

Forestry in Poland with special attention to the region of the Pomeranian Young Moraine

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Abstract

In the year 2004 the ASFV celebrated its 50th anniversary holding a conference in Sulęczyño, Kartuzy. This event offered the possibility to give an actual overview of forest resources and forest functions in Poland. The excursions of the meeting focused on the fascinating, diversified forest landscape formed by the Pomeranian phase of the Baltic glaciation. The Kartuzy Forest District is situated in the heart of the Kashubian Lakeland and the moraine hills. The landscape is not only characterized by the natural occurrence of Baltic beech forests but also by high diversity of soils and meso- and microclimatic deviations providing habitats for rare plant species, including some plants typical of mountain regions. The tree species combination of the District is formed by pine, spruce, and beech. The oldest parts of the forests are legally protected as nature reserves.

I. POLISH FOREST RESOURCES

At the end of the 18th century the Polish forest area comprised about 40%, nowadays forests in Poland cover approximately 8,942,000 hectares, which is 28.6% of an overall country area. According to international standards (**FAO Forestry Department**) and tests on economic forestry areas, the wooded area in Poland comprises more than 9,040,000 hectares, which is as many as 30% forest cover and is close to Central European average (www.fao.org/forestry/site/18308/en/pol).

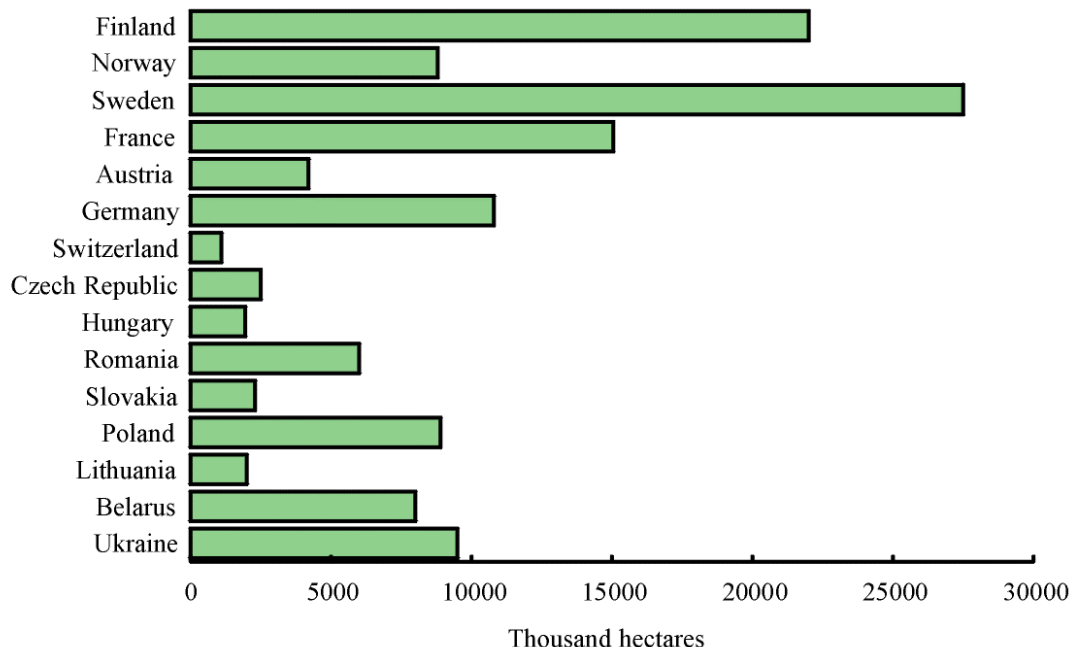


Fig.1: Total forest area.

This proportion allows Poland to rank among a group of countries with the largest share (after France, Germany and Ukraine) in the region (Fig.1). Forest area per person covers 0.24 ha and is one of the smallest in the region.

1. The forest ownership structure

State forests (78,5%) dominate in the forest ownership structure, which has not changed since end of World War II, whilst the national parks share of wooded areas has increased from 1% in 1985 to 2% in 2003 (Table 1).

Table 1: The ownership structure of forests in Poland (source: CENTRAL STATISTICAL OFFICE).

