Program of conserving forest genetic resources and breeding of trees in Poland for the years 2011–2035

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ul. Bitwy Warszawskiej 1920 r. nr 3
02-362 Warszawa
phone 22 822 49 31, fax 22 823 96 79
e-mail: **cilp@cilp.lasy.gov.pl**
www.lasy.gov.pl

The program was developed by the following team:
Prof. dr hab. Władysław Chałupka – Institute of Dendrology of the Polish Academy of Sciences in Kórnik, (chairman)
Prof. dr hab. Władysław Barzdajn – Faculty of Forestry of the Poznań University of Life Sciences
Mgr inż. Stanisław Blonkowski – Susz Forest District, Olsztyn Regional Directorate of the State Forests
Prof. dr hab. Jarosław Burczyk – Institute of Experimental Biology of the Kazimierz Wielki University in Bydgoszcz
Mgr inż. Wojciech Fonder – Warsaw Regional Directorate of the State Forests
Mgr inż. Tomasz Grądzki – Department of Silviculture and Forest Utilization of the Directorate-General of the State Forests (DGSF)
Mgr inż. Zbigniew Gryzło – Nawojowa Forest District, Kraków Regional Directorate of the State Forests
Mgr inż. Piotr Kacprzak – Radom Regional Directorate of the State Forests
Dr inż. Jan Kowalczyk – Department of Silviculture and Genetics, Forest Research Institute, Warsaw
Mgr inż. Czesław Kozioł - Kostrzyca Forest Gene Bank in Miłków
Dr inż. Jan Matras - Department of Silviculture and Genetics, Forest Research Institute (FRI), Warsaw, (secretary)
Mgr inż. Tadeusz Pytko – Leżajsk Forest District, Krosno Regional Directorate of the State Forests
Mgr inż. Zenon Rzońca – Wisła Forest District, Katowice Regional Directorate of the State Forests
Prof. dr hab. Janusz Sabor – Faculty of Forestry of the Agricultural University in Kraków
Mgr inż. Zbigniew Szeląg – Łopuchówko Forest District, Poznań Regional Directorate of the State Forests
Prof. dr hab. Stefan Tarasiuk – Faculty of Forestry of the Warsaw University of Life Sciences
The team to prepare the 'Program of conserving forest genetic resources and breeding of trees in Poland for the years 2011-2035' was appointed by the Director-General of the State Forests under Directive no. 88 dated 14 November 2008, no. ZG-7132-33/2008.

Translator
prof. Maciej Giertych

Photographs
Stanisław Blonkowski (S.B.), Jan Kowalczyk (J.K.), Jan Matras (J.M.),
Tadeusz Pytko (T.P.), Zenon Rzońca (Z.R.)

Graphic design
Andrzej Leśkiewicz

Proofreading
Włodzimierz Adamczyk

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Anter – Poligrafia, ul. Jaracza 18 m. 18, 00-378 Warszawa

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Spruce clonal seed orchard (in the foreground) in the Zwierzyniec Forest District;
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1. Introduction

The development and importance of breeding forest trees and forest seed management occurred primarily thanks to two eminent personalities: prof. Stanisław Tyszkiewicz and Stefan Kocięcki and their students. S. Tyszkiewicz, the author of the academic textbook 'Forest Seed management', is considered to be 'the father of breeding of forest trees' in Poland (40, 41).

First actions in the field of breeding of forest trees were undertaken in Poland in the inter-war period when, following the directive of the Director-General of the State Forests dated 29 December 1933, Poland was divided into 8 seed regions and the selection of 'seed stands' was recommended, defining the rules for collecting, storage and transfer of seed between Forest Districts. However, the practical selection of seed trees and stands occurred in the State Forests only in the 1950s, partly on the initiative of the Department of Dendrology and Pomology of the Polish Academy of Sciences (PAS) in Kórnik, which in 1959 obtained a permission from the Minister of Forestry and Wood Industries to select plus trees (PT) '*so as to preserve the best individual trees of various species and forms for the national economy*' (Dendrological Archives of PAS). In later selection work, which was coordinated by the head of the Department of Seed Management and Selection of the Forest Research Institute (FRI) Prof. S. Tyszkiewicz, use was partially made of the evaluation and selection procedures for plus trees developed in the PAS Department of Dendrology and Pomology in Kórnik. Breeding activity in the State Forests began formally in 1959 when the Ministry of Forestry and Wood Industries issued a regulation concerning the selection of seed stands of the most important forest species. These stands were to serve three main purposes:

- preservation of the most valuable populations for research purposes, primarily on intra-specific variability;
- establishment of a basis for the collection of seed, permitting the reproduction of the rich collection of genotypes in registered progeny plantations;
- establishment of a basis for the selection of plus trees (PT) and the planting of clonal and seedling seed orchards.

The idea of selection development in forest seed management has been implemented for many decades in the form of programs whose realisation provided a basis for modern seed management in the State Forests. On the initiative of the Directorate-General of the State Forests (DGSF) and the Department of Seed Management and Selection of the Forest Research Institute, 'A program of improvement of seed management and the introduction of achievements of practical forest genetics in the State Forests for the years 1975–1990' was prepared (19). This document outlined for

Production of the forest reproductive material of Norway spruce in one of the nurseries in the Bialystok RDSF (J.M.)

the first time the obligations in this field of various administrative units of the State Forests.

Directive no. 7 of the Director-General of the State Forests dated 7 April 1988 on the selection of forest trees for the needs of seed production defines precisely the rules for selecting, managing, maintaining and utilizing clonal and seedling seed orchards and for establishing progeny plantations (8, 48).

In 1991, as a continuation of these activities, 'The program of conserving forest genetic resources and breeding of forest trees in Poland for the years 1991–2010' was introduced, which was revised in 2000 (13, 14). This program followed from the work already conducted in breeding of forest trees and it introduced for the first time in the State Forests the notion of the need to conserve the existing genetic variability in the forests.

The basic concern, resulting in the expansion of the proposed program to include gene variation conservation, was the observation in the 1980s

Clonal seed orchard of European larch in the Leżajsk Forest District (J.M.)

that the environment was being endangered, particularly by industrial emissions which were causing pathological symptoms over substantial areas, reduction of the health of the trees and local forest decline, e.g. in the western Sudety Mountains. The purpose of these activities was to reintroduce a state of environmental stability in the long term.

The program had the following goals:

- to conserve forest genetic resources which are to serve the continuity of ecological processes in the forest ecosystem and, in particular, the maintenance of forests and the possibility of their utilization, as well as reintroduction of forests in degraded and destroyed environments and the conservation of the genetic- and bio-diversity for future generations;
- to improve seed management in order to ensure a constant supply for all users of propagation material of an appropriate quality and in required quantity;
- to select forest trees so as to ensure an intensification of the production and improvement of quality, taking into consideration the plasticity and resistance of trees to biotic factors.

Since Poland's entry into the European Union (EU) new requirements were placed on seed collection and the functioning of seed management procedures in order to comply with the principles obligatory in the EU. In 2006 Regulation no. 7A concerning protection of forest genetic resources for the needs of seed management and forest silviculture was developed and introduced (2, 7, 15).

1.1. Conditions justifying the need for the preparation of the 'Program of conserving forest genetic resources and breeding of trees in Poland for the years 2011–2035'

A. The objectives of the „Program of conserving forest genetic resources and breeding of forest trees in Poland for the years 1991–2010' have been realized.
B. The pro-ecological principles of forest management and increase in importance of non-productive functions of the forest may lead to a reduction of the production functions.
C. In spite of the considerable increase of timber production in the years 1991–2010 (an increase from 24 to 34 million cubic meters) the demand for wood continues to exceed supply. At the same time the production potential of Polish forests is not fully utilized.

Beech crop in northern Poland in 2006 (J.M.)

Clonal seed orchard of silver birch in the Susz Forest District (S.B.)

D. The global climatic changes should represent a significant element modifying the strategic objectives of the new program. The functioning of the program should guarantee the conservation of genetic variability and sustainability of forest in the changing environmental conditions and, at the same time, prevent a reduction of genetic diversity of stands. The breeding of forest trees should first of all be directed towards a genetic modification of forest populations in order to increase their potential to adapt to the changing environmental conditions.
E. Adaptation of seed management procedures to the requirements of the European Union and protection of Polish forests against the uncontrolled introduction of seeds and planting material of unknown origin which encroach on the specificity of our native stands and endangering the stability of forest ecosystems (6, 16, 17).

1.2. Basic terms and definitions

Below is a list of the basic terms and definitions used in the description of the tasks in the field of protection of genetic diversity and breeding of forest trees and of the most important terms used in the Forest Reproductive Material Act, knowledge of which is essential for the proper execution of the obligatory regulations.

Genetic diversity – the genetic differentiation between various populations of the same species and the specific intra population variability that resulted from the adaptation of the population to the given environmental conditions over many generations.

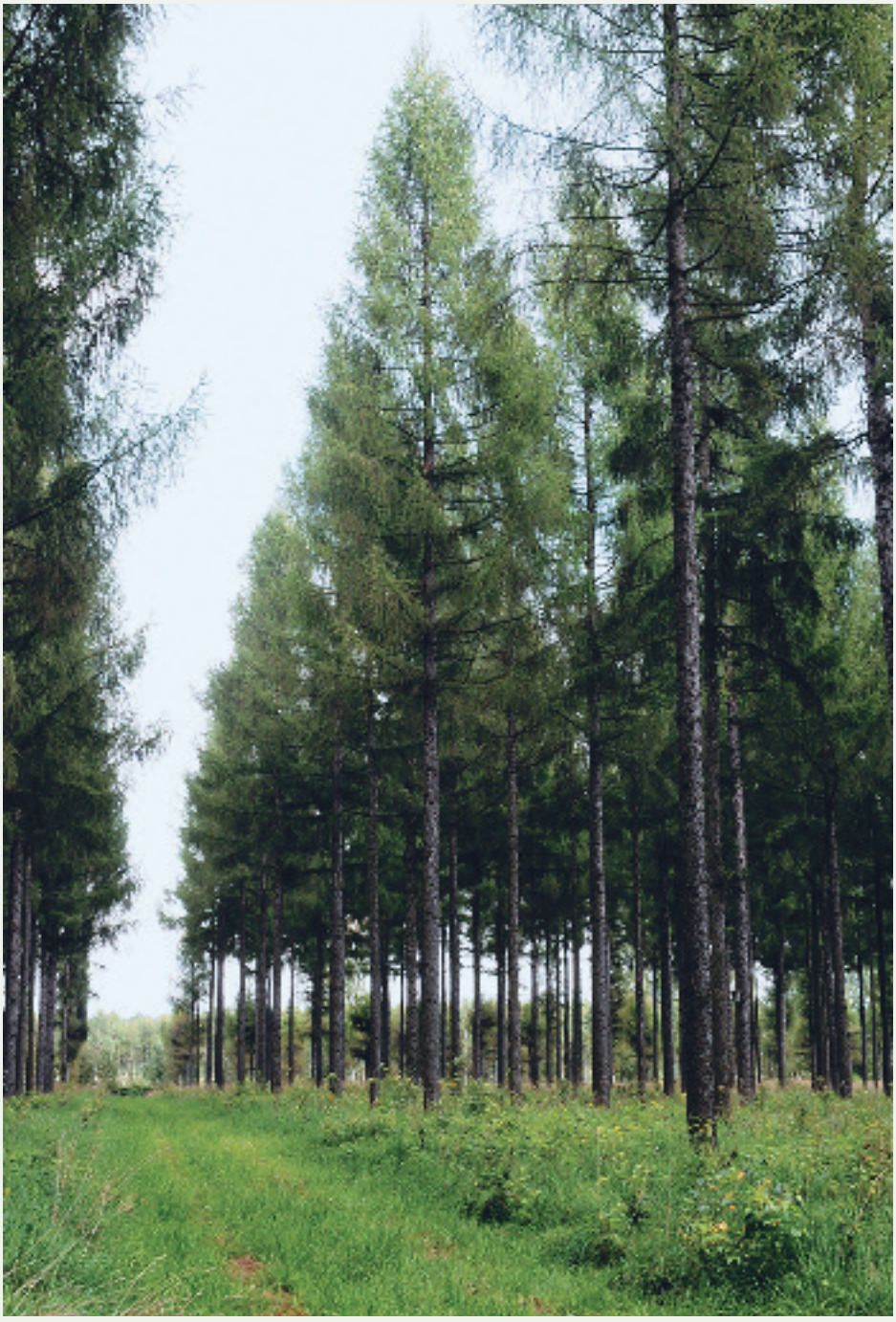
Conservation of gene resources – all activity aimed at the preservation of the intra- and inter-population genetic variability.

Conservation stand – a forest stand selected for the preservation of its genetic pool in view of its specific traits.

Conservation plantation – a forest area formed from natural or artificial regeneration of a conservation stand.

Conservation area *in situ* – a forest stand and its progeny from natural or artificial regeneration within the area of occurrence of the population selected for the preservation of its gene resources.

Conservation area *ex situ* – a forest stand established beyond the range of natural occurrence of the given population in order to preserve it from an endangered situation.



Clonal seed orchard of European larch in the Leżajsk Forest District (T.P.)

Gene bank – the genetic resources of a selected population and of individual trees protected in the form of a conservation area *in situ* or *ex situ*, as well as the long term storage of seeds, pollen and plant tissues.

Population – a group of organisms (trees) of one species living simultaneously in a given environment, interacting with each other and capable of producing fertile progeny.

Source population – a group of trees of one species from which biological material is taken for use in the breeding process and for the production of forest reproductive material for economic purposes.

Breeding population – a group of selected trees which are in the process of genetic improvement so as to produce the next generation in the selection cycle.

Production population – a group of selected trees from a breeding population serving the raising of improved reproductive material for the needs of forest production.

Genotype – an individual containing a specified set of genes determining its heritable characteristics.

Invasive species – introduced species that are very expansive, which spread naturally or with the help of man and constitute a risk for the native flora and fauna of a given ecosystem, competing with the native species for a given ecological niche and contributing to the decline of a native species.

Anthropophytes – species or other taxa of introduced synantrophic plants in a given region; they occur both in artificial environments, formed as a consequence of the activity of man, as well as on natural and semi-natural sites. The degree of domestication of the anthropohytes can change with time, for example a species domesticated initially in an anthropogenic site may with time colonise semi-natural and natural environments.

Breeding – a set of procedures and processes for the development of a cultivated organism with the aim of obtaining more valuable populations, varieties and races. The aim is to improve the genetic value so that the progeny population would be better than the parental one in some specific traits;
- **population breeding** – a large population is the object of improvement,
- **individual breeding** – an individual or a family is the object of improvement.

Heritability – a genetic indicator determined by the proportion of the genetic variance in the phenotypic variance. It pertains only to the

A correct registration number assigned to a Scots pine maternal tree (J.M.)

Spruce clonal seed orchard in the Susz Forest District (S.B.)

populations, progenies and individuals for which it was calculated in a given set of environmental conditions.

Breeding value – genetically determined ability of an organism (tree) to transfer a given trait or traits to its progeny (both for an individual trait and for a complex of traits included in an index value).

Genetic gain – a mean hereditable improvement of a given trait in a progeny population relative to the maternal population that underwent selection.

Plasticity – trait of a population or of an individual permitting similar growth and development in a variety of ecological conditions.

Basic forest material (BFM) – single individuals (maternal trees, tested trees), groups of trees (source of seed) and populations (stands of identified origin, selected stands, tested stands) serving for the gathering of forest reproductive materials (FRM). Basic forest material consists of:

a) **source of seed** – trees growing in a given region from which seeds are collected,
b) **forest stand** – a group of trees of similar morphological traits growing next to each other and influencing each other,
c) **seed orchard** – a group of selected clones or progenies managed or isolated in a way preventing pollination from external sources, specially designated for the production of abundant, easy to collect seed,
d) **maternal tree** – a tree used for the collection of forest reproductive material through controlled or free pollination, treated as the maternal individual given pollen of one or many paternal trees,
e) **clone** – a group of individuals with an identical genetic identity obtained through asexual reproduction of a single individual,
f) **clonal mixture** – a group of several identified clones mixed in some predetermined proportion.

Forest reproductive material (FRM) – the following can be considered as forest reproductive material:

a) seed units – cones, infructestences, fruit and seed intended for the production of planting material,
b) parts of plants intended for the vegetative production of planting material,
c) planting materials raised from seed units or parts of plants or seedlings from natural regeneration.

Forest reproductive material is obtained from the basic forest material (BFM).

Progeny – offspring of a given maternal tree obtained by sexual reproduction.

Autochthonous origin – a stand or seed source is autochthonous if it was regenerated naturally or artificially for several generations using forest reproductive material from basic forest material growing locally or in direct vicinity of the place.

Indigenous origin – a stand or seed source is indigenous when:
a) it is autochthonous,
b) it originated artificially from seed coming from the same region of origin in which it grows.

Initial origin – under this term the following are understood:
a) for autochthonous stands or seed sources the place in which grow the trees that were the source of seed or in which the stand grows,
b) for non-autochthonous stands or seed sources the place in which the stand stood at the time seeds or cuttings were harvested, from which the seed source or stand resulted.

Artificial hybrid – forest reproductive material obtained by crossing individuals from two or more tree species.

Forest reproductive material intended for forest needs – forest reproductive material which is intended for reforestation or afforestation or serves the needs of forest management in the understanding of Art. 6, § 1 pt. 1 of the Forest Act of 28 September 1991.

Production of forest reproductive material – all stages of producing forest reproductive material from the basic forest material in order to place it on the market, including the stages of making the seed unit and growing plants from the seed unit or from cuttings.

Manager of the basic forest material – a State organisational unit that does not have a legal personality and which conducts the work on the basis of specific directives, having the rights of usage relative to the basic forest material that is the property of the State Forests.

Producer – a physical, legal or organisational entity that does not have a legal personality and is engaged in the production of the forest reproductive material.

Turnover of the forest reproductive material consists of:
a) buying forest reproductive material,
b) offering for sale or selling forest reproductive material,
c) acting as intermediary in the functions described under a) and b).

A plus tree of wild cherry in the Gdańsk RDSF (J.M.)

Supplier – this refers to the physical, legal or organisational entity that does not have a legal personality for which the subject of commercial activity is turnover of forest reproductive material.

Seed regionalization – division into regions of origin and the principles of utilization of forest reproductive material of a given species within them.

Region of origin – a designated region or group of regions in which currently a forest stand grows or which constitutes a seed source for basic material.

1.3. Current rules and legal regulations

Prior to Poland's entry into the European Union, the functioning of the forest genetic resources was primarily based on directives of the Director-General of the State Forests. In practice, the majority of forest seed base was located in the State Forests. Only in the case of import and export of forest reproductive material was use made of the agricultural rules for seed management. Currently, the functioning of the forest seed base is in concordance with the EU rules (Directive no. 1999/105/EC dated 22 December 1999 concerning marketing of forest reproductive material and the detailed specifications of the EU to this directive) (3, 21–23), as well as with the Forest Reproductive Material Act of 7 June 2001, together with the executive provisions to this act (25–39, 43).

The European Union has no common forest policy. The present position of the EU on the general directions of forest development, which are obligatory for member states, have been included in the resolution of the EU Council dated 15 December 1998 on the EU strategy for forestry. Trade in timber and in forest reproductive material and the supply of forest services are covered by the regulations concerning free transfer of capital, goods and services.

Detailed information concerning the majority of currently obligatory rules pertaining to functioning of the forest seed base and the protection of forest genetic biodiversity can be found in Supplement 1 to the current document.

The maternal tree of pedunculate oak numbered 10 000 in the Brzeg Forest District (J.M.)

2. Realisation of the 'Program of conserving forest genetic resources and breeding of trees in Poland for the years 1991–2010'

2.1. Tasks of the 'Program for 1991–2010' and the state of their realisation

The tasks placed for realisation by individual Regional Directorates of the State Forests (RDSF) within the 1991–2010 program included:

- increase of the area of reserved seed stands (RSS) to 15 700 ha,
- maintain the area of production seed stands (PSS) at a level of 220 000 ha,
- increase the number of plus trees (PT) (maternal) to 9270,
- establish 1160 ha of clonal seed orchards and 800 ha of seedlings seed orchards,
- establish 50 000 ha of progeny plantations (9, 11, 12, 13, 14).

The degree of realisation of the tasks in the program for the years 1991–2010 is presented in a systematic format in the tables further in this chapter (source GDSF and FRI).

2.1.1. Source of seed

Source of seed is a new subcategory of the forest seed base belonging to the category of identified sources. This base started in 2004 after the Forest Reproductive Material Act entered into force. According to the situation on 1 January 2009, in the State Forests there were jointly 2567 sources of seed primarily for subsidiary tree species (Supplement 2, Table 1).

Production of white fir transplants with covered root system in the container nursery in the Oleszyce Forest District (J.M.)

2.1.2. Stands of known origin (production seed stands – PSS)

According to the adopted norms all Regional Directorates of the State Forests (RDSF) have been obliged to select, prepare, use and maintain at a constant set level the area of stands of 11 native forest forming species and of 2 introduced species. The total task for all the RDSFs was 220 000 ha. At the end of 2008 the total area of stands of known origin (PSS) in the State Forests was 216 707 ha thus the tasks in this field are being realized on a proper level. As can be judged from an evaluation of the potential possibilities of seed supply from these stands in the average and pessimistic variants, they are above needs (Supplement 5, Tables 1 and 2).

Yew bred in a nursery in the Oleszyce Forest District as part of the 'Country-wide program of re-establishment of yew' (J.M.)

2.1.3. Selected stands (reserved seed stands – RSS)

According to the program the area of selected stands (RSS) should have increased from 13 350 ha in 1990 to 15 600 ha (after a correction made in 1998) in 2010, that is by about 2250 ha. Currently the State Forests have 16 734 selected stands (RSS) (Supplement 2, Tables 3 and 4).

2.1.4. Maternal trees (plus trees – PT)

According to the tasks included in the 'Program' it was planned to increase the number of maternal trees (PT) by 4390 individuals. The final number

of PT should have been 9270 individuals. In the years 1991–2010 jointly 6000 maternal trees (PT) were recognized. The largest number given to a plus tree is 10 274. However, a certain number of maternal trees have dropped out of the list and are not represented in the clone archives or in seed orchards, thus the final number of plus trees that the State Forests have now is 9775 individuals (Supplement 2, Table 5).

2.1.5. Clonal seed orchards

The plan was to have by the year 2010 a total area of seed orchards of 1160 ha, including 450 ha of Scots pine, 95 ha of Norway spruce, 260 ha of European larch, 15 ha of white fir, 35 ha of black pine, 35 ha of other conifer species, 65 ha of silver birch, 20 ha of common beech, 10 ha of pedunculate oak, 20 ha of sessile oak, 80 ha of black alder and 75 ha of small leaved lime. In the years 1991–2010 jointly 869 ha of clonal seed orchards were established so that now in the State Forests there are 200 seed orchards with a total area of 1260 ha (Supplement 2, Tables 6 and 7).

2.1.6. Seedling seed orchards

The program envisaged the establishment of 800 ha of seedling seed orchards. In the years 1991–2010 an area of 395 ha of seedling seed orchards was established for 10 different species. Thus currently the State Forests have 103 seedling seed orchards with a total area of 699 ha (Supplement 2, Tables 8 and 9).

2.1.7. Progeny plantations

In the program it was assumed that the totality of breeding efforts obtained as a result of applied selection in the State Forests would be assured by the establishment of progeny plantations from the selected material. Hence the great emphasis in the program on the proper realisation of the blocks of progeny plantations and the magnitude of the tasks. It was planned that by 2010 there should be 50 000 ha of progeny plantations and in fact 60 000 ha have been established for the basic forest species (Supplement 2, Table 10).

2.1.8. Conservation stands

The most important criteria qualifying a stand for conservation is its being indigenous, determined on a basis of its age (minimum 150 years for

Maternal pine trees selected in 2005 in the territory of the Toruń RDSF (J.M.)

conifers and 200 years for broadleaved), vitality indicating adaptation to the local conditions and its silvicultural value. Stands qualified as such represent exceptionally valuable objects from the point of view of protecting gene resources because they are remnants of natural populations adapted to growth in the local conditions by natural selection over several generations. Up to the year 2010 in all the RDSFs 210 conservation stands were qualified, including 126 of Scots pine, 17 of Norway spruce, 5 of European larch, 13 of white fir, 29 of pedunculate oak, 4 of sessile oak and 10 of common beech. The joint area of conservation stands in the State Forests is 3157 ha (Supplement 2, Tables 11 and 12). From the qualified conservation stands so far 866 ha of progeny plantations have been established. A detailed list of the plantations established prior to 1 January 2009 is given in Table 13 of Supplement 2.

Conservation stands were also qualified in National Parks where 117 such populations of trees and shrubs have been selected for the protection of forest genetic resources. The total area of these stands is 2539 ha (Supplement 2, Tables 14 and 15).

