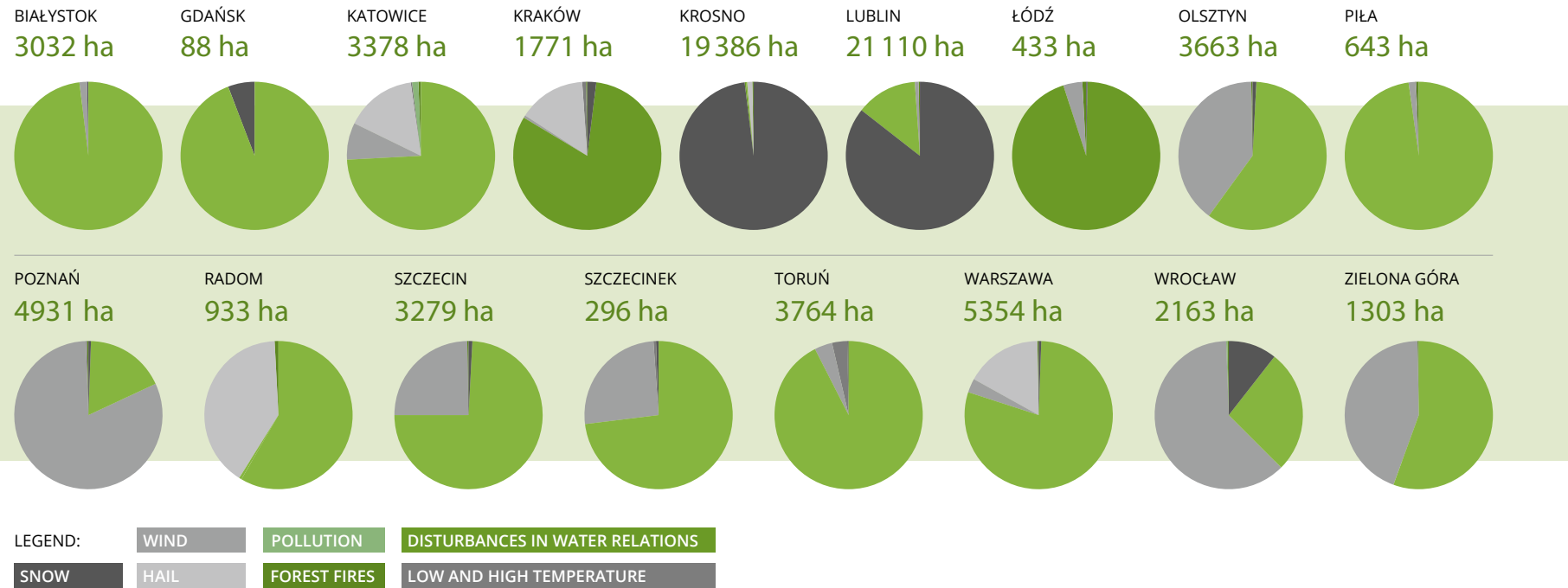
Damage caused by abiotic factors to forests in 2013 was reported on an area of 71 504 hectares in total. The largest area of 33 513 hectares was damaged by snow and ice accretion, disturbances in water relations caused damage to 26 213 hectares, high winds to 9230 hectares and hail to 2255 hectares.

In 2013 the threat from abiotic factors was most evident in the stands in the south-east regions of Poland. Other regions of the country suffered significantly less damage.