Detail	31.12.1987		31.12.1995		31.12.1998		31.12.1999	
	Th. ha	%	Th. ha	%	Th. ha	%	Th. ha	%
Total	8668	100.0	8756	100.0	8813	100.0	8850	100.0
Public forests	7189	82.8	7262	82.9	7304	82.9	7331	82.8
Treasury-owned including:	7145	82.4	7186	82.0	7226	82.0	7252	81.9
State Forests-managed	6810	78.5	6868	78.4	6915	78.5	6936	78.4
National Parks	84	1.0	162	1.9	181	2.0	182	2.0
Other	-	-	156	1.7	129	1.5	134	1.5
Local authority owned	44	0.5	76	0.9	78	0.9	79	0.9
Private forests including ownership:	1479	17.2	1494	17.1	1509	17.1	1519	17.2
by natural persons	1382	15.9	1397	15.9	1415	16.0	1424	16.1
by land cooperatives	72	0.8	68	0.8	68	0.8	69	0.8
by farming cooperatives	25	0.3	14	0.2	11	0.1	9	0.1
other	-	-	15	0.2	17	0.2	17	0.2

State forests also predominate in Western European countries such as Switzerland or Germany. The European countries can be divided into 3 groups: post-Soviet Union States, where 100% of forests belong to the state, Scandinavian countries together with France and Austria with a vast majority of forests in private ownership, and other countries with varied ownership structure and with state forest dominance (Fig. 2). In Poland the biggest amount of forests in private ownership concentrates on the south/east of Poland (39-44%) whilst the western regions hold the smallest amount (1.2-2.3%).

2. The area structure of trees resources

Forests in Poland mainly occur on the poorest soils, as reflected in the structure of the forest site types. Here coniferous forest habitats prevail, occupying 58.7% of the overall forest area. Forest sites with a better nutrient supply cover 41.3% of the area including alder forests and flooded swamp forests, which cover 3.7%.

The distribution of the forest site types in Poland shows a clear central area with predominant coniferous forest habitats close to the northern and eastern Polish borders, with more coniferous and mixed forests than in any other parts of the country. In most parts of the country the stands are dominated by Scots pine. Coniferous species dominate in 75.8% of the forest area. Here the pine has found the best climatic and site conditions within its Eurasian range, and has created many valuable ecotypes, such as the pine originating in north-east Poland.

During the post-war period the share of state forests significantly increased, effecting a rise of broad-leaved species from 13% to 23%. Despite the extension of the deciduous forests their share is still smaller than the potential.

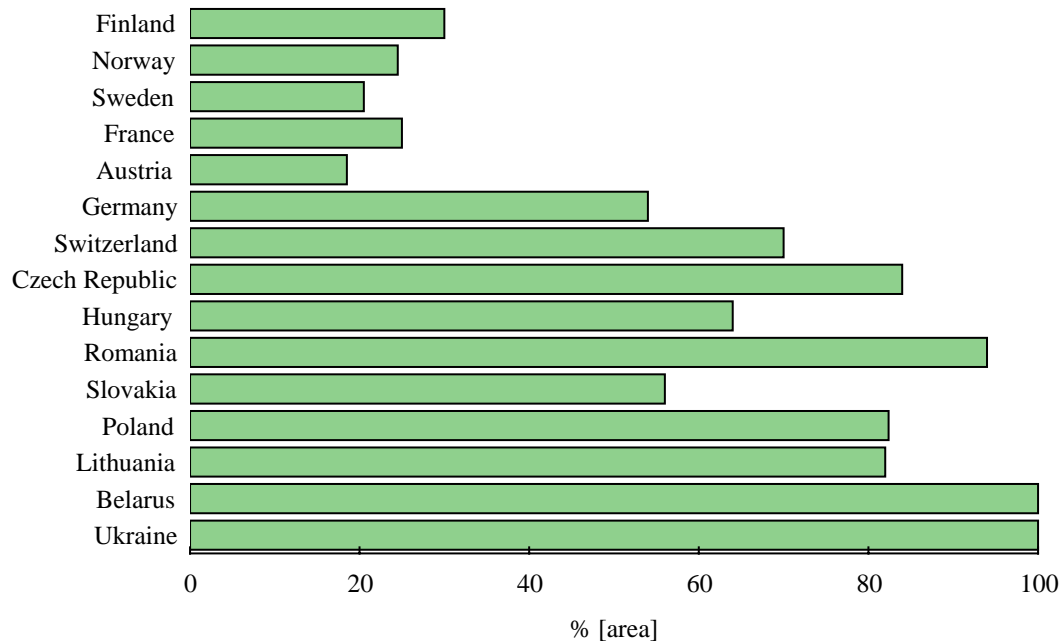


Fig. 2: Shares of total forest area under public ownership.

In the age structure classes of second and third age stands prevail, covering 21.8% resp. 23.8% of the overall area. Stands older than 100 years cover 8.3% of the area and comprise 13.3% of stand volume. The change in the stand age structure is indicated by following facts:

- stands of 80 years and older have been steadily increasing, with about 0.9 mio ha in 1945 and about 1.6 mio ha in 2003,
- the average age of the stands also steadily increased, in 2003 constituting 59 state and about 40 private forests.