2.2. Program of testing the progeny of basic forest material (BFM)

Realization of the 'Program of testing the progeny of reserved seeds stands, plus trees, clonal and seedling seed orchards' in the State Forests started in 2005 after the relevant Directive no. 85 was signed on 31 December 2004 by the Director-General of the State Forests. It defined the duties of organisational units of the State Forests relative to the program of BFM progeny testing.

2.2.1. Purpose and scope of testing

The purpose of testing the progenies of forest trees conducted within the breeding program 'Program of testing the progeny of reserved seeds stands, plus trees, clonal and seedling seed orchards' (1) is to determine the genetic value and silvicultural components of the basic forest material which is used in forestry practice, i.e. seed stands, clonal and seedling seed orchards, plus trees, clones and clonal mixtures (31, 43); to prepare the principles of rational use of the seed base by determining the area of possible transfers according to the adopted seed regionalization norms (4, 30, 37, 38, 46); and to modify these norms on the basis of genetic information obtained from these tests.

The results of these tests will help the optimization of tasks realized in the State Forests with regard to forest permanence, i.e. the improvement of forest management practices on ecological basis with the aim of conserving forest genetic resources.

The detailed aims of testing the progeny are:

- determination of the genetic and silvicultural value of reserved seed stands (RSS), plus trees (PT), clonal and seedling seed orchards (2),
- qualification of basic forest material (BFM), i.e. reserved seed stands (RSS), plus trees (PT), clonal and seedling seed orchards, to the category of tested units,
- verification of the current borders of regions of origin and of the rules for the transfer of forest reproductive material (FRM),
- development of a database concerning the genetic characteristic of BFM registered in the Country-wide Register of Species under this program of testing,
- increase of the market value of the FRM.

Detailed rules for the testing of BFM registered in the Country-wide Register are specified in the Directive of the Minister of the Environment dated 23 April 2004 concerning the mode of conducting the testing of basic

The 'Taborska' pine population reserve showing maternal trees (J.M.)

forest material (31), which would confirm the fulfilment of the requirements needed for the registration of the basic forest materials in part IV of the Country-wide Register of Basic Forest Material.

2.2.2. State of realization of the testing program

The state of realisation of the program of testing the progeny of BFM in the State Forests as of 31 December 2009 has been presented in tabular form (Supplement 3, Table 1). In the table information is given of the size of the resources of FRM gathered for testing in the Kostrzyca Forest Gene Bank and the number of testing areas already established or in the process of being established. However, there is no information on the resources for the testing of clonal and seedling seed orchards gathered in the Kostrzyca Gene Bank because, following the adopted program of testing, these objects will be dealt with at the end (after 2020).

The FRM collected for testing is immediately being included in the field trials. Firstly, use was made of the population gene resources of common beech and white fir deposited in the Gene Bank, which were in the process of being removed from the Bank. Currently, use of other species gathered in the Gene Bank has started. According to the data provided by the Kostrzyca Forest Gene Bank, it gathered large quantities of the populations of FRM: 52% for Scots pine, 68% for Norway spruce and 45% for European larch. For other species the population material for testing in the Gene Bank is small. A much smaller proportion of material for testing (less than 25%) pertains to plus trees (PT).

It is necessary to intensify the collection of FRM for testing, especially of species whose seeds can be stored, so as to be able to establish annually 16–20 testing areas regardless of the current seed supply. This number of testing areas will assure the completion of the 'Program' in the time envisaged.

The first testing areas with common beech have been established in the spring of 2006. So far the following have been established:
- 17 test areas for all populations of white fir in Poland,
- 16 test areas for the majority of common beech populations in Poland,
- 12 test areas for 195 common beech plus trees from regions:
  I – northern and II – central.

Currently there are being established:
- 20 test areas for plus trees of white fir,
- 12 test areas for plus trees of Scots pine from regions:
  I – Białystok, V – Piła and VI – Szczecin,

Clonal seed orchard of the 'Tarnawa' spruce population in the Oleszyce Forest District (J.K.)

Plantation of small-leaved lime in the Susz Forest District (S.B.)

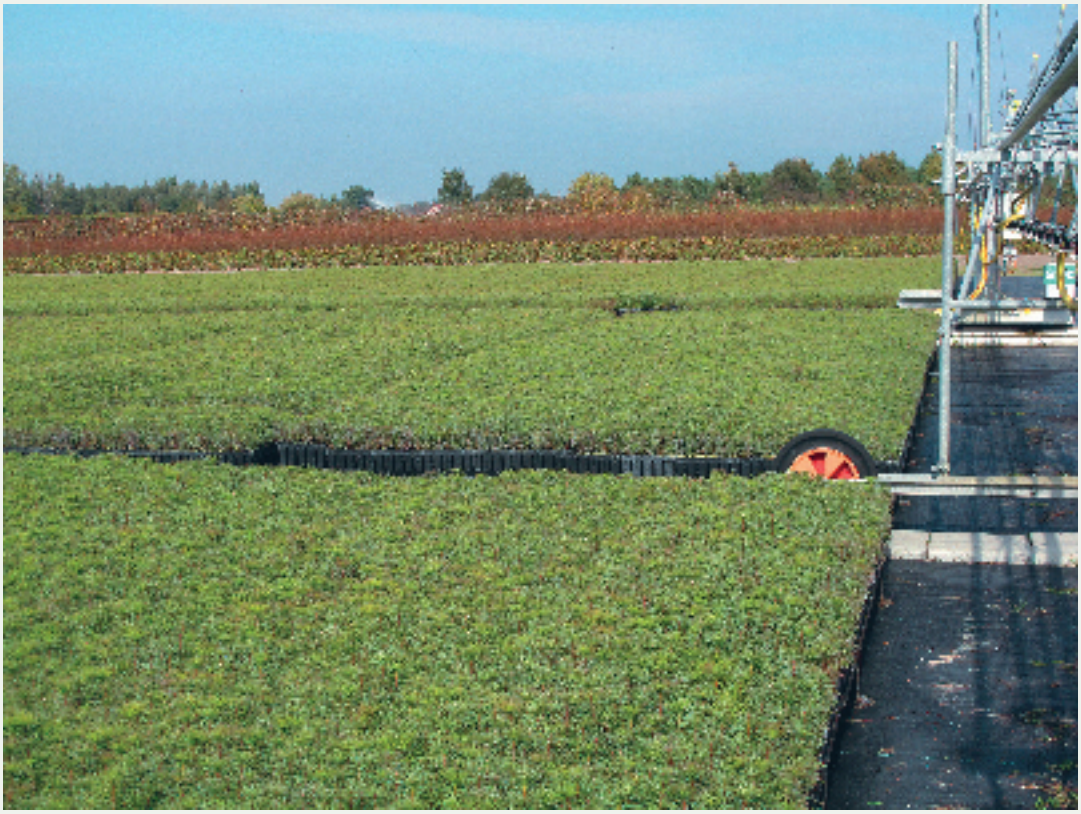
– 12 test areas for populations of Scots pine from regions:
I – Białystok, II – Olsztyn and IX – Radom–Lublin.

In all the established test areas observations and measurements are being conducted in accordance with the methodology specified in the 'Program'.

2.3. Technical infrastructure for forest seed management

It is not possible to provide forest nurseries with a steady supply of seed of a determined origin, quality and silvicultural value without a quality

Production of pine transplants for progeny testing in the Kołaki forest nursery (J.M.)



technical infrastructure for seed management that would assure their proper extraction, storage, stratification and evaluation. To cover the needs of forest districts in an average year it is necessary to have in storage a dozen or so tons of conifer seed and several thousand tons of broadleaved species seed. The changes taking place in the last years in the direction of naturalization of silvicultural processes are accompanied by technical developments.

In the last decade of the 20th century many modern facilities were established (seed extraction and seed storage plants) forming a system encompassing the whole country (Fig. 1). Also many new technologies in the field of collecting, cleaning, extracting and storing seeds have been

Clonal seed orchard of European larch in the Kwidzyn Forest District (J.M.)

introduced, for example collection with the use of nets, cleaning and separation of seeds in the IDS and PREVAC systems, gravitational separation, de-winging using water, long term storage of seeds of common beech, oaks, fir and other wood species, storage by cryogenic methods. These technologies are employed using machines and equipment of both Polish and foreign manufacture.

The building and modernisation of infrastructure facilities serving seed management required significant organisational and logistic effort and enormous financial resources. In the years 1995–2005 alone more than 1 billion PLN was spent on investments and realisation of seed management and nursery programs.

In the years 1994–1998, within the 'Program of development of selected fields in forestry and national parks', additional resources were directed towards the development of infrastructure: from a World Bank loan – 10.4 million USD and from the Global Environmental Fund (GEF) – 5 million USD.

Changes in seed management and in the used techniques and technologies one can truly refer to as a civilisational leap forward. At the same time, objects built by our predecessors have been conserved and restored, among others the cone extraction plants in Białogard, Ruciane, Janowice Wielkie, Czarna Białostocka, Klosnowo and Zwierzyniec.

Thanks to all these efforts in the State Forests optimal conditions have been generated for the storage and preparation for sowing of seeds collected in the forest districts.

2.3.1. Seed extraction plants and seed storage facilities

As mentioned earlier, the precursor of the Polish seed extraction procedures was Prof. S. Tyszkiewicz who, based on his own laboratory studies and tests in the post-war period, formulated the principal rules for seed extraction. His principles were later utilized in the construction of ten two-stage extraction plants, subsequently referred to as 'FRI type'. All Polish extraction plants use the system of thermal cone extraction consisting of slow gradual drying in dry, hot air, starting from low temperatures. As the cones dry the temperature is increased. Currently in Poland there are 16 mostly new or modernized seed extraction plants which have been made available for utilization after 1990.

The modern new extraction plants (e.g. in Jarocin, Dukla, Grotniki, Kostrzyca Forest Gene Bank) or the modernized ones (Białogard, Czarna Białostocka, Brzesko, Klosnowo, Lasowice, Zwierzyniec) are equipped with electronic control systems of the cone drying process.

The specificity of forest management requires that there be long term storage of large quantities of seed of various species of trees and shrubs in order to ensure a regular supply for the needs of forest nurseries. Seed reserves for the current needs and for the blank years when there is no new seed available have to be held in storage. As a rule these are storage facilities for conifer seed, usually functioning near the seed extraction plants or else they are specially built for the storage of common beech nuts. The proper storage of seed of Scots pine, Norway spruce, European larch, white fir, silver birch, black alder, common beech and oaks for several years and even several decades has become possible thanks to the development of principles determining the permissible level of moisture and optimal storage temperature. The lowering of the moisture content of seeds is one of the basic factors reducing the life functions of the seeds that will permit

Selected seed stand of pedunculate oak in the Susz Forest District (S.B.)

their long term storage. The drying of the seeds can take place only to the required threshold level which for birches, alder, pine and spruce is 3.5%, for ash and lime 8%, for common beech and fir 8–12%, for sycamore 27% and for oak 40%. The maximal drying temperature for the seeds of birch, alder, pine and spruce should not exceed 45°C, for fir 40°C and for lime, ash and common beech 25°C. The traditional method of storage is to keep the dried seed at a temperature of –10°C. The low moisture content does not destroy the seed of the majority of species but causes a slowing of the metabolic activity both of the seeds themselves and of the micro-organisms such as fungi and bacteria which are present in the seeds.

The developed technologies permit storage for several years or several decades in controlled conditions of air moisture and temperature. However, not all seed can by subjected to drying and storage in low temperatures without loss of viability. The deterioration of the physiological condition of the seed of some species is one of the most important and most difficult problems in the storage of seed material. The storage of seed in traditional conditions for longer periods does not ensure maintenance of 100% of the original seed viability.

One of the methods of storing, particularly for species exceptionally sensitive to partial drying from the group of recalcitrant seeds (pedunculate oak, sycamore) and of species that set seeds irregularly and lose viability during storage (beech, oaks, white fir and others), is based on the conservation of plant parts or seeds in liquid nitrogen. The cryoconservation employed in the Kostrzyca Forest Gene Bank assumes that the methods of such storage will be improved so as to increase the percentage of survival of seed embryo axes. Storage in conditions of controlled air temperature and humidity for coniferous seed, belonging to the orthodox category, is usually located in the vicinity of the seed extraction plants. Conifer seed, except for white fir, can be stored without loss of germination capacity for several decades and the same is true for the seed of birch and alder. Species with heavy seeds, such as oaks and beech, create more problems. The developed technologies permit the storage of oak seeds only until the third spring after seed collection and of common beech for four years. However, the weight and volume of these seeds result in the cost of their storage being higher than for the other broadleaved species. Thus there are no storage facilities built in this country for oak (one experimental store adapted for oak seed functions in Łopuchówko Forest District), and for common beech there are only a few. The best known ones were built in the 1990s in Białogard, Dukla and Gryfino Forest Districts.

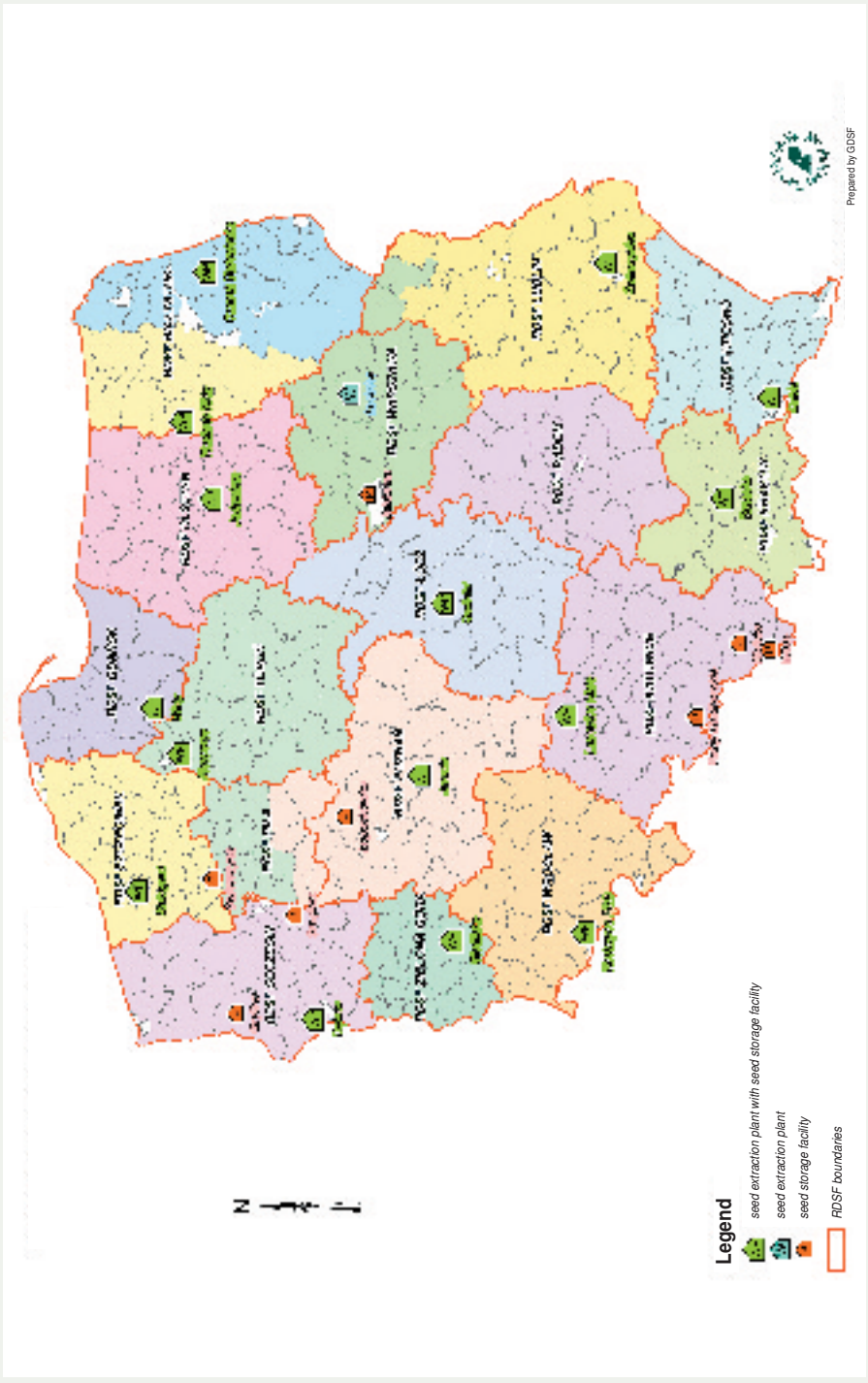


Fig. 1. Technical infrastructure of forest seed management in the State Forests

2.3.2. Seed testing stations and stations for the control of seed quality

Seed testing stations (STS) began to operate in the State Forests in the 1930s. Their development and high quality are owed to Prof. S. Tyszkiewicz who was also interested in the problem of seed testing. The methodology developed by Prof. Tyszkiewicz, supplemented with newer methods, is in operation to this day. In 1939 a study entitled 'Evaluation of tree seeds' was published, which included the full methodology for the testing of seed of forest trees and shrubs. In 1996 new principles of seed testing were developed in the Forest Research Institute by a team led by A. Załęski and confirmed for use in the State Forests (47). They include current research results and the rules obligatory in the European Union. These methods have been enriched, for example, by X-ray methods permitting a rapid evaluation of the seeds without destroying them. Currently in the State Forests the following methods of seed testing are obligatory:

- germination method,
- tetrazolium method,
- indigo-carmine method,
- cutting method,
- X-ray method.

The network of seed quality testing stations (STS) functioning in the State Forests (Fig. 2) permits the systematic accumulation of data on seed and cone quality from all regions of the country. A statistical analysis of the data is conducted in the Forest Research Institute. The system of information gathering using the internet permits following the seed crops and the quality of seeds and allows the prompt publication of annual communiqués about the expected crop of the most important forest trees and shrubs. Information and the published documents constitute the basis for the silvicultural decision-making at all levels of administration in the State Forests. The seed testing stations are located in the following Forest Districts: Białogard, Zwierzyniec, Dukla, Rytel, Siewierz and also in the Kostrzyca Forest Gene Bank, in the State Forests Development and Training Centre in Bedoń and in the Production and Trade Unit in Olsztyn. Stations controlling the quality of seed operate in Bielsko Biała, Jarocin, Kaliska, Rudy Raciborskie and Wisła Forest Districts (Fig. 2).

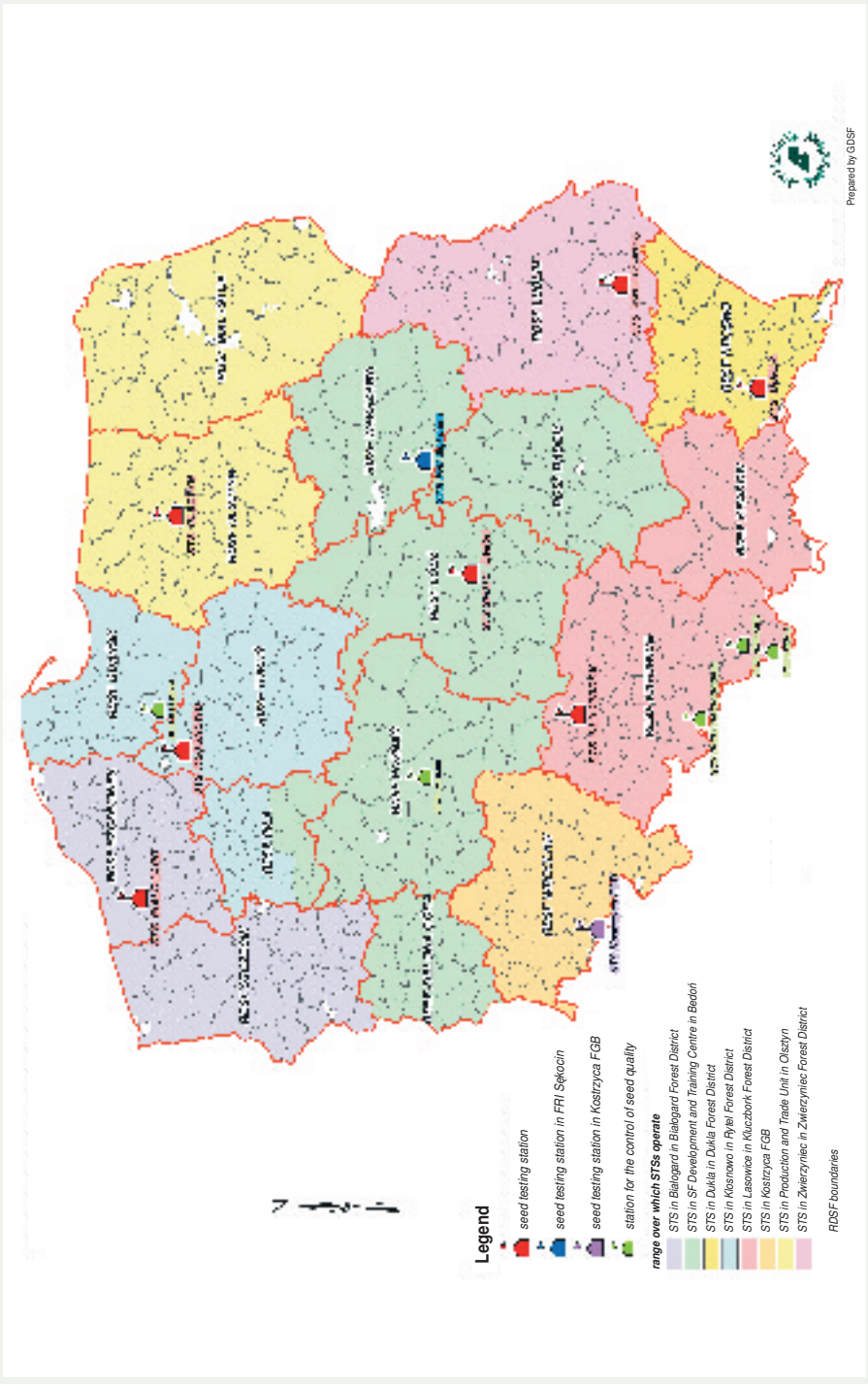


Fig. 2. Location of seed testing stations and stations for the control of seed quality, including the regions over which STSs operate

Black locust plus trees in the Krosno Odrzańskie Forest District (J.M.)

3. Assumptions pertinent to the 'Program of conserving forest genetic resources and breeding of trees in Poland for the years 2011–2035'

The program is based on the following assumptions:

A. The program is a continuation and development of the programs currently being realized, thus the main aims of these programs as well as the modes of their realization are being preserved.

B. The program covers both the activities in the field of conservation of biodiversity, including gene conservation, and the breeding program of forest trees. Joint approach will permit attaining systematic progress in the carrying out of the various functions of managed forest communities, including their production functions.

C. The program determines the scope of factual and material tasks as well as supplementary activities, which include primarily:
   - scientific research essential for the realization of the 'Program',
   - conservation of the gene resources of other plant components of the forest ecosystems,
   - establishment of a technical infrastructure serving the realization of the 'Program'.

3.1. Strategic aims

The strategic aims adopted in 1991 in 'The program of conserving forest genetic resources and breeding of forest trees in Poland for the years 1991–2010' have not changed. The priorities for the 2011–2035 'Program' are:

a) conservation and enrichment of the genetic diversity in the forests,
b) breeding of forest trees,
c) finding and maintaining at an appropriate quantitative and qualitative level the basic forest material for the needs of reforestation and afforestation.

3.2. Priority action plans

3.2.1. Conservation and enrichment of genetic diversity in the forests

The conservation of genetic diversity in the forests is essential to ensure continuity of basic ecological processes, permanence of the forest and the utilization of the ecological systems, restitution of forests on degraded sites, increase in the natural resistance of stands and communities, and the preservation of the genetic diversity for future generations. Forest trees, together with their genetic resources, represent the most important components of the forest ecosystems which shape the ecological niches for other species of flora and fauna. At the same time, it is the purpose of the forests to serve the various growing social and economic needs. Thus the preservation of the genetic diversity of forest tree populations is of special importance in view of the growing anthropopressure and the expected climatic changes (5). Forms of passive nature protection in many instances do not give the desired effect, often resulting in the elimination from the ecosystem of elements crucial for natural heritage and in their replacement by more dynamic ones. Thus it is necessary to develop programs of active nature conservation and of restitution of certain plant species, including some forest forming tree species, accessory species and rare species in some special regions (stands).

It is also necessary to establish the formal-legal possibilities of utilising forest genetic resources existing in regions under special protection, such as nature reserves, national parks and regions of Natura 2000, so as to establish progeny plantations within the State Forests in the vicinity of the regions under protection. On the one hand this will permit rational utilization of the genetic variability of natural populations (in agreement with one of the purposes of protection) and on the other it will establish

Clonal seed orchard and seedling seed orchard of pedunculate oak in the Leżajsk Forest District (T.P.)

a buffer zone surrounding the protected areas, which will have a genetic diversity comparable with the protected areas and therefore it will represent a better isolation of the protected areas from populations that are the object of an intensive forest exploitation.

