

# POLISH ACADEMY OF SCIENCES

Information about the

## INSTITUTE OF DENDROLOGY



IUFRO Executive Board Meeting

28<sup>th</sup> Aug. 1992

KÓRNIK



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POLISH ACADEMY OF SCIENCES  
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1. Introduction

Formally the beginning of our research center dates from the creation of the Kórnik Foundation "Zakłady Kórnickie". This was established by the last owner of the Kórnik estate, Count Władysław Z a m o y s k i, who donated all his property towards the upkeep of the Foundation. Sejm, the parliament of Poland, in a special Act confirmed in 1925 the legal status of the Foundation as national property. The Foundation included a book collection and a museum under the "Kórnik Library" with its own scientific activity in the field of the humanities, while the park and the arboretum, following the will of the benefactor as confirmed by the Act of Sejm, was to constitute a base for the establishment of a forest biology institution devoted to studies on trees and forests. In 1927 the "Kórnik Gardens" were placed under the directorship of an eminent botanist and dendrologist dr. Antoni W r ó b l e w s k i. He remained associated with Kórnik until his death in 1944 in spite of the fact that in 1939 he was removed from leading this institution.

Among the scientists who were engaged in promoting forest and dendrological research in Kórnik were such eminent professors as Władysław S z a f e r, Stanisław S o k o l o w s k i, Aleksander K o z i k o w s k i and many others, the position of whom in the world scientific community is also a measure of the rank of this developing scientific center in its early days.

A scientific institution in the field of natural sciences cannot rely solely on even the best ideas. It must be engaged in experimental work and must perform field investigations. Such a base for the Kórnik Gardens (later the Institute for the Study of Trees and Forests, the Center for Dendrology and Pomology and finally the Institute of Dendrology) was provided by the

dendrological collection, richest and oldest in our country. The former palace park, gradually merging into a natural forest, was being organized by the owners of the Kórnik estates (G ó r k a and C z a r n k o w s k i families) as they fancied and according to current fashions. It was only in the 19th c. that the successive owners, Count Tytus D z i a l y ń s k i, and later his son Jan, begun creating a collection based on scientific principles. The aim as they defined it was "to enrich the flora and forest cover of the fatherland". Their work was being continued by the last owner, Count Wladyslaw Z a m o y s k i.

When the scientific institution was officially being formed in the arboretum there were already hundreds of species of trees and shrubs, both indigenous and exotic, the oldest of the latter almost a hundred years old.

The 2nd World War did not affect the Kórnik Foundation and the Kórnik Gardens substantially. Scientific activity and the publication of results had to stop but the dendrological collections survived. However, when after the end of military activity the institution was taken over by prof. Stefan B i a - I o b o k, who remained director till 1979, the scientific activity had to be revived almost from zero. A major shake up took place in 1952. The Foundation was transformed into a scientific station with budget financing from the Polish Academy of Sciences. It later received the status of a Polish Academy of Sciences Institute, the current Institute of Dendrology.

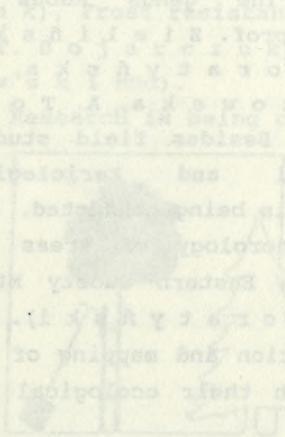
Following the principles under which institutions of the Polish Academy of Sciences functioned, from the very beginning basic research was the main objective here, and the scope was defined in general terms as the biology of trees and shrubs. Always there were maintained close contacts with academic Forestry and Horticultural faculties of the Agricultural Academies and biology faculties of Universities, as well as with forestry and horticultural professions.

