

THE MOST VALUABLE ARBORESCENT PLANTS OF THE GORAJ FOREST RANGE (KRUCZ FOREST DISTRICT, PIŁA REGIONAL DIRECTORATE OF STATE FORESTS)

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Abstract. The inventory carried out on the area of the Goraj Forest Range allowed to catalogue 531 valuable specimens of arborescent plants from 48 taxons and 20 families, including 33 native taxons and 15 taxons of foreign origin. *Fagus sylvatica*, *Carpinus betulus* and *Quercus robur* were found to have the greatest share. The circumference of the majority of the measured plants ranged from 201 to 340 cm, although specimens measuring from 121 to 180 cm were also quite common. The health condition of almost 87% of the examined plants was assessed as very good and good. The Goraj Forest Range is a very valuable area from the point of view of dendrology. Thirty-four plant specimens growing in this forest range are covered by monumental protection, 158 specimens are characterised by monumental circumferences and 296 specimens have circumferences close to monumental. That is why 100 trees and bushes found here were recommended to be placed under protection in the form of nature monuments.

Key words: nature monuments, splendid trees, Goraj Forest Range

INTRODUCTION

New trends have recently appeared in modern nature conservation whereby grand trees or bushes are treated as individual living organisms inhabited by many species of fungi, plants and animals. Therefore, old trees and bushes are considered as ecosystems full of complex and not fully understood and investigated interrelationships. This approach encourages restricting interference in the life of plants, also after their demise. Another important issue associated with the protection in the form of nature monuments is the departure from prioritising the importance of the circumference by restricting the

application of strict rules and regulations associated with values of circumferences of specimens intended for protection. However, as long as this criterion remains in force, it is important to adjust monumental circumferences to regional conditions. Such approach has been adopted by the Ministry of Environment in its latest proposal for a directive regarding the criteria connected with the requirements to be fulfilled for the status of nature monument (www.mos.gov.pl). Recapitulating, this new approach takes the view that it is not only the oldest and the thickest trees and bushes that should be granted the status of nature monuments but the criterion should rather be the beauty and grandeur of trees and bushes so as to give a chance to protected specimens to live long and healthy lives [Buliński 1999, Garbalewski and Zieliński 1999].

Investigations carried out in years 2000-2002 showed that there were 104 998 monumental trees registered in Poland [Zarzyński 2003 a]. Data from the Main Statistical Office (GUS) for the year 2002 state that there were 26 720 individual monumental trees, 4479 in groups and 792 in alleyways. It is evident that monumental protection concentrates on single specimens and that is why it appears essential to pay special attention to protect groups of splendid trees such as alleyways, old cemeteries, parks surrounding palaces and manor houses. Zarzyński [2003 b] maintains that in Poland, it is old lime-trees – *Tilia cordata* (36 112) and *T. platyphyllos* (1005) and oaks – *Quercus robur* (28 194) and *Q. petraea* (850) that attain appropriate measurements to be classified as monumental trees.

The report on the condition of forests in Poland [Raport... 2005] states that in the year 2004 there were 8023 single trees, 1316 groups and 156 alleyways classified as monumental. In the Czarnkowsko-Trzcianecki county, where the Goraj Forest Range is situated, in the year 2003, there were 167 nature monuments [Program... 2005], whereas the total of 100 monumental specimens was inventoried in the entire Krucz Forest District of which the range is part (<http://www.pila.lasy.gov.pl>).

Results of studies carried out by Szmyt [2002] confirm that the Goraj Forest Range is valuable for its exceptional floristic qualities. Favourable site conditions, almost 30% share of older stands (80-160 years of age) and the historic park dating back to the second half of the 20th century indicate that this area is also valuable from the point of view of dendrology [Operat... 1998]. The 6.5 ha park adjoins a neo-Renaissance palace which, from 1865-1945 was the property of the count family of Hochberg. At the present time, the palace houses the dormitory of the Complex of Forestry Schools in Goraj.

The aim of this study was to inventory the most valuable trees, bushes and climbers in the Goraj Forest Range, i.e. the existing nature monuments, or specimens with monumental or close to monumental circumferences as well as plants distinguished for their interesting form or the thickest in their species occurring in the examined forest range. The collected data were then to be used to assess the condition of these specimens and elaborate the most important conservation recommendations.