In the field of protection and conservation of gene resources the State Forests are primarily interested in the basic forest forming species that are of economic value. Many populations of these species, frequently of great economic importance, are demonstrating symptoms of instability and even decline, together with the manifestation of biotic symptoms that are secondary to abiotic and anthropogenic ones.

Stands of Scots pine and of Norway spruce of unknown origin, which are unsuited for the given site, may show a weakening and greater susceptibility to the action of biotic and abiotic factors. Thus there is an urgent need to conserve the still existing natural and acclimatized to the local conditions populations of these species.

For many years during the latter part of the 20th century it was observed that white fir declines from its natural sites, primarily in the Sudety Mountains. In the last 20 years, however, it has been noted that there is a steady increase in the number of regenerated areas and stands of white fir in that region, as well as in other parts of the country.

As regards the indigenous European larch, there occurs locally an 'infestation' of the gene pool with genes from Japanese larch, in view of the easy crossing of these two species, and this leads to an erosion of the genome of the indigenous species. For this reason it is particularly important to take note of the species purity of the seed bases proposed for confirmation. The existing stands of Japanese larch and of hybrid ones in the vicinity of the populations selected and qualified as basic seed material should be successively removed. This is particularly important in the following RDSFs: Gdańsk, Olsztyn, Piła, Poznań, Toruń, Szczecinek and Szczecin. It is also necessary to eliminate the Euro-Japanese components of young larch stands that were established within the program of reconstruction of the Sudety Mountains using maternal material of European larch from other regions (701 and 702).

Broadleaved species are significantly endangered by changes in site conditions. In the last decades we have observed a substantial weakening of the broadleaved stands, particularly of ash and oak. It is believed that the original cause of losing stability by broadleaved stands and the occurrence of pathological symptoms are the drastic fluctuations in the level of ground water and the activation of fungal pathogens and insect pests, which had a lesser impact in the past. A lowering of health condition is also noticeable in the stands of birch, beech, elm and alder.

Clonal seed orchards of Scots pine and black pine in the Leżajsk Forest District (T.P.)

Much attention needs to be devoted to the gene resources of accessory species such as yew, wild service tree, European white elm, wych elm, field elm, small-leaved lime, large-leaved lime, European ash, wild cherry, European wild apple and European pear. Conservation of genetic diversity *in situ* frequently requires simultaneous actions aimed at conservation of the sites on which the species grow.

Anthropophitic (foreign) species of woody plants have, in the majority of cases, established a permanent presence in the functioning of our forest ecosystems. Some of them, however, have the characteristic of being invasive and thereby represent a danger to the naturalness of our forest ecosystems. We consider as invasive some tree and shrub species, among them Japanese larch, box elder maple and black cherry. Among the foreign species of some economic importance for the State Forests there is black locust, for which a limited breeding program is in progress. Other woody species of foreign origin are considered neutral for the environment because of limited possibilities of natural regeneration, lack of possibility to form viable hybrids with native species, and also because of the environment being resistant to them (pathogens, animals etc.). This group of species includes red oak, black pine, Douglas fir, eastern white pine, Sitka spruce and grand fir. For black pine and Douglas fir some limited breeding work is conducted in the State Forests. It needs to be remembered, however, that the proportion of species of foreign origin in Polish forests is rather small and their areal contribution in the State Forests does not exceed 0.5% and has remained at this level for many years. Currently these species occupy 23 750 ha (data for black locust, Douglas fir, black pine, eastern white pine, red oak – areal contribution on the basis of the true participation of the species – data for 2009 supplied by The Forest Management and Geodesy Bureau and the Directorate-General of the State Forests).

The greatest effort in the protection of genetic diversity is needed for the tree species endangered with extinction. The 'Red list of plants and fungi in Poland' and the 'Polish red book of plants' (49) record 6 such species: yew, Arolla pine, wild service tree, marsh pine, Savin juniper and downy oak. For these species individual programs of protection have to be introduced so as to combine conservation of genetic diversity with their reintroduction.

The general scheme of action in the realization of this program of conservation of gene resources of forest species is presented in Fig. 3.

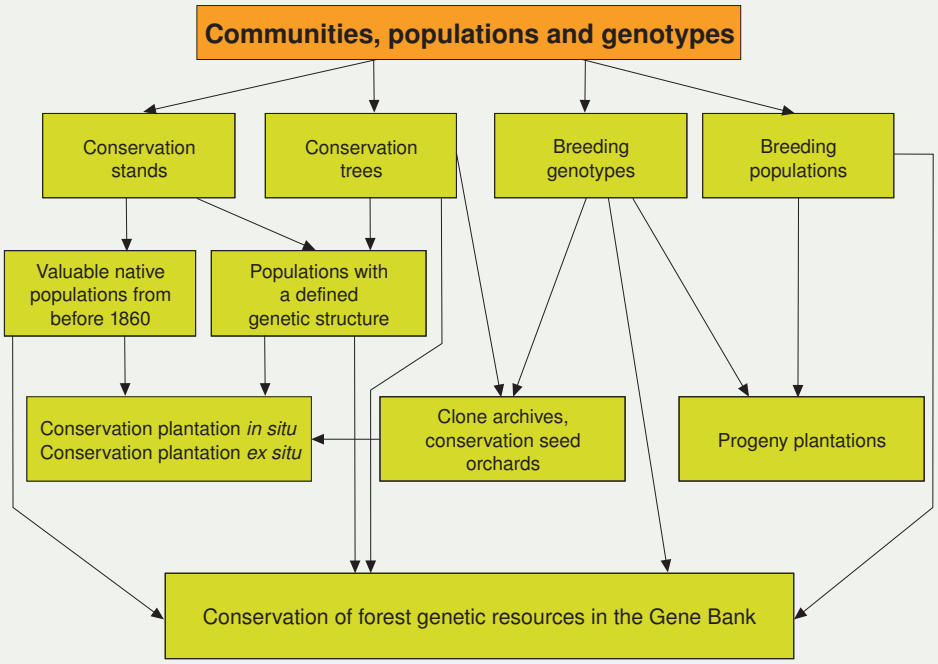


Fig. 3. Scheme of action for the conservation of forest genetic diversity in the new 'Program' for 2011–2035

3.2.2. Breeding of forest trees

The breeding of forest trees and the establishment of the basic forest material will be conducted, as was the case until now, in special programs using methods of population and individual tree selection (clonal and progeny). The basic importance of population selection will be maintained, which should satisfy 60% of the needs for seeds of the State Forests administrative units. The remainder will be provided by seeds from clonal and seedling seed orchards. The breeding program will cover the tasks currently dealt with which include the selection of stands of known origin (the production seed stands – PSS), selected seeds stands (reserved seed stands – RSS), maternal trees (plus trees – PT) and also the establishment of progeny plantations, clonal seed orchards and seedling first generation seed orchards of selected species. The breeding of forest trees in already existing trials will make use of the results of testing of selected stands, trees and seed orchards and then classify them into basic forest materials (BFM)

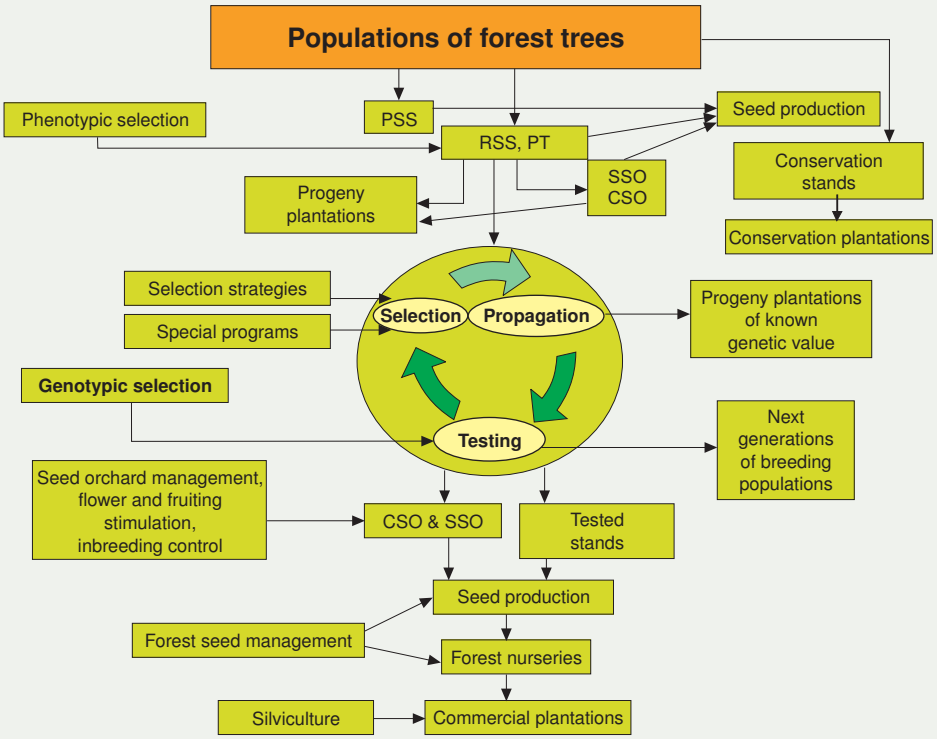


Fig. 4. Scheme of forest tree breeding in Poland

Abbreviations used: PSS – Stands of known origin (earlier: production seed stands); RSS – Selected stands (earlier: reserved seed stands); PT maternal trees (earlier: plus trees); SSO – seedling seed orchards; CSO – clonal seed orchards

for inclusion in part IV of the Country-wide Register. An important element of the program is always the verification and modification of principles of the utilization and transfer of forest reproductive material (seed regionalization). It is also necessary to include in the program methods and ideas about the conservation of genetic diversity of populations used on an economic scale, for example the use of natural regeneration where possible. The general scheme of action in the field of breeding forest trees which is to be realized within this 'Program' is shown in Fig. 4.

Within the selection work it is planned to achieve the following aims:

- improvement of quality and increase of productivity of stands – population selection (choice of selected stands (RSS) and tested ones);
- selection of populations and genotypes of high plasticity for practical use in the conditions of a changing climate (population and individual selection);

- increase of stability of future stands through the formation of breeding populations on the basis of clonal seed orchards with a determined genetic variability – individual selection – establishment of seed orchards utilizing genetic diversity of clones;
- improvement of qualitative traits – individual selection – choice of genotypes of determined traits – establishment of artificial breeding populations for forestry needs;
- increase of resistance to biotic and abiotic factors – individual selection;
- increase of timber volume production in short and long term production cycles – individual selection.

The planned tasks in the breeding program of forest trees include:

a) continuation of tasks realized so far:
   - selection, management and utilization of reserved seed stands (RSS),
   - selection and utilization of plus trees (PT),
   - establishment of clonal seed orchards and first generation seedling seed orchards,
   - establishment of blocks of progeny trials,
   - evaluation of silvicultural traits in progeny trials that enter the generative phase;

b) new tasks associated with the evaluation of genetic value of BFM:
   - establishment, management and evaluation of BFM used for the production of FRM of category II and III (selected RSS), maternal trees (PT), clonal seed orchards, seedling seed orchards) in progeny tests,
   - choice of BFM used for the production of FRM in the category 'tested',
   - development of norms for the management and utilization in the forests of BFM registered in part IV of the Country-wide Register,
   - establishment of clonal and seedling seed orchards of higher generations,
   - establishment of plantations with BFM of known genetic value.

3.2.3. Establishment and maintenance of basic forest material at an appropriate qualitative and quantitative level for the needs of reforestation and afforestation

Natural regeneration, which we consider to be the most desirable for the maintenance of the genetic richness and permanence of a forest, represents about 10% of reforestations in the State Forests, while the remaining areas are regenerated by planting.

These conditions determine the extent of artificial regeneration both now and in the foreseeable future as the main means of growing forests. What kind of forests these will be, their shape, genetic structure and durability, depends to a large extent on the seeds used for regeneration since they will carry the qualities of their parents to the next generation. It is for this reason that seed management is of such great importance for forestry practice and in consequence for the future of our forests. We must maintain a proper magnitude in terms of area of the basic forest material (seed base), which serves seed collection for the normal needs of reforestation and afforestation tasks. For the needs of the current 'Program' the calculations for the quantities of seeds of the basic forest tree species needed by forest nurseries were revised. These quantities were translated in to the needed areas of stands from which it will be possible

Scots pine maternal trees in the Susz Forest District (S.B.)

to collect seed, assuming that 60% of the seed will come from these stands, while the remainder will be supplied by seed orchards. The calculated areas for each regional directorate of the State Forests have been subjected to consultation procedures and given final approval. The same was done with the other BFM composing the totality of the seed base. It needs to be stressed that the chosen seed base and that prepared under the previous programs is capable of fully supplying the current demand for seed. The most important task now is to maintain the available stands and orchards and to replace them when they are eventually removed from the seed base. Simultaneously, we must conduct scientific research in the field of testing progenies so as to acquire a detailed knowledge about the variability and genetic value as well as utilization possibilities for the BFM.

Special role in the program is played by autochthonous and indigenous seed stands of the most important forest tree species, which are outstanding among other stands growing in the same site conditions because of their quality, health and adaptability, high production of timber volume, and which maintain the specific characteristics of indigenous ecotypes of trees. They represent a valuable source for the collection of seed of the highest silvicultural and genetic quality and serve the raising of new generations of stands of improved value.

Realization of the program should ensure:

- establishment of a population seed base at the level of 60% of the reforestation and afforestation needs and of 40% from individual selection;
- establishment of a tested seed base at the level of 10% for the needs throughout the country (the expected genetic gain for production traits at the population level should be 10% and at progeny level 15%);
- maintenance of a permanent seed base of identified source at a level of 60% of the country-wide needs (the expected genetic gain for production traits for these populations should be at the level of 2–5%).

Clonal seed orchard of black alder in the Leżajsk Forest District (J.M.)

4. Realization of the strategic aims of the 'Program' for the years 2011–2035

4.1. Conservation and enrichment of the existing genetic diversity in the forests

The adopted strategy of biodiversity conservation contained in the 'Convention on Biodiversity' operates at four levels: conservation of species, landscapes, ecosystems and genetic value. The State Forests are engaged in the conservation of biodiversity on the specific and genetic levels (10).

The program of protecting the gene resources covers the following categories of objects:

a) tree stands (populations of trees);
b) maternal and conservation trees (genotypes);
c) other endangered plant components of forest communities.

Within these categories it is necessary to place under protection:

- populations valuable for forestry in view of their favourable phenotypic traits (objects destined for the production of FRM in the category of 'selected');
- individuals of valuable genotypes, important from the production point of view for forest management, which have developed as a consequence of intended selection (objects destined for the production of FRM in the category 'qualified');

- native populations and individuals of coniferous and broadleaved species that arose before 1860. It is also desirable to preserve the gene resources of other valuable stands and trees in view of their adaptability (conservation stands and trees);
- populations and individual trees with genotypes confirmed as valuable on the basis of genetic studies;
- populations and individuals of supplementary tree species and other plant species which in view of their scattered distribution and lack of active protection are endangered by decline or extinction from the forest ecosystems.

Actions aimed at the conservation of genetic diversity should be conducted both *in situ* through actively supporting them in the forest environment and also *ex situ*, depending on the degree of endangerment of the species. In the case of protected plants that occur in regions under the State Forests administration, the use of active methods of conservation of their gene resources should be the subject of consultation between administrative units of the State Forests, the Regional Directorates for Environmental Protection and the General Directorate for Environmental Protection. The recommendations agreed between these bodies should be included in the protection program for forest reserves in the working plans and in the plan of protection for the regions of Natura 2000.

The protection activities *ex situ* are aimed at the reduction of the risk of losing valuable species as a consequence of unpredictable events in the forest environment, such as climate change, forest fires, floods, insect outbreaks, activity of fungal and viral pathogens, and the action of animals or changes in plant successions in the forest communities. Protection of genetic diversity *ex situ* is to be conducted simultaneously by the establishment of conservation areas, progeny plantations, clonal and seedling seed orchards, clone archives in the *in vivo* form, as well as by the gathering for long term storage of genetic material in the form of seeds or plant parts as the gene resources of gene banks.

Within the 'Program' for 2011–2035 multi-year actions need to be taken with regard to the restitution and reintroduction of protected plant species or endangered populations. For this purpose the 'Program' has no specific formal tasks envisaged.

4.1.1. Role of the gene banks

The Kostrzyca Forest Gene Bank participates in the realization of the 'Program' and conducts a protection of gene resources *ex situ* in the form of long term storage of seed, pollen and other plant parts; it develops

instructions for the collection of gene resources in order to conserve as large as possible number of objects under protection; it monitors their quality and takes care to remove them from storage at the appropriate time; it exerts control over the establishment of conservation plantations *ex situ* made from seed after their storage. The Kostrzyca Forest Gene Bank verifies the proper accumulation of material for storage and conducts its genetic identification. It develops and implements new methods and technologies for the storage and preparation for sowing of seed and monitors the state of gene resources in other regional gene banks. Together with the Forest Research Institute and with other research centres it participates in the realization of the 'Program of testing the progeny of reserved seeds stands, plus trees, clonal and seedling seed orchards'. It compiles and keeps a country-wide register of information about DNA of the gathered and molecularly studied gene resources as well as a register of experimental areas pertaining to tree breeding and conservation of forest gene resources in Poland.

Regional gene banks, having attained proper facilities, i.e. a proper technical infrastructure and a team of qualified employees, are established

Selected seed stand of black locust in the Krosno Odrzańskie Forest District (J.M.)

by the Regional Director of the State Forests (one already exists in the Katowice Regional Directorate in the Wisła Forest District). They are supervised locally by the Forest District Manager and in the institutional sense by the Director of the RDSF. The country-wide coordinator of the gathering of gene resources in the regional gene banks, in compliance with the current regulations, is the Kostrzyca Forest Gene Bank. All criteria for the establishment of gene resources in the gene banks, as well as their evaluation, are the same for the whole country. The only feature differentiating the gene resources in the regional gene banks is the size of the collection determined by the needs of the region. These resources serve primarily the restitution of declining or lost populations and single individuals in a given area and are of economic importance. Seeds gathered by administrative units of the State Forests for the purpose of creating a gene reserves are primarily destined for the Kostrzyca Forest Gene Bank. All information about the gene resources gathered in the regional gene banks are systematically recorded in the Country-wide Register of FRM.

4.1.2. General tasks for the State Forests

The scope and scheme of activity in the field of protection and enrichment of genetic diversity of forest trees have been presented in Fig. 3. The basic actions planned for realization within this program cover:

a) the legislative work:
- to undertake action aimed at the introduction of legislative regulations sanctioning the realization in Poland in the regions under the administration of the State Forests of an active protection of genetic diversity;
- amendment of the current law concerning nature protection and forests in order to adopt regulations permitting the employment of active methods of genetic diversity conservation, also for regions that are protected by law (national parks, nature reserves, areas of Natura 2000, and others);

b) in field work:
- management of the reserved seed stands selected in the previous program and the selection of new objects in this category;
- establishment of progeny generations for the reserved seed stands (areas *in situ*);
- establishment and management of conservation areas *ex situ* as progenies of the existing reserved seed stands and other objects;
- establishment of progeny plantations of breeding populations;

- establishment and management of conservation and breeding clonal seed orchards, seedling seed orchards and clonal archives (*ex situ* protection of individual genotypes);
- collection of reproductive material (seeds, plant parts, pollen) in reserved seed stands, breeding populations and from single genotypes for long term storage in the Forest Gene Bank;
- selection and protection of species, populations and genotypes of native woody flora (apart from the forest forming species) and the preparation and realization of their restitution programs in given areas;
- supplementary selection (on the basis of genetic studies) of successive populations and genotypes characterized by specific genetic properties in order to increase the scope of genetic variability currently under protection in conservation stands and breeding populations;

c) within the scope of activity realized by the Forest Gene Bank and research units:

- collection of gene resources of categories II, III and IV in the Country--wide Register of BFM and from conservation objects;

Natural regeneration of beech in a production seed stand (J.M.)

- long term storage of seed, pollen and plant parts, including expansion of the cryogenic methods for further species;
- genetic characterization (DNA, isoenzymes and other markers) of populations and genotypes intended for the protection of forest gene resources;
- monitoring of changes in the genetic variability in forests, taking particularly into consideration the regions that are under anthropogenic pressure;
- systematic accumulation of silvicultural and genetic information about the breeding and conservation populations.

4.1.3. Particular tasks for realization by the State Forests

Particular tasks for realization by administrative units of the State Forests in the field of protection of genetic diversity comprise primarily the management of already qualified and selection of new conservation objects (populations and genotypes), and the establishment of conservation plantations (for populations) and clone archives (for individual genotypes) for selected objects. The particular tasks in this field can only be specified for the already existing conservation objects. Assuming as minimal the establishment for each population of one conservation area *in situ* and one conservation area *ex situ* (or two conservation areas *ex situ*), each being 10 ha in area, the minimal total area of conservation areas for the already existing objects in the State Forests should comprise 4200 ha (Supplement 4, Table 10). These tasks will systematically increase as the number of consecutively selected objects for the conservation of gene diversity increases. Furthermore, it would be very useful if the conservation areas were also established in the State Forests for the conservation stands selected in national parks. In this way it will be possible in the future to include these exceptionally valuable objects in the seed base of the State Forests.

4.1.4. Research needs

Results of research concerning genetic variation of forest tree species should determine the long term conservation of genetic diversity in the process of forest utilization, and in particular the preservation of the gene pool of valuable populations and genotypes. The research needs include:

a) studies on genetic variability and diversity on the basis of quantitative characteristics and molecular analyses:
   - development and unification of the study method;

- study of populations selected for the protection of gene resources in the State Forests (seed stands, conservation stands, plus trees); comparative studies and the identification of valuable populations;
- study of populations in regions under protection (nature reserves, national parks, areas of Natura 2000); identification of valuable populations so as to establish on their basis conservation areas in the State Forests;
- evaluation of the extent to which stands are autochthonous and identification of the non-autochthonous ones;
- verification of seed regionalization based on studies of genetic variability; the seed regionalization must be individualized for each species;
- linking research on genetic variability with the program of testing progenies;
- linking variability in quantitative characteristics with the variation on the molecular level;

b) study of changes in genetic diversity in the process of selection, breeding and long term storage of seed;

c) evaluation of the influence of forest practice in Poland on the genetic variation of forest trees;

Natural regeneration of pine in stands of known origin in the territory of the Toruń RDSF (J.M.)

d) study of mechanisms conditioning the preservation of genetic diversity and an evaluation of the use of natural regeneration in the process of conservation of genetic resources;
e) detailed determination of the criteria of establishing and managing conservation plantations;
f) evaluation of the possibility of restitution of species on the basis of an analysis of variation in genetic diversity;
g) study of hybridizing species and development of a method of identifying the species and their hybrids.

4.2. Breeding of forest trees

The notion of breeding of forest trees refers to the branch of science dealing with the improvement of traits of practical importance on the genetic basis and the practical actions whose aim is to develop a variety that is more productive, qualitatively better and more resistant to biotic and abiotic agents, relative to the wild populations or those that have been used so far. The basic tasks of forest tree breeding, as expected by society, are the following:

a) identification and protection of genetic variability, taking into consideration the conservation and restitution of endangered resources;
b) rational utilization of genetic resources for the needs of man.

Identification and protection of genetic diversity of trees is the starting point for breeding work. Genetic variation is a necessary condition for the success of selection work, thus all breeding work starts with the identification and utilization of the natural variability or from its artificial enhancement.

The social demand for timber of good quality is continuously on the increase. The most effective and profitable increase, improvement and conservation of the durability of the production functions of the forest, as well as of the non-production functions, can be achieved by various methods of selecting forest trees.

Artificial selection, as distinct from natural selection, is guided by the breeder (specific aim) and conducted intentionally in specific environmental conditions. Best results are obtained when the selection is conducted for a single trait only. The object of selection could be whole populations – we are then dealing with population selection, or single trees within populations (and also without taking into consideration their belonging to any population) – we then talk about individual selection. In each of these cases different selection methods are employed.

Selected stand of pedunculate oak in the Brzeg Forest District (J.M.)

Population selection consists of the selection of the best populations (from the point of view of silvicultural aims) and the fixing of their phenotypic variability (indirectly also of their genotypic variation). This ensures a high level of genetic variability of the stands and of their adaptation to the local conditions. At the same time there is a relatively small possibility of improving traits of productive value, at the most by 10–15% for the traits taken into consideration when selecting the stands.