## 2. Organizational structure and research program

The scientific activity is being realized in six Departments each having a separate program and staff. Prof. dr hab. Wladyslaw

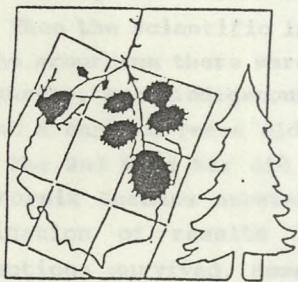
B u g a I a is the Director and prof. dr hab. Tadeusz P r z y -  
b y l s k i is the Vice-Director responsible for scientific  
programs. The Institute has a Scientific Council which has an  
advisory and controlling function. It is composed of 36 senior  
scientists from various Universities and Institutes, specialists  
in the fields of research that is being conducted here.

Currently the Institute of Dendrology employs 98 people,  
including 36 scientists (13 senior), 41 technicians and 21 in  
administration and maintenance.



2.1. The Department of Systematics and Geography led by prof. dr hab. Jerzy Z i e l i ń s k i includes dr Adam B o r a t y ń s k i, dr Krystyna B o r a t y ń s k a, Anna T o m l i k MSc and Anna D o l a t o w s k a MSc. The department has a herbarium with about 65 000 sheets.

The scientific program is realized in the following projects:



2.1.1. "The genus Rubus in Poland" (prof. Z i e l i ń s k i, dr K. B o r a t y ń s k a, A. D o l a t o w s k a, A. T o m l i k). Besides field studies anatomical and kariological research is being conducted.

2.1.2 "Chorology of trees and shrubs in Eastern Sudety Mts." (dr. A. B o r a t y ń s k i). The

studies include detailed distribution and mapping of all taxa of dendroflora together with their ecological and geographic characteristics.

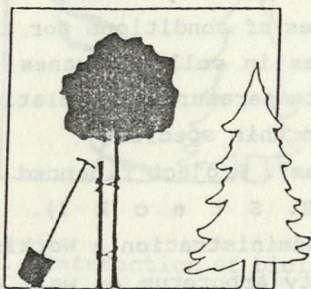
2.1.3. Monographs "Our Forest Trees" (prof. S. B i a l o b o k, dr. A. B o r a t y ń s k i). Since many years monographs are being produced on the most important genera and species of forest trees. So far 14 volumes have already appeared from this series, and currently the volume on hornbeam (Carpinus) is under preparation, as well as a revised version of the first volume handled, that on Scots pine.

2.1.4. "Chorology of trees and shrubs in South-West Asia and Eastern Mediterranean" (prof. K. B r o w i c z, prof. J. Z i e l i ń s k i and dr. A. B o r a t y ń s k i). Detailed maps of distribution and systematic evaluations are being prepared and published on the dendroflora of that region. So far eight volumes have already been published and two further ones are in preparation.



2.2 Department of Introduction and Acclimatization, led by prof. dr hab. Władysław Bugała includes prof. dr hab. Tadeusz Przybylski, doc. dr hab. Zbigniew Stecki, dr hab. Paweł Pukaćki, dr Krystyna Bojarczuk, dr Tomasz Bojarczuk, dr Jarosław Figaj, Jakub Dolałowski MSc and Maciej Filipiak MSc. The Department has the following laboratories: Vegetative propagation (dr K. Bojarczuk), Frost resistance (dr hab. P. Pukaćki), Arboretum (dr T. Bojarczuk) and Dendrological Museum (J. Dolałowski MSc).

Research is being conducted in the following projects:



2.2.1. "Organogenesis and in vitro regeneration of selected trees and shrubs" (dr K. Bojarczuk). Under investigation are cultivars of rhododendrons and azaleas, lilacs, poplars and birches in which the physiological conditions for organogenesis are investigated as well as means of protecting

cultures against fungal infections.

2.2.2. "Adaptation processes in selected species of introduced trees and shrubs" (prof. W. Bugała and dr T. Bojarczuk). Regular observations are being conducted on the development of introduced woody plants as well as of injuries caused by climatic factors. The laboratory collects and exchanges seeds, supplements the arboretum collections and maintains its records.