In Polish forests there are relatively few stands older than 120 years, influenced by the superiority of coniferous stands, which usually have a shorter lifespan than broad-leaved trees.

3. Changes in forest area

In the years 2001-2020 Polish forestry intends to afforest barren grounds covering about 680 thousand ha, enlarging the forest area to 30% in 2020 and to 33% in 2050. The main and the largest area to be afforested will probably be situated in central and eastern Poland. In the last few years a significant (almost double) increase of forest areas on private grounds has been noticed.

Table 2: Area of forest in Poland by group of types and ownership structure (source: OFFICE OF FOREST MANAGEMENT AND SURVEY).

Detail	State Forests		National Parks		Private Forests		Total	
	Th. ha	%	Th. ha	%	Th. ha	%	Th. ha	%
Total	6900.6	100.0	180.0	100.0	1590.6	100.0	8671.2	100.0
Coniferous trees	5383.6	78.0	107.4	59.7	1170.4	73.6	6661.4	76.8
Pine and larch	4858.2	70.4	68.2	37.9	1008.9	63.4	5935.3	68.4
Spruce	388.9	5.6	30.1	16.7	89.2	5.6	508.2	5.9
Fir	136.5	2.0	9.1	5.0	72.3	4.6	217.9	2.5
Broad-leaved trees	1517.0	22.0	72.6	40.3	420.2	26.4	2009.8	23.2
Oak, ash, maple, elm	462.0	6.7	8.4	4.7	65.4	4.1	535.8	6.2
Beech	320.8	4.7	37.2	20.7	45.2	2.8	403.2	4.6
Hornbeam	20.9	0.3	1.0	0.5	17.2	1.1	39.1	0.5
Birch and robinia	385.7	5.6	11.1	6.2	131.7	8.3	528.5	6.1
Alder	298.1	4.3	13.4	7.4	143.1	9.0	454.6	5.2
Aspen, lime, willow	8.3	0.1	1.5	0.8	15.7	1.0	25.5	0.3
Poplar	21.2	0.3	-	-	1.9	0.1	23.1	0.3

An alarming thing is the constant decrease of the youngest stand area (first age class) in state forests, which may influence the future forest stability. The reasons for such a trend may be: reduction of final cutting in favour of intermediate cutting as well as reduction of clear cut systems. However, the positive consequence of the final cutting reduction is the increase of the older stand area. Nevertheless, the fact that trees are kept over cutting age leads to a depreciation of the timber price.

4. The volume structure of tree resources

At present the estimated tree resources of Polish state forests comprise 1,523 mio m³ of merchantable timber and 0,189 mio m³ of gross merchantable timber in private forests - altogether about 1,787 mio m³ of gross merchantable timber. Stands at the age of 41-80 are the majority of the resources, covering 42% of the overall forest area. On state territory pine trees constitute almost 70% of the tree resources compared to 55% in private and communal forests. Poland has a relatively big overall forest area, larger than the European average content (213 m³/ha including brush wood) and (after Germany and France with 1,908 mio m³) the third largest tree resources of merchantable and brush wood, as far as size is concerned, in the region.

5. Changes in tree resources

In the years 1983-2003 in forests administered by State Forests the gross merchantable wood increment was about 903 mio m³. At that time 514 mio m³ of large timber were cut, which means that 389 mio m³ of gross merchantable wood, which is about 43% of the overall increment, increased stand resources. At that time the average annual increment of gross merchantable wood volume was 6.58 m³/ha while the average increment of gross merchantable wood from the last five years was 7.73 m³/ha in the State Forests' area. A diverse stand structure and species composition requires a wide range of nursery and protective activities by Polish forestry. Therefore the logging process in Poland includes site-adapted techniques such single tree or group selection systems.

II. FOREST FUNCTIONS

Forests perform various functions:

- **Ecological (protective) functions**, such as a valuable influence on the climate, water circulation, reduction of the risks of flooding, avalanches and landslides, protection of soil against erosion and protection of landscape against the development of steppes.
- **Productive (economic) functions**, i.e. producing timber and by-products.
- **Social functions**, such as profitable health and recreation conditions for the society and support of the job market.

1. Productive forest functions

In 2003 in Poland 28.7 mio m³ of net merchantable wood were cut, with 1.15 mio m³ in private forests and 0.2 mio in National parks. A significant factor in the process of wood exploitation was dry-wood volume obtained during sanitary cuttings as well as the volume of windthrows, having reached 6.5 mio m³. The quantity of wood harvested from 1 ha is 3.88 m³.