Individual selection consists of the selection of individual trees in a stand on the basis of the particular traits and the improvement of these traits according to the aims of the breeder. Methods of individual selection are a more effective way of improving the traits chosen by the breeder. The achieved improvement of the value of the chosen traits is at the expense of narrowing genetic variability of the progeny population.

In order to fix the positive effects of selection in the progeny it is necessary to assure that, for reproduction only, the selected individuals cross with each other, and the selected varieties need to be effectively isolated from the influence of non-selected individuals of the same species.

The achievement of these effects will be possible through the realization of successive long term programs of silvicultural strategy in the breeding programs of forest trees for individual species and through the selection of special aims.

4.2.1. Long-term silvicultural strategies for breeding programs of forest trees

The long term breeding strategy realized in consecutive stages of the 'Program' of breeding forest trees is based on the following general assumptions:

- for the long term breeding strategy for individual species the established breeding populations have a determined number of selected genotypes;
- in each breeding cycle the size of the breeding population is similar;
- in successive selection cycles the breeding population is formed by selection within the progeny obtained from free pollination or controlled crossing of selected genotypes from the previous cycle;
- criteria for selection are quantitative and qualitative traits, as well as plasticity, which assure the permanence of forest production;
- selection intensity in successive cycles should be similar for individual traits.

Below are given the detailed assumptions covering the specific actions necessary for the long term breeding strategy in the State Forests:

- breeding populations will be established in regions of origin that represent the maternal population, where the most valuable for the State Forests seed base is located and the number of selected genotypes is greatest. The currently realized 'Program of testing the progeny of reserved seeds stands, plus trees, clonal and seedling seed orchards' will permit the formation of the first breeding populations from selections made among the progeny of genotypes. Further actions in this field will concentrate in the same regions;
- in each selection cycle the breeding populations for the region of origin and species will be formed by 50 different genotypes selected in the tests. The possibility should exist of expanding this base or exchanging some genotypes in the population if the breeding effects are not satisfactory or if the genetic variability of the breeding population will prove to be too limited;
- the number of breeding populations for a species should be equal to the number of maternal regions (however in no case less than 5);
- in each successive breeding program one full selection cycle should be realized.

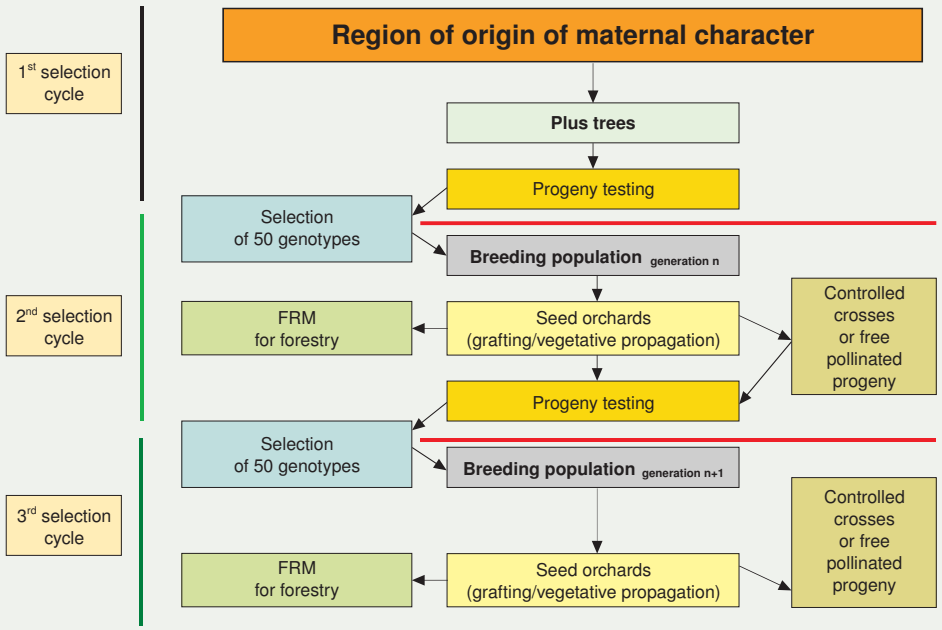


Fig. 5. The scheme of the realization of the breeding strategy in the State Forests

Thus the programs should be written for periods no shorter than the breeding cycles, which is for 25 years.

The scheme of the realization of the breeding strategy in the State Forests is presented in Fig. 5.

4.2.2. Breeding for special aims

The breeding programs for special aims are proposed as supplementary to the main breeding program. They will concern small populations (up to 50 progenies) selected on the basis of the traits defined below. In these programs it is permitted and recommended to use artificial crossing and other available techniques including molecular ones. In order to obtain a high genetic gain it is recommended that in one population no more than two traits be simultaneously selected. Work is being planned for the following species:

Species	Selection aim
Silver birch and black alder	volume production, wood quality, chemical qualities of wood
European larch	volume production, wood quality
Douglas fir	
Pedunculate and sessile oak	wood quality (choice timber)
Norway spruce	resistance to biotic and abiotic factors
European ash	
European white elm, wych elm, field elm	

A. Silver birch

Scope and methods

Work will be conducted primarily in the north-eastern part of Poland in seed regions nos. 202, 203, 204, 252, 253, 207 and 208 where the most valuable birch populations are located, as shown by the provenance trials that have been conducted so far. In the first selection cycle the testing will be based on generative reproduction of genotypes that have been selected for the breeding program. In the choice of the introductory material use should also be made of the existing plus trees and progeny trials. During selection control crossings will be made. From the obtained full 50 progenies of each breeding population test areas will be established. Genetic evaluation of the effects of selection will be possible after 10 years. In successive selection cycles vegetative reproduction and clone testing should be used (Fig. 6).

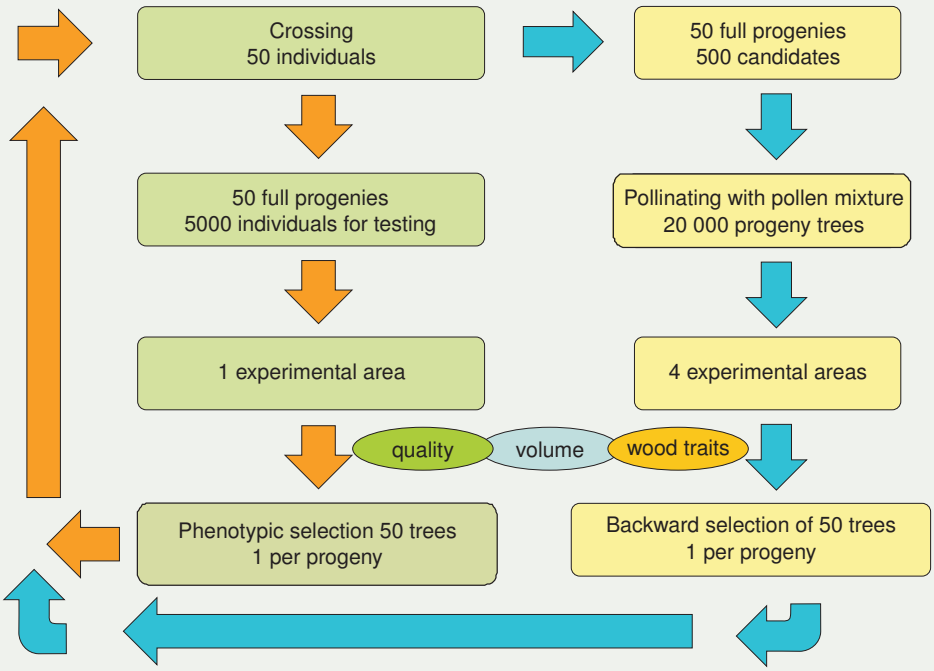


Fig. 6. An example scheme for the breeding of silver birch to improve the quality of its wood, its chemical properties and volume of timber production

Expected effects

Production seed orchards will give a progeny that will be characterized by a genetic gain from the first stage of selection in the order of 15–20%, relative to the selected stands. These will be used for the establishment of plantations of trees for special usage. Also production of clones with special qualities will be possible.

B. European larch and Douglas fir

Scope and methods

For European larch it is planned to establish breeding populations in the Sudety and in the Świętokrzyskie Mountains. When choosing the initial material use should be made of the existing plus trees and the results of progeny trials. It is recommended to conduct the breeding program in international cooperation with such countries as the Czech Republic and France.

Pedunculate oak in a selected stand in the Brzeg Forest District (J.M.)

In breeding Douglas fir the basic material should primarily consist of selected individuals from populations adapted to the Polish conditions. Selection of European larch and Douglas fir will be based on generative reproduction. Breeding populations should be composed of minimum 50 progenies. After 15 years the best progenies will be selected on the basis of available information about the growth of trees in the test areas.

Expected effects

After 15 years the genetic gain should be in the order of 20–25%, relative to the forest stands in this region. Second generation seed orchards will be established to produce seed for forestry needs.

C. Norway spruce, elms and ash

Scope and method

The initial material will consist of individuals chosen from among those in populations of forest trees which demonstrate resistance to fungal pathogens, insect pests and drought. In the selection use will be made of generative reproduction and cloning. Breeding populations should be composed of 50 progenies. After 20 years the best individuals will be selected on the basis of available information about their resistance and the growth of trees in the progeny trials.

Expected effects

After 20 years the genetic gain should be 10–15%, relative to the forest stands of the given region. Second generation seed orchards will be established, which will produce seed for forestry practice. Clonal archives will be established which can serve the function of conservation seed orchards.

D. Pedunculate and sessile oaks

Scope and method

The initial material will consist of individuals chosen in selected stands. In the choice of the initial material use should also be made of the existing plus trees and progeny trials. In the selection work primarily generative reproduction will be employed. The breeding populations should be composed of at least 50 progenies. While testing, consideration should be given to both genetic and ecological variation. After 30 years the best progenies will be selected on the basis of the available information from progeny trials and from correlations between juvenile traits and those of wood at felling time.

Expected effects

After 30 years the genetic gain should be 15–20% in relation to the forest stands in the given region. Second generation seed orchards will be established to produce seed for forestry practice.

4.2.3. The re-establishment of silvicultural populations

As a result of the economic history of the forests, natural disasters and processes of ecological succession, some populations of forest forming species and others have been to a large extent destroyed in their natural range. On the basis of a series of provenance studies some of them have been recognized as exceptionally valuable from the point of view of productivity and plasticity and for this reason their disappearance would mean losing the most valuable part of the genetic variability of a species. As an example one can quote some especially valuable populations of Norway spruce: the Istebna spruce (a population known by the name 'Istebna 149h' was tested in a large number of provenance experiments), spruce of 'Kolonowskie' population (Zawadzkie Forest District) tested in the 1964/68 IUFRO series of provenance studies, spruce populations 'Nowe Ramuki' and 'Tarnawa' tested and shown to be different from other populations in the 1972 IUFRO series of provenance studies. A similar example of a 'lost' and yet particularly valuable population is Scots pine 'Kubryk' from the Milicz Forest District, which has been tested in a series of experiments established by the Institute of Dendrology and the Forest Research Institute. A re-establishment of these populations is possible from the material present in the experimental plots and it would be valuable to do so from the economic point of view, as well as from the motive of protecting the gene resources of species.

An example of actions in the field of re-establishment of a valuable and to some extent lost population is the program of re-establishing the 'Kolonowskie' spruce population, conducted by the Institute of Dendrology, the scheme of which is presented in Fig. 7.

A different approach is needed for populations dying or declining in their natural environment, from which no *ex situ* populations exist in the form of provenance experiments or progeny plantations. Their re-establishment can only be based on the single trees, small groups or depleted stands still existing. These are not necessarily exceptionally valuable populations from the economic point of view but it is necessary to re-establish them to maintain the genetic diversity, not only from the population point of view but also on the species level. This concerns elms, ash, indigenous poplars (black, white and grey poplars) and wild cherry

almost throughout the country, as well as the Sudetan populations of white fir and of spruce that survived the forest decline calamity in the Sudety Mountains. An example of the scheme for the re-establishment of white fir in the Sudety Mountains is given in Fig. 8.

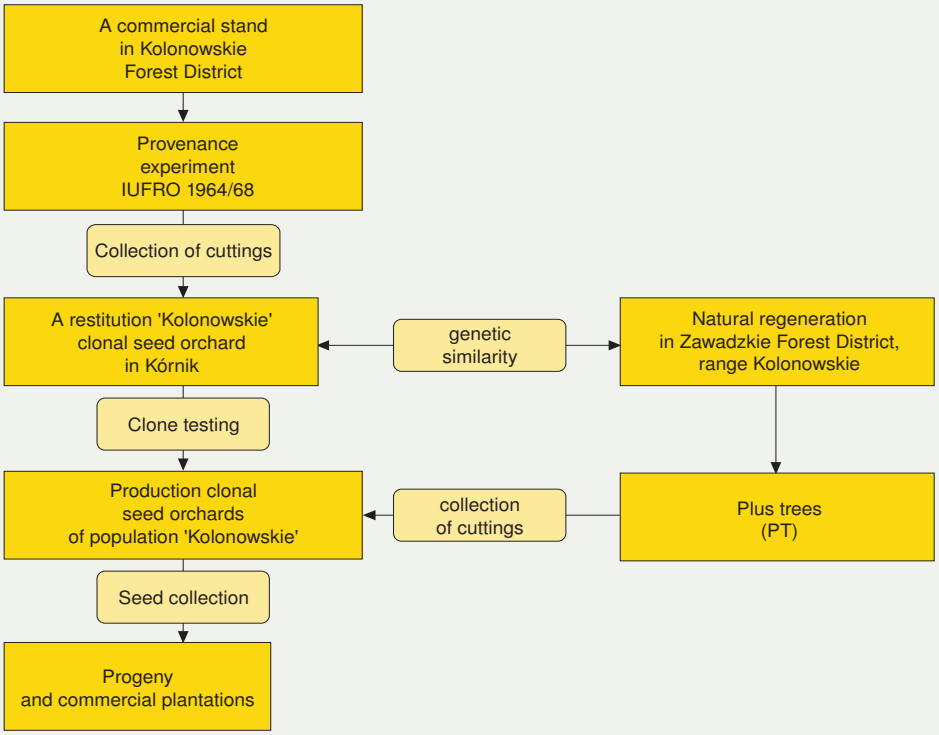


Fig. 7. Scheme of re-establishing the Norway spruce population 'Kolonowskie'

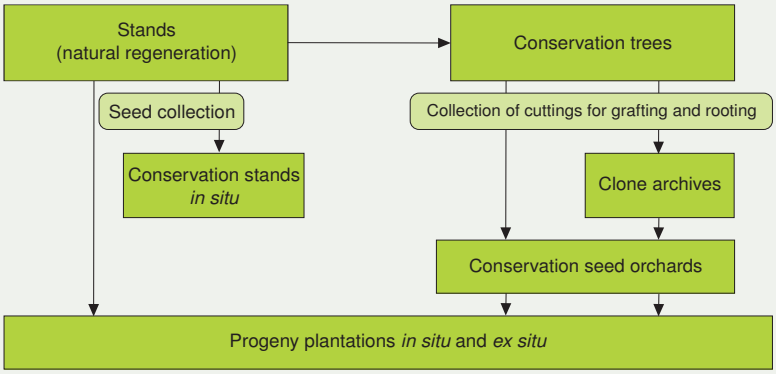


Fig. 8. Scheme of the re-establishment program for declining species and populations

4.2.4. Tasks for the State Forests

1. Establishment of breeding populations in the long term selection program in regions maternal in character (or outside them), employing the results of the 'Program of testing the progeny of reserved seed stands, plus trees, clonal and seedling seed orchards' for such species as Scots pine, Norway spruce, European larch, Douglas fir, silver birch, common beech, pedunculate oak, sessile oak and black alder.
2. Establishment of breeding populations within the selection program for special aims with such species as silver birch, European larch, Douglas fir, pedunculate oak, sessile oak, Norway spruce, European ash and elms.
3. Re-establishment of the most valuable populations of Norway spruce and Scots pine.
4. Re-establishment of the declining populations of ash, black, white and grey poplars, yew, European white elm, wych elm, field elm, small-leaved lime, large-leaved lime, wild service tree, wild cherry, European wild apple and European pear, and also white fir and Norway spruce in the Sudety Mountains.

4.2.5. Research needs

Results of these studies should contribute to an increase in the productivity of forest trees, and in particular to the improvement of populations in quantitative and qualitative characters, and therefore increases in the economic effectiveness of forest husbandry. Research needs include:

a) evaluation of the genetic variability of silviculturally important traits at the level of populations and genotypes, selection of populations and genotypes for the realisation of selected breeding programs aimed at:
   - improvement of populations and genotypes in terms of qualitative and quantitative traits (timber volume production in short and long term cycles);
   - improvement of populations and genotypes in their resistance to biotic and abiotic factors;
   - increase of plasticity of the populations and genotypes chosen for further breeding;
   - establishment of breeding populations of high genetic variability;

b) studies on the mating system of forest forming species;

c) determination of genetic parameters of selected and breeding populations (heritability, combining ability, genetic correlations);

d) adaptation of the existing methods of auto vegetative propagation and the development of new methods;
e) selection of stocks for the needs of seed orchards, particularly for Douglas fir;
f) use of molecular methods for the characterisation and modelling of genetic variability in the breeding populations:
   - genetic identification of the basic and reproductive forest material (DNA certificates for seed lots obtained from plus trees (PT) and from clonal seed orchards);
   - studies on the natural reproductive processes taking place in the breeding populations and conditioning maintenance of genetic variability within them (in clonal and seedling seed orchards and in seed stands);
   - studies on *loci* determining quantitative properties responsible for the productive value of forest forming species;
g) breeding of the basic forest tree species using genetic markers (DNA):
   - selection of trees aimed at the production of wood and adaptation to variable conditions of the environment;
   - *in vitro* propagation of selected clones;
   - verification of the selected clones in tests;
   - estimation of genetic gain on the basis of tree growth simulation, taking into consideration the molecular characteristic and growth parameters of the species;
   - determination of selection directions in order to improve quality of selected traits from the point of view of usage of the timber in paper industry, including variation in the structure of the wood (fibre/cell length, proportion of early and late wood) in the selected trees;
h) study on the possibility of using molecular markers in the breeding process, including identification of DNA markers for the characterisation of genetic quantitative characters and resistance of forest trees, to be followed by selection based on the markers:
   - early evaluation of quantitative characters in forest reproductive material (transplants) on the basis of molecular analyses;
   - alternative methods of breeding for quantitative traits based on an analysis of parents through progeny trials;
i) evaluation of the testing program and perfection of its methodology.
j) an inventory and utilization of the already established trial areas aimed at comparative studies;
k) utilization of molecular markers for the verification of correctness in the establishment of provenance and progeny trials;

l) studies on the possibility of using indigenous and introduced species for the intensification of wood production;
m) evaluation of the possibility of intensifying tree selection, including the prospects of introducing genetically modified varieties of trees (GMOs).

Clonal seed orchard of East-Carpathian spruce in the Oleszyce Forest District (J.M.)

4.3. Establishment and maintenance of basic forest material at an appropriate quantitative and qualitative level for the needs of reforestation and afforestation

A constant improvement and protection of the seed base present in the forests is needed for several principal reasons. As mentioned earlier, in spite of the significant increase in the production of timber, the demand continues to exceed supply. At the same time the possibilities of an increase in exploitation may be significantly curtailed in the very near future by the substantial increase in the area of forests performing other than production functions (Natura 2000). Persistent selection work, choice and breeding of populations and genotypes can in the future substantially increase the timber resources and satisfy the increasing demand for them. A further factor that will force the constant improvement and protection of the seed base is the global climate change. This will affect the strategic aims of breeding programs which will have to be altered to permit the maintenance of genetic variability at a level guaranteeing a permanent functioning of forests in the changing environmental conditions and actions will be undertaken aimed at increasing the natural adaptability of successive generations.

Also needed are the full compliance of principles of forest seed management with the EU norms, and actions aimed at the protection of Polish forests from the uncontrolled importation of seeds and transplants unsuited for growth in our conditions, which could endanger the durability and stability of forest ecosystems.

4.3.1. General principles

For the realization of silvicultural tasks related to reforestation and afforestation it is necessary to have a sufficiently large seed base. The optimal size of the seed producing areas is mainly determined by:

- the total area of reforestation and afforestation,
- proportion of artificial regeneration in the total area of reforestation and afforestation,
- production possibilities (seeds, cones) of individual species.

In Poland the average annual (based on the last 10 years) area of reforestation and afforestation amounts to 55–60 thousand ha. Currently, natural regeneration does not exceed 10%. Assuming that in the coming 20 years the area of natural regeneration will increase to 15%, the majority of reforestations and afforestations will be conducted by artificial planting.

For these purposes the seed base has to be maintained at a level ensuring the production of the needed forest reproductive material (FRM).

4.3.2. Demand for forest reproductive material (FRM)

Reforestation and afforestation needs determine the demand for the forest reproductive material. The needed amount of seed, calculated on the basis of tree cutting plans for the years 1981–2008, is presented in Table 1 of Supplement 4 . On the basis of many years of experience and taking into account the occurring changes (decline in demand for conifer seed), it was calculated that for the needs of this program the following quantities of seed will be needed to satisfy the annual demand for FRM:

pine	8000 kg
spruce	1500 kg
larch	1000 kg
fir	15 000 kg
oak	1 000 000 kg
beech	87 000 kg

4.3.3. Categories of FRM

The forest reproductive material (FRM) for reforestation and afforestation can be gathered from stands listed in the Country-wide Register of BFM and in the Register of the Basic Forest Material in the State Forests.

The Basic Forest Material (BFM) and the Forest Reproductive Material (FRM) gathered from it can, in agreement with the adopted norms, be classified into the following categories:

1) of known origin
2) selected
3) qualified
4) tested

The basic role of stands of known origin, production seed stands (PSS), is to supply seed for normal silvicultural needs.

The selected stands, reserved seed stands (RSS), serve the establishment of progeny plantations (in blocks and scattered), provenance trials (progeny trials) and the qualification of stands as tested.

Objects serving the production of FRM in the qualified category – plus trees (PT), clonal and seedling seed orchards – are used for the establishment of progeny plantations (in blocks consisting of progenies of RSS of the same provenance), for the establishment of small blocks and scattered progeny areas only from seed from clonal seed orchards, for the

establishment of plantations of fast growing species and for the qualification of trees, clonal and seedlings seed orchards into the category 'tested'.

Objects serving the production of FRM in the category 'tested' will be used for the establishment of blocks of progeny plantations of known genetic value, clonal and seedling seed orchards of higher generations and for the establishment of plantations of fast growing trees.

The qualified conservation stands serve the establishment of conservation areas *in situ* and *ex situ* and for the collection of reproductive material for long term storage in a gene bank.

Detailed information about the demands and criteria for qualifying BFM can be found in the Forest Reproductive Material Act and in the executive directives and other internal regulations of the State Forests.

4.3.4. Proposed magnitude of tasks for various kinds of BFM

Based on a detailed analysis of the needs for FRM in the period of the last 30 years and on assumed needs in the coming years, a proposal was made for the magnitude of tasks for each Regional Directorate of the State Forests (Supplement 4).

4.3.4.1. Trees of known origin (production seed stands PSS)

In the years 1991–2010 in the State Forests there were 220 000 ha of stands of known origin (PSS). This permitted the complete elimination of uncontrolled seed collection. The decline in the demand for FRM of the majority of conifer species (Supplement 4, Table 1) observed in that period and the planned increase of production needs of other categories of FRM were the basis for the proposed reduction of tasks for the nearest years. It is proposed to reduce the area of PSS for Scots pine by 25% and for spruce and larch by 20%. In the new program the area of such stands should amount to 192 390 ha (Supplement 4, Table 2). In spite of the considerable reduction of the area of seed stands in this category in the new 'Program', this base will be capable of supplying enough seed to fully satisfy the demand, even with crops falling below the average yield measured over several years (Supplement 5, Table 1 and 2).

4.3.4.2. Selected stands (reserved seed stands RSS)

The area of selected stands classified as RSS by 2010 was 16 993 ha. When establishing tasks in this respect the following premises were considered:

Natural regeneration of a selected seed stand of Scots pine in the territory of the Szczecinek RDSF (J.M.)

- there is no need, and in the case of conifer species no technical possibility, to increase the total area of these stands;
- current effort should concentrate primarily on the increase of reserve seed stands (RSS) of broadleaved species, in particular of common beech, pedunculate and sessile oak and silver birch. There is also a need to eliminate the disproportions in the localization of selected stands in different Regional Directorates of the State Forests. The program envisages an increase in the years 2011–2035 of the area of reserved seed stands (RSS) by about 3500 ha, 60% of which will be broadleaved and 40% coniferous stands. The total target area of RSS in 2035 is about 19 000 ha (Supplement 4, Table 3)

4.3.4.3. Maternal trees (plus trees PT)

Until 2010 the total of 10 274 plus trees (PT) have been registered (this being the last number in the register of the Forest Research Institute). Of these, 9775 trees still exist *in situ* or in clonal seed orchards and clone archives. Until now the effort was concentrated on the main coniferous species. In the current program the individual selection will be directed at broadleaved and supplementary species for which the creation of population seed base is difficult or even impossible. For such species as Norway maple, sycamore, field maple, wych elm, European white elm, field elm, ash, small leaved lime, aspen, wild cherry, European wild apple, European pear and yew special seed orchards will be established which will be treated as breeding populations. In order to achieve the above results, it is planned to select about 3100 maternal trees by 2035 (Supplement 4, Table 4).