2.2.3. "Ecological basis for the functioning of Scots pine in conditions of a deformed and degraded environment" (prof. T. Przybylski). Using experimental areas of the Institute and material originating from forests injured by environmental emissions (in Upper Silesia) circulation of elements in the ecosystem is investigated as well as its

deformations in relation to biomass production.

2.2.4. "Adaptation of grand fir (*Abies grandis*) to the climatic and site conditions of Poland" (doc. Z. S t e c k i and dr J. F i g a j). The studies are based on provenance experimental areas in the Institute of Dendrology Experimental Forest and in forests administered by the Forest Service.

2.2.5. "Ecological factors limiting acclimatization of Japanese larch (*Larix kaempferi* Carr.) in northwestern Poland" (M. F i l i p i a k MSc). Studies are being conducted on various age plantations of this species. They include an analysis of site conditions and growth increment.

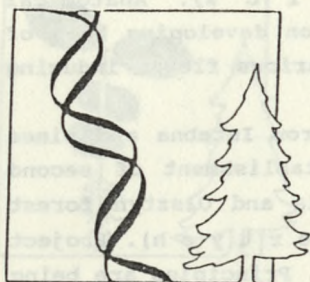
2.2.6. "Tolerance mechanisms of trees to low temperatures" (dr P. P u k a c k i). Laboratory studies of conditions for the formation and appearance of changes in cell membranes of spruce tissues during lowering of temperatures in relation to intraspecific variability within this species.

2.2.7. "Management of the Wirty Arboretum". Project financed by the State Forest Service (doc. Z. S t e c k i). In cooperation with the State Forest Administration a Working Plan is being prepared for the Wirty Arboretum as well as a program of its scientific utilization.

2.2.8. "Occurrence of Japanese larch in northwestern Poland - evaluation of cultivation conditions and practical suggestions". Project financed by the State Forest Service. A report is being prepared on the importance and expansion possibilities for the cultivation of Japanese larch.

2.3 Department of Genetics, led by prof. dr hab. Maciej G i e r - t y c h includes prof. dr hab. Leon M e j n a r t o w i c z doc. dr hab. Władysław C h a I u p k a, doc. dr hab. Alina H e j n o - w i c z, dr Henryk F o b e r, dr. Andrzej L e w a n d o w s k i and dr Jarosław B u r c z y k. The Department has the following laboratories: Population genetics (doc. W. C h a I u p k a), Biochemical Genetics (prof. L. M e j n a r t o w i c z) and Anatomy (doc. A. H e j n o w i c z).

Research is being conducted in the following projects:



2.3.1. "An analysis of provenance, progeny and individual variation of forest trees in relation to site conditions" (prof.. M. G i e r t y c h). The studies cover such problems as genotype environment interactions, heritabilities, marker genes, cytoplasmic inheritance and genotypic selection.

2.3.2. "Interaction of biological and physical properties of the medium with progeny variation of spruce *Picea abies* (L.) Karst." (dr H. F o b e r). These are greenhouse experiments with spruces cultured on different media and analyzed for mineral content.

2.3.3. "Phenotypic and genotypic analysis of green Douglas fir populations" (prof. L. M e j n a r t o w i c z). These are primarily isozyme studies of trees grown in a provenance experiment.

2.3.4. "Genetic changes taking place in selected populations of Polish larch" (dr A. L e w a n d o w s k i). Genetic polymorphism and mating systems are investigated in populations of Polish larch using isozyme methods.

2.3.5. "Effectiveness of some populations of conifer species in transmitting genetic information to the progeny" (dr J. B u r c z y k). The model for this study is a Scots pine

seed orchard in Forest District Gniewkowo. The mating system in the plantation is investigated from the point of view of flowering biology and genetic (isozyme) comparison of the progeny with the male and female parents.