2. Ecological forest functions

The protective forest area in State Forests is as big as 3.3 mio ha, which constitutes 47.2% of an overall forest area. The biggest area is covered by water-protecting forests – 1.4 mio ha, followed by city-neighbouring forests - 0,6 mio ha, forests protecting from industrial pollution – 0.6 mio ha and soil-protecting forests – 0.3 mio ha. The private protecting forest area is estimated to be as big as 83.7 thousand ha, which is 5.4% of an overall area.

3. Forest biodiversity protection

For many years the state forests have compiled lists of valuable types of biological variety updating them regularly in the programme "Nature preservation in Poland" in almost 90% of the Polish forest districts. The state forests incorporate 1,162 nature reserves (overall number 1,368) covering an area of 108,812 ha, and 9,993 nature monuments. Additionally 2,949 protection zones for selected animal species were created, covering an overall area of 178,459 ha, including 57,158 ha of strict protection zones. They are also working on updating the area of virgin forests and other ecologically important forests, e.g. those appearing on humid or dune sites. The records also include forms and objects with importance for the protection and preservation of the biological forest variety. They include swamps, marshland, peatlands and little lakes. Over 243,000 ha of seed stands should be taken into consideration as well.

The forest fauna variety may be expressed by game, whose number in Poland is one of the biggest in Europe. The majority of hoofed species exist in large quantities, being at the same time a permanent threat to the forests. Since the late 1990s a steady but rather insignificant increase of the number of the majority of game species has been noticed. Over the last two years such an increase was also visible in case of the populations of hare, pheasant and partridge, whose number had significantly decreased before.

4. Forests in nature and landscape preservation

Forests and their components are the most valuable and widespread element of all types of nature and landscape conservation. 23 national parks, covering an area of 315,000 ha and including 192,000 ha (61%) untouched central zones (http://www.mos.gov.pl/kzpn/ind_gb.htm). In Poland 120 landscape parks have been created, covering an area of 2,573,000 ha. Both national and landscape parks cover the overall area of 32% (10,053,000 ha) of the country.

5. Natura 2000 network

The total list contains 248 sites (this includes 8 sites which consist of SPAs¹ and pSCIs² within the same borders i.e. where SPAs and pSCI overlap completely), covering in total 10.3% of Poland's terrestrial territory (Tab. 4). One-third of the SPA area is covered by forests (1,115,000 ha). According to the NGOs' assessment, the list is definitely insufficient and according to scientific criteria needs to be significantly increased. The locations and the boundaries of the areas can be investigated under:

<http://natura2000.mos.gov.pl/natura2000/en/mapy.php>

Table 4: Natura2000-Data submitted to the European Commission on 1st May 2004. Source:

http://www.iucn-ce.org/documents/natura2000/natura2000_ce.pdf

Natura2000 sites:	Number	Area (ha)	% of country area
SPAs	72	3,312,800 (2,433,400 terrestrial)	7.8 of terrestrial area
pSCIs	184	1,171,600 (1,171,600 terrestrial)	3.6 of terrestrial area
SPAs & pSCIs	8	378,978	no data
Total	248	no data	10.3

III. FORESTS IN REGIONAL DIRECTORATES OF THE STATE FORESTS GDAŃSK

State Forests Regional Directorate (RDLP) in Gdańsk was created in 1945. In the years 1945-2003 the area of over 37,000 ha was afforested and restored, which increased the local forest area from 19.5% to 29.0%. Owing to the improvement proceedings, stand volume increment increased from 2.87m³/ha in 1946 to 5.12m³/ha in 2003. At present, RDLP Gdańsk administers the area of 304 thousand hectares, including 285 000 hectares of forest lands. The management (within its range there is, on average, 0.15 ha of forest per one inhabitant) supervises the work of 15 forestry districts being subdivided into 262 forest ranges. At present, they employ 1,012 workers including 573 people in forest service and 213 people and 226 workers besides forest service.

The prevailing species area of the Gdańsk RDLP is the pine, covering 69.2% (189,600 hectares) of the forest area, followed by the beech 12.3% (33,700 hectares) and the Norway spruce 5.2% (14,200 hectares) (Fig. 3). Total forest area (wooded) in Gdansk region is 273,000 hectares. The landscape in Gdańsk RDLP's area is varied. From the north it is limited by the Baltic Sea and a seaside zone with dunes and Hel Peninsula. In the south there are morainic hills surrounding 3 cities: Gdańsk, Sopot, Gdynia and the lake area with moraines, called "The Kashubian Switzerland". The most fertile lowlands are those located along the Wisła, especially the so-called Zulawy by its outlet. On the other hand Tuchola Forest ["Bory Tucholskie/*Tucheler Heide*"], between the Czarna Woda and Brda rivers, is not at all fertile and is largely covered with pine forests (National Park established in 1996, http://www.mos.gov.pl/kzpn/en/bory_gb.htm). The surface height varies from 1.8m above sea level in