4.3.4.4. Clonal and seedling seed orchards

When proposing tasks in the field of establishing new clonal and seedling seed orchards consideration was taken of the need to establish on a country-wide scale a stable seed base for the supplementary species. For each of these species it is planned to establish across the whole country 3–4 seed objects of the type of either clonal or seedling seed orchards, which will create a seed base that will satisfy the needs of the country in a long term.

A further significant factor taken into consideration during the planning of these tasks is the information about local deficiencies of seed. On a larger scale this concerned such species as common beech, silver birch, pedunculate and sessile oak, as well as Scots pine, Norway spruce

and other species. In order to perform the tasks it is planned to establish by 2035 as many as 72 clonal seed orchards with a total area of 360 ha (Supplement 4, Tables 5 and 6) and 65 seedling seed orchards with a total area of 325 ha (Supplement 4, Table 7 and 8). Taking into consideration the planned increase of area, in 2035 the State Forests should have about 1600 ha of clonal seed orchards and 1100 ha of seedling seed orchards. Additionally, it would be beneficial to establish conservation clonal seed orchards for endangered species aimed at their reintroduction in the forests, for example: for yew in the Toruń, Krosno, Szczecinek and Wrocław Regional Directorates of State Forests, for wild service tree in the Katowice and Wrocław RDSFs and for Arolla pine in the Poznań, Toruń and Gdańsk RDSFs.

4.3.4.5. Progeny plantations

Progeny plantations which are descended from the reserved seed stands (RSS) are a practical realization of the program of selection in forests. Their role is to preserve the gain obtained as a result of phenotypic selection and to allow its further utilization through the qualification of progeny plantations as a seed base. For this reason, both in the previous program and in the present one, greatest stress is placed on proper qualitative and quantitative realization of these objects. By 2010 a total of 59 000 ha of progeny plantations were established. This is 3.6 times more than the area of the reserved seed stands (RSS). This indicator was also used when determining the tasks in this field and an objective was set for 2035 to create an area that is 5.5 times greater than the area of existing at that time reserved seed stands (RSS). This would imply an increase of 32 548 ha in the area of progeny plantations within the duration of this 'Program' (Supplement 4, Table 9). Assuming the above, the total area of progeny plantations in 2035 should be in the order of about 100 000 ha.

The tasks proposed in the 'Program' are what is envisaged for the year 2035. During realization of the 'Program' these tasks may undergo modifications and updating, depending on the needs and financial position of the State Forests.

4.3.5. Utilization of FRM

The current utilization of the existing seed base in the State Forests is much diversified. The majority of FRM is gathered in stands of known origin – category I (80–90%) and only 10–20% comes from categories II and III of the seed base. The current 'Program' envisages significant changes in this

respect. When realized, the State Forests will be able to use for silvicultural needs about 10% of the seed base from the category 'tested', about 30% from the categories 'selected' and 'qualified' and only 60% from category 'of known origin'. Also the source of seed of supplementary species will change significantly after the planned seed orchards of these species reach fructification stage. The planned proportions of utilizing various categories of FRM have to be treated as only approximate. Thus one has to allow for adjustments to the planned tasks during the operation of the 'Program'.

4.3.6. Needs for expansion and modernisation of the technical infrastructure

During the realization of the last stage of the program for the years 1991–2010 substantial funds were invested for the building of new and modernization of old plants servicing the proper functioning of the State Forests seed base. Seed extraction plants and storage facilities for seed form a country-wide network in which the equipment, technology, appropriate technical level and the education of staff assure proper conditions for rational seed management. The present infrastructure in forest seed management does not require new investments, other than periodic repairs and supplementary purchases. The present number and distribution of seed extraction plants can be considered as representing the final model. However, there is a need for the development of new and improvement of the existing facilities for the storage of seed, particularly of the heavy type.

Also, the modern and properly organized seed testing network does not require new investments though, of course, periodically a modernization of facilities in the seed testing stations and seed control stations will be needed. It is also necessary to establish cooperation with the International Seed Testing Association (ISTA). At least one of the best seed testing stations functioning in the State Forests should become a member of this recognized international organization.

4.3.7. Research needs

The results of research concerning the forming and utilization of forest seed base should guarantee the owners and the administrators of forests the opportunity to conduct reforestations and afforestations using the forest reproductive material of increasingly better silvicultural and genetic quality and resistance.

Potential maternal trees of black alder in the territory of Toruń RDSF (J.M.)

Natural regeneration of spruce in the Beskid Śląski region – Wisła Forest District (J.M.)

The studies should encompass the following topics:

a) perfection of the methods of monitoring the fruiting of trees, evaluation of seed quality and the prediction of crops;
b) development of a method of evaluating the utilitarian quality of seeds before conducting the collection operation;
c) studies on influence of the method of collecting and extracting seed on the genetic variability of FRM;
d) perfection of methods of long term storage of seed which will permit the maintenance of genetic variability;
e) studies on the physiological and genetic changes in FRM that has been stored for a long time;
f) verification of the methods of testing the predisposition of seed to long term storage;
g) verification of the seed regionalization and the development of principles of using seed beyond the region of origin, appropriate for individual tree species;
h) development of controlled conditions for the stratification of seeds of species that demonstrate dormancy;
i) the conditions for the production of seedlings of indigenous shrub species in container and open root nurseries for the needs of maintaining biodiversity in the forests;
j) analysis of the conditions needed for dormancy breaking and seed storage for rare species of trees and shrubs as well as those under legal protection;
k) epigenetic changes during storage of seed;
l) influence of the conditions of collection and treatment of seeds of trees and shrubs in the period preceding long term storage on their vitality and physiological properties.

Variability of the quality of stems in the clonal seed orchard of silver birch in the Susz Forest District (S.B.)

5. Conditions for the realization of the 'Program' for the years 2011–2035

Realization of the 'Program of conserving forest genetic resources and breeding of trees in Poland for the years 2011–2035' requires the following:

a) in the legal sphere:
   - introduction of legislation similar to this of other EU countries concerning the protection of genetic variability of forest species;
   - amendment to the Forest Reproductive Material Act with regard to the use and trade in forest reproductive material from the conservation seed base;
   - amendment of other legal provisions, such as the Forest Act and the Nature Protection Act, to take into account issues arising from the realization of the breeding program of forest trees and the protection of genetic diversity in forests;
   - amendment of internal directives issued by the State Forests connected with the functioning of the seed base, as envisaged in the 'Program', and concerning primarily actions aimed at the selection and protection of gene resources;
   - establishment of formal legal framework for the use of gene resources in populations of forest trees present in areas under protection, such as nature reserves, national parks and areas of Natura 2000, in order to establish conservation plantations in the State Forests;

b) in the technical sphere:
   - construction of three cool houses for long term storage of seeds;
   - modernization of the Forest Gene Bank and introduction of facilities for the storage of pollen and plant parts;
   - periodic modernization of the existing seed extraction plants and seed storage facilities;
   - construction of a fully automated storage facility for container transplants;

c) in the economic sphere:
   - to ensure necessary financial support to cover the costs associated with the 'Program' and the conduct of selection and protection of gene resources in the State Forests. The estimated costs of these tasks are given in Supplement 5;
   - designation of funds for scientific research that would permit the full realization of needs connected with this 'Program';
   - fixing of appropriate prices for seed from reserved seed stands and plantations and for reproductive material coming from these seeds, which would increase the economic cost-effectiveness of conducting selection in the Forest Districts;

d) in the field of popularizing knowledge about selection:
   - to undertake complex actions aimed at giving seed management and selection a proper rank, and at increasing public understanding and acceptance of the employed norms. These can be achieved, among others, through intensification of training of forest practitioners;
   - publishing of a handbook containing basic theoretical and practical information concerning the principles of selection employed in the State Forests;
   - preparation and publication of a series of popularizing articles about the role of breeding of forest trees in fulfilling the social needs, as realized in the programs followed by State Forests;
   - production of a series of films for public television devoted to these topics, etc.;

e) in the field of scientific research:
   - research in identifying genetic variability and ability to utilize it for the needs of practical forestry. Other research centres should be more widely involved in this research, in particular the Institute of Dendrology of the Polish Academy of Sciences, the Warsaw University of Life Sciences, The Agricultural University in Krakow and the Poznan University of Life Sciences;
   - in spite of the general tendency towards universality of scientific research, the forest sciences in different countries require very deep individualization. This is because of the diversification in the specific composition of forests, the actual forest-environmental conditions and the employed model of forest management. The results of studies obtained in other countries are frequently not applicable in Poland. Therefore in this country we need research that takes into consideration the current state of forest resources, relates to the indigenous populations and to the practices used so far for the protection of the gene pool of indigenous populations and the

Potential maternal trees of Scots pine
in the territory of the Toruń RDSF (J.M.)

Clonal seed orchard of Scots pine
in the Leżajsk Forest District (J.M.)

improvement of breeding populations. While for the realization of the aims of the 'Program' most important are the applied sciences which can be directly employed in forestry practice, attention should also be devoted to basic research, the practical value of which is not measurable in a short term;

- there is a necessity to coordinate research: there are several research institutions in Poland which conduct research associated with the widely understood problem of conserving gene resources and the breeding of forest trees. However, the majority of research currently conducted by individual centres concerns single problems of local or restricted importance. There is insufficient transfer of information and lack of coordination between scientific centres realizing similar research projects. It is essential to form a country-wide scientific network or a scientific consortium of the nature of a technological platform which would deal with the genetics of forest trees in the context of protection of gene resources and breeding. Such consortium should include the State Forests (or a body representing it, eg. the Forest Gene Bank), as the institution most directly interested in the results of such research, and having a means of influencing the further directions for developing research projects;
- principles of financing the research: the cost of financing research on the conservation of forest tree gene resources cannot be covered by the State Forests alone, in view of the immeasurable long term benefits for the whole state economy. The aim should be to enter the topic of conserving gene resources into the list of strategic research projects financed from the State budget.

Selected stand in the territory of the Białystok RDSF (J.M.)

Literature

1. **Barzdajn W., Blonkowski S., Chałupka W., Fonder W., Giertych M., Korczyk A., Matras J., Potyralski A., Sabor J., Szeląg Z., Zajączkowski S. 2004.** Program testowania potomstwa wyłączonych drzewostanów nasiennych, drzew doborowych, plantacji nasiennych i plantacyjnych upraw nasiennych. DGLP [Program of testing the progeny of reserved seeds stands, plus trees, clonal and seedling seed orchards. Directorate-General of the State Forests].
2. **Burczyk J., Fonder W., Kowalczyk J., Lewandowski A., Matras J., Nowakowska J., Załęski A. 2003.** Opracowanie szczegółowych wymagań wynikających z dyrektywy Rady 1999/105/WE z 22 grudnia 1999 roku w odniesieniu do leśnego materiału podstawowego i produkowanego z niego leśnego materiału rozmnożeniowego [Detailed requirements resulting from the Council Directive 1999/105/WE of 22 December 1999 with respect to the basic forest material and produced from it forest reproductive material]. *Spr. Naukowe IBL*, Warszawa (1–179).
3. **Council Directive** 1999/105.EC of 22 December 1999 on the marketing of forest reproductive material. 2000. *Official Journal of the European Communities* L11/17: (17–40).
4. **Fonder W., Kantorowicz W., Matras J., Sabor J., Zajączkowska B., Zajączkowski G., Załęski A. 2003.** Zmodyfikowanie aktualnych zasad regionalizacji nasiennej z dostosowaniem do ustawy o leśnym materiale rozmnożeniowym [Amendments to the current norms of seed regionalization in compliance with the Forest Reproductive Material Act]. *Spr. Naukowe IBL*, Warszawa (1–34).
5. **Fonder W. 2001.** Ochrona zasobów genowych rodzimych gatunków drzew i krzewów leśnych w Lasach Państwowych [Conservation of gene resources of native forest trees and shrubs in the State Forests], *Biblioteczka leśniczego*, no. 151, Wydawnictwo Świat.
6. **Fonder W. 2006.** Podstawowe uregulowania prawne z zakresu nasiennictwa leśnego ze szczególnym uwzględnieniem przepisów ustawy o leśnym materiale rozmnożeniowym [Basic legal regulations with regard to seed management, particularly the requirements of the Forest Reproductive Material Act]. In.: *Wybrane zagadnienia nasiennictwa leśnego* [Selected topics of seed management]. *Materiały szkoleniowe* [Training materials], Jedlnia.
7. **Fonder W., Matras J., Załęski A. 2007.** Leśna baza nasienna w Polsce [Forest seed base in Poland]. CILP, Warszawa (1–300).
8. **Kocięcki S., 1988.** Wytyczne w sprawie selekcji drzew na potrzeby nasiennictwa leśnego [Guidelines for tree selection for the needs of forest seed management]. *Prace IBL series B*, no. 7 (1–61).
9. **Kocięcki S., 1990.** Wykaz uznanych drzewostanów nasiennych [List of recognized seed stands]. DGLP, IBL, Warszawa.

10. **Konwencja o różnorodności biologicznej**, sporządzona w Rio de Janeiro dnia 5 czerwca 1992 r. [**Convention on biodiversity**, prepared in Rio de Janeiro on 5 June 1992]. (*Dz. U.* 2002 Nr 184, poz. 1532).
11. **Matras J., 1991.** Rejestr drzew doborowych, plantacji i plantacyjnych upraw nasiennych [Register of plus trees, clonal and seedling seed orchards]. DGLP, IBL, Warszawa.
12. **Matras J., 1996.** Rejestr bazy nasiennej w Polsce [Register of the forest seed base in Poland], DGLP, IBL, Warszawa.
13. **Matras J., Burzyński G., Czart J., Fonder W., Korczyk A., Puchniarski T., Tomczyk A., Załęski A. 1993.** Program zachowania leśnych zasobów genowych i hodowli selekcyjnej drzew leśnych w Polsce na lata 1991– 2010 [The program of conserving forest genetic resources and breeding of forest trees in Poland for the years 1991–2010]. DGLP, IBL, Warszawa.
14. **Matras J., Burzyński G., Czart J., Fonder W., Korczyk A., Puchniarski T., Tomczyk A., Załęski A. 2000.** Program zachowania leśnych zasobów genowych i hodowli selekcyjnej drzew leśnych w Polsce na lata 1991–2010 [The program of conserving forest genetic resources and breeding of forest trees in Poland for the years 1991–2010]. DGLP, IBL, Warszawa. 2nd amended edition (1–79).
15. **Matras J., Fonder W. 2006.** Wytyczne w sprawie ochrony leśnych zasobów genowych na potrzeby nasiennictwa leśnego. Załącznik nr 1 do zarządzenia nr 7 A z 7 kwietnia 2006 r. dyrektora generalnego LP (zn. sp. ZG/7130/7/2006) w sprawie ochrony leśnych zasobów genowych na potrzeby nasiennictwa i hodowli drzew leśnych [Guidelines concerning conservation of forest gene resources for the needs of seed management. Supplement no. 1 to the Director-General of the State Forests' Directive no. 7A of 7 April 2006 (item ZG/7130/7/2006) on conserving forest gene resources for the needs of seed management and silviculture of forest trees]. IBL, DGLP, Warszawa.
16. **Matras J., Fonder W. 2006.** Założenia „Programu ochrony leśnych zasobów genowych i hodowli drzew leśnych w Polsce na lata 2011–2035 [Assumptions of the 'Program of conserving forest genetic resources and breeding of trees in Poland for the years 2011–2035']. *Biblioteczka leśniczego*, no. 234 (1–15). DGLP, SITLiD.
17. **Matras J. 2007.** Założenia programu ochrony leśnych zasobów genowych i hodowli selekcyjnej drzew leśnych w Polsce na lata 2011–2035 [Assumptions of the 'Program of conserving forest genetic resources and breeding of trees in Poland for the years 2011–2035']. In: Quo vadis forestry? Ed. Zbigniew Sierota. *Proceedings of International Conference 29-30 June 2006*, *Sękocin Stary, Poland*: (346–355).
18. **OECD** scheme for the control of forest reproductive material moving in international trade. 2001. Organization for Economic Co-operation and Development, Paris 1974 (including the 2001 amendment): (1–28).
19. **Program** doskonalenia gospodarki nasiennej i wdrażania osiągnięć leśnej genetyki stosowanej w Lasach Państwowych w okresie 1975–1990 [A program of improvement of seed management and the application of achievements of practical forest genetics in the State Forests for the years 1975–1990]. NZLP, Warszawa 1975. Typescript (1–64).

20. **Rezolucja nr 2** „Ochrona leśnych zasobów genowych" Konferencji Strasburskiej z 1988 r. [**Resolution no. 2** 'Protection of forest gene resources' of the 1988 Strasbourg conference]. Typescript (1–18).
21. **Rozporządzenie Komisji (EC)** Nr 1597/2002 z dnia 6 września 2002 roku ustanawiające szczegółowe zasady stosowania Dyrektywy Rady 1999/105/EC dotyczące formy krajowej listy leśnego materiału podstawowego dla produkcji leśnego materiału rozmnożeniowego [**Regulation of the Commission (EC)** no. 1597/2002 dated 6 September 2002 establishing the detailed principles of employing the Council Directive 1999/105/EC concerning the form of national lists of basic forest material for the production of forest reproductive material].
22. **Rozporządzenie Komisji (EC)** Nr 1598/2002 z dnia 6 września 2002 roku ustanawiające szczegółowe zasady stosowania Dyrektywy Rady 1999/105/EC w zakresie wzajemnego świadczenia pomocy administracyjnej przez organy urzędowe [**Regulation of the Commission (EC)** no. 1598/2002 dated 6 September 2002 establishing the detailed norms of employing the Council Directive 1999/105/EC in the scope of mutual administrative assistance by official organs].
23. **Rozporządzenie Komisji (EC)** Nr 1602/2002 z dnia 9 września 2002 roku ustanawiające szczegółowe zasady stosowania Dyrektywy Rady 1999/105/EC w zakresie upoważnienia Państw Członkowskich do wprowadzania zakazu obrotu określonym leśnym materiałem rozmnożeniowym [**Regulation of the Commission (EC)** no. 1602/2002 dated 9 September 2002 establishing the detailed norms of employing the Council Directive 1999/105/EC in the scope of allowing Member States to introduce a prohibition of marketing specified forest reproductive material].
24. **Rozporządzenie Ministra Rolnictwa i Rozwoju Wsi** z dnia 19 lutego 2003 roku w sprawie wykazu roślin, produktów roślinnych i przedmiotów, których uprawę, wytwarzanie lub obrót mogą prowadzić podmioty wpisane do rejestru producentów roślin, terminu składania wniosków o wpisanie do tego rejestru oraz limitów ilości lub powierzchni [**Regulation of the Minister of Agriculture and Rural Development** dated 19 February 2003 concerning the list of plants, plant products and items whose cultivation, production and marketing is permitted by subjects included in the register of plant producers, time limits for applications for inclusion in the register and the limits pertaining to quantities and areas]. (*Dz. U.* Nr 47, poz. 404).
25. **Rozporządzenie ministra środowiska** z 14 kwietnia 2003 roku w sprawie wzorów wniosków o wydanie świadectwa pochodzenia leśnego materiału rozmnożeniowego [**Regulation of the Minister of the Environment** dated 14 April 2003 concerning forms for applications to obtain certificates of origin of forest reproductive material]. (*Dz.U.* Nr 86, poz. 802).
26. **Rozporządzenie ministra środowiska** z 14 kwietnia 2003 roku w sprawie wzorów świadectw pochodzenia leśnego materiału rozmnożeniowego [**Regulation of the Minister of the Environment** dated 14 April 2003 concerning forms for certificates of origin of forest reproductive material]. (*Dz.U.* Nr 86, poz. 803).
27. **Rozporządzenie ministra środowiska** z 14 stycznia 2004 roku w sprawie wysokości opłat za wyszukiwanie informacji w Krajowym Rejestrze Leśnego Materiału Podstawowego BNL, rejestrze świadectw pochodzenia leśnego materiału rozmnożeniowemu i rejestrze dostawców, za sporządzanie odpisów i wyciągów i ich

przesyłanie oraz sposobu uiszczenia opłat [**Regulation of the Minister of the Environment** dated 14 January 2004 concerning the fees for finding information in the Country-wide Register of Basic Forest Material in the Bureau of Forest Seed Management and in the register of suppliers, for the preparation of copies and extracts and for their postage, as well as the manner of paying the fees]. (*Dz.U.* Nr 20, poz. 190).

28. **Rozporządzenie ministra środowiska** z 18 lutego 2004 roku w sprawie szczegółowych wymagań, jakie powinien spełniać leśny materiał rozmnożeniowy [**Regulation of the Minister of the Environment** dated 18 February 2004 concerning detailed requirements which forest reproductive material must meet]. (*Dz.U.* Nr 31, poz. 272).
29. **Rozporządzenie ministra środowiska** z 25 marca 2004 roku w sprawie struktury organizacyjnej Biura Nasiennictwa Leśnego [**Regulation of the Minister of the Environment** dated 25 March 2004 concerning the structure of the Bureau of Forest Seed Management]. (*Dz.U.* Nr 62, poz. 584).
30. **Rozporządzenie ministra środowiska** z 19 kwietnia 2004 roku w sprawie wykorzystania leśnego materiału rozmnożeniowego poza regionem jego pochodzenia [**Regulation of the Minister of the Environment** dated 19 April 2004 concerning the use of forest reproductive material beyond its region of origin]. (*Dz.U.* Nr 84, poz. 791).
31. **Rozporządzenie ministra środowiska** z 23 kwietnia 2004 roku w sprawie sposobu przeprowadzania testów leśnego materiału podstawowego [**Regulation of the Minister of the Environment** dated 23 April 2004 concerning norms for testing forest reproductive material]. (*Dz.U.* Nr 94, poz. 928).
32. **Rozporządzenie ministra środowiska** z 23 kwietnia 2004 roku w sprawie sposobu prowadzenia przez dostawców dokumentacji w zakresie obrotu leśnym materiałem rozmnożeniowym [**Regulation of the Minister of the Environment** dated 23 April 2004 concerning the mode of maintaining documentation when marketing forest reproductive material]. (*Dz.U.* Nr 94, poz. 929).
33. **Rozporządzenie ministra środowiska** z 26 kwietnia 2004 roku w sprawie podmiotów upoważnionych do przeprowadzania testów i oceny leśnego materiału rozmnożeniowego [**Regulation of the Minister of the Environment** dated 26 April 2004 concerning subjects entitled to conduct tests and evaluation of forest reproductive material]. (*Dz.U.* Nr 97, poz. 975).
34. **Rozporządzenie ministra środowiska** z 23 kwietnia 2004 roku w sprawie szczegółowych wymagań, jakie powinien spełniać leśny materiał podstawowy [**Regulation of the Minister of the Environment** dated 23 April 2004 concerning detailed requirements that basic forest material should meet]. (*Dz.U.* Nr 100, poz. 1026).
35. **Rozporządzenie ministra środowiska** z 18 lipca 2005 roku, zmieniające rozporządzenie w sprawie szczegółowych wymagań, jakie powinien spełniać leśny materiał podstawowy [**Regulation of the Minister of the Environment** dated 18 July 2004 altering the regulation concerning detailed requirements that basic forest material should meet]. (*Dz.U.* Nr 144, poz. 1212).
36. **Rozporządzenie ministra środowiska** z 9 marca 2004 roku w sprawie wykazu obszarów i mapy regionów pochodzenia leśnego materiału podstawowego [**Regulation of the Minister of the Environment** dated 9 March 2004 concerning the list

of regions and maps of regions of origin of forest reproductive material]. (*Dz.U.* Nr 67, poz. 621).
37. **Rozporządzenie ministra środowiska** z 25 października 2006 roku zmieniające rozporządzenie w sprawie wykazu obszarów i mapy regionów pochodzenia leśnego materiału podstawowego [**Regulation of the Minister of the Environment** dated 25 October 2006 amending the regulation concerning the list of regions and maps of regions of origin of forest reproductive material]. (*Dz.U.* Nr 201, poz. 1481).
38. **Rozporządzenie ministra środowiska** z 2 listopada 2006 roku, zmieniające rozporządzenie w sprawie wykorzystania leśnego materiału rozmnożeniowego poza regionem jego pochodzenia [**Regulation of the Minister of the Environment** dated 2 November 2006 amending the regulation concerning the use of forest reproductive material beyond its region of origin]. (*Dz.U.* Nr 206, poz. 1519 i 1520).
39. **Rozporządzenie Ministra Środowiska** z dnia 16 stycznia 2008 r. zmieniające rozporządzenie w sprawie wykorzystania leśnego materiału rozmnożeniowego poza regionem jego pochodzenia [**Regulation of the Minister of the Environment** dated 16 January 2008 amending the regulation concerning the use of forest reproductive material beyond its region of origin]. (*Dz.U.* Nr 14, poz. 90).
40. **Tyszkiewicz S. 1934.** O wyborze drzewostanów nasiennych [The selection of seed stands]. IBLP, series C, no. 3 Warszawa.
41. **Tyszkiewicz S. 1949.** Nasiennictwo leśne [Forest Seed Management]. IBL,Warszawa, ser. D no. 2 . PWRiL (1–357).
42. **Ustawa** z dnia 28 września 1991 r. o lasach [The Forest Act of 28 September 1991] (*Dz. U.* 2000 Nr 56, poz. 679, Nr 86, poz. 958 i Nr 120, poz. 1268).
43, **Ustawa** z 7 czerwca 2001 roku o leśnym materiale rozmnożeniowym [The Forest Reproductive Material Act of 7 June 2001]. (*Dz.U.* Nr 73, poz. 761).
44. **Ustawa** z dnia 16 kwietnia 2004 r. o ochronie przyrody [The Nature Protection Act of 16 April 2004]. (*Dz.U.* Nr 92, poz. 880).
45. **Ustawa** z dnia 18 grudnia 2003 r. o ochronie roślin [The Plant Protection Act of 18 December 2003]. (*Dz. U.* 2004 Nr 11, poz. 94).
46. **Załęski A., Matras J., Sabor J., Zajączkowska B. 2000.** Leśna regionalizacja dla nasion i sadzonek [Forest regionalization for seeds and transplants]. CILP, Warszawa.
47. **Załęski A. 2000.** Zasady i metodyka oceny nasion w Lasach Państwowych [Principles and methods of evaluating seed in the State Forests]. CILP, Warszawa (1–180).
48. **Zarządzenie nr 7** naczelnego dyrektora Lasów Państwowych z dnia 7 kwietnia 1988 r. w sprawie selekcji drzew na potrzeby nasiennictwa leśnego [**Directive no. 7** of the Director-General of the State Forests dated 7 April 1988 concerning the selection of trees for the needs of forest seed management]. *Prace IBL,* series „B", no. 7, Warszawa 1988.
49. **Zarzycki K., Szeląg Z. 1992.** Czerwona lista roślin naczyniowych zagrożonych w Polsce [Red list of endangered vascular plants in Poland]. In: K. Zarzycki, W. Wojewoda, Z. Heinrich (Ed.), W. Szafer Institute of Botany of the Polish Academy of Sciences, Kraków (87–98).