2.3.6. "Regulation of generative processes in Scots pine and Norway spruce" (doc. W. C h a I u p k a). Methods are investigated of stimulating floral induction and otherwise controlling fructification in clonal seed orchards.

2.3.7. "Morphogenesis of the stem apex in Norway spruce at the stage of transfer from the vegetative to the generative state" (doc. A. H e j n o w i c z). Anatomical investigations are being conducted on developing buds of Norway spruce clones subjected to various flower inducing treatments.

2.3.8. "Determination of elite spruces from Istebna and pines from the Mazury region for the establishment of second generation seed orchards in the Piła and Olsztyn forest regions respectively" (prof. M. G i e r t y c h). Project financed by the State Forest Service. Principles are being developed for index selection of elite clones within existing genetic experiments with the species in question coupled with a practical identification of such trees for the needs of forestry practice.

2.4 Department of Seed Biology, led by prof. dr hab. Boleslaw S u s z k a includes: dr Tadeusz T y l k o w s k i, Pawel C h m i e l a r z MSc, Danuta J a k u n MSc and Barbara B u j a r s k a - B o r k o w s k a MSc. The Department includes a Seed Laboratory (dr T. T y l k o w s k i) and the Phytotron (B. B u j a r s k a).

Research is being conducted in the following projects:



2.4.1. "Overcoming seed dormancy in insufficiently studied species and their short term storage" (prof. B. S u s z k a, dr T. T y l k o w s k i, B. B u j a r s k a). In phytotron conditions the storage and stratification conditions are studied for seeds of alder, white fir, dogwood, hawthorn, hazelnut and Mazzard

cherry. For the latter species both Polish and French populations are studied.

2.4.2. "Storage of dormant and non-dormant tree seeds resistant and susceptible to partial drying" (dr T. T y l k o w s k i, B. B u j a r s k a - B o r k o w s k a, D. J a k u n). For these studies seeds of wild rose, evonymus, sycamore, European ash and linden are used.

2.4.3. "Effects of storing in liquid nitrogen of embryo axes of woody plant (Quercus, Acer pseudoplatanus) seeds sensitive to dehydration" (prof. B. S u s z k a, P. C h m i e l a r z). The possibility of storing embryo axes in liquid nitrogen followed by their activation and growth are investigated, primarily for the needs of gene banks.

2.4.4. "Short- and long-term storage of seeds of beech, hornbeam, ash, maple, lime and oak" (prof. B. S u s z k a, dr T. T y l k o w s k i, B. B u j a r s k a, D. J a n k u n). This project is financed by the State Forest Administration. Methods are being developed for the storage of forest tree

seeds in modern storage facilities with a possibility of regulating the physical environment.

Department of Seed Biology, Institute of Horticulture, University of Agriculture, Krakow, Poland. The author is indebted to Prof. Dr. J. Kowalski for his kind and helpful criticism of the manuscript. The author is also indebted to the staff of the Seed Laboratory for their kind assistance in the laboratory work.

Research is being conducted in the following projects: 1. "Effect of storing seeds in liquid nitrogen on the germination of woody plant species." 2. "Effect of storing seeds in liquid nitrogen on the germination of European ash and linden seeds." 3. "Effect of storing seeds in liquid nitrogen on the germination of woody plant species (Acer pseudoplatanus) seeds sensitive to dehydration." (Prof. Dr. J. Kowalski, Krakow, Poland).

The possibility of storing empty axes in liquid nitrogen followed by their activation and growth are investigated, primarily for the needs of gene banks. "Short- and long-term storage of seeds of beech, hornbeam, ash, maple, lime and oak" (Prof. Dr. J. Kowalski, Krakow, Poland).

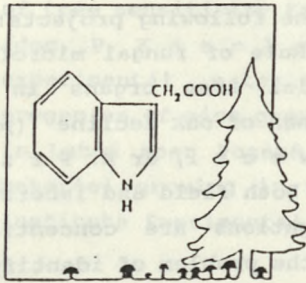
Methods are being developed for the storage of forest tree project is financed by the State Forest Administration. The author is indebted to the staff of the Seed Laboratory for their kind assistance in the laboratory work.