¹ Special Protection Areas are classified under the EC Directive on the Conservation of Wild Birds (79/409/EEC)

² proposed Sites of Community Interest

the area of the Vistula delta to 329m above sea level at the Wieżyca hill peak. Hel Peninsula is a landscape peculiarity. Its width varies from 150m to 3km. This narrow strip of land separates 'The Bay of Puck' (http://www.iopan.gda.pl/projects/puckbay/html/pkt_01p.html) from the Baltic Sea. On the so-called Sobieszów Isle in the estuary of the Vistula (Polish: *Wisła*) River a famous bird sanctuary has been established. An inventory revealed 206 bird species, with 45 of them nesting. The Vistula Spit in the Kały Rybackie sanctuary has been colonised by black cormorants (Landsat photo: http://en.wikipedia.org/wiki/Image:Vistula_Lagoon.jpg). 9,000 couples are estimated to be nesting there at present, which representing the biggest colony of this species in Europe and making up 50% of the Polish population.

The Gdańsk RDLP's territory is an amber basin. The value of confirmed amber lodes is estimated to reach 60 million dollars and, importantly, there will be enough of the stock for the nearest hundreds of years. The forest area in the Gdańsk RDLP's territory covers 29%. There predominate broad-leaved sites and the forests are significantly varying as far as species are concerned. There are 6 landscape parks covering the overall area of 1,076 km², including 496 km² of the State Forests' grounds. The protected landscape area cover 2.985 km². Among 64 nature reserves covering the overall area of 3 789 ha there predominate forest (27) and flora (13) reserves, 3 of them are strict reserves. 109 out of 697 nature sanctuaries are erratic blocks. In 2002 in 66 bird nest zones being under protection, 40 nests were found vacant and in 33 cases bird broodings were proofed.

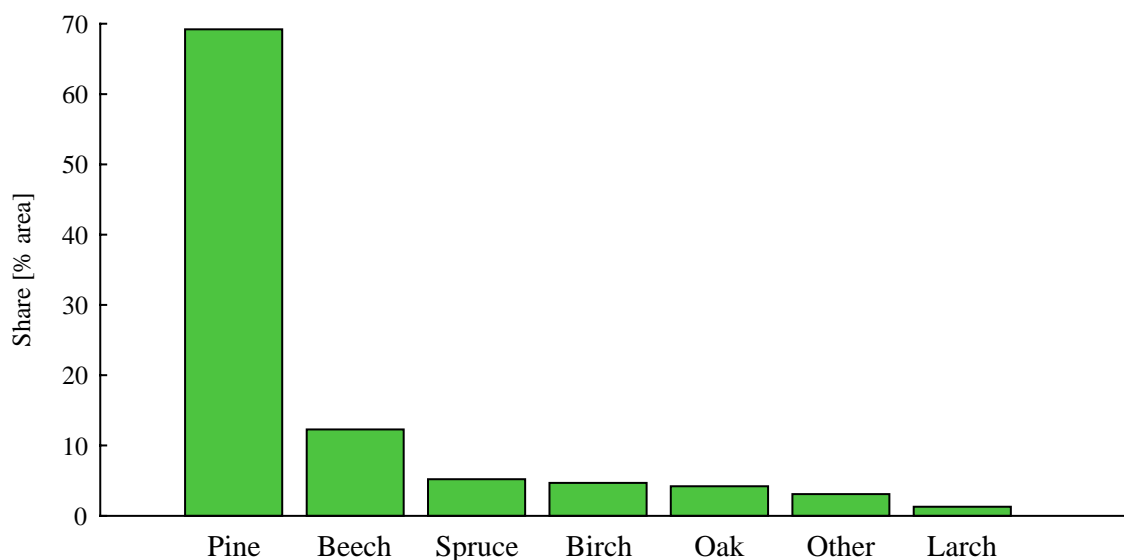


Fig. 3. Stand structure of state forests in Gdańsk Regional Directorate (RDLP).

In the area of the Directorate also 85 out of 198 vascular plant species are under strict protection. Birds, especially black cormorant, constitute the biggest group of species being under protection. Further species are: white-tailed eagle, lesser-spotted eagle, black stork and eagle owl. As far as mammals are concerned, the population of European castor has significantly increased. The peculiarity of the Gdańsk RDLP may be "*Arboretum Wirty*" with experimental plots established by A. PUTRICH and Prof. A. SCHWAPPACH in 1875. It is the oldest forest arboretum in Poland and covers the area of 33 hectares, in which 450 various tree and bush species have been gathered (<http://zblewo.kociewiak.pl/Artykul166.html>).