Over **71 000** ha of forest were damaged by abiotic factors





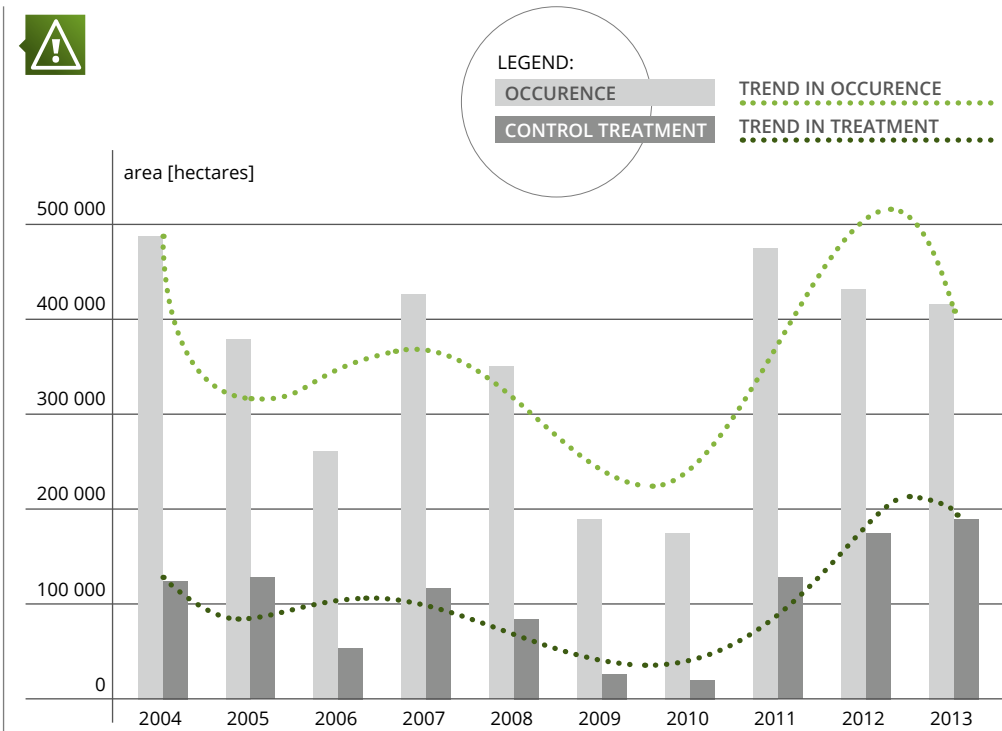
## Biotic threats

### Threats to forests from primary insects

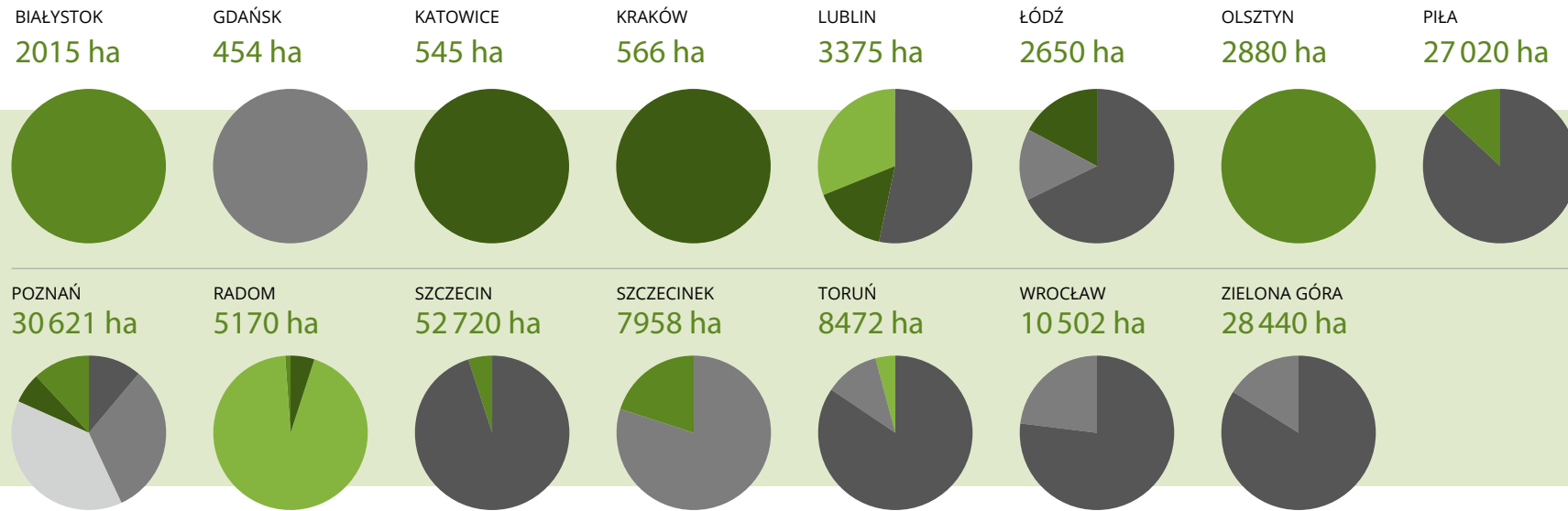
Threat to forests from primary insect pests in 2013 was at a comparable level to the years 2011–2012. In the State Forests the total area on which these pests occurred was 421.5 thousand hectares and was smaller only by 1% than the area affected in 2012. It was necessary to apply control treatment aimed to reduce populations of 42 primary insect species and groups. In the State Forests the control treatment in 2013 covered an area of 193.5 thousand hectares, which was 7.2% larger than in the previous year.

In the State Forests most damage was done by folivorous insects attacking pine and broadleaved (mainly oak) stands and by primary pests in nurseries, plantations and young pine stands.

The area of pine stands attacked by folivorous insects in 2013 was 320.5 thousand hectares, a 1% decrease on 2012. Control treatment against this category of pests covered 160.8 thousand hectares, a 1.5% increase on the previous year.





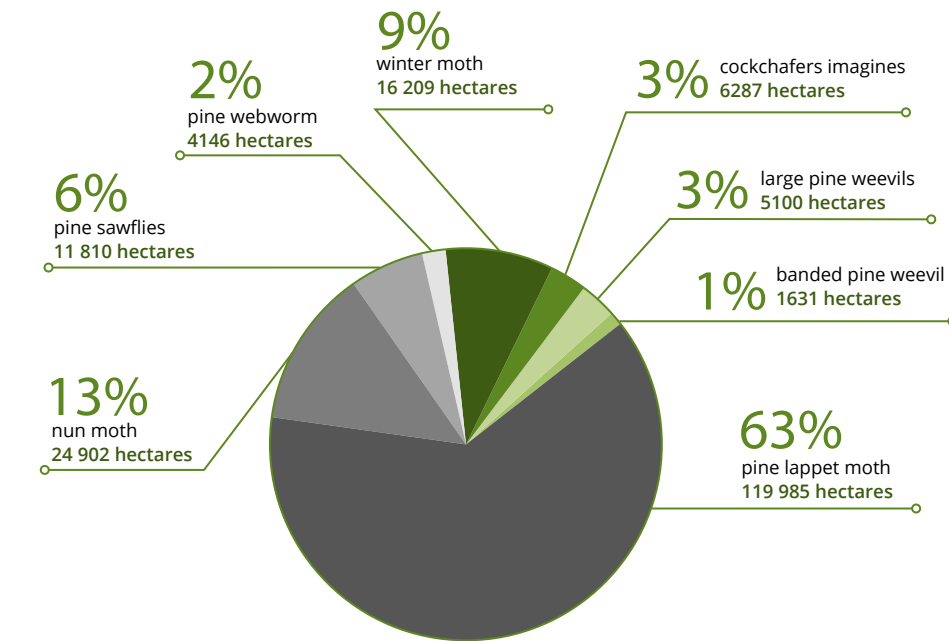


#### LEGEND:



AREA OF POPULATION CONTROL TREATMENT against main species of primary insect pests in each RDSF in 2013

No control treatment was used in the territories of RDSF Krosno and Warsaw



AREAL SHARE OF POPULATION CONTROL TREATMENT applied against major primary insect pests in 2013

pests occurring in pine stands are marked in grey, in broadleaved stands in dark green and in nurseries, plantations and young stands in light green

Primary insects were fought against on **195** thousand ha in the State Forests

In 2013, a 13% decrease in a total area affected by folivorous insects attacking broadleaved stands (mainly oak) was noted, from 61.5 thousand hectares in 2012 to 53.3 thousand hectares. This was due to a decrease in size of an area affected by infestation of cockchafers. Other groups of insect pests were also active in 2013, among them those which attack the roots of forest trees and shrubs, as well as pests affecting spruce, larch, fir and Douglas fir.

The total area of broadleaved stands where control treatment against folivorous insects was applied was 22.5 thousand hectares, an increase of 77% on the previous year.

The presence of pests attacking roots of trees and shrubs was observed on a total area of 32.3 thousand hectares in 2013, an increase of 1.2 % on the previous year.

Insect pests attacking plantations and young stands occurred on a total area of 12.6 thousand hectares in 2013, which was a decrease of 3.7 thousand hectares (23%), compared with the previous year. Control treatment was applied in an area of 8.8 thousand hectares, a small increase (of 42.5 hectares) on 2012.

Insect pests feeding on spruce, larch, fir and Douglas fir occurred on an area of 2.8 thousand hectares, which was 6% larger than the area affected in 2012. The increase in the area of affected stands was a result of the growth of populations of insects which hitherto did not constitute a significant threat. The control treatment was used on a total area of 85 hectares of fir, spruce and larch stands, which was 2.5 times smaller than in the previous year.