These studies seeds of wild rose, European spruce, European ash and linden are used. "Effects of storing in liquid nitrogen of empty axes of woody plant species. Acer pseudoplatanus) seeds sensitive to dehydration" (Prof. Dr. J. Kowalski, Krakow, Poland).



2.5 Department of Physiology, led by doc. dr hab. Zofia S z c z o t k a includes dr Stanisława P u k a c k a, dr Maria R u d a w s k a, dr Barbara K i e l i s z e w s k a-R o k i c k a, dr Kazimierz K r a w i a r z and Magdalena Ż y m a ń c z y k MSc. The Department has two laboratories: Physiology of Growth and Development (dr S. P u k a c k a) and Physiology of Mycorrhizae and Pathogenesis (dr M. R u d a w s k a).

Research is being conducted in the following projects:



2.5.1. Metabolism and dormancy breaking in seeds of Norway maple, Silver maple and European ash (doc. Z. S z c z o t k a, M. Ż y m a ń c z y k). Physiological processes are being studied in seeds during storage and stratification.

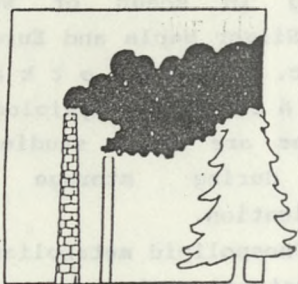
2.5.2. Phospholipid metabolism during natural ageing and partial drying of seeds (dr. S. P u k a c k a). Under investigation are ageing processes in seeds controled under controlled conditions.

2.5.3. "Some physiological processes accompanying the establishment of mycorrhizal symbiosis" (dr M. R u d a w k a, dr. B. K i e l i s z e w s k a-R o k i c k a, dr. K. K r a w i a r z). In laboratory conditions the physiology of mycorrhizae is being studied particularly from the point of view of the enzymes involved and differences between fungal strains in auxin activity.

2.5.4. "Role of fungal toxins in the metabolism of infected plants" (dr K. K r a w i a r z). Following chromatographic identification of fungal toxins their role is investigated in the metabolism of plants attacked by pathogenic fungi.

2.6 Department of Resistance, led by prof. dr hab. Ryszard Siweccki includes doc. dr hab. Gabriela Lorenć-Płuciską, doc. dr hab. Piotr Karolewski, doc. dr hab. Antoni Werner, dr. Krystyna Przybył, dr. Jacek Oleksyn, Lesław Rachwał MSc, Marian Gierczyk MSc. The Department has two laboratories: Biotic Diseases (dr A. Werner) and Abiotic Diseases (doc. G. Lorenć-Płuciską)

Research is being conducted in the following projects:



2.6.1 "Role of fungal microflora in aerial tree organs in the phenomenon of oak decline" (prof. R. Siweccki, dr K. Przybył). Both field and laboratory investigations are concentrated around the problem of identifying disease causing fungi and of species important in constituting the fungal ecosystem protecting

the tree against pathogenic attack.

2.6.2. "Symbiotic systems in the conditions of a polluted forest environment" (doc. A. Werner). An attempt is being made at determining the composition of soil fungi and their role in disease forming processes, infection possibilities and transfer of spores. Laboratory studies complement field observations.

2.6.3. "Resistance of Scots pine to rust" (prof. R. Siweccki) Greenhouse artificial inoculations of pine seedlings of three Polish provenances with the fungus *Melampsora pini-torqua* are aimed at identifying the role of intermediate hosts on the degree of rust infection.

2.6.4 "Reaction of pine, spruce and poplars to industrial pollution under field conditions" (prof. R. Siweccki, L. Rachwał). Field trials with 20 provenances of pine and 81 cultivars of poplars near the Legnica Copper Plant



are under investigation. Also the sensitivity of spruces to pollution from the Nowa Huta smelter near Kraków are conducted in the Niepołomice Forest.