STUDY AREA

The Goraj Forest Range is situated in the Wielkopolska Voivodeship in the county of Czarnkowsko-Trzcianecki, Lubasz, Czarnków and Czarnków City communes. The boundaries of the examined area are as follows: Czarnków (N 52°54', E 16°34') – from the north, Lubasz (N 52°51', E 16°31') – from the south, Śmieszkowo (N 52°53', E 16°36') – from the east and Goraj (N 52°35', E 15°45') – from the west.

The Goraj Forest Range constitutes part of the Regional Directorate of State Forests (RDSF) in Piła and belongs to the Krucz Forest District. According to the data from 2002, the area of this forest range was 858.17 ha, of which circa 50 ha were non-forest land.

The investigated forest range is situated in the Pojezierze Chodzieskie, one of the most beautiful spots of the Wielkopolska, called "Szwajcaria Czarnkowska". The most important climatic characteristics of this area include: low mean total annual atmospheric precipitation (550-625 mm), mean annual temperature from 7.8 to 8.4°C, domination of western winds, the length of the vegetation period 210-225 days, length of the period without frosts – 145-170 days, days with snow cover – 45-55, the greatest number of clear days during the summer period with the maximum in August (the smallest – in November and December) and the greatest number of cloudy days – in December and January (the smallest – in April and September) [Woś 1970, Żynda 1978, Opady... 2000].

The largest area of soils in the Goraj Forest Range is taken up by brown soils (75.49%), with podzolic soils occurring on a considerably smaller area (15.67%). The proportion of the remaining types of soils (poorly developed, muck, ground-gley, black earths and pseudo-gley soils) is not high and does not exceed 8.84% [Operat... 1998]. Therefore, the prevailing forest site types are: the greatest areas are occupied by fresh broad-leaved forest (46.51%) and fresh mixed broad-leaved forest (27.03%) with the fresh mixed coniferous forest also making up a fair proportion (16.60%). Fresh coniferous (3.99%), moist broad-leaved forest (2.27%), ash-alder swamp forest (2.11%), moist mixed broad-leaved forest (1.31%) and typical alder forest (0.19%) take up much smaller proportions of the total area [Plan... 1993].

METHODS

The inventories were carried out during the vegetation seasons in the following years: 2002, 2003 and 2005. Species covered by legal protection were singled out from among the inventoried specimens [Rozporządzenie... 2004].

Because of the large area of the Goraj Forest Range, only compartments and sub-compartments with the oldest tree-stands or with younger stands in which the grand trees, bushes and climbers were left as hold-overs were selected for investigations. The performed inventory consisted in a strip review of stands along transects of 50 m wide marked out in the direction north-south in the following compartments of the Goraj Forest Range: 2-5, 7-20, 104-109 and 111. The positions of the existing nature monuments were determined using the registry found in the Czarnkowsko-Trzcianeckie Starostwo Powiatowe in Czarnków.

The inventoried specimens were included into the following categories: nature monuments – P, specimens with monumental circumferences – WP [Kasprzak 2001] and specimens with circumferences close to monumental – ZP (their circumference was assumed at the 80% of the monumental specimens for a given species). 'Interesting' trees (Dc) and bushes (Kc) were also inventoried. These were defined as plants characterised by unusual forms or growing singly. This category also comprised the thickest specimens growing in the Goraj Forest Range.

The health condition of plants was determined using the Kamiński and Czerniak [2000] classification and the plant names were given after Mirek et al. [2002].

Because of the imposed limits, it was not possible to include in this paper tables with all the data of the inventoried plants as well as maps which would show the distribution of the identified specimens. This information can be found in the manuscript by Szukała and Kolenda [2003].

RESULTS

Characterisation of the inventoried arborescent plants

In all, 531 specimens of the most valuable arborescent plants were identified in the Goraj Forest Range which belonged to 48 taxons and 20 families (Table 1). The above-mentioned number included: 37 tree taxons, 5 bush taxons, 4 forms which were either trees or bushes and 2 species of climbers. Gymnosperms were represented by 3 families and angiosperms – by 17 families. The most numerous taxons were found in *Rosaceae*, *Pinaceae*, *Salicaceae* and *Fagaceae* families (Table 2).