Maternal tree qualified in 1979 with the number 2942 in the Wisła Forest District (Z.R.)

Supplement no. 1.

Legal regulations concerning the forest seed base

I. Current national rules and legal regulations

A. Establishment and functioning of the forest seed base

1. Directive 1999/105/EC

Problems concerning forest reproductive material in the European Union are regulated by the EU Council Directive no. 1999/105.EC of 22 December 1999 on the marketing of forest reproductive material.

The Directive has been made more specific by the following regulations which establish detailed principles of employing it:

- Regulation of the Commission (EC) no. 1597/2002 dated 6 September 2002 concerning the form of national lists of basic forest material for the production of forest reproductive material (21),
- Regulation of the Commission (EC) no. 1598/2002 dated 6 September 2002 concerning mutual administrative assistance by official organs (22),
- Regulation of the Commission (EC) no. 1602/2002 dated 9 September 2002 concerning authorization for Member States to introduce a prohibition of marketing specified forest reproductive material (23).

The directive regulating the marketing of forest reproductive material (FRM) in the European Union came into force on 1 January 2003 (3). It determines the principles of registering and selecting of basic forest material (BFM) and the production and marketing of forest reproductive material (FRM). The directive introduced common definitions and classifications of FRM, obliging member states to employ them. The directive defines the kinds of basic forest material used for the production of forest reproductive material, as well as the requirements the BFM and the FRM must meet.

The directive refers only to species that are of importance for reforestation and afforestation of formerly agricultural or fallow land. It defines the norms for registering basic forest material, allowing at the same time the option of waving norms of the directive with respect to species that are not of importance for forestry in the given member state.

The directive requires that regions of origin be defined for the basic forest material (BFM) intended for the production of FRM and that the lists of regions of origin and their maps are prepared.

The European Union has no common forestry policy. The forestry issues have not been mentioned in the Treaty of Rome on the establishment of the European Community (1957) nor in the Treaty of Maastricht (1992). The majority of EU member states believe that responsibility for the forest

sector should remain within the competence of individual countries in view of the greatly diversified types of forests and systems of forest management in Europe. However, a substantial number of EU legal norms pertain directly to forestry as part of the legislative activity in this area is connected with the realization of aims specified primarily within the common agricultural policy, the policy on transferring goods and services within the community and the policy on nature conservation. Some legal provision has resulted from the 'Strategy and program of action of the European Community for the forest sector', which was adopted by the Council in 1989 and amended in 1992. The current position of the European Union with regard to the general directions of forestry development is contained in the Resolution of the Council on forestry strategy for the EU, dated 15 December 1998 and obligatory for all member states.

Legal regulations of the European Union concerning forestry refer to many different aspects. Joint actions in this sector concentrate on financial support of forestry as a factor stimulating the development of agriculture and rural areas, on monitoring the condition of the forests, on creating information systems relating to forest resources and the economic situation of the forestry sector, and on preventing and fighting forest fires. The trade in timber and in forest reproductive material, as well as forestry services, are subject to the general rules on free transfer of capital, goods and services.

The issues related to the forest reproductive material in the EU member states had been regulated by three directives of the EU Council, namely:

- no. 66/404/EEC dated 14 June 1966 on marketing forest reproductive material;
- no. 71/161/EEC dated 30 March 1971 on the external quality norms of forest reproductive material that is on the market in the Community.

Directives 66/404/EEC and 71/161/EEC determined norms pertaining to the genetic and external qualities (standards) which had to be met by forest reproductive material placed on the market in the EU.

These directives had not been amended since 1975 and changes due to development of scientific research in this field and in the relationship between supply and demand for forest reproductive material led to the development of a new, uniform directive no. 1999/105/EC, which has replaced the two previous ones.

2. The Forest Reproductive Material Act of 7 June 2001

Adjusting the Polish legal norms to the EU norms, the Parliament of the Republic of Poland passed in 2001 the Forest Reproductive Material Act, which entered into force on the day of Poland's entry into the EU, i.e. on 1 May 2004 (43).

This act regulates all issues associated with the collection, production and marketing of reproductive material of trees and their artificial crosses of importance for forestry. It applies to the forests and to the regions designated to be afforested, regardless of their ownership, and the obligation lies with both physical and legal personalities and with the state institutions not having legal personality which deal in production aimed at placing it on the market, as well as with those who deal with the marketing itself. In particular the act regulates the following issues:

- registration of forest reproductive material,
- marketing of forest reproductive material,
- seed regionalization – the establishment of regions of origin of basic forest material intended for the production of forest reproductive material,
- control of forest reproductive material.

The act does not apply to reproductive material that is not intended for forestry, i.e. it is not introduced into forest areas or into areas designated for afforestation, or to forest reproductive material that is intended for export to countries that are not members of the European Union.

Tree species considered important for forestry which have been mentioned in the act include:

Abies alba Mill.	white fir
Abies cephalonica Loud.	Greek fir
Abies grandis Lindl.	grand fir
Abies pinsapo Boiss.	Spanish fir
Acer platanoides L.	Norway maple
Acer pseudoplatanus L.	sycamore
Alnus glutinosa Gaertn.	black alder
Alnus incana Moench.	grey alder
Betula pendula Roth.	silver birch
Betula pubescens Ehrh.	downy birch
Carpinus betulus L.	hornbeam
Castanea sativa Mill.	chestnut
Cedrus atlantica Carr.	Atlas cedar
Cedrus libani A. Richard	Lebanese cedar
Fagus sylvatica L.	common beech

Fraxinus excelsior L.	ash
Fraxinus angustifolia Vahl.	desert ash, narrow-leaved variety
Larix decidua Mill.	European larch
Larix x eurolepis Henry	hybrid larch
Larix kaempferi Carr.	Japanese larch
Larix sibirica Ledeb.	Siberian larch
Picea abies Karst.	Norway spruce
Picea sitchensis Carr.	Sitka spruce
Pinus canariensis C. Smith	Canary Island pine
Pinus cembra L.	Arolla pine
Pinus contorta Loud.	lodgepole pine
Pinus halepensis Mill.	Aleppo pine
Pinus halepensis var. brutia Henry	Turkish pine
Pinus leucodermis Antoine	Bosnian pine
Pinus nigra Arnold	black pine
Pinus pinaster Ait.	maritime pine
Pinus pinea L.	stone pine
Pinus radiata D. Don	Monterey pine
Pinus strobus L.	eastern white pine
Pinus sylvestris L.	Scots pine
Populus spp.	poplars and artificial hybrids of these species
Prunus avium L.	wild cherry
Pseudotsuga menziesii Franco	Douglas fir
Quercus cerris L.	Turkey oak
Quercus ilex L.	holm oak
Quercus petraea Liebl.	sessile oak
Quercus pubescens Willd	downy oak
Quercus robur L.	pedunculate oak
Quercus rubra L	red oak
Quercus suber L.	cork oak
Robinia pseudoacacia L.	black locust
Tilia cordata Mill.	small-leaved lime
Tilia platyphyllos Scop.	large-leaved lime

These species are mentioned in the Directive 1999/105/EC and are obligatory for all member states. A member state wishing to abandon any of them should submit an application to the decision making body and prove that use of these species would be of harm to that country.

The act presents unified legal norms for the basic and reproductive forest materials pertaining to genetic and external qualities. These have

been further defined in more detail in the subsequent regulations relating to the types of BFM used for the production of FRM, their categories and the requirements they must meet. (Regulation of the Minister of the Environment dated 23 April 2004 concerning detailed requirements that basic forest material should meet. *Dz.U.* 2004 no. 100, item 1026 (34); amended Regulation of the Minister of the Environment dated 18 July 2005, *Dz.U.* no. 144, item 1212 (35); Regulation of the Minister of the Environment dated 18 February 2004 concerning detailed requirements that forest reproductive material must meet, *Dz.U.* 2004 no. 31, item 272 (28)). Basic material which does not meet the requirements cannot be registered in the Country-wide Register of BFM and the forest reproductive material produced from it will not be permitted for marketing. The rules concerning the transfer of forest reproductive material, seed and transplants produced from the registered BFM are outlined in the legislation on regionalization and specified in detail in two regulations of the Minister of the Environment:

- Regulation of the Minister of the Environment dated 9 March 2004 concerning the list of regions and maps of regions of origin of forest reproductive material, (*Dz.U.* 2004 no. 67, item 621) (36), with later amendments of November 2006 (37);
- Regulation of the Minister of the Environment dated 19 April 2004 concerning the use of forest reproductive material beyond its region of origin (*Dz.U.* 2004 no 84, item 791) (30), with later amendments (38, 39).

The compliance with these requirements is subject to evaluation and control by organs of public administration independent from the producer – by the Minister of the Environment and by the Bureau of Forest Seed Management (Regulation of the Minister of the Environment dated 25 March 2004 concerning the structure of the Bureau of Forest Seed Management, (*Dz.U.* 2004 no. 62, item 584) (29). The established system of control encompasses the process from collection of seed to the delivery of reproductive material to the final user. The control is made possible by a system of documentation of the collection and production of FRM (Regulation of the Minister of the Environment dated 23 April 2004 concerning the mode of maintaining documentation when marketing forest reproductive material, (*Dz.U.* 2004 no. 94, item 929) (32) and by the requirement to have a certificate of origin by the producer and trader. Detailed regulations in this respect are contained in the Regulation of the Minister of the Environment dated 14 April 2003 concerning forms for application to obtain certificates of origin of forest reproductive material, (*Dz.U.* 2003 no. 86, item 802) (25) and the Regulation of the Minister of the

Environment dated 14 April 2003 concerning forms for certificates of origin of forest reproductive material, (*Dz.U.* 2003 no 86, item 803) (26).

The act introduced a requirement that the basic forest material be registered with the Bureau of Forest Seed Management which is authorized by the Minister of the Environment to maintain the Country-wide Register. On fulfilling the conditions outlined in the act the item is entered into the register, which is equivalent to a permit to collect, produce and market forest reproductive material raised from this BFM.

The Register is divided into four parts; in part I – for the category 'of known origin', production seed stands are included and the source of seed; in part II – for the category 'selected', reserved seed stands are included and their progeny plantations; in part III – for category 'qualified', plus trees, clonal and seedling seed orchards, as well as clones, are included; in part IV – for category 'tested', only FRM obtained after appropriate tests of the genetic and silvicultural value of the material will be registered. The methodology of conducting the tests and the subjects permitted to conduct them are determined in the regulations below:

- Regulation of the Minister of the Environment dated 23 April 2004 concerning norms for testing forest reproductive material (*Dz.U.* 2004 no 94, item 928) (31),
- Regulation of the Minister of the Environment dated 26 April 2004 concerning subjects entitled to conduct tests and evaluation of forest reproductive material, (*Dz.U.* 2003 no 97, item 975) (33).

The main purpose of the act is to ensure the use, adapted to the site conditions, of forest reproductive material from tree species and artificial hybrids of only the highest genetic and utilitarian quality, and also to maintain biodiversity together with the whole genetic variability, which is of fundamental importance for permanent, sustained forest economy.

The act ensures free transfer of reproductive material within the EU, which is of great importance for Poland in view of the fact that we have valuable populations of species that are crucial for forest husbandry (Scots pine, Norway spruce, European larch, common beech, pedunculate oak, sessile oak and others).

3. The Plant Protection Act of 19 February 2003

The Plant Protection Act and the Regulation of the Minister of Agriculture and Rural Development dated 19 February 2003 concerning the list of plants, plant products and items whose cultivation, production and marketing is permitted by subjects included in the register of plant producers, time limits for the applications for inclusion in the register and

the limits pertaining to quantities and areas, (*Dz. U.* 2003 No. 47, item 404) (24, 45), have placed on the Forest Districts additional obligations to register producers in the Plant Protection and Seed Management Inspectorate and to supply plant identity documents for all forest reproductive materials being placed on the market. This additional formalities result from the system of health controls of reproductive materials adopted by the European Union and from the abandoning of border sanitary plant control. The risk of spreading injurious organisms and the need to combat the so called quarantine organisms are the reasons for transferring the responsibility to control the health of reproductive materials directly to the local authorities appropriate to the place of production, in order to assure plant sanitary safety. The identity documents for plants given after positive results of control pertain to a limited number of species used in forestry and apply only to instances of external trade in FRM.

4. Internal regulations of the State Forests

In the State Forests the sphere of issues connected with seeds, the establishment of BFM, applied selection, production and trade in forest reproductive material is regulated not only by the law of the European Union and the Polish state but also by internal regulations, directives and decisions issued by the Director-General of the State Forests. The most important regulations that need to be mentioned are:

- Directive no. 7A dated 7 April 2006 on conserving forest gene resources for the needs of seed management and silviculture of forest trees;
- Directive no. 8 dated 25 January 1993 on the realization of 'The program of conserving forest genetic resources and breeding of forest trees in Poland for the years 1991–2010';
- Directive no. 85 dated 31 December 2004 on the realization in the administrative units of the State Forests of the 'Program of testing the progeny of reserved seeds stands, plus trees, clonal and seedling seed orchards';
- Directive no. 42 dated 29 December 1995 concerning the establishment of the Kostrzyca Forest Gene Bank;
- Directive no. 17 dated 24 February 2003 concerning the norms of functioning of the Kostrzyca Forest Gene Bank in Miłków;
- Directive no. 14A dated 11 December 2000 on the norms for evaluating seed in the State Forests;
- Directive no. 77 dated 13 December 2004 amending the directive 14A dated 11 December 2000 concerning the norms for evaluating seed in the State Forests;

- Directive no. 37 dated 15 May 2002 concerning the organisation, scope and range of activity of seed extraction plants in the State Forests;
- Directive no. 84 dated 15 October 1999 concerning the organisation and performance of seed evaluation in the State Forests;
- Directive no. 82 dated 29 December 2004 amending the directive no. 84 dated 15 October 1999 concerning the organisation and performance of seed evaluation in the State Forests;
- Decision no. 101 of the Director-General of the State Forests dated 6 July 2000 concerning the establishment of a Country-wide Commission for the recognition of seed stands of indigenous ecotypes and of plus trees in the State Forests.

B. Protection of forest gene resources

In Poland there are no detailed legal regulations concerning the protection of the genetic diversity present in forests. In the realization of the programs of protecting forest genetic diversity use is made of the general norm contained in the Forest Act and the Nature Protection Act. Additionally, Poland is a signatory of international agreements, in particular of the Rio de Janeiro Convention on biodiversity, which places obligations for action in this area.

1. The Forest Act of 28 September 1991

The Forest Act (42), in chapter 2. art. 7 §1, recommends the conduct of forest husbandry so that:

1) forests and their positive influence on the climate, air, water, soil, life conditions, health of people and biological balance are preserved;

2) forests are protected, particularly the forests that represent fragments of indigenous nature or forests that are especially valuable for the:

a) conservation of forest gene resources,

b) landscape quality,

c) needs of science.

2. The Nature Protection Act of 16 April 2004

Art. 2.

1. Nature protection, in the understanding of the act, consists of preserving, sustained utilization and rebuilding of natural resources, formations and components:

1) wild plants, animals and fungi;

2) *plants, animals and fungi covered by species protection;*
3) *animals that have a wandering mode of life;*
4) *natural sites;*
5) *sites endangered with extinction, rare and protected species of plants, animals and fungi;*
6) *live and lifeless formations and palaeontological specimens of plants and animals;*
7) *landscape;*
8) *town and village greenery;*
9) *tree-covered areas.*

2. *The purpose of protection is to:*
   1) *maintain ecological processes and the stability of ecosystems;*
   2) *conserve biodiversity;*
   3) *conserve the geological and palaeontological legacy;*
   4) *assure continuity of the existence of species of plants, animals and fungi, together with their environments, through their conservation or restitution to a proper state;*
   5) *protect the landscape quality, greenery in towns and villages and tree-covered areas;*
   6) *maintain or re-establish the proper state of natural environments, as well as remaining resources, formations and components of nature;*
   7) *form appropriate attitudes of man towards nature through education, information and promotion of matters pertaining to nature protection.*

Art. 117.

1. *The management of wild growing plants, animals and fungi and of the genetic resources of plants, animals and fungi utilized by man should ensure their permanence, appropriate numbers and protection of genetic diversity, in particular through:*
   1) *protection, maintenance or regional management of natural or semi-natural ecosystems, including forests, peat bogs, bogs, meadows, saline areas, seaside cliffs and dunes, banks of water runs, river valleys, springs and well heads, and also of rivers, lakes and marine areas, and sites and refugia for plants, animals and fungi;*
   2) *provision of conditions for the reproduction and spreading of endangered species of plants, animals and fungi and protection and restitution of their sites and refugia, as well as protection of the migration routes for animals;*
2. *Landscape protection is conducted on economically utilized parts of national parks or nature reserves (44).*

II. Resolutions and international conventions

The resolution no. 2 on 'Protection of forest gene resources' of the 1988 Strasbourg Conference, to which Poland is a signatory, states that:

1.1. maintenance of genetic diversity of forest species, which is the basic human legacy, is a first order aim;

1.2. there exists a serious risk of depleting or changing this diversity;

1.3. the genetic diversity existing on the European continent results primarily from the wide range of occurrence of species adapted to various ecological conditions;

1.4. the use of improved genetic material is of great importance in reforestations and afforestations, particularly in those for production purposes.

In view of this:

1.5. the States which are signatories to this resolution agree to conduct in their respective countries a policy of protecting forest genetic resources in agreement with the adopted norms (20).

In the 'Convention on Biodiversity' agreed in Rio de Janeiro on 5 June 1992 and ratified by Poland, the signatories are:

- *aware of the significant importance of biodiversity and the ecological, genetic, social, economic, scientific, educational, cultural, recreational and esthetical value of its elements,*
- *aware of the importance of biodiversity for evolution and for the functioning of ecosystems sustaining life in the biosphere,*
- *alarmed by the fact that some human actions significantly diminish biodiversity,*

and therefore have agreed that:

Each signatory, according to their circumstances and abilities:

a) will develop a national strategy, together with plans and programs, concerning protection of biodiversity and moderate utilization of its elements; or will adapt to this aim the existing strategies, plans and programs so that the requirements of the Convention be reflected in its actions (Art. 6).

b) will include, as far as possible and when needed, the protection of biodiversity and moderate utilization of its elements in its departmental and interdepartmental plans, programs and strategies (Art. 6).

Each signatory, as far as possible and as the need arises, will begin the protection of biodiversity *in situ* (Art. 8) and as supplementary to actions *in situ* also the protection *ex situ* (Art. 9) (10).