1. Forests in Kartuzy Forest District

Kartuzy Forest District occupies the central, landscape and nature most attractive part of the Kashubian Lakeland with its highest hill – Wieżyca. Its territory covers the area of 18,000 hectares, out of which 16,500 hectares are occupied by forest land. The district is divided into 3 forest precincts and 17 forest ranges. Apart from the state forests the district supervises 6,500 hectares of private forests. Its forest area is slightly bigger than 30%. Rivers and water reservoirs occupy over 6% of the area. The state forests cover quite fertile sites – forest sites occupy over 77% of the forest land. The main forest habitat type is fresh mixed broadleaved forest (LMśw) covering 69% of the area. Coniferous habitats occupy about 23% of the area and the most common site type is fresh mixed coniferous forest (BMśw) (13%) and boggy mixed coniferous forest (BMb) (7.5%, Fig. 4).

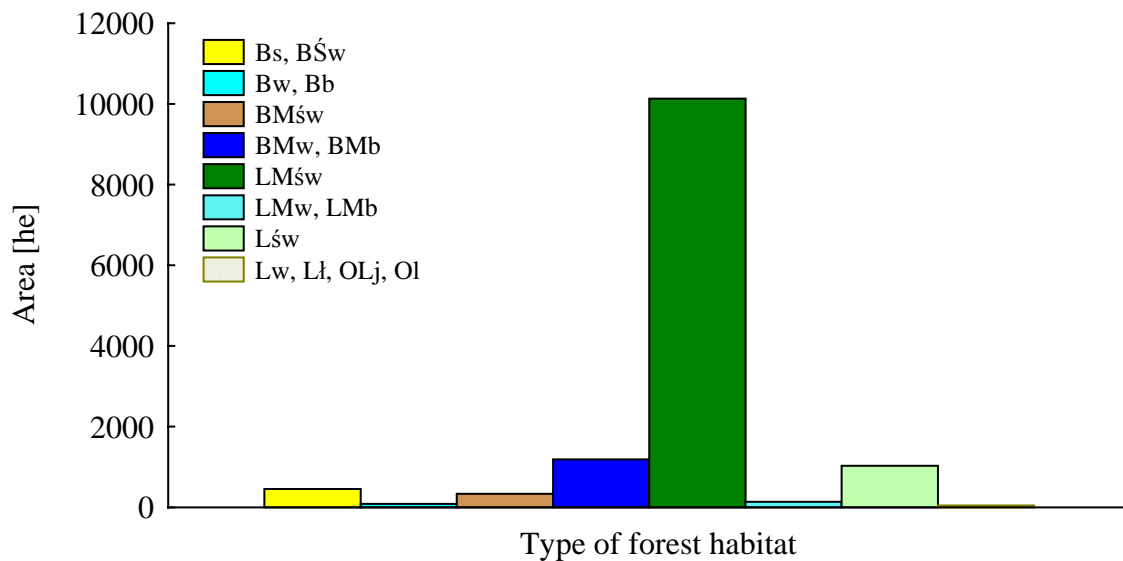


Fig. 4: Habitat structure of state forests in Kartuzy Forest District.

Kartuzy Forest District has a stable stand composition. Main species forming the local forests are pine, spruce and beech, having prevailed for decades. Mixed stands dominate with a prevalence of pine, covering 57% of the forest area (Fig.5). Spruce is a dynamically increasing species, which spreads in natural manner (Fig. 6). Natural regeneration of Norway spruce at Kartuzy region occupies about 4,100 hectares.

It here occurs, however, out of its natural range and is assessed as undesirable in this area by some ecologists. Beech, by contrast, is a much welcome species, especially in forest sites, whose share is still increasing. Beech under current conditions has revealed strong regeneration abilities, with 900 hectares stands in the regeneration class (Fig. 7). Together with beech and spruce the birch constitutes the forest stands. Oak and ash are presently introduced into the forest stands to a higher extent than before, especially on nutritious sites. Other species such as alder, larch, elm, Douglas fir and common fir complement the species structure and are a valuable addition depending on the site.

Kartuzy Forest District is situated in the transition zone of the natural ranges of beech and spruce, becoming obvious in the specific participation of these species in the stand structure (Fig. 8,9). In the Kartuzy Forest District stands of four or more species prevail, underlining to the exceptional wealth of our forests. They cover more than 45% of the forest area, with a significantly higher variety of the first and second age class stands. Their vertical structure is predominated by one-storied stands (94% of the area).