## Threats to forests from secondary insects

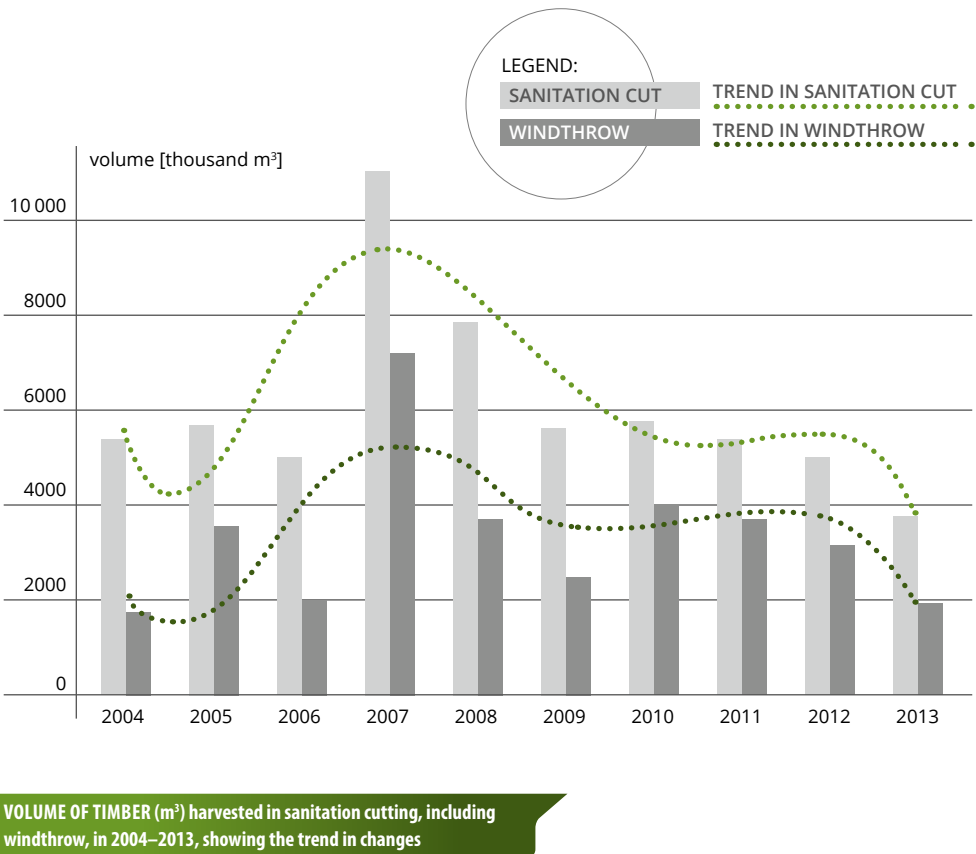
The level of threat to forests from secondary insect pests in 2013, measured by the volume of wood removed in sanitation cutting, was by 25.6% lower than in 2012. Sanitation cutting produced 3803 thousand m<sup>3</sup> of timber, of which just over half was windthrow (50.6%). This was the lowest level of threat from secondary pests in the last ten years.

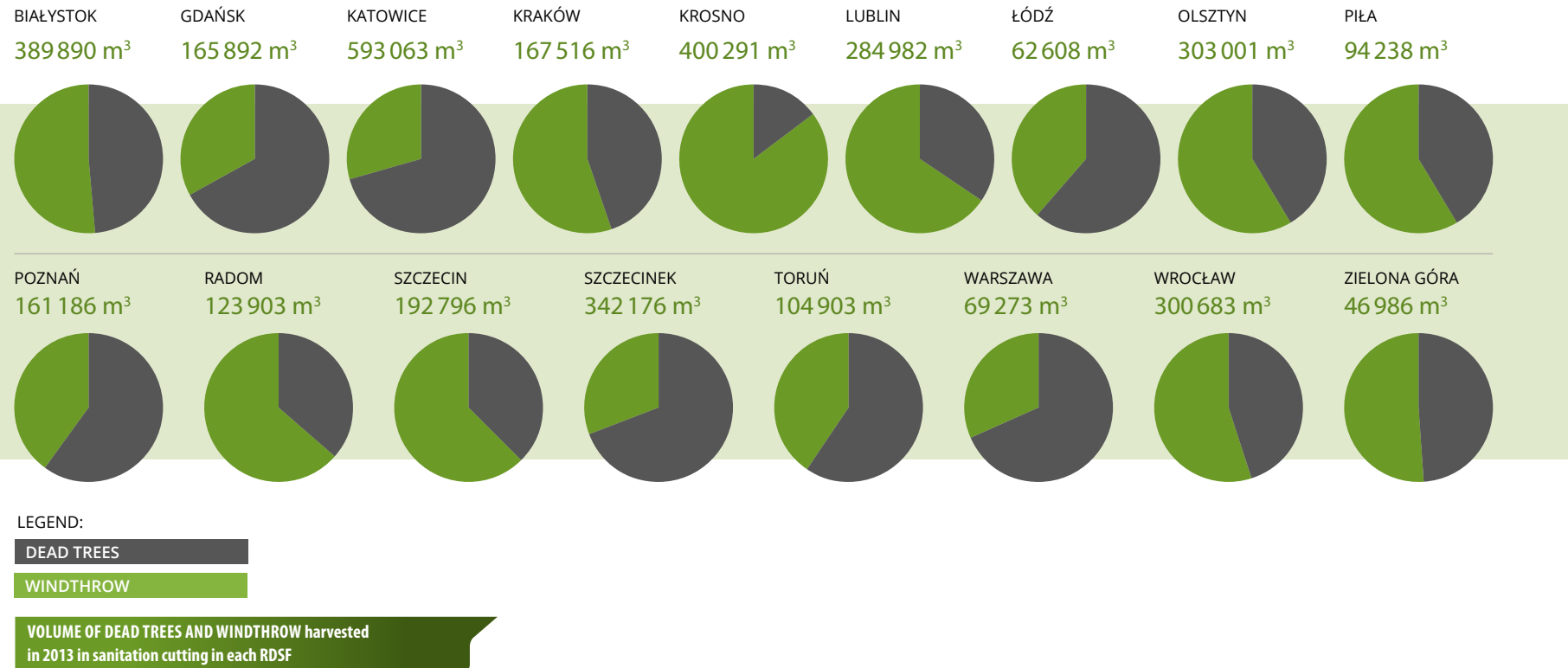
Most affected were coniferous stands, from which 2900 thousand m<sup>3</sup> of timber was harvested, of which nearly half was windthrow and 35% of raw timber was infested by secondary pests.

Over half of the conifer timber harvested in 2013 in sanitation cutting was pine, amounting to 1537.2 thousand m<sup>3</sup>, of which 60.8% was windthrow.

The amount of spruce timber harvested in sanitation cutting in 2013 was 1239.3 thousand m<sup>3</sup>, of which 25.7% was windthrow.

Significantly lower level of threat from secondary insect pests was observed in broadleaved stands in 2013. Sanitation cutting produced 903.4 thousand m<sup>3</sup> of hardwood. Timber obtained from windthrow amounted to 64% of the total volume of sanitation cutting.





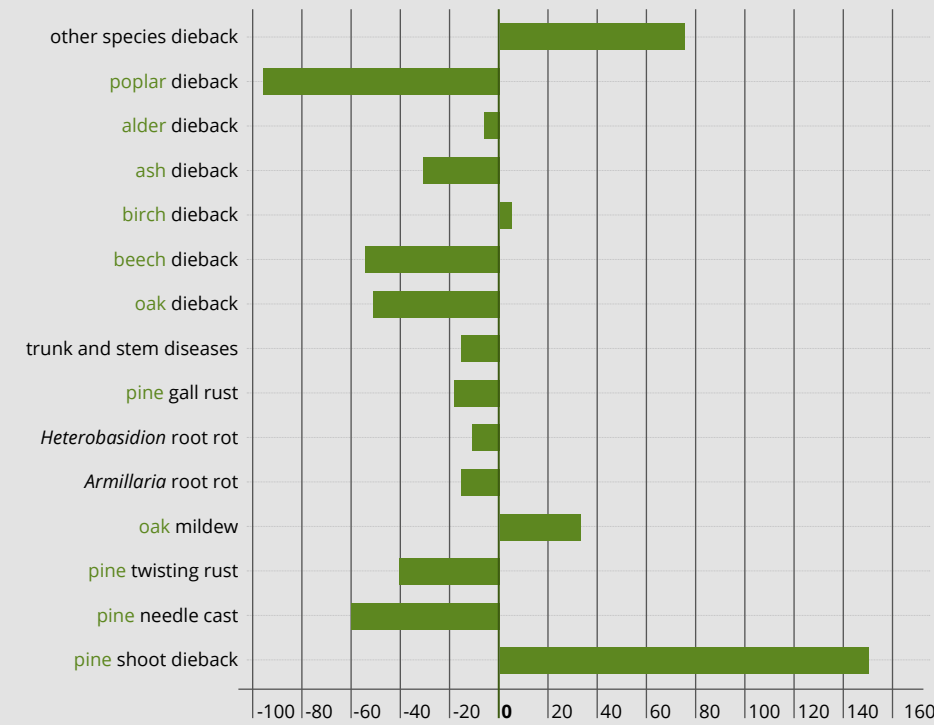
## Threats to forests from infectious fungal diseases