Table 1. Proportion of specimens of the inventoried taxons
Tabela 1. Udział okazów zinwentaryzowanych taksonów

No Lp.	Species name Nazwa gatunkowa	Number of trees Liczba drzew	Participation, % Udział, %
1	2	3	4
1	<i>Fagus sylvatica</i> L.	233	43.9
2	<i>Carpinus betulus</i> L.	54	10.2
3	<i>Quercus robur</i> L.	30	5.6
4	<i>Fraxinus excelsior</i> L.	19	3.6
5	<i>Sorbus tominalis</i> (L.) CRANTZ	18	3.4
6	<i>Cerasus avium</i> (L.) MOENCH	14	2.6
7	<i>Hedera helix</i> L.	13	2.4
8	<i>Ulmus laevis</i> PALL.	13	2.4
9	<i>Acer platanoides</i> L.	11	2.1
10	<i>Alnus glutinosa</i> (L.) GAERTN	11	2.1
11	<i>Crataegus monogyna</i> JACQ.	10	1.9
12	<i>Acer pseudoplatanus</i> L.	9	1.7
13	<i>Pinus sylvestris</i> L.	9	1.7
14	<i>Malus sylvestris</i> MILL.	8	1.5
15	<i>Populus ×canadensis</i> MOENCH*	8	1.5
16	<i>Pyrus pyraeaster</i> (L.) BURGSD.	7	1.3
17	<i>Quercus petraea</i> (MATT.) LIEBL	7	1.3
18	<i>Quercus rubra</i> L.*	5	0.9
19	<i>Tilia cordata</i> MILL.	5	0.9
20	<i>Salix fragilis</i> L.	4	0.8
21	<i>Taxus baccata</i> L.	4	0.8
22	<i>Pinus nigra</i> J. F. ARNOLD*	3	0.6
23	<i>Sambucus nigra</i> L.	3	0.6

Table 1 – cont.

1	2	3	4
24	<i>Sorbus aucuparia</i> L.	3	0.6
25	<i>Tsuga canadensis</i> (L.) CARRIÈRE*	3	0.6
26	<i>Corylus avellana</i> L.	2	0.4
27	<i>Euonymus europaeus</i> L.	2	0.4
28	<i>Pseudotsuga menziesii</i> (MIRB.) FRANCO*	2	0.4
29	<i>Rhamnus cathartica</i> L.	2	0.4
30	<i>Abies concolor</i> (GORDONEY et GLEND) LINDL. ex HILDEBR.*	1	0.2
31	<i>Acer saccharinum</i> L.*	1	0.2
32	<i>Aesculus hippocastanum</i> L.*	1	0.2
33	<i>Betula pubescens</i> EHRH.	1	0.2
34	<i>Betula pendula</i> ROTH	1	0.2
35	<i>Cornus sanguinea</i> L.	1	0.2
36	<i>Larix decidua</i> MILL.*	1	0.2
37	<i>Liriodendron tulipifera</i> L.*	1	0.2
38	<i>Padus serotina</i> EHRH.	1	0.2
39	<i>Parthenocissus quinquefolia</i> (L.) PLANCH.*	1	0.2
40	<i>Picea abies</i> (L.) H. KARST.*	1	0.2
41	<i>Pinus strobus</i> L.*	1	0.2
42	<i>Populus alba</i> L.	1	0.2
43	<i>Populus tremula</i> L.	1	0.2
44	<i>Prunus spinosa</i> L.	1	0.2
45	<i>Rosa canina</i> L.	1	0.2
46	<i>Salix caprea</i> L.	1	0.2
47	<i>Thuja occidentalis</i> L.*	1	0.2
48	<i>Ulmus minor</i> MILL. EMEND. RICHENS	1	0.2

*Introduced taxons.

*Taksomy introdukowane.