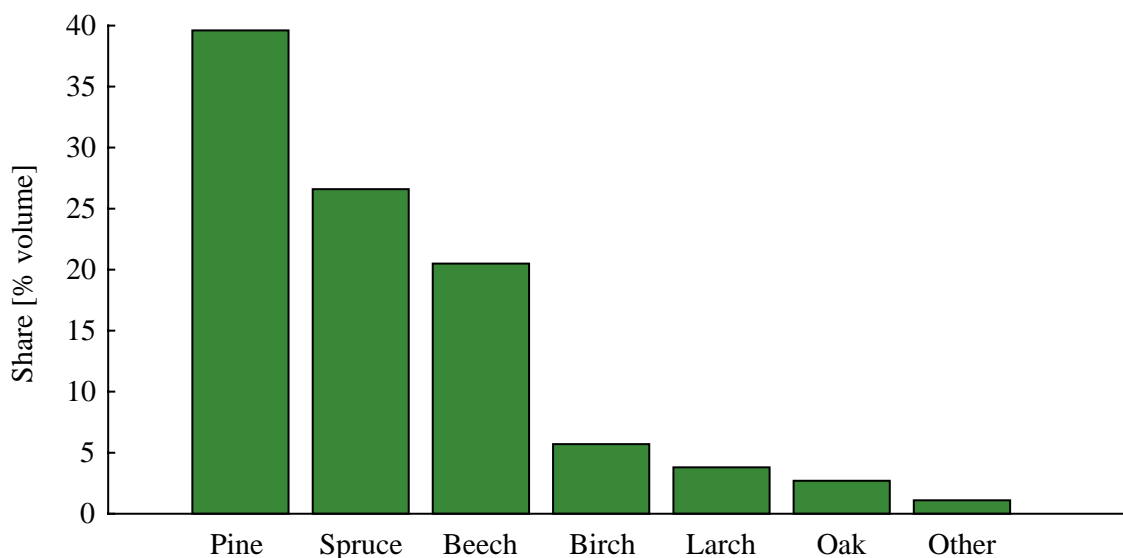


Fig. 5: Species stands structure of state forests in Kartuzy Forest District.



Fig. 6: Natural regeneration of Norway spruce (*Picea abies* (L.) Karst.) at Kartuzy Forest District (age 17 years, fresh mixed hardwood forest site).

First and second age class stands cover altogether 48% of the forest area. Stands of 100 years and older occupy 2,330 ha, which is 14% of the forest area. About 21% of the forests in Kartuzy region were found protective and over 58% of the forests are within the boundaries of Kashubian Landscape Park. The area is reckoned to be one of the most attractive tourist regions in the Gdańsk province.



Fig. 7: Natural regeneration of beech (*Fagus sylvatica* L.) at Kartuzy Forest District.

The view stations allowing tourists to admire the landscape are quite appealing. One of such places is a view tower on the top of Wieżyca hill built in 1996. In the forest area one may find 119 hectares of plus seed stands and 385 hectares of temporary seed production stands, registered 56 extra-quality trees (highly-selective trees). The forest district has an annual gain of 50-60 thousand m³ of timber. The annual quantity of timber comprises 65% of coniferous assortment, 35% of leaved assortment, there is on average 56% of saw timber.

Kartuzy Forest District supervises the hunting economy in 16 hunting districts being hired by the hunting organisations. An average annual game population comprises 220 units of a red deers, 1186 units of a roe-deers and 320 units of a wild boars. The hunting grounds are not very opulent here. Seedlings are produced in a forest nursery covering the area of 7 ha. Every year, for the State's and private owners' needs, the district produces, on average, about 1 mio plants including 0.8 mio older leaved seedlings.

2. Objects under protection

Early-medieval burial ground in Uniradze Forest Range

The barrow (burial) ground is situated in forests stretching along Radunia Lake. It comprises over 4,000 grave constructions being in use from about 500 B.C. until 1,200 A.D., which makes it the biggest early-medieval barrow (burial) ground in Central Europe.