In 2013 infectious diseases were reported over a total area of 286.6 thousand hectares of stands, a decrease by nearly 37.1 thousand hectares (or 11.5%) compared with 2012. The most important change in the level of threat concerns pine shoot dieback which was reported on a total area of 3.13 thousand hectares, which was 2.5 times larger than in 2012.

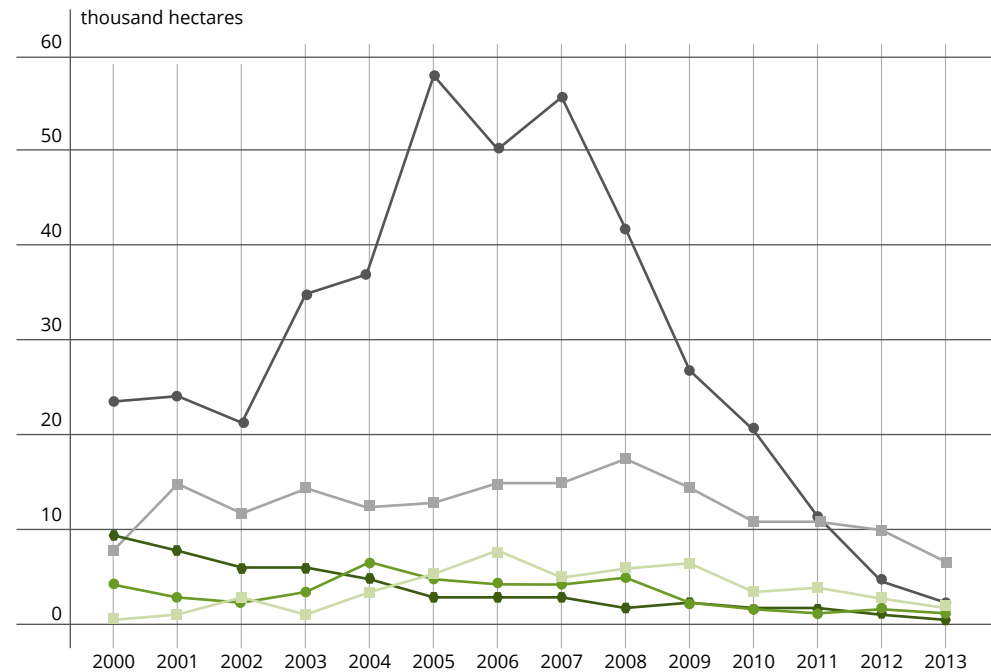
Other diseases of assimilatory apparatus (pine needle cast *Lophodermium*, pine twisting rust, rust fungi) affected smaller areas than in 2012. The area affected by gall rusts of pine decreased by 500 hectares. The incidence of trunk and stem diseases was reported on an area of 29.2 thousand hectares (a decrease of 5.2 thousand hectares on 2012).

The improvement in health condition of broadleaved stands continued in 2013. Areas affected by dieback of oak, beech, ash, alder and poplar decreased by 55%, 56%, 29%, 6% and 94%, respectively. The area affected by birch dieback was only larger by 36 hectares. However, dieback of other species was on the increase and affected an area of almost 1 thousand hectares (566 hectares in 2012), which was mainly due to dieback of larch and to a lesser extent of sycamore and spruce.

Areas affected by root diseases generally decreased by 25.6 thousand hectares and a decrease was noted in spread of *Armillaria* root rot and *Heterobasidion* root rot by 16% and 7%, respectively.







LEGEND:

ALDER BIRCH BEECH ASH OAK

AREA AFFECTED BY DIEBACK of selected species of broadleaved trees in the State Forests in 2000–2013

Generally, the health condition of forest stands with a share of broad-leaved tree species significantly improved in 2013. The multi-factor disturbances occurred in stands in an area of 14 506 hectares, a decrease of nearly 7.0 thousand hectares (32%) on the previous year.

In the State Forests the health condition of forests across all RDSF largely showed improvement or stabilisation, as compared with 2012. The largest increase in hazard (by 79.3%) was observed in the Poznań RDSF, which was caused entirely by a nine-fold increase in the area affected by oak mildew (5.6 thousand hectares, compared with 613 hectares in 2012). A small increase (10–20%) in occurrence of fungal diseases was reported in the Katowice, Kraków and Wrocław RDSFs. In the remaining regions the areas affected by diseases were largely at the level seen in 2012 (within 90–108%) or they decreased (by 20–60%).

Infectious fungal diseases are controlled in forest nurseries using mainly chemical methods and, as necessary, in stands using biological or mechanical methods. In 2013 the total area to which chemical treatments were applied was 58.3 hectares. Biological methods of control were used on 19 652 hectares and mechanical methods on 2866 hectares.

## Damage caused by animals

In 2013, as compared with 2012, there was a small increase (by 8.4%) in damage to forests caused by animals. Damage to trees occurred on 105.1 thousand hectares in total, including 39.9 thousand hectares of plantations, 40.7 thousand hectares of young stands and 24.5 thousand hectares of stands in older age classes.

Various preventive measures were put in place on nearly 100 thousand hectares of plantations in 2013. The size of the area of renewed forests needing protection from animals has been increasing every year.

In addition to damage caused by game animals in 2013, the stands were under pressure from species under various forms of protection, eg. elk, beaver and bison.



LEGEND:

OLDER STANDS YOUNG STANDS PLANTATIONS

AREA OF STANDS in which damage caused by herbivore mammals in 2004–2013 exceeded 20%



## Anthropogenic threats

### Forest fires

There were 4883 forest fires in 2013 (compared to 9265 in 2012). The burnt area covered 1289 hectares of stands, which is almost 6 thousand hectares less than in the previous year. The largest number of fire events took place in the Mazowieckie province (23% of the total number), the lowest – in the Opolskie and Warmińsko-Mazurskie provinces.

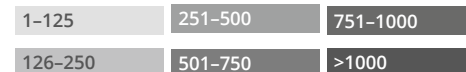
In the State Forests there were 1682 forest fires in 2013 (34.4% of all forest fires in Poland), which covered an area of 261 hectares (20.2% of the total). These figures exclude the territories used by the military where there were 31 forest fires covering an area of 25 hectares (in the previous year the corresponding figures were 51 and 391 hectares).