Supplement no. 2

Realization of tasks envisaged in the ‘Program’ for the years 1991–2010

Abbreviations for species names in the Tables:

A – ash (*Fraxinus excelsior*)
AlM – ash-leaf maple (*Acer negundo*)
AP – Arolla pine (*Pinus cembra*)
AS – aspen (*Populus tremula*)
B – beech (*Fagus sylvatica*)
BA – black alder (*Alnus glutinosa*)
BL – black locust (*Robinia pseudoacacia*)
BP – black pine (*Pinus nigra*)
BPo – black poplar (*Populus nigra*)
BN – bladder nut (*Staphylea pinnata*)
DB – downy birch (*Betula pubescens*)
DF – Douglas fir (*Pseudotsuga menziesii*)
EL – European larch (*Larix decidua*)
GA – grey alder (*Alnus incana*)
GF – grand fir (*Abies grandis*)
H – hornbeam (*Carpinus betulus*)
NM – Norway maple (*Acer platanoides*)
NS – Norway spruce (*Picea abies*)
LLL – large leaved lime (*Tilia platyphyllos*)
OB – other broadleaved
OC – other conifers
Pop – poplar (*Populus*)
PO – pedunculate oak (*Quercus robur*)
RO – red oak (*Quercus rubra*)
S – sycamore (*Acer pseudoplatanus*)
SB – silver birch (*Betula pendula*)
SLL – small leaved lime (*Tilia cordata*)
SO – sessile oak (*Quercus petraea*)
SP – Scots pine (*Pinus sylvestris*)
WC – wild cherry (*Prunus avium*)
WE – wych elm (*Ulmus glabra*)
WF – white fir (*Abies alba*)
WhE – white elm (*Ulmus laevis*)
EWP – eastern white pine (*Pinus strobus*)
WST – wild service tree (*Sorbus torminalis*)
Y – yew (*Taxus baccata*)

Table 1. Number of seed sources in the State Forests – situation on 1 January 2009

No.	RDSF	Species																		
		NM	S	SLL	LLL	A	DB	GA	H	RO	WC	BL	AIM	Pop	Bpo	GF	BP	EWP	DF	Total
1.	Białystok	37	12	31	0	8	1	0	31	3	3	0					0	0	0	**126**
2.	Gdańsk	18	22	24	0	9	0	3	32	3	23	0					0	1	28	**163**
3.	Katowice	14	39	29	2	15	3	1	16	6	9	6	1				3	2	6	**152**
4.	Kraków	7	20	21	1	6	0	2	6	2	11	0					0	0	2	**78**
5.	Krosno	4	19	17	1	3	0	0	11	7	5	3					1	3	6	**80**
6.	Lublin	21	24	24	0	5	0	0	12	7	14	4		1		1	0	2	3	**118**
7.	Łódź	22	30	37	1	3	0	4	25	6	18	2		1			1	1	3	**154**
8.	Olsztyn	29	29	27	2	19	1	3	22	2	16	6					0	0	5	**161**
9.	Piła	10	13	15	1	0	0	32	11	6	10	4					0	0	2	**104**
10.	Poznań	24	31	27	1	10	1	9	35	16	19	7		4	1		4	3	9	**201**
11.	Radom	22	23	33	0	3	0	0	15	2	10	3					0	0	2	**113**
12.	Szczecin	32	53	56	9	19	1	9	59	15	35	4	2				1	4	16	**315**
13.	Szczecinek	25	27	30	0	7	1	13	24	0	18	3					1	1	8	**158**
14.	Toruń	30	34	45	5	14	2	18	30	3	15	4		4	1		3	3	4	**215**
15.	Warszawa	24	22	28	0	6	0	1	18	0	13	0					0	0	2	**114**
16.	Wrocław	21	26	29	4	14	0	9	32	14	22	5		3			0	5	24	**208**
17.	Zielona Góra	11	17	15	0	6	1	9	14	10	11	2					2	1	8	**107**
Total for SF		**351**	**441**	**488**	**27**	**147**	**11**	**113**	**393**	**102**	**252**	**53**	**3**	**13**	**2**	**1**	**16**	**26**	**128**	**2 567**

Table 2. Area (in ha) of stands of known origin (production seed stands PSS) by species and Regional Directorates of the State Forests – situation on 1 January 2009

RDSF	Species													Total
	SP	NS	EL	WF	BP	OC	SB	B	PO	SO	BA	SML	OB	
Białystok	18 000	4 600	10				1390		1 000		3300	20	250	**28 570**
Gdańsk	8 000	650	30		10	20	20	2 300	210	300	50		10	**11 600**
Katowice	12 000	3 700	100	100	25	10		1 200	1 000	150	110	10	20	**18 425**
Kraków	800	200	150	1 800	10		20	1 350	200		50	10	10	**4 600**
Krosno	3 500	50	150	2 600			20	3 400	410		100		20	**10 250**
Lublin	11 000	50	10	550			100	300	700	85	500		30	**13 325**
Łódź	8 700	50	10	80			50	20	300	100	90			**9 400**
Olsztyn	20 500	850	20		10		570	4 000	1 680		1 100	210	160	**29 100**
Piła	6 600	20	10				20	100	370	300	30			**7 450**
Poznań	10 000	20	30	10	10	20	60	200	2 330	600	160		60	**13 500**
Radom	4 000	30	60	350			20	80	400	50	250		10	**5 250**
Szczecin	12 000	100	30		10	60	60	1 200	1 000	700	230		60	**15 450**
Szczecinek	11 100	150	20			20	30	900	300	200	50		30	**12 800**
Toruń	14 500	50	10		5	10	80	450	750	50	170		10	**16 085**
Warszawa	4 200			50			80		180	80	290			**4 880**
Wrocław	3 000	3 500	350	40	10	20	50	1 600	1 800	40	100	50	60	**10 620**
Zielona Góra	6 600	30	30		10	20	30	200	695	50	120		10	**7 795**
Razem	**154 500**	**14 050**	**1 020**	**5 580**	**100**	**180**	**2 600**	**17 300**	**13 325**	**2 705**	**6 700**	**300**	**740**	**219 100**

Table 3. Number of selected stands (reserved seed stands RSS) by species and Regional Directorates of the State Forests – situation on 1 January 2009

RDSF	Species															Total
	B	SB	SO	PO	A	SLL	BA	OC	SP	NS	EL	WF	DF	BP	OC	
Białystok		6		10		2	9		58	27	7					**119**
Gdańsk	15		5	5	2	2	1		27	2	5	1	6			**71**
Katowice	13	1		4			3		18	42	9	8	6	1	1	**106**
Kraków	11	1		4	1				7	7	3	19		3		**56**
Krosno	13			8	2		2		4	2	15	20	3		1	**70**
Lublin	7	4		8			12		20	2	1	10				**64**
Łódź	2			1			4		28			2		1		**38**
Olsztyn	2	1		11		3	7	2	69	2	3				1	**101**
Piła	2		8	3			1		30	2	1		3		1	**51**
Poznań	2		7	11	2		2		16		3		4	3	1	**51**
Radom	3		1	3			5		13	2	10	10				**47**
Szczecin	17	3	19	2				1	32	3	2		6			**85**
Szczecinek	10		7	1	2		4		27	1	2	2	6		1	**63**
Toruń	6	5	9	2			6	1	53				6	4	2	**94**
Warszawa		2				1	6		12	1						**22**
Wrocław	15		2	13	1	3	1	1	19	24	21	2	7	3	1	**113**
Zielona Góra	5	2	4	3				2	18							**34**
Total	**123**	**25**	**62**	**89**	**10**	**11**	**63**	**7**	**451**	**117**	**82**	**74**	**47**	**15**	**9**	**1185**

Table 4. Area (in ha) of selected stands (reserved seed stands RSS) by species and Regional Directorates of the State Forests – situation on 1 January 2009

RDSF	Species															Total
	B	SB	SO	PO	A	SLL	BA	OB	BP	SP	NS	WF	EL	DF	OC	
Białystok		1381.68	406.91		22.29				52.16		161.56		24.70	84.46		**2133.76**
Gdańsk		329.92	15.38	1.13	11.91	19.92		229.34		42.83	30.17	10.21	18.71	7.59		**717.11**
Katowice	15.90	188.90	1033.66	57.73	45.23	32.53	2.94	138.81	1.20		90.12			16.03		**1623.05**
Kraków	14.92	66.75	209.87	413.84	21.62			197.15	20.00		81.69	2.50				**1028.34**
Krosno		86.52	75.00	462.10	61.56	2.87	6.00	332.69			71.41	5.83		20.59		**1124.57**
Lublin		362.61	10.48	142.03	9.46			159.19	42.38		129.12			70.83		**926.10**
Łódź	2.00	225.43		9.79				46.46			4.23			39.14		**327.05**
Olsztyn		1483.86	44.23		16.66		1.30	13.87	16.00		111.81		53.71	62.87	5.00	**1809.31**
Piła		220.94	5.25		3.81	5.98	2.46	21.92		127.57	25.24			1.20		**414.37**
Poznań	17.31	256.07			33.59	7.06	2.56	13.04		252.25	280.30	8.69		27.06		**897.93**
Radom		198.06	11.36	253.92	118.89			179.74		29.38	57.41			124.02		**972.78**
Szczecin		528.01	25.50		18.41	19.86		286.05	13.25	499.72	26.04				8.40	**1425.24**
Szczecinek		392.12	4.17	23.15	3.12	15.20	1.00	185.91		292.17	14.96	16.82		9.60		**958.22**
Toruń	10.36	582.91				16.46	2.83	58.59	29.54	130.82	25.84			42.77	4.08	**904.20**
Warszawa		287.14	21.37						12.78				6.94	38.84		**367.07**
Wrocław	11.49	200.77	212.59	6.77	78.64	24.00	2.85	157.49		31.45	233.67	2.93	37.87	4.89	1.63	**1007.04**
Zielona Góra		188.20						55.72	7.77	45.61	54.69				5.29	**357.28**
Total	**71.98**	**6979.89**	**2075.77**	**1370.46**	**445.19**	**143.88**	**21.94**	**24.40**	**71.98**	**6979.89**	**2075.77**	**1370.46**	**445.19**	**143.88**	**21.94**	**16 993.42**

Table 5. Number of maternal trees (plus trees PT) by species and Regional Directorates of the State Forests – situation on 1 January 2009

RDSF	Species																					Total
	B	SB	DB	WC	SO	PO	DF	WF	A	S	NM	SLL	EL	BA	AS	BL	SP	BP	EWP	NS	WE	WhE	
Białystok		52	1			199			43	1	3	59	3	94	49		600			302	62	44	**1512**
Gdańsk	66			34	38	11	64	5	2			5	68	1			184						**478**
Katowice	50			36	40	50	56	49	2	3			94				201	8	36	167			**792**
Kraków	84	30		24		43		131	19			31	143	32	2		144	117		55			**855**
Krosno	94			35		70	54	143		3			107	33	4		53			53	2		**651**
Lublin	34	35		35	1	47	2	53	9				10	77			208			54	1		**566**
Łódź		32		32										37			164	4					**269**
Olsztyn	6	46				7	5		1			33	33	52			344		1				**528**
Piła	5	1			39	9	7						4				170		1	3			**239**
Poznań	2				50	36	33		15				41	33			112	15					**337**
Radom	44					7		46		1			166	83	1		84			33			**465**
Szczecin	77	23			100	15	134	2	1	31		1	71	3			460			86			**1004**
Szczecinek	39	33		16	61	1	68	39	31				80	38			212		2				**620**
Toruń	13	40			7	45	54							58			359	40					**616**
Warszawa		2										6		51			52			4			**115**
Wrocław	50	4		32		13	50	25	3	1		32	146	2			103	39		94	1		**595**
Zielona Góra																34	99						**133**
Total	**564**	**298**	**1**	**244**	**336**	**553**	**527**	**493**	**126**	**40**	**3**	**167**	**966**	**594**	**56**	**34**	**3549**	**223**	**40**	**851**	**66**	**44**	**9775**

Table 6. Number of clonal seed orchards by species and Regional Directorates of the State Forests – situation on 1 January 2009

RDSF	Species																		Total
	B	SB	Y	WC	SO	PO	DF	WF	WST	A	AP	SLL	EL	BA	BL	SP	BP	EWP	NS	
Białystok		2				1				1		3	3	2		4			3	**19**
Gdańsk	1	1								1		3	2	1		4				**13**
Katowice	4				1		1						6			1	2	1	1	**17**
Kraków						1							1			1				**3**
Krosno		1		1	1	2	1	1				1	1	1		2	1		1	**14**
Lublin				1		1		1				1	2	1		3			2	**12**
Łódź		1					1					1	1	1		3	1			**9**
Olsztyn		1										2	2	1		5			2	**13**
Piła		1			1							1	1			2				**6**
Poznań		1	1	1	1	1	1					2	4	2		5	2		2	**23**
Radom													5	1		2			1	**9**
Szczecin	1	1			1							1	4			3			1	**12**
Szczecinek	1				1		1					1	2			4				**10**
Toruń							3						2	1		4	1			**11**
Warszawa					1							1				1				**3**
Wrocław								10	1		1	1	2			3	1			**19**
Zielona Góra					2							1			1	3				**7**
Total	**7**	**9**	**1**	**3**	**9**	**6**	**8**	**12**	**1**	**2**	**1**	**19**	**38**	**11**	**1**	**50**	**8**	**1**	**13**	**200**

Table 7. Area (in ha) of clonal seed orchards by species and Regional Directorates of the State Forests – situation on 1 January 2009

RDSF	Species																		Total
	B	SB	Y	WC	SO	PO	DF	WF	WST	A	AP	SLL	EL	BA	BL	SP	BP	EWP	NS	
Białystok		10.17				5.95				6.22		9.70	11.57	6.10		31.18			18.92	**99.81**
Gdańsk	11.96	3.50								4.05		8.15	12.80	5.00		36.37				**81.83**
Katowice	22.00				6.47		5.93						31.62			6.50	2.05	2.80	4.20	**81.57**
Kraków						4.83							7.11			3.01				**14.95**
Krosno		2.79		5.30	4.00	10.74	4.22	5.32				4.03	6.60	3.59		11.15	3.30		5.40	**66.44**
Lublin				5.00		4.30		7.88				5.34	16.38	5.57		20.79			10.31	**75.57**
Łódź		8.86					5.76					6.90	12.50	6.30		14.69	3.64			**58.65**
Olsztyn		9.46										25.40	22.58	16.32		95.47			15.89	**185.12**
Piła		5.18			7.90							6.90	5.42			17.34				**42.74**
Poznań		3.80	0.50	2.18	5.48	6.13	7.33					6.40	29.84	8.19		41.92	9.18		10.94	**131.89**
Radom													30.50	5.00		8.21			4.98	**48.69**
Szczecin	8.62	3.86			5.50							2.63	26.45			30.42			4.96	**82.44**
Szczecinek	5.13				4.99		6.30					3.80	12.00			22.58				**54.80**
Toruń							8.07						10.30	6.03		33.56	3.90			**61.86**
Warszawa					4.20							6.27				5.96				**16.43**
Wrocław								65.33	1.35		4.97	5.74	11.58			14.19	2.93			**106.09**
Zielona Góra					14.84							5.30			5.54	25.04				**50.72**
Total	**47.71**	**47.62**	**0.50**	**12.48**	**53.38**	**31.95**	**37.61**	**78.53**	**1.35**	**10.27**	**4.97**	**96.56**	**247.25**	**62.10**	**5.54**	**418.38**	**25.00**	**2.80**	**75.60**	**1259.60**

Table 8. Number of seedling seed orchards by species and Regional Directorates of the State Forests – situation on 1 January 2009

RDSF	Species													Total
	B	SB	SO	PO	DF	WF	S	AP	EL	SP	BP	EWP	NS	
Białystok		1								1			1	**3**
Gdańsk					1				1	2	2			**6**
Katowice									1		7	1	1	**10**
Kraków	1					1		1	5		4			**12**
Krosno				2										**2**
Lublin									1	2				**3**
Łódź						1	1		2	5				**9**
Olsztyn									2	1				**3**
Piła									1	3				**4**
Poznań			1	2	1				4	5	5			**18**
Radom	1					1			2					**4**
Szczecin					2					3				**5**
Szczecinek					1									**1**
Toruń		1	1							3	3			**8**
Warszawa									2					**2**
Wrocław									1	3	1			**5**
Zielona Góra									2	5	1			**8**
Total	**2**	**2**	**2**	**4**	**5**	**3**	**1**	**1**	**24**	**33**	**23**	**1**	**2**	**103**

Table 9. Area (in ha) of seedling seed orchards by species and Regional Directorates of the State Forests – situation on 1 January 2009

RDSF	Species													Total
	B	SB	SO	PO	DF	WF	S	AP	EL	SP	BP	EWP	NS	
Białystok		7.39								14.35			5.66	**27.40**
Gdańsk					4.20				5.09	13.23	4.34			**26.86**
Katowice									4.00		34.26	4.40	5.23	**47.89**
Kraków	5.50					4.44		10.00	20.43		20.60			**60.97**
Krosno				12.20										**12.20**
Lublin									12.05	13.13				**25.18**
Łódź						5.85	4.55		19.84	31.40				**61.64**
Olsztyn									36.27	21.74				**58.01**
Piła									13.39	45.31				**58.70**
Poznań			5.00	11.20	7.60				20.70	25.63	24.06			**94.19**
Radom	5.72					5.06			10.26					**21.04**
Szczecin					13.00					26.15				**39.15**
Szczecinek					8.10									**8.10**
Toruń		6.00	6.00							24.27	15.54			**51.81**
Warszawa									13.29					**13.29**
Wrocław									5.04	18.58	6.94			**30.56**
Zielona Góra									11.53	45.82	4.90			**62.25**
Total	**11.22**	**13.39**	**11.00**	**23.40**	**32.90**	**15.35**	**4.55**	**10.00**	**171.89**	**276.51**	**110.64**	**4.40**	**10.89**	**699.24**

Table 10. Area (in ha) of progeny plantations in blocks by species and Regional Directorates of the State Forests – situation on 1 January 2009

RDSF	Species												Total
	B	SB	SO	PO	BA	SLL	OB	SP	NS	EL	WF	OC	
Białystok		145		263	56	13	4	4756	270	285			**5792**
Gdańsk	458	154	191	352	26	31	6	1369	42	160	8	21	**2818**
Katowice	102	4	125	121	31			1347	516	193	67	216	**2722**
Kraków	136	17		56			2	152	44	47	727	10	**1191**
Krosno	633	3		235	52			395	375	313	781	21	**2808**
Lublin	197	85	13	169	244			948	8	18	329		**2011**
Łódź	102			10	27	4	1	1643		24	21		**1832**
Olsztyn	60	174		457	187	47	12	8147	110	89			**9283**
Piła	102	8	495	106	3	7		2659	10	186		78	**3654**
Poznań	149		55	259	40			2340	23	42		116	**3024**
Radom	364		67	161	202			1159	50	114	541		**2658**
Szczecin	642	5	469	15			20	3517	97	71		59	**4895**
Szczecinek	415	35	373	82	10	17	7	1415	37	161	66	134	**2752**
Toruń	378	403	214	325	80		11	4058		85		75	**5629**
Warszawa		28			65			2159	18	10			**2280**
Wrocław	320		2	337	27	31	11	773	399	509	29	157	**2595**
Zielona Góra	419	45	194	164	2		4	5574		11		27	**6440**
Total	**4477**	**1106**	**2198**	**3112**	**1052**	**150**	**78**	**42 411**	**1999**	**2318**	**2569**	**914**	**62 384**

Table 11. Number of conservation stands by species and Regional Directorates of the State Forests – situation on 1 January 2009

RDSF	Species										Total
	SP	B	SO	PO	WF	A	EL	NS	Lime	H	
Białystok	11+3*			4+1*		4		1+2*			**26**
Gdańsk	9+1*	1		1*							**12**
Katowice	10+1*	1*		3	3		1	10+1*			**30**
Kraków		1			5			1			**7**
Krosno				2	1		1				**4**
Lublin	10			4	1						**15**
Łódź	2			1							**3**
Olsztyn	16										**16**
Piła	2+1*			1+1*							**5**
Poznań					2		1				**3**
Radom	6		1				2				**9**
Szczecin	34		1	1							**36**
Szczecinek	5+1*	3+2*	2	4*						1*	**18**
Toruń	4+2*	2*		1+3*					1*		**13**
Warszawa	4				1						**5**
Wrocław	3			2				2			**7**
Zielona Góra	1										**1**
Total	**126**	**10**	**4**	**29**	**13**	**4**	**5**	**17**	**1**	**1**	**210**

* Stands selected for protection of more than one species.

Table 12. Area (in ha) of conservation stands by species and Regional Directorates of the State Forests – situation on 1 January 2009

RDSF	Species										Total
	SP	B	SO	PO	WF	A	EL	NS	Lime	H	
Białystok	221.20			62.08		39.73		47.18			**370.19**
Gdańsk	167.89	8.90		2.64							**179.43**
Katowice	135.94	15.60		37.09	20.65		15.00	291.33			**515.61**
Kraków		17.98			120.85			43.42			**182.25**
Krosno				28.44	51.25		1.10				**80.79**
Lublin	110.24			51.93	84.49						**246.66**
Łódź	84.09			3.98							**88.07**
Olsztyn	199.50										**199.50**
Piła	52.30			71.23							**123.53**
Poznań					14.52		1.94				**16.46**
Radom	87.64		59.13				42.15				**188.92**
Szczecin	254.15		25.21	30.60							**309.96**
Szczecinek	53.81	103.21	11.28	103.18						11.37	**282.85**
Toruń	56.04	51.05		69.54					13.83		**190.46**
Warszawa	54.46				45.00						**99.46**
Wrocław	35.21			8.33				39.00			**82.54**
Zielona Góra	**										**0.00**
Total	**1512.47**	**196.74**	**95.62**	**469.04**	**336.76**	**39.73**	**60.19**	**420.93**	**13.83**	**11.37**	**3156.68**

** Single trees in younger stands.

Table 13. Area (in ha) of conservation plantations by species and Regional Directorates of the State Forests – situation on 1 January 2009

RDSF	Species										Total
	SP	NS	EL	WF	OC	B	SO	PO	Lime	OB	
Białystok	220	21		1							**242**
Gdańsk	23										**23**
Katowice	116	2						2			**120**
Kraków											**0**
Krosno	40										**40**
Lublin	45						4				**49**
Łódź											**0**
Olsztyn	1	28									**29**
Piła	19						52	11			**82**
Poznań			8	8							**16**
Radom	17										**17**
Szczecin	61										**61**
Szczecinek	38							15			**53**
Toruń	46	15					15				**76**
Warszawa	20										**20**
Wrocław	8			13			6				**27**
Zielona Góra	10										**10**
Total	**664**	**66**	**8**	**22**	**0**	**0**	**77**	**28**	**0**	**0**	**865**

Table 14. Number of conservation stands in national parks – situation on 1 January 2009

National Park	Species													Total
	SP	B	SB	SO	PO	WF	A	S	AP	EL	BA	NS	BN	
Babiogórski NP		1*				1*						4+1*		**7**
Białowieski NP			1	2										**3**
Biebrzański NP											2			**2**
Bieszczadzki NP		1										2		**3**
NP Bory Tucholskie	3													**3**
Drawieński NP	1	1												**2**
Gorczański NP		1+8*				6*		1		1		8*		**25**
NP Gór Stołowych	1*											3+1*		**5**
Kampinoski NP	4										1			**5**
Karkonoski NP		4								1		2		**7**
Magurski NP						1							1	**2**
Narwiański NP														**0**
Ojcowski NP						1	1*	1*						**3**
Pieniński NP	2	3				2		1						**8**
Poleski NP			1								1			**2**
Roztoczański NP	1					2								**3**
Słowiński NP	1*	1*												**2**
Świętokrzyski NP	1	1												**2**
Tatrzański NP		1*				3+3*			1			7+2*		**17**
NP Ujście Warty														**0**
Wielkopolski NP	2+2*	1			2*									**7**
Wigierski NP	6									1				**7**
Woliński NP														**0**
Total	**24**	**23**	**2**	**2**	**2**	**19**	**1**	**3**	**1**	**3**	**4**	**30**	**1**	**115**

* Stands selected for protection of more than one species.

Table 15. Area (in ha) of conservation stands in national parks – situation on 1 January 2009

National Park	Species													Total
	SP	B	SB	SO	PO	WF	A	S	AP	EL	BA	NS	BN	
Babiogórski NP		56.1				56.1						211.4		**323.6**
Białowieski NP			6.5	25.1										**31.6**
Biebrzański NP											29.6			**29.6**
Bieszczadzki NP		80.0										75.0		**155.0**
NP Bory Tucholskie	27.5													**27.5**
Drawieński NP	3.5	28.0												**31.5**
Gorczański NP		288.0				205.8		7.5		3.4		256.0		**760.7**
NP Gór Stołowych	1.0											47.2		**48.2**
Kampinoski NP	161.2										6.2			**167.4**
Karkonoski NP		38.2								1.5		74.7		**114.4**
Magurski NP						24.0							28.1	**52.1**
Narwiański NP														**0**
Ojcowski NP						16.3	6.8	6.8						**29.9**
Pieniński NP	5.3	27.0				20.3		3.8						**56.4**
Poleski NP			19.3								3.0			**22.3**
Roztoczański NP	41.0					119.4								**160.4**
Słowiński NP	4.0	4.0												**8.0**
Świętokrzyski NP	10.8	60.0												**70.8**
Tatrzański NP		16.0				64.2			16.5			154.6		**251.3**
NP Ujście Warty														**0**
Wielkopolski NP	56.8	2.8			24.4									**84.0**
Wigierski NP	91.8									2.2				**94.0**
Woliński NP														**0**
Total	**402.1**	**600.1**	**25.8**	**25.1**	**24.4**	**506.1**	**6.8**	**18.1**	**16.5**	**7.1**	**38.8**	**818.9**	**28.1**	**2518.7**

Supplement no. 3

Realization of the tasks envisaged in the 'Program of testing the progeny of reserved seeds stands, plus trees, clonal and seedling seed orchards' – situation on 31 December 2009

Table 1. The advancement of gathering FRM for testing and the establishment of testing areas of selected stands (reserved seed stands RSS) and maternal trees (plus trees PT) – situation on 31 August 2009

Species	Region of testing	RDSF	Objects gathered for testing						Areas established or being realized					
			RSS			PT			RSS			PT		
			Stage	Realization	%	Stage	Realization	%	Tasks	Realization	%	Tasks	Realization	%
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Scots pine	I – białostocki	Białystok	59	49	83.05	602	229	38.04	8	4	50.00	24	4	16.67
	II – olsztyński	Olsztyn	66	38	57.58	349	5	1.43	8	4	50.00	16	0	0.00
	III – gdańsko-szczecinecki	Gdańsk, Szczecinek	55	39	70.91	389	191	49.10	4	0	0.00	16	0	0.00
	IV – toruński	Toruń	52	7	13.46	362	24	6.63	4	0	0.00	16	0	0.00
	V – pilski	Piła	30	16	53.33	174	107	61.49	4	0	0.00	8	4	50.00
	VI – szczeciński	Szczecin	32	11	34.38	386	94	24.35	4	0	0.00	8	4	50.00
	VII – poznańsko-zielonogórski	Poznań, Zielona Góra	34	15	44.12	231	42	18.18	4	0	0.00	12	0	0.00
	VIII – łódzko-warszawski	Łódź, Warszawa	40	12	30.00	216	24	11.11	4	0	0.00	12	0	0.00
	IX – lubelsko-radomski	Lublin, Radom	33	33	100.0	301	29	9.63	4	4	100.0	12	0	0.00
	X – katowicko-wrocławski	Katowice, Wrocław	38	13	34.21	344	28	8.14	4	0	0.00	16	0	0.00
	XI – krakowsko-krośnieński	Kraków, Krosno	11	4	36.36	251	12	4.78	4	0	0.00	12	0	0.00
	Total		**450**	**237**	**52.68**	**3605**	**785**	**21.77**	**52**	**12**	**23.08**	**152**	**12**	**7.89**
Norway spruce	I – north-eastern	Białystok	30	21	70.00	306	129	42.16	4	0	0.00	12	0	0.00
	II – northern	Gdańsk, Olsztyn, Piła, Szczecin, Szczecinek, Warszawa	12	10	83.33	90	42	46.67	4	0	0.00	4	0	0.00
	III – sudecki	Wrocław	24	20	83.33	110	7	6.36	4	0	0.00	4	0	0.00
	IV – śląski	Katowice	48	29	60.42	193	0	0	4	0	0.00	8	0	0.00
	V – south-eastern	Kraków, Krosno, Lublin, Radom	14	7	50.00	221	30	30	4	0	0.00	8	0	0.00
	Total		**128**	**87**	**67.97**	**920**	**208**	**22.61**	**20**	**0**	**0.00**	**36**	**0**	**0.00**