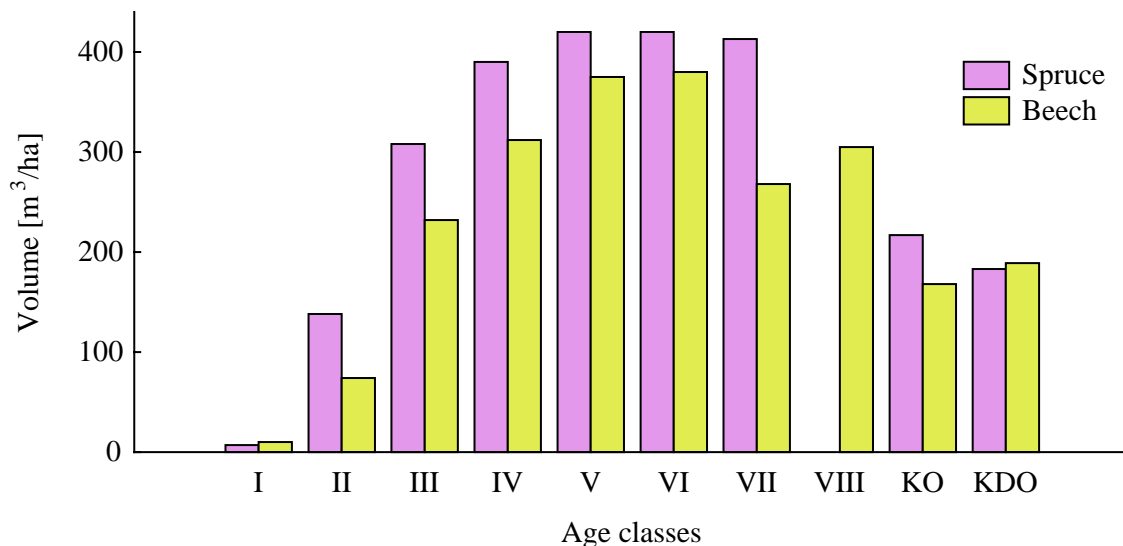


Fig. 8: Volume of Norway spruce and beech pro hectare in age classes.
 KO – regeneration class of stand (over 50% of stand's area is regenerated),
 KDO – under 50% of stand's area is regenerated in shelterwood.

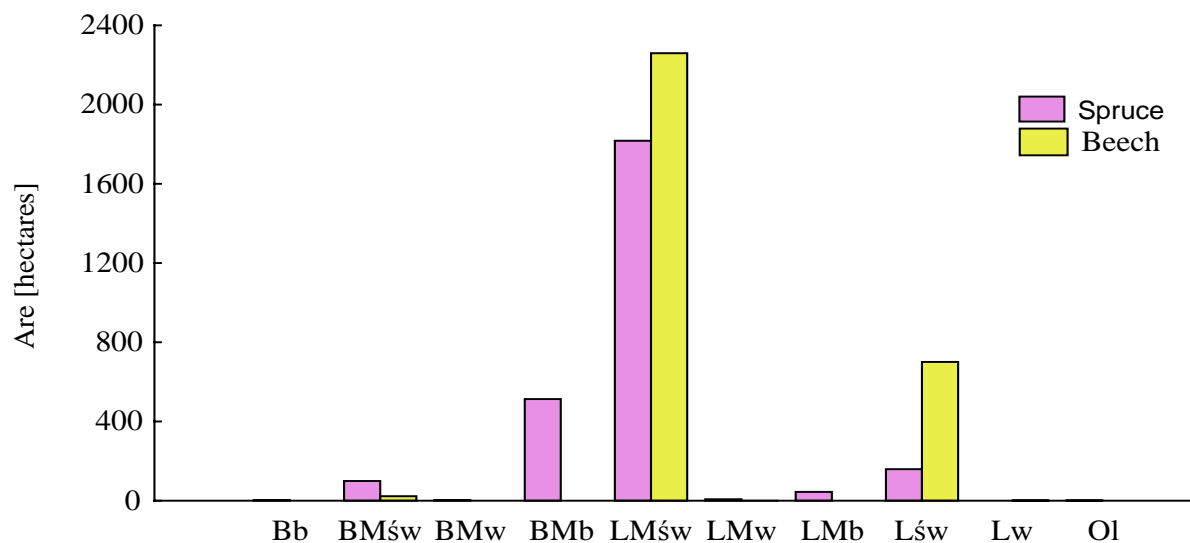


Fig. 9: Area's participation of Norway spruce and beech in habitat types of forest.

3. Nature preservation

In the district territory there are 13 nature reserves covering 727 ha, constituting 5% of the forest land. If you visit the Kashubian region you may see reserves such as:

- **Zamkowa Góra** (Castle Hill) – a reserve situated in Dąbrowa Forest Range territory, 3 km away from Kartuzy. It covers the area of 8.85 ha. It protects a well-preserved, eastern-most strip of an Atlantic-type Pomeranian beech forest covering a morainic elevation of 225 m above sea level. The most valuable constituent of the reserve is a beech stand with sporadic oak intermixture which is 240 years old. Individual trees reach extraordinary sizes – the diameters at breast height reach 100 cm and the tree heights reach up to 34-41 m. At the top of the elevation there is an archaeological relic – the ruins of a medieval castle.
- **Wieżyca Hill** – a landscape reserve in Drozdowo Forest Range created in 1962, covering an area of 33.59 ha. It encloses a significant part of the slope of the highest elevation in the Central European Depression. The slopes are completely wooded, and dominant forest community is an acidophilus beech forest without soil cover. The forest bed is strewn with folded beech leaf litter (F a g e t u m n u d u m). Irrespective of the formal classification of the reserve, it is a most valuable peculiarity from the point of view of the beech forest preservation. There is a view tower in the reserve.

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