The most frequent causes of fires in the State Forests were arson (41%) and careless adults (25%). 4% of fires spread from areas other than forests. The number of fires of unknown origin (25% of all fires and 27.6% of burnt forest area) is still high. The corresponding figures for forests under all ownership categories were: 41.3% fires caused by arson, 33.8% caused by careless adults and 18.6% of unknown causes.

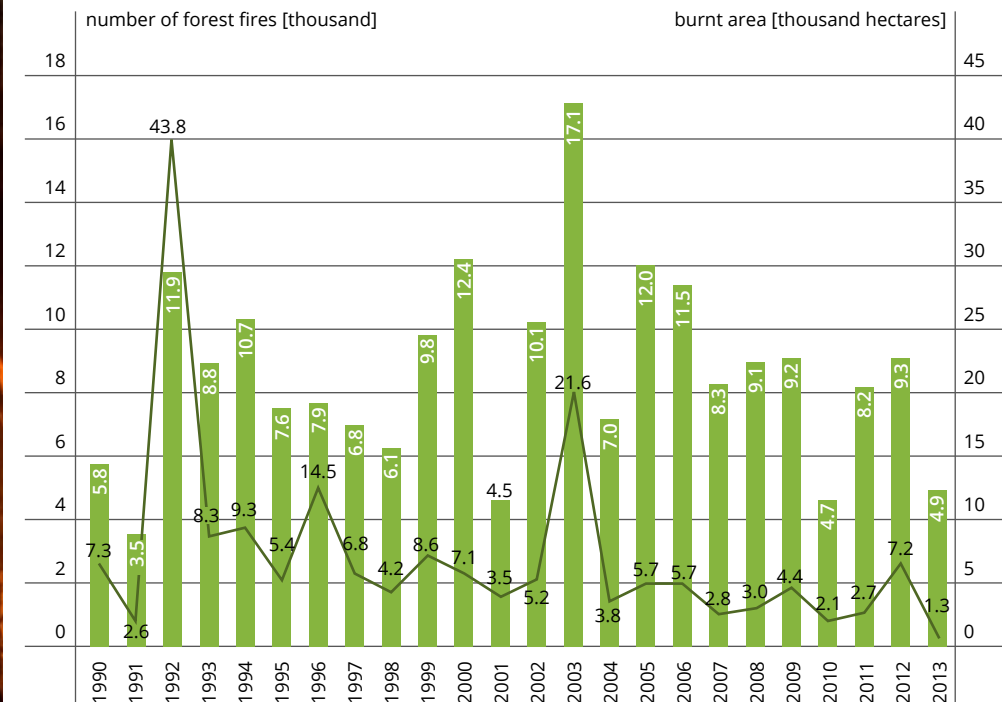
The largest number of fires occurred in August (1307 fires, or 26.8% of all fires), July (19.2%), April (17.5%) and May (14.6%). The smallest number (of the risk period) occurred in June and September.



NUMBER OF FOREST FIRES:



NUMBER OF FOREST FIRES AND THE BURNT AREA  
by province in 2013



LEGEND: NUMBER OF FOREST FIRES BURNT AREA

NUMBER OF FOREST FIRES and burnt  
area of stands in Poland in 1990–2013

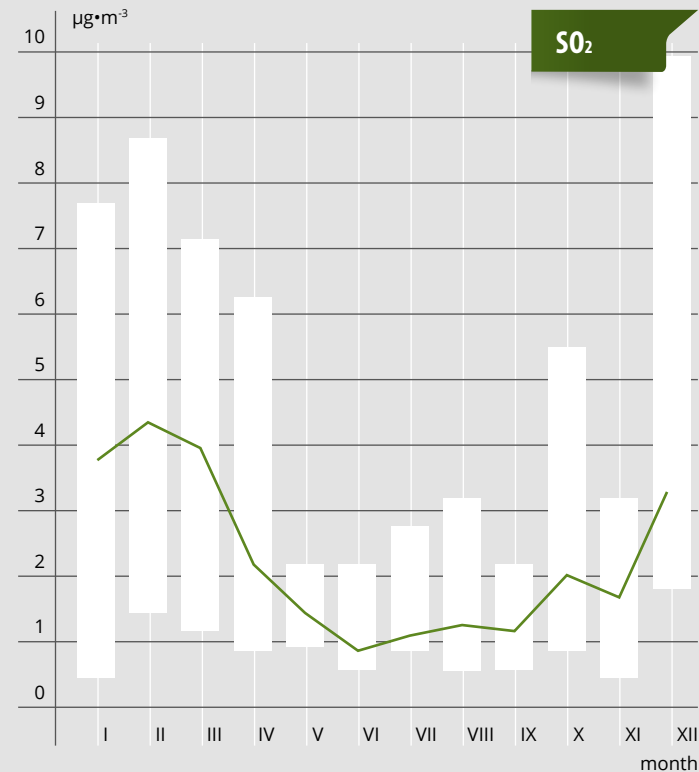


Chemical composition of the air pollution changed with the seasons: the highest concentration of  $\text{SO}_2$  and  $\text{NO}_2$  was observed in the six winter months, which coincided with the heating season and therefore increased emissions.

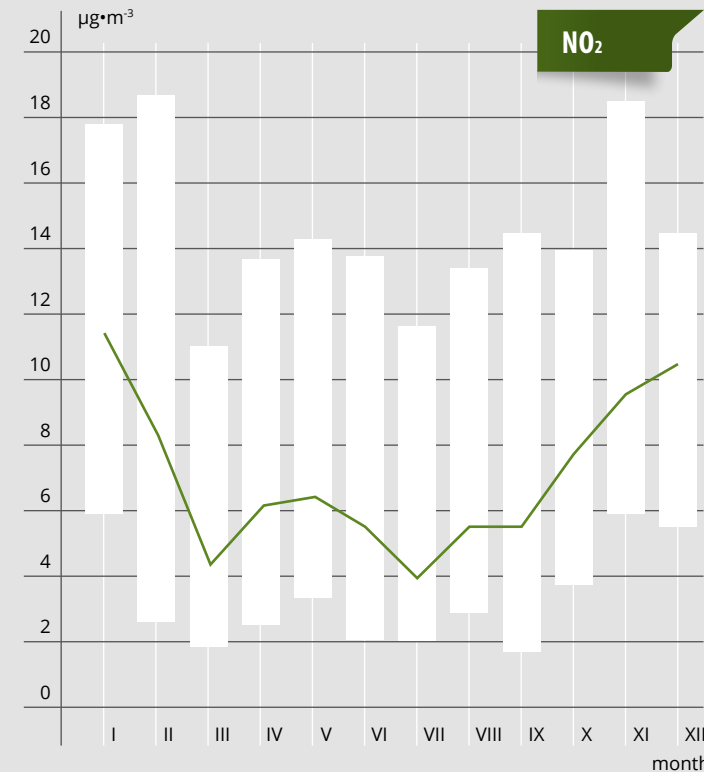
## Air pollution

Information on major pollutants in forests in different regions of Poland is supplied by the forest monitoring network. The network consists of 12 permanent observation plots located in pine, spruce, oak and beech stands across the country.