Table 2. Proportion of the taxons representing individual families
Tabela 2. Udział taksonów reprezentujących poszczególne rodziny

No Lp.	Name of the family Nazwa rodziny	Number of species Liczba gatunków	Participation, % Udział, %
1	2	3	4
1	<i>Rosaceae</i>	10	20.8
2	<i>Pinaceae</i>	7	14.6
3	<i>Salicaceae</i>	5	10.4
4	<i>Fagaceae</i>	4	8.3
5	<i>Aceraceae</i>	3	6.3
6	<i>Betulaceae</i>	3	6.3
7	<i>Corylaceae</i>	2	4.2
8	<i>Ulmaceae</i>	2	4.2

Table 2 – cont.

1	2	3	4
9	<i>Araliaceae</i>	1	2.1
10	<i>Caprifoliaceae</i>	1	2.1
11	<i>Celastraceae</i>	1	2.1
12	<i>Cornaceae</i>	1	2.1
13	<i>Cupressaceae</i>	1	2.1
14	<i>Hippocastanaceae</i>	1	2.1
15	<i>Magnoliaceae</i>	1	2.1
16	<i>Oleaceae</i>	1	2.1
17	<i>Rhamnaceae</i>	1	2.1
18	<i>Taxaceae</i>	1	2.1
19	<i>Tiliaceae</i>	1	2.1
20	<i>Vitaceae</i>	1	2.1

Highlighted – gymnosperm families.

Cieniowanie – rodziny z nagozalązkowych.

Thirty three native taxons were inventoried and, most frequently, they were associated with fertile sites of broad-leaved forests and such species composition well reflected site conditions prevalent in the Goraj Forest Range. The most numerous were *Fagus sylvatica* (233 trees), *Carpinus betulus* (54) and *Quercus robur* (30), and the remaining species took up a much smaller share. The most numerous from among the 15 introduced taxons are *Populus ×canadensis* (8 trees) and *Quercus rubra* (5). The remaining taxons are usually represented by 1, rarely by 2 or 3 trees. The introduced species also included *Larix decidua* and *Picea abies* which are domestic species but they occur in the examined area outside their natural range (Table 1).

The grandest trees were found most numerous in compartment No. 15 – 140 specimens, whereas in the 10th compartment – 58 and in the 16th compartment – 49 specimens were identified. In compartments 9, 11, 12, 14, 18, 108, from 26 to 39 specimens were found, while in the remaining compartments the number of valuable arborescent plants varied and ranged from 1 to 18.

The health condition of the majority of the examined plants is very good (61.5%) and good (25.2%) and, much less frequently, moderate (9.3%), bad (3.2%) or very bad (0.4%) – meaning that the plant is dead.

The majority of the measured trees (298 specimens – 56.1%) reach circumferences ranging from 201 to 340 cm with a considerable proportion of specimens (108 – 20,3%) measuring from 121 to 200 cm. Much smaller proportion of trees (46 – 8.66%) are characterised by circumferences ranging from 341 to 400 cm and only 40 (7.53%) specimens measure from 41 to 120 cm. The smallest number of trees had the circumference either smaller than 40 cm (18 – 3.39%) or 401 to 580 cm (21 specimens – 3.95%).

The total of 211 monumental specimens as well as specimens with circumferences close to monumental was selected for height measurements. It was found that the shortest plants measured 4 m and the tallest – 52 m. The majority of trees measured from 21 to 40 m (148 specimens – 70.1%), 55 specimens (26.1%) reached the height of 4 to 20 m, while

8 trees (3.8%) measured from 41 to 52 m. One hundred and sixty nine specimens were selected from the same two categories and their crown diameters were measured. These diameters were contained in the interval from 1.5 to 29 m, of which 91 specimens (53.8%) were characterised by diameters from 11 to 20 m, 50 specimens (29.6%) – from 1.5 to 10 m and the remaining 28 specimens (16.6%) – from 21 to 30 m.

The following species of arborescent plants are covered by legal protection: *Hedera helix* (13 specimens of which 7 have monumental circumferences) and *Sorbus torminalis* (8 specimens of which 5 are characterised by monumental circumferences). *Taxus baccata* was not placed on the list of protected species because it was introduced on the examined area by man. Yew trees grow in the former forest nursery in the 8i compartment as well as in the park adjoining the palace in the compartments 15 b and c.