2.6.5. "Physiological mechanisms of tree sensitivity to industrial air pollution" (doc. G. L o r e n c - P l u c i Ń s k a). These are laboratory studies of metabolite transport and phloem loading under stress conditions induced by the sulphite ion.

2.6.6. "Phenolic compounds and proline as biochemical indicators of tree sensitivity to the action of abiotic stress agents" (doc. P. K a r o l e w s k i, M. G i e r t y c h). The experimental material are selected provenances and progenies of pine growing in the vicinity a Phosphate Plant in Luboń near Poznań compared to samples from analogous material growing in the non-polluted environment of the Institute Experimental Forest.

- 2.7. The State Committee for Scientific Research provided funds for the following research projects proposed individually:
- 2.7.1. "Structure and function of root systems of trees in a polluted environment" (coordinator dr M. Rudawska).
- 2.7.1.1. "Mycorrhiza as an indicator of stress" (dr B. Kieliszewska-Rokicka, dr. M. Rudawska)
- 2.7.1.2. "Identification of the specific and quantitative composition of fungi occurring in roots of selected trees growing under controlled conditions and in a polluted environment" (dr K. Przybyl)
- 2.7.1.3. "Structural changes in roots, on tissue and cellular level, taking place under the influence of toxic substances and their influence on the course of mycorrhizal symbiosis and on pathogens" (doc. A. Werner).
- 2.7.1.4. "The root system of forest trees in a degraded environment" (dr. K. Bojarczuk).
- 2.7.1.5. "Evaluation of the sensitivity of Scots pine to toxic substances under conditions of differential mineral nutrition" (dr H. Fober).
- 2.7.1.6. "Evaluation of the course of physiological processes and biomass increment in European populations of Scots pine depending on the accumulation of toxic substances and mycotrophy" (dr J. Oleksyn, dr. M. Rudawska)
- 2.7.1.7. "Role of phenolic compounds in the reaction of roots and other organs of Scots pine to aluminum" (doc. P. Karolowski, M. Giertych)
- 2.7.1.8. "Effect of industrial pollution on the energy status of cells and tissues of forest tree roots" (doc. G. Lorenć-Płucińska)
- 2.7.2. "Biomass production and energy transfer in a Scots pine forest ecosystem" (prof. T. Przybylski)
- 2.7.3. "Effect of pH and aluminum ions on ectomycorrhizal fungi and on the functioning of Scots pine (*Pinus sylvestris* L.) ektomycorrhizae in laboratory conditions" (dr M. Ru -

d a w s k a, dr B. K i e l i s z e w s k a-R o k i c k a).

2.7.4. "The genus *Rubus* L. (blackberry) in Poland" (prof. K. B r o w i c z, prof. J. Z i e l i Ń s k i, dr. K. B o - r a t y Ń s k a, T. T o m l i k).

2.7.5. "Cryogenic storage of oak (*Quercus robur*) gene resources" (prof. B. S u s z k a, P. C h m i e l a r z).

2.7.6. "Analysis of genetic value of populations and progenies of Douglas fir" (prof. L. M e j n a r t o w i c z)

2.7.7 "Species monograph - *Pinus sylvestris* L. (revized edition)" (prof. S. B i a l o b o k).

The arboretum is a place of special interest in the field of phenology, especially in relation to climate and site conditions. Comparative and systematic studies are also being conducted here.

From Spring to Autumn the arboretum is open to the public and it is visited by numerous excursions and individual tourists who are interested in the botanical collections or in the landscape and history of the region.

2.8. The Institute Library has more than 40 000 volumes including



more than 15 000 special publications: old prints, maps, tapes, microfilms and other. The reading room displays 264 foreign and 45 Polish periodicals. These are either from subscription or from exchange for our own publications.