Average monthly concentration of sulphur dioxide and nitrogen dioxide in the air measured on the observation plots were within  $0.4\text{--}9.8\ \mu\text{gSO}_2\cdot\text{m}^{-3}\cdot\text{m}\cdot\text{c}^{-1}$  and  $0.3\text{--}18.8\ \mu\text{gNO}_2\cdot\text{m}^{-3}\cdot\text{m}\cdot\text{c}^{-1}$ . The lowest concentration of sulphur dioxide was observed in the north-east regions of the country while the highest occurred in the south, particularly in the foothill and mountain regions and in Upper Silesia. In central Poland these values were in the mid-range.



CHANGES IN CONCENTRATION (average, minimal and maximal values) of sulphur dioxide and nitrogen dioxide in the air, measured on intensive monitoring observation plots in 2013



CHANGES IN CONCENTRATION (average, minimal and maximal values) of nitrogen dioxide in the air, measured on intensive monitoring observation plots in 2013

The level of concentration of nitrogen dioxide, as in previous years, was the highest in the central regions of Poland. Forests in the north-eastern regions and in the southern foothill and mountain areas had a significantly lower concentration of  $\text{NO}_2$ .

Pollution is cleared from the atmosphere by means of precipitation and deposition, such as rain, snow, drizzle, fog, etc. Acidic precipitation is defined as having pH value below 5.6. More than half of the monthly precipitation recorded on permanent observation plots in 2013, as in the previous year, was acidic with the pH value below 5.5.

The levels of air pollution such as those recorded in the last few years rarely cause direct, acute or large-scale hazard to forests in Poland. However, they pose a risk of chronic damage to stands caused by constant exposure to substances such as compounds of sulphur and nitrogen.

The forest monitoring network consists of

12 permanent plots





## Threats to forest sustainability

In addition to insect infestations, fungal pathogens and animals, forests in Poland are also exposed to a variety of abiotic factors which, on occasions, cause large-scale disasters threatening the sustainability of forests. Climate changes observed in recent years have an impact on the health condition of stands and also on populations of forest insect pests.

The main responsibility for rebuilding forests and maintaining them in good health and appropriate structure falls on the State Forests. In 2013 rebuilding of forest stands was carried out in an area of 9.1 thousand hectares, cleaning on 141.4 thousand hectares and thinning on 456.4 thousand hectares. Additionally, the stability of stands was being reinforced by the introduction of understory (0.5 thousand hectares), a second story (4.5 thousand hectares), by filling gaps (1.4 thousand hectares) and by water drainage work (60.6 thousand hectares).

The work which is being done in order to enhance the sustainability of forests, mainly by rebuilding stands to match them with the

habitat conditions, does not always prevent damage, especially when faced with unpredictable weather conditions. It was necessary, therefore, to find more long term solutions to preserving threatened forest ecosystems in Poland, including securing seed material from trees, shrubs and forest floor plants. As a result the Kostrzyca Forest Gene Bank was opened in December 1995. It is located in Miłków in the foothills of the Karkonosze mountains and was a collaborative project between the State Forests and the Institute of Dendrology of the Polish Academy of Sciences.

The Kostrzyca Forest Gene Bank has a stock of 5809 genetic resources relating to 90 species of forest flora, both whole populations and individual plants. Of these, 28 species are of trees and forest-forming shrubs and the remaining 62 species are of rare and protected plants which are listed in the *Polish red book of plants*. Resources of the Gene Bank constitute seed batches kept in liquid nitrogen for a long-term storage, which have been harvested from the selected seed stands, conservation stands and from maternal trees and tree-monuments.

The work of the Kostrzyca Gene Bank is focused on maintaining the genetic diversity of forest plant communities. Communities characterised by greater genetic diversity adapt better to constantly changing environmental conditions because they are less susceptible to the negative impact of biotic and abiotic factors.

The Kostrzyca Gene Bank in Miłków collaborates with other scientific institution in Poland and abroad. It initiates research and contributes to a variety of scientific projects.



## Level of damage to forests

The level of damage to forests in Poland has been assessed every year since 1989 as part of the forest monitoring programme which is one of the elements of the National Environment Monitoring system.

Assessment of defoliation in 2013 covered 39 640 trees over the age of 20 years, which were located on 1982 Level I permanent observation plots (20 trees on each plot).

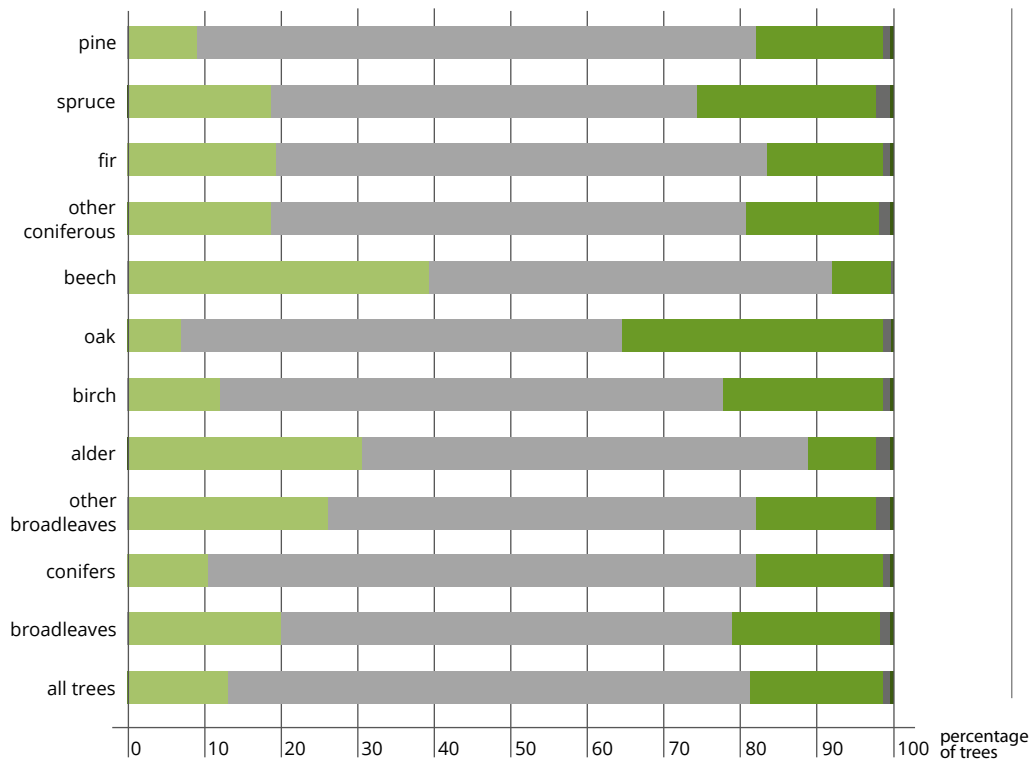
In that sample, 13.7% of trees showed no defoliation (defoliation class 0 – healthy trees), including 10.4% of conifers and 20.0% of broadleaves. The largest share of coniferous trees without any defoliation was reported for fir (19.2%), and the smallest – for pine (9.2%). The largest share of healthy broadleaved trees was reported for beech (39.4%) and the smallest – for oak (6.4%).