The most valuable specimens according to the identified categories

The most numerous trees and bushes are those with circumferences close to monumental, although the group of specimens with monumental circumferences is also quite numerous. On the other hand, the proportion of the already existing nature monuments as well as ‘interesting’ trees and bushes is considerably smaller (Fig. 1).

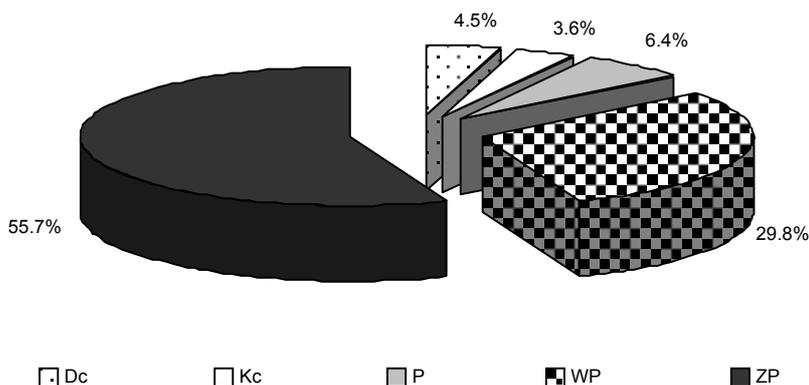


Fig. 1. Percentage proportion of the inventoried taxons included into the following categories: P – nature monuments, WP – specimens with monumental circumference, ZP – specimens with circumference close to monumental, Dc – ‘Interesting’ trees, Kc – ‘Interesting’ bushes

Rys. 1. Procentowy udział zinwentaryzowanych taksonów włączonych do następujących kategorii: P – pomniki przyrody, WP – okazy o wymiarach pomnikowych, ZP – okazy o wymiarach zbliżonych do pomnikowych, Dc – drzewa „ciekawe”, Kc – krzewy „ciekawe”

Out of 34 monument trees, 23 specimens belong to x. The health conditions of trees from this category can be characterised as follows: 25 trees are in very good (16) or good (9) condition, 4 trees are in moderate and 5 – in bad health condition.

All in all, 158 specimens with monumental circumferences from 31 taxons were inventoried. Most frequently, they were *Fagus sylvatica* – 54, much less frequently, among others *Carpinus betulus* – 13, *Ulmus laevis* – 9, *Cerasus avium* – 8, or *Hedera*

helix – 7. Out of this category, 140 specimens are in very good (100) or good health conditions (40), 15 trees in moderate, 1 in bad and 1 in very bad (dead specimen) health conditions. The total of 100 trees and bushes of monumental circumferences and characterised by a very good health condition were selected to be covered by monument protection (Table 3).

Table 3. Specimens proposed as nature monuments

Tabela 3. Okazy proponowane do objęcia ochroną w formie pomników przyrody

No Lp.	Species name Nazwa gatunkowa	Number of trees Liczba drzew	Range of circumference, cm Zakres obwodów, cm
1	<i>Fagus sylvatica</i>	30	290-440
2	<i>Carpinus betulus</i>	8	190-308
3	<i>Hedera helix*</i>	7	9-31
4	<i>Cerasus avium</i>	7	98-150
5	<i>Ulmus laevis</i>	6	232-355
6	<i>Taxus baccata**</i>	4	30-104
7	<i>Quercus petraea</i>	4	389-466
8	<i>Sorbus tominalis</i>	4	160-183
9	<i>Quercus robur</i>	3	225-261
10	<i>Crataegus monogyna</i>	3	137-206
11	<i>Pyrus pyraeaster</i>	3	106-202
12	<i>Malus sylvestris</i>	3	99-216
13	<i>Fraxinus excelsior</i>	3	278-282
14	<i>Alnus glutinosa</i>	3	222-246
15	<i>Acer platanoides</i>	2	239-240
16	<i>Pinus sylvestris</i>	2	248-340
17	<i>Pseudotsuga menziesii</i>	1	251
18	<i>Abies concolor</i>	1	180
19	<i>Acer pseudoplatanus</i>	1	263
20	<i>Tilia cordata</i>	1	306
21	<i>Pinus nigra</i>	1	203
22	<i>Populus × canadensis</i>	1	370
23	<i>Ulmus minor</i>	1	233
24	<i>Thuja occidentalis</i>	1	112

*Included are all flowering specimens irrespective of their circumference.