The Library handles sale and exchange of our Institute publications, namely our annual journal "Arboretum Kórnickie", the monographic series "Nasze Drzewa Leśne" (Our forest trees) with a volume for each species - 14 have already been published, "Atlas Rozmieszczenia Drzew i Krzewów w Polsce" (Atlas of distribution of trees and shrubs in Poland) 32 volumes, "Chorology of Trees and Shrubs in South-West Asia and Adjacent Regions" 8 volumes so far and various individual publications such as Ph.D. and habilitation theses of our employees and materials from symposia organized in Kórnik.

### 3. Arboretum

In terms of the scientific program the Arboretum belongs to the Department of Introduction and Acclimatization. However, in view of its role and importance, it has a special place in the structure of the Institute.

The oldest part of the Arboretum is located around the castle, in place of the previous park. In that part there are the oldest specimens of trees and old tree alleys. In the 1960's the Arboretum was expanded to include the region around the Institute building. The youngest part is a section of the Institute Forest "Zwierzyniec", where primarily collections of rhododendrons and some conifer species were planted. The Arboretum collections cover about 50 ha and number about 3000 species, varieties and forms of trees and shrubs. The more valuable collections include rhododendrons, lilacs, ornamental apple trees, forsythias and many conifers.

Geographically the woody plants of the Arboretum originate from the Temperate zones of Europe, Asia and America and are obtained and enriched primarily through exchange arrangements.

The Arboretum is a place of many observations in the field of phenology, sensitivity to climatic and site conditions. Comparative and systematic studies are also being conducted here.

From Spring to Autumn the Arboretum is open to the public and it is visited by numerous excursions and individual tourists who are interested in the botanical collections or in the landscape and history of the region.

#### 4. Forest Range Zwierzyniec

The growing role of forest research in the scientific program of the Institute created a need for forest experimental areas. For this purpose, the State Forest Administration transferred a small forest complex, called the Zwierzyniec Forest, to the Institute. This 200 ha forest has many advantages:-

- Only 2 km away from the Institute, it is readily accessible.
- It is well defined, since on one side it borders on the Kórnik lake and on all others it borders on agricultural fields.
- The greatest advantage of Zwierzyniec forest lies in its richness. Within a small area there occur fragments of soil differing substantially. Diverse water relations make it possible to select experimental plots for species with differing water requirements. The proximity of the lake permits artificial watering of the nursery and if necessary also of plantations. The fauna is also very rich, including some rarities. Ravens (*Corvus corax* L.) nest here and a family of badgers (*Meles meles* L.) have lived here for a number of years.
- An unquestionable advantage of the forest is the fact that it has its own ranger's house, so that the ranger and guardian of the experiments and Arboretum lives on the location. This is important because Kórnik and its lake attract many tourists and in the immediate vicinity there is a very busy camping site and many gardens.

Presently about 60 ha of the Zwierzyniec forest is occupied by experiments and the Forest Arboretum. In all there are 50 different field trials located here with both native and exotic tree species: *Pinus sylvestris* L., *Picea abies* (L.)Karst., *Quercus robur* L., *Fraxinus excelsior* L., *Alnus glutinosa* (L.) Gaertner, *Betula pendula* Roth., *Larix decidua* Mill., *Populus* sp. L., *Abies grandis* Lindl., *Pseudotsuga menziesii* (Mirb.)Franco.

A wide range of experiments are included in the Zwierzyniec Forest. There are model seed orchards, clone archives, full-sib

and half-sib progeny tests and provenance trials very important in our research, some of them of international IUFRO status. Several experimental areas are devoted to research on tree resistance to diseases.

The age of the different experiments varies substantially. The oldest ones are about 30 years old, while the IUFRO *Quercus petraea* Liebl. provenance trial was outplanted in 1992.

The Forest Arboretum is devoted primarily though not exclusively to a collection of *Rhododendrons* and *Azaleas*. Besides the introduced trees and shrubs which are of primary interest to us, there are also a few old monumental indigenous pines and oaks.

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