The share of damaged trees with defoliation over 25% (defoliation classes 2–4) for all species was 18.8%; the share among conifers was 17.8% and among broadleaves 20.7%. The lowest share among the conifers had fir (15.9%) and the highest spruce (27.0%). Among the broadleaves beech had the lowest share (7.3%) and oak the highest (34.8%).



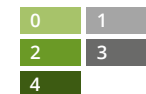
**Fir  
and  
beech**  
are the healthiest  
species in Polish  
forests





SHARE OF MONITORED TREE SPECIES on Level I permanent observation plots (Forest Monitoring) in defoliation classes in 2013

#### CLASS:



Class 0 – 0%–10% defoliation  
 Class 1 – 11%–25% defoliation  
 Class 2 – 26%–60% defoliation  
 Class 3 – above 60% defoliation  
 Class 4 – dead trees

The health condition of forests varies slightly on a national scale depending on their ownership status. In the forests administered by the State Forests the share of healthy trees of all species (class 0) was 14.1% and damaged trees (classes 2–4) 18.1%. Forests in private ownership had a smaller share of healthy trees (12.7%) and a larger share of damaged trees (19.8%). In national parks the shares of healthy and damaged trees were greater than in both the State Forests and in private forests at, respectively, 15.3% and 22.2%.

The condition of stands which were part of large forest complexes was significantly better than of stands in smaller and scattered forest areas.

In the years 2009–2012 there was deterioration in the health of Polish forests but in 2013 a small improvement was observed.

Compared with other European countries, Polish forests rate as average with respect to their health status. In our region, Czech Republic, Slovak Republic and Germany have a higher proportion of damaged trees, whereas Belarus, Russia, Denmark, Ukraine, Estonia, Latvia and Finland have for several years reported a lower level of damage to forests.

## SUMMARY

- In our climatic and geographical zone, forests are the most natural formation. They are a crucial element of ecological balance, life continuity, landscape and neutralisation of contaminants, thus counteracting environmental degradation. Forests, as a form of land use, assure biological production with a market value and help to shape the quality of human life.
- Forest ecosystems account for 37.0 % of the land area under legal protection. The share of protected forests in the total forest area is 40.4%, while the share of protective forests is 40.5%. The areas of Natura 2000 network cover about 20% of the country's land area. Within the State Forests, Special Protection Areas for birds (SPAs) cover 2205 thousand hectares (29.1% of the State Forests territory) and Sites of Community Importance (SCIs) – 1640 thousand hectares (21.7%).
- Poland's timber absorbed every year by forests resources have been steadily increasing. Their volume stands at 2.4 billion m<sup>3</sup> of gross merchantable timber. Timber resources in the State Forests (1.9 billion m<sup>3</sup>) are the largest in the country, the standing volume is 272 m<sup>3</sup>/ha and their average age is 58 years. In privately-owned forests these indicators are 228 m<sup>3</sup>/ha and 47 years, respectively.
- In 2013 the area of post-agricultural land and wasteland afforested under the "National programme for the augmentation of forest cover", which assumes the increase in forest cover to 30% by 2020 and to 33% by 2050, decreased again in comparison with the previous years. The total area of (artificial) afforestation was 4.1 thousand hectares (4.9 thousand hectares in 2012 and 5.3 thousand hectares in 2011).



Forest ecosystems occupy 37.0% of the area under legal protection in Poland. In the country's total forest area protected forests occupy 40.4% while forests designated as protective 40.5%.



Only  
**18.1%**  
of timber is harvested  
in clear-cutting

- 35 796 thousand m<sup>3</sup> of net merchantable timber was harvested in Poland in 2013, of which 34 149 thousand m<sup>3</sup> came from the State Forests (100% of the volume of approximated annual prescribed cut). Area size of clear-cuts was limited to 25.7 thousand hectares and timber harvested from clear-cutting to 6166 thousand m<sup>3</sup> of merchantable timber (18.1% of total harvest). Utilisation of timber resources in the State Forests in 2013 was at a lower level than the volume of increment, as it was in the past 20 years when harvest volume was about 55% of the volume of increment.
- Health condition of Polish forests, assessed on the basis of the level of defoliation of tree crowns, showed a slight improvement in 2013. The share of damaged trees (defoliation in excess of 25%, defoliation classes 2–4) stood at 18.8% (23.4% in 2012); the share of healthy trees increased from 11.3% in 2012 to 13.7% in 2013.
- Activity of the most dangerous primary insect pests in 2013 stayed at similar level to that of the years 2011–2012. This group of pests occurred on 421.5 thousand hectares of the State Forests territory and the control treatment covered an area of 193.5 thousand hectares. Threat to forests from secondary insect pests has decreased by 25.6% in comparison with the previous year.
- The area affected by infectious fungal diseases decreased by nearly 12% in 2013 and stood at 286.5 thousand hectares (324 thousand hectares in 2012).
- Damage to forests was also caused by herbivore mammals, mainly red deer, roe deer and elk, and locally by rodents (beavers and mice).

## GLOSSARY

**Afforestation** – the establishment of new forests on the land previously used for agriculture or on wasteland.

**Age class** – an agreed period, usually 20 years, which allows the grouping of stands by age; for example, stands aged up to 20 years form class I, stands ranging from 21 to 40 years form class II, and so on.

**Amount of cut, yield** – the amount (volume) of timber for harvesting derived from management objectives and financial plans.

**Annual prescribed cut by volume in the State Forests** – an annual measure of utilisation of forests as set out in forest management plans. It is calculated as a sum of final and pre-final (intermediate) cuts for each forest district (approximately equalling 1/10 of the cut prescribed for a 10-year period). The annual quotas may vary depending on forest condition, but the overall harvest in each district must balance over a 10-year period during which the current forest management plan is in force.

**annual prescribed cut in final cuts in the State Forests** – an annually averaged sum of final cuts agreed for every forest district; the volume of harvest is set out in the forest management plan (usually established for a 10-year period) and should not be exceeded.

**annual prescribed cut in pre-final cuts in the State Forests** – an annually averaged sum of approximate pre-final cuts agreed for every forest district.

**Bark stripping (peeling)** – a method of feeding by ungulate animals using their teeth to strip off the bark from standing or cut trees.



A

B

**Biological diversity (or biodiversity)** – the variety of life forms on Earth or in a given area, usually related to three levels of nature organisation:

- species diversity – a variety of species,
- ecological diversity – a variety of community types (biocoenoses, ecosystems),
- diversity of genetic resources – a variety of genes forming a gene pool of a population.

**Class for restocking (KDO)** – a type of vertical structure of stands in which there is simultaneous utilisation and regeneration under the canopy of the parent stand, and in which the level of regeneration does not yet meet the standard requirements.

**Cleaning** – a series of tending treatments aimed at adjusting the composition of species, the structure and density of stands and the quality of young trees;

**early cleaning** – cleaning in plantations prior to crown closure;

**late cleaning** – cleaning during the period between crown closure and the beginning of self-thinning of trees.

**Clear-cuts** – an area from which all trees have been removed in one operation (final cut) and which is designated for reforestation within five years.

**Deadwood** – trees which are dead or dying as a result of excessive crowding in the stand, attacks by primary or secondary insect pests, the impact of industrial emissions, changes in water relations, etc.

**Defoliation** – loss of leaves or needles which intensifies with a worsening health condition of a tree.

**Diameter at breast height** – diameter (thickness) of a standing tree measured at the standard height of 1.3 m above ground level.