**The minimum circumference of 30 cm was assumed as qualifying for a nature monuments in forests.

*Włączono wszystkie okazy kwitnące bez względu na obwód.

**Przyjęto obwód minimalny 30 cm jako kryterium kwalifikujące do kategorii pomników przyrody w lasach.

The inventory carried out in 2005 revealed that 9 trees considered as valuable in years 2002 and 2003 can no longer remain in this category. One of these trees was cut down, while the remaining ones either fell, died or were subjected to various types of tending operations (removal of boughs caused that they no longer fulfil the requirements of monumental trees).

RECAPITULATION AND CONSERVATION RECOMMENDATIONS

All in all, 531 specimens of the most valuable arborescent plants were inventoried in the Goraj Forest Range which belonged to 48 taxons and 20 families. Gymnosperms are represented by 9 species derived from 3 families, whereas the remaining taxons belong to angiosperms.

The inventoried arborescent plants included 33 native taxons and 15 introduced taxons. The following species associated with extensive areas of fertile broad-leaved forest sites occurring in the Goraj Forest Range derive from the first group: *Fagus sylvatica*, *Carpinus betulus* and *Quercus robur*, whereas in the second group, the most numerous are: *Populus ×canadensis* and *Quercus rubra*.

Two species, namely: *Hedera helix* and *Sorbus torminalis* are under legal protection.

The Goraj Forest Range is a very valuable area from the point of view of dendrology. Thirty four plant specimens growing in this forest range are covered by monument protection, 158 specimens have monumental circumferences, while the circumference of 296 specimens is close to monumental. Therefore, 100 plants of monumental circumferences and very good health condition were recommended to be placed under protection in the form of nature monuments. This considerable disproportion between the number of existing nature monuments and the number of plants which either already fulfil or will fulfil the requirements of this form of protection (specimens with monument circumferences or circumferences close to monumental) indicates a very significant "potential" which requires appropriate actions intended, on the one hand, to establish new nature monuments and, on the other, to support "candidates" for nature monuments.

In order to ensure appropriate protection for the valuable dendroflora found in the Goraj Forest Range, the following steps should be undertaken:

1. The most valuable specimens mentioned in this study (with monument circumferences or circumferences close to monumental as well as "interesting" ones) should be excluded from economic activities either completely or partially.

2. Felling of exceptionally valuable native species of trees, bushes and climber should be banned. in the case of others, specific breast height diameter values should be established beyond which the plants could not be cut; they would be protected and nurtured by regular tending and sanitary operations.

3. Selected, most valuable specimens should be placed under monument protection.

4. Protected species of arborescent plants should be maintained by the protection of communities in which they occur.

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NAJCENNIERSZE ROŚLINY DRZEWIASTE LEŚNICTWA GORAJ (NADLEŚNICTWO KRUCZ, RDLP PIŁA)

Streszczenie. Na terenie leśnictwa Goraj zinwentaryzowano 531 cennych okazów roślin drzewiastych z 48 taksonów i 20 rodzin. W tym 33 taksony rodzime oraz 15 obcego pochodzenia. Największy udział mają *Fagus sylvatica*, *Carpinus betulus* oraz *Quercus robur*. Większość pomierzonych roślin osiąga obwody 201-340 cm, dość znaczny udział mają okazy, które mierzą 121-180 cm. Stan zdrowotny niemal 87% badanych roślin jest bardzo dobry i dobry. Leśnictwo Goraj jest obszarem bardzo cennym pod względem dendrologicznym. Rosną tu 34 okazy objęte ochroną pomnikową, 157 okazów o obwodach pomnikowych i 296 okazów o obwodach zbliżonych do pomnikowych. W związku z tym aż 100 drzew i krzewów wytypowano do objęcia ochroną w formie pomników przyrody.

Słowa kluczowe: pomnik przyrody, okazałe drzewa, leśnictwo Goraj

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