**Epiphytotic** – epidemic (mass) occurrence of plant diseases in a given

area, caused by a single pathogenic agent (eg. fungus) whose development is facilitated by a particular set of favourable conditions.

**Economic seed stands** – stands whose origin and quality indicate that seeds harvested from them will produce valuable progeny thus ensuring long-lasting production of timber of satisfactory quality and quantity.

**Ecotype** – race, ecological form – the entire population of one plant species found in a specific location; it develops as a result of long-term conditioning by specific (local) properties of the environment; ecotypes vary with regard to their physiological and, less frequently, morphological characteristics.

**Final cutting (felling)** – harvesting of wood associated with renewal of stands or deforestation as a result of a change in land-use; the wood obtained from final felling is known as the final cut timber.

**Folivores (folivorous species)** – leaf-eating animals.

**Forest cover (or index thereof)** – percentage of the area covered by forests in the country's total land area.

**Forest ecosystem** – a basic ecological entity which is represented by a relatively homogenous plot of forest and in which habitat, flora and fauna are interdependent and function as a whole.

**Forest habitat (site) type** – a generalised concept of the group of stands on sites of similar suitability for forest production; the basic unit of the typological classification applied in Poland.

**Gene conservation stands (in situ conservation stands)** – stands selected for preservation of endangered populations of the indigenous tree species.

**Managed forests** – forests which are managed according to a plan and whose function is to produce wood and other forest products, while applying the principles of spatial and temporal order.

**Merchantable timber (large timber)** – (1) the volume of a tree above stump with a diameter at the thinner end of at least 7 cm with bark (refers to standing timber), (2) round wood with a diameter at the thinner end of at least 5 cm without bark (refers to harvested timber).

**gross merchantable** – timber with bark,

**net merchantable** – timber without bark and losses during harvest.

**Outbreak (gradation, infestation)** – a mass occurrence of insect pests as a consequence of favourable environmental factors for a given species.

**Pathogens** – factors causing diseases; primary pathogens attack healthy organisms while secondary pathogens attack already damaged organisms (eg. trees).

**pH** – indicator of acidity level, eg. of soil.

**Pollutant emission** – gaseous substances and particles in the air, which impact upon their surroundings, i.e. by reaching organisms and ecosystems and exerting influence on them.

**Pre-final (intermediate) cutting (felling)** – harvest of wood associated with stand tending procedure.

**Promotional forest complex (PFC)** – a forest area of special ecological, educational and social value, established for the purpose of promoting sustainable forest management and protection of natural resources.

**Protective forests** – forests under special protection because of their functions or vulnerability to threats.

**Repellents** – substances used to protect young trees from damage caused by animals

**Regeneration (renewal, restocking, reforestation)** – new forest

stands established after the removal of previous stands by felling or as a result of damage by natural causes;

**natural regeneration** – stands established as a result of self-seeding or suckering;

**artificial regeneration** – stands established by man by planting or seeding.

**Restocking class (KO)** – a type of vertical structure of stands in which there is simultaneous utilisation and regeneration under the canopy of the parent stand, and in which the level of regeneration permits the subsequent stages of tending.

**Selected seed stand** – a stand of high quality trees whose main purpose is seed production; they are excluded from felling for a defined period of time (excluded from final felling).

**Selection structure (BP)** – a type of vertical structure of stands, representing groups and clumps of trees of uneven age and size.

**Small-sized timber** – round wood with a diameter at the thicker end (under bark) of up to 5 cm.

**Standing volume** – the volume of all live trees in a given area (stand, province, country, etc.), with a diameter (with bark) over 7 cm at breast height. Standing volume is often calculated per hectare.

**Thinning** – cuts made in immature stands after they have passed through the cleaning period, during which economically undesirable trees are removed. Thinning has a positive effect on the quality of stands as it allows the trees to increase their volume, height and crown size.

**early thinning** – cuts covering a period of intensive natural self-thinning process;

**late thinning** – cuts following early thinning.



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**Timber resources** – a total volume of trees in forest, usually equated with the estimated volume of merchantable timber in stands

**Tree volume** – the amount of wood expressed in cubic metres ( $\text{m}^3$ ).

**Volume increment** – an increase in the volume of 1) a tree, 2) a stand (including harvested timber) over a period of time;

**current increment** – an increase in volume over a specified period of time; depending on the length of that period it can be:

- current annual increment,
- periodic current increment (more than one year),
- current increment over the whole period (from origin to a specified age);

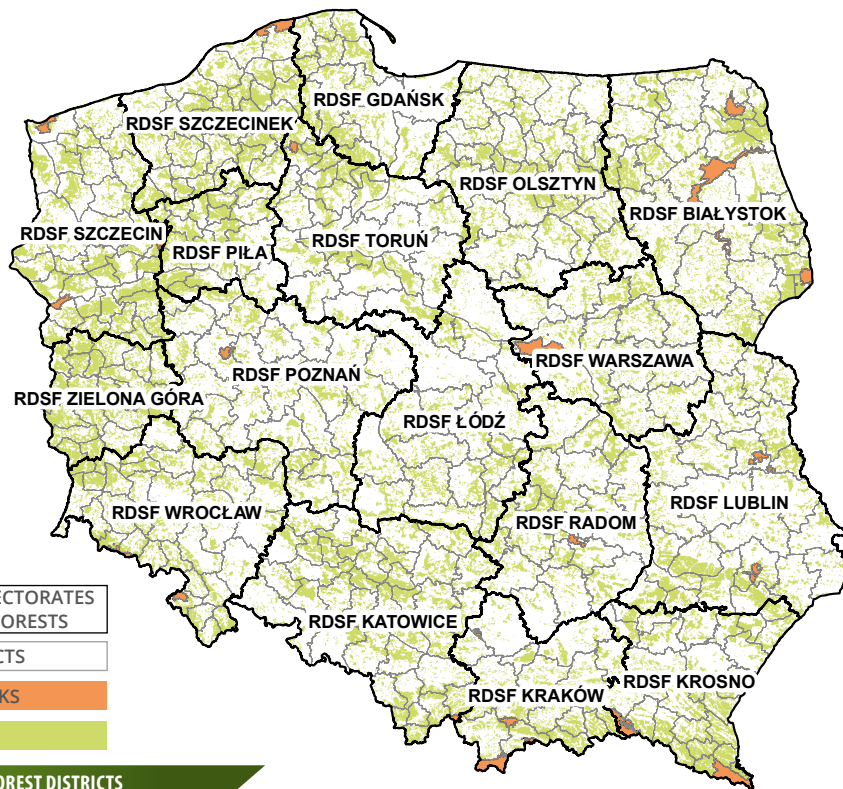
**mean annual increment** – quotient of the current increment and the length of the period of time:

- mean annual increment over a specified period,
- mean annual increment over the whole period (from origin to a specified age).

**Windthrows** – trees broken or brought down by wind.







LEGEND:

REGIONAL DIRECTORATES  
OF THE STATE FORESTS

FOREST DISTRICTS

NATIONAL PARKS

FORESTS

TERRITORIES OF FOREST DISTRICTS  
and regional directorates of the State Forests



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