Table 1. cont.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
European larch	I – northern	Białystok, Gdańsk, Olsztyn, Piła, Poznań, Szczecin, Szczecinek	23	11	47.83	311	77	24.76	4	0	0.00	12	0	0.00
	II – south-western	Katowice, Wrocław	29	16	55.17	251	50	19.92	4	0	0.00	12	0	0.00
	III – south-eastern	Kraków, Krosno, Lublin, Radom	30	10	33.33	454	8	1.76	4	0	0.00	20	0	0.00
	Total		**82**	**37**	**45.12**	**1016**	**135**	**13.29**	**12**	**0**	**0.00**	**44**	**0**	**0.00**
White fir	I – east-central	Lublin, Łódź, Radom	24	21	87.50	99	84	84.85	4	4	100.0	4	4	100.0
	II – south-western	Katowice, Wrocław	11	11	100.0	61	56	91.80	4	4	100.0	4	4	100.0
	III – south-eastern 1	Kraków	19	19	100.0	143	126	88.11	4	4	100.0	8	8	100.0
	IV – south-eastern 2	Krosno	20	18	90.00	145	111	76.55	4	4	100.0	8	4	50.00
	V – Pomeranian	Gdańsk, Szczecin, Szczecinek	3	3	100.0	36	36	100.0	1	1	100.0	0	0	0.00
	Total		**77**	**72**	**93.51**	**484**	**413**	**85.33**	**17**	**17**	**100.0**	**24**	**20**	**83.33**
Douglas fir	I – northern	Gdańsk, Szczecin, Szczecinek, Olsztyn	18	1	5.56	270	27	10.00	4	0	0.00	4	0	0.00
	II – central	Piła, Poznań, Toruń	14	3	21.43	96	15	15.63	4	0	0.00	4	0	0.00
	III – southern	Katowice, Kraków, Krosno, Lublin, Wrocław	16	2	12.50	168	32	19.05	4	0	0.00	8	0	0.00
	Total		**48**	**6**	**12.50**	**534**	**74**	**13.85**	**12**	**0**	**0.00**	**16**	**0**	**0.00**
Beech	I – northern	Gdańsk, Olsztyn, Szczecin, Szczecinek	46*	31	95.23	181*	129	96.10	4	4	100.0	8	8	100.0
	II – central	Łódź, Piła, Poznań, Toruń, Zielona Góra	17*	29	95.23	22*	66	96.10	4	4	100.0	4	4	100.0
	III – south-western	Katowice, Wrocław	28	26	92.86	92	0	0.00	4	4	100.0	4	0	0.00
	IV – south-eastern	Kraków, Krosno, Lublin, Radom	34	26	76.47	258	0	0.00	4	4	100.0	12	0	0.00
	Total		**125**	**112**	**89.60**	**553**	**195**	**35.26**	**16**	**16**	**100.0**	**28**	**12**	**42.86**

Table 1. cont.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Pedunculate oak	I – northern	Białystok, Gdańsk, Olsztyn, Piła, Szczecin, Szczecinek, Toruń	31	0	0.00	238	0	0.00	4	0	0.00	12	0	0.00
	II – south-western	Katowice. Łódź, Poznań, Wrocław, Zielona Góra	32	0	0.00	89	0	0.00	4	0	0.00	4	0	0.00
	III – south-eastern	Kraków, Krosno, Lublin, Radom	23	0	0.00	168	0	0.00	4	0	0.00	4	0	0.00
	Total		**86**	**0**	**0.00**	**495**	**0**	**0.00**	**12**	**0**	**0.00**	**20**	**0**	**0.00**
Sessile oak	I – northern	Gdańsk, Piła, Szczecinek, Toruń	27	0	0.00	144	0	0.00	4	0	0.00	4	0	0.00
	II – western	Poznań, Szczecin, Wrocław, Zielona Góra	30	0	0.00	133	0	0.00	4	0	0.00	8	0	0.00
	III – southern	Katowice, Radom, Lublin	1	0	0.00	41	0	0.00	0	0	0.00	4	0	0.00
	Total		**58**	**0**	**0.00**	**318**	**0**	**0.00**	**8**	**0**	**0.00**	**16**	**0**	**0.00**
Black alder	I – north-eastern	Białystok, Olsztyn, Warszawa	26	3	11.54	192	0	0.00	4	0	0.00	8	0	0.00
	II – north-central	Gdańsk, Łódź, Poznań, Szczecinek, Toruń	17	0	0.00	120	0	0.00	4	0	0.00	4	0	0.00
	III – southern	Katowice, Kraków, Krosno, Lublin, Radom, Wrocław	23	0	0.00	205	33	16.10	4	0	0.00	12	0	0.00
	Total		**66**	**3**	**4.55**	**517**	**33**	**6.38**	**12**	**0**	**0.00**	**24**	**0**	**0.00**
Silver birch	I – north-eastern	Białystok, Olsztyn, Warszawa	10	0	0.00	100	0	0.00	2	0	0.00	4	0	0.00
	II – west-central	Łódź, Piła, Szczecin, Toruń, Zielona Góra	10	2	20.00	101	11	10.89	2	0	0.00	4	0	0.00
	III – south-eastern	Katowice, Kraków, Krosno, Lublin	6	2	33.33	66	8	12.12	2	0	0.00	4	0	0.00
	Total		**26**	**4**	**15.38**	**267**	**19**	**7.12**	**6**	**0**	**0.00**	**12**	**0**	**0.00**

Supplement no. 4

Proposed tasks in the ‘Program’ for the years 2011–2035

Table 1. Demand for seed (in kg) of main tree species in the years 1981–2009 according to felling requests

Years	Pine	Spruce	Larch	Fir	Oak	Beech
Mean (1981–1990)	17 189	4 016	3 453	21 486	893 310	84 483
Mean (1991–2000)	10 574	1 926	2 222	13 958	1189 844	90 005
2001	7 348	1 249	1 427	9 776	1 150 311	79 373
2002	7 593	830	996	6 537	869 490	83 963
2003	6 944	840	1 102	5 974	909 805	77 861
2004	5 996	795	908	6 427	890 081	87 003
2005	6 479	788	800	8 785	1 125 543	74 857
2006	6 907	756	697	6 987	1 068 532	105 700
2007	6 047	720	614	6 730	1 085 626	79 403
2008	5 328	675	607	6 720	998 251	75 373
2009	4 920	455	453	5 667	917 792	74 021
Mean (2000–09)	6 396	790	843	7 067	1 001 715	81 950
Overall mean	11 559	2 294	2 219	14 163	1 023 398	85 601
Assumed demand	**8 000**	**1 500**	**1 000**	**15 000**	**1 000 000**	**87 000**

Table 2. Proposed area (in ha) of stands of known origin (production seed stands PSS) by species and RDSF

RDSF	Species												Total
	B	SB	SO	PO	SLL	BA	OB	WF	EL	SP	NS	OC	
Białystok	0	1000	0	1 200	100	2 500	500	0	10	15 000	3 600	0	**23 910**
Gdańsk	2 800	150	600	400	20	100	30	0	50	6 500	400	30	**11 080**
Katowice	1 600	140	130	1 400	120	270	200	560	250	9 000	2 700	30	**16 400**
Kraków	1 400	50	10	300	10	100	50	1 700	200	650	100	10	**4 580**
Krosno	3 400	150	30	600	20	200	100	2 500	200	2 800	20	0	**10 020**
Lublin	400	500	150	1 500	50	600	300	600	50	9 000	60	20	**13 230**
Łódź	200	200	350	700	0	300	30	130	60	7 000	10	20	**9 000**
Olsztyn	3 500	600	0	2 500	200	600	100	0	20	16 500	500	0	**24 520**
Piła	300	50	400	450	10	50	10	0	20	5 300	50	20	**6 660**
Poznań	250	300	800	2 100	0	200	50	10	30	7 000	0	20	**10 760**
Radom	250	50	150	400	0	300	30	500	100	3 200	50	0	**5 030**
Szczecin	1 300	100	1 000	1 000	10	250	100	0	60	9 500	100	50	**13 470**
Szczecinek	1 100	100	400	450	0	100	30	20	50	8 000	150	50	**10 450**
Toruń	450	150	300	600	30	200	50	0	70	11 000	30	20	**12 900**
Warszawa	40	100	100	200	30	250	20	50	0	3 400	10	0	**4 200**
Wrocław	1 700	100	100	1 800	100	150	100	100	350	2 400	3 000	50	**9 950**
Zielona Góra	100	50	150	700	0	100	40	0	50	5 000	20	20	**6 230**
Total	**18 790**	**3 790**	**4 670**	**16 300**	**700**	**6 270**	**1 740**	**6 170**	**1 570**	**121 250**	**10 800**	**340**	**192 390**

Table 3. Proposed area (in ha) of newly approved select stands (reserved seed stands RSS) by species and RDSF

RDSF	Species												Total
	B	SB	SO	PO	WF	A	S	SLL	EL	BA	SP	NS	
Białystok		10		50		5	5	10		30	200	50	**360**
Gdańsk	50	5	10	10		5		10	5	5	70		**170**
Katowice	30	5	20	30	20	5	5	5	20	5	30	150	**325**
Kraków	40	5	10	20	80	5	5	5	10		10	40	**230**
Krosno	70	10	10	15	90	5	5	5	10	5	20	10	**255**
Lublin	40	10	10	30	30	5		5		20	70	5	**225**
Łódź	20									5	40		**65**
Olsztyn	10	10		30		5			5	15	200	10	**285**
Piła	10		30	10							40		**90**
Poznań	20		50	50					5	5	50		**180**
Radom	30	5	20	20	50				30	25	40	5	**225**
Szczecin	50	5	100	50		5		5	5	5	110		**335**
Szczecinek	40		60	10							70		**180**
Toruń	30	10	30	10						10	120		**210**
Warszawa		5								5	50		**60**
Wrocław	40	10	10	40	10	5	5	10	25	5	40	30	**230**
Zielona Góra	10	5	20	15							40		**90**
Total	**490**	**95**	**380**	**390**	**280**	**45**	**25**	**55**	**115**	**140**	**1200**	**300**	**3515**

Table 4. Proposed number of newly selected maternal trees (plus trees PT) by species and RDSF

RDSF	Species																		Total
	B	SB	WC	SO	PO	DF	WF	A	S	NM	SLL	EL	BA	AS	BL	SP	NS	WE	WhE	
Białystok	0	10	0	0	40	0	0	10	15	5	20	0	20	10	0	100	50	10	10	**300**
Gdańsk	15	0	10	0	25	20	0	5	15	5	0	10	15	5	0	30	0	5	5	**165**
Katowice	40	40	10	25	25	20	30	5	15	5	0	25	0	5	0	40	40	5	5	**335**
Kraków	15	10	15	0	10	0	40	15	15	5	0	30	10	5	0	30	10	5	5	**220**
Krosno	25	10	10	0	15	10	40	5	15	5	10	25	10	5	0	15	10	5	5	**220**
Lublin	10	10	10	10	10	0	15	5	15	5	10	5	15	0	0	45	10	5	5	**185**
Łódź	0	10	0	0	0	0	0	0	0	5	0	0	10	0	0	30	0	5	5	**65**
Olsztyn	0	10	0	0	15	0	0	0	15	5	10	5	20	0	0	70	0	5	5	**160**
Piła	0	0	0	15	15	10	0	0	0	5	0	0	0	0	0	35	0	5	5	**90**
Poznań	0	40	0	15	10	10	0	0	0	5	10	10	10	0	0	25	0	5	5	**145**
Radom	15	0	0	0	0	0	20	0	5	5	10	40	30	10	0	20	10	5	5	**175**
Szczecin	30	10	0	25	20	30	0	0	0	5	10	10	10	0	0	100	0	5	5	**260**
Szczecinek	15	10	15	20	15	25	10	10	0	5	0	10	10	0	0	45	0	5	5	**200**
Toruń	0	10	0	25	10	15	0	0	10	5	0	0	15	0	0	50	0	5	5	**150**
Warszawa	0	0	0	0	0	0	0	0	0	5	10	0	15	5	0	25	0	5	5	**70**
Wrocław	25	10	10	15	25	15	15	10	15	5	10	40	15	5	0	25	25	5	5	**275**
Zielona Góra	0	10	0	15	0	0	0	0	0	5	0	0	0	0	20	20	0	0	5	**75**
Total	**190**	**190**	**80**	**165**	**235**	**155**	**170**	**65**	**135**	**85**	**100**	**210**	**205**	**50**	**20**	**705**	**155**	**85**	**90**	**3090**

Table 5. Proposed number of newly established clonal seed orchards by species and RDSF

RDSF	Species														Total
	B	SB	WC	SO	PO	WF	A	SLL	EL	BA	SP	WE	WhE	NS	
Białystok												1	1		**2**
Gdańsk			1		1										**2**
Katowice		1	1		1	1		1			1			2	**8**
Kraków	1	1	1			1	1	1		1	1			1	**9**
Krosno	1								1						**2**
Lublin	1	1										1			**3**
Łódź			1	1		1									**3**
Olsztyn			1		1								1		**3**
Piła	1				1					1					**3**
Poznań		1													**1**
Radom	1					1		1							**3**
Szczecin				1	1					1		1			**4**
Szczecinek		1	1		1	1	1			1					**6**
Toruń		1		1	1			1					1		**5**
Warszawa		1	1							1	1				**4**
Wrocław	1	1	1	1	1		1		2	1		1		2	**12**
Zielona Góra	1	1													**2**
Total	**7**	**9**	**8**	**4**	**8**	**5**	**3**	**4**	**3**	**6**	**3**	**4**	**3**	**5**	**72**

Table 6. Proposed area (in ha) of newly established clonal seed orchards by species and RDSF

RDSF	Species														Total
	B	SB	WC	SO	PO	WF	A	SLL	EL	BA	SP	WE	WhE	NS	
Białystok												5	5		**10**
Gdańsk			5		5										**10**
Katowice		5	5		5	5		5			5			10	**40**
Kraków	5	5	5			5	5	5		5	5			5	**45**
Krosno	5								5						**10**
Lublin	5	5										5			**15**
Łódź			5	5		5									**15**
Olsztyn			5		5								5		**15**
Piła	5				5					5					**15**
Poznań		5													**5**
Radom	5					5		5							**15**
Szczecin				5	5					5		5			**20**
Szczecinek		5	5		5	5	5			5					**30**
Toruń		5		5	5			5					5		**25**
Warszawa		5	5							5	5				**20**
Wrocław	5	5	5	5	5		5		10	5		5		10	**60**
Zielona Góra	5	5													**10**
Total	**35**	**45**	**40**	**20**	**40**	**25**	**15**	**20**	**15**	**30**	**15**	**20**	**15**	**25**	**360**

Table 7. Proposed number of newly established seedling seed orchards by species and RDSF

RDSF	Species													Total
	B	SB	SO	PO	DF	WF	S	AP	EL	SP	WE	WhE	NS	
Białystok				1									1	**2**
Gdańsk	1										1			**2**
Katowice	1		1	1	1		1	1	1	1			1	**9**
Kraków		1		1	1	1				1				**5**
Krosno	1					1			1	1		1	1	**6**
Lublin	1	1		1		1			1				1	**6**
Łódź											1			**1**
Olsztyn				1						1			1	**3**
Piła	1		1		1									**3**
Poznań		1												**1**
Radom						1			1	1		1		**4**
Szczecin	1		1	1			1		1					**5**
Szczecinek	1	1	1			1			1	1				**6**
Toruń					1				1					**2**
Warszawa										1		1		**2**
Wrocław	1			1	1	1	1		1				1	**7**
Zielona Góra											1			**1**
Total	**8**	**4**	**4**	**7**	**5**	**6**	**3**	**1**	**8**	**7**	**3**	**3**	**6**	**65**

Table 8. Proposed area (in ha) of newly established seedling seed orchards by species and RDSF

RDSF	Species													Total
	B	SB	SO	PO	DF	WF	S	AP	EL	SP	WE	WhE	NS	
Białystok				5									5	**10**
Gdańsk	5										5			**10**
Katowice	5		5	5	5	5	5	5	5	5			5	**50**
Kraków		5		5	5	5				5				**25**
Krosno	5					5			5	5		5	5	**30**
Lublin	5	5		5		5			5				5	**30**
Łódź											5			**5**
Olsztyn				5						5			5	**15**
Piła	5		5		5									**15**
Poznań		5												**5**
Radom									5	5		5		**15**
Szczecin	5		5	5			5		5					**25**
Szczecinek	5	5	5			5			5	5				**30**
Toruń					5				5					**10**
Warszawa										5		5		**10**
Wrocław	5			5	5	5	5		5				5	**35**
Zielona Góra											5			**5**
Total	**40**	**20**	**20**	**35**	**25**	**30**	**15**	**5**	**40**	**35**	**15**	**15**	**30**	**325**

Table 9. Proposed increase in the area (in ha) of progeny plantations in blocks by species and RDSF

RDSF	Species														Total
	B	SB	SO	PO	DF	WF	A	S	SLL	EL	BA	BL	SP	NS	
Białystok	0	100	0	300	0	0	0	0	40	40	160	0	2600	700	**3940**
Gdańsk	400	0	50	50	40	0	10	0	30	20	20	0	600	20	**1240**
Katowice	300	2	0	200	60	120	0	0	0	90	30	0	400	1800	**3002**
Kraków	400	30	10	150	30	500	10	40	0	50	50	0	130	300	**1700**
Krosno	650	0	0	150	6	900	10	0	0	120	40	0	170	10	**2056**
Lublin	300	80	0	250	0	300	0	0	0	20	140	0	700	20	**1810**
Łódź	100	0	0	10	0	20	0	0	0	20	40	0	450	0	**640**
Olsztyn	30	30	0	200	0	0	0	0	100	30	120	0	2900	100	**3510**
Piła	50	0	250	50	10	0	0	0	0	10	0	0	440	10	**820**
Poznań	30	0	500	400	10	0	10	0	0	60	60	0	500	0	**1570**
Radom	360	0	60	100	0	500	0	0	0	240	250	0	500	25	**2035**
Szczecin	550	30	1000	50	40	0	0	20	0	40	0	0	1000	50	**2780**
Szczecinek	350	0	600	30	30	50	30	0	0	10	20	0	800	10	**1930**
Toruń	100	59	250	50	30	0	0	0	0	0	70	0	1100	0	**1659**
Warszawa	0	50	0	0	0	0	0	0	30	0	80	0	720	20	**900**
Wrocław	300	0	60	450	50	20	6	10	80	160	10	0	400	400	**1946**
Zielona Góra	120	20	200	120	0	0	0	0	0	0	0	50	500	0	**1010**
Total	**4040**	**401**	**2980**	**2560**	**306**	**2410**	**76**	**70**	**280**	**910**	**1090**	**50**	**13 910**	**3465**	**32 548**

Table 10. Minimal area (in ha) of conservation plantations from conservation stands in the State Forests by species and RDSF

RDSF	Species										Total
	SP	B	SO	PO	WF	A	EL	NS	Lime	H	
Białystok	280			100		80		60			**520**
Gdańsk	200	20		20							**240**
Katowice	220	20		60	60		20	220			**600**
Kraków		20			100			20			**140**
Krosno				40	20		20				**80**
Lublin	200			80	20						**300**
Łódź	40			20							**60**
Olsztyn	320										**320**
Piła	60			40							**100**
Poznań					40		20				**60**
Radom	120		20				40				**180**
Szczecin	680		20	20							**720**
Szczecinek	120	100	40	80						20	**360**
Toruń	120	40		80					20		**260**
Warszawa	80				20						**100**
Wrocław	60			40	20			40			**140**
Zielona Góra	20										**20**
Total	**2520**	**200**	**80**	**580**	**260**	**80**	**100**	**340**	**20**	**20**	**4200**

Supplement no. 5

Estimated production possibilities of the production seed stands PSS

Table 1. Estimated data concerning the possibility of gathering seed of individual species in production seed stands (average variant)

Species	Seed year periods	Assumption	Yield of seed (fruits) per ha	Adopted for the calculation	Yield of seed from 100 kg of crop in kg	Yield of seed per ha in kg	Times in 30 years	Possible seed yield per ha in 30 years in kg	Possible yield from existing PSS in tons	Mean annual yield in kg
Pine	3–4	3	100–500	300	1.0–1.5	3.5–4.5	10.00	35–45	4244–5456	141 458–181 875
Spruce	3–5	8	500–1500	1000	2.0–3.0	20–30	6.00	120–180	1296–1944	43 200–64 800
Larch	2–4	3	200–500	350	5–8	17.5–28.0	10.00	175–280	275–440	9158–14 653
Fir	3–4	4	500–2000	1000	10–15	100–150	7.50	750–1125	4627–6941	154 250–231 375
Beech	5–8	7	30–50	40	60–70	24–28	4.29	103–120	1935–2255	64 512–75 160
Oak ped.	3–8	5	300–1500	500	90–95	450–475	6.00	2700–2850	4450–4702	1455–1567 (t)
Oak sess.	5–8	7	300–1500	500	90–95	450–475	4.29	1930–2037	901–951	300–317 (t)
Alder	2–3	2	100–300	150	10–15	15.0–22.5	15.00	225–337	1410–2116	47 025–70 537
Birch	1–2	2	50–500	225	50–70	110–160	15.00	1650–2400	6253–9096	208 450–303 200
Lime	1–2	2	25–100	60	60–70	36–42	15.00	540–630	378–441	12 600–14 700

Table 2. Estimated data concerning the possibility of gathering seed of individual species in production seed stands (pessimistic variant)

Species	Seed year periods	Assumption	Yield of seed (fruit) per ha	Adopted for calculation	Seed yield from 100 kg of crop in kg	Yield of seed per ha in kg	Times in 30 years	Possible seed yield per ha in 30 years in kg	Possible yield from existing PSS in tons	Mean annual yield in kg
Pine	3–4	4	100–500	100	1.0–1.5	1.0–1.5	7.50	7.50–11.25	909–1364	30 312–45 469
Spruce	3–8	8	500–1500	500	2.0–3.0	10.0–15.0	3.75	37.50–56.25	405–607	13 500–20 250
Larch	2–4	4	200–2000	200	5.0–8.0	10.0–16.0	7.50	75.00–120.00	118–188	3925–6280
Fir	3–4	4	100–400	500	10.0–15.0	50.0–75.0	7.50	375.00–562.50	2313–3470	77 125–115 687
Beech	5–8	8	300–500	30	60.0–70.0	18.0–21.0	3.75	67.50–78.75	1268–1479	42 277–49 324
Oak ped.	3–8	8	300–1500	300	90.0–95.0	270–285	3.75	1012–1069	16 698–17 638	557–588 (t)
Oak sess.	3–8	8	100–300	300	90.0–95.0	270–285	3.75	1012–1069	4726–4992	158–166 (t)
Alder	2–3	3	25–100	100	10.0–15.0	10.0–15.0	10.00	100.0–150.0	627–940	20 900–31 350
Birch	1–2	2	50–150	25	60.0–70.0	15.0–17.5	15.00	225.0–262.5	853–995	28 425–33 162
Lime	2–3	3	50–150	50	80.0–90.0	40.0–45.0	10.00	400.0–450.0	280–315	9333–10 500

Supplement no. 6

Estimated cost of realizing the ‘Program’ for the years 2011–2035

Table 1. Estimated cost of realizing the 'Program of conserving forest genetic resources and breeding of trees in Poland for the years 2011–2035'

Task		Cost in thousand PLN in RDSF																	Total
		Białystok	Gdańsk	Katowice	Kraków	Krosno	Lublin	Łódź	Olsztyn	Piła	Poznań	Radom	Szczecin	Szczecinek	Toruń	Warszawa	Wrocław	Zielona Góra	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Selection of reserved seed stands (RSS)		Unitary cost 30 PLN/ha																	
	ha	360	170	325	230	255	225	65	285	90	180	225	335	180	210	60	230	90	3515
	PLN*	10.80	5.10	9.75	6.90	7.65	6.75	1.95	8.55	2.70	5.40	6.75	10.05	5.40	6.30	1.80	6.90	2.70	105.45
Selection of stands of known origin (PSS)		Unitary cost – 20 PLN/ha																	
	ha	23910	11080	16400	4580	10020	13230	9000	24520	6660	10760	5030	13470	10450	12900	4200	9950	6230	192 390
	PLN	478.2	221.6	328.0	91.6	200.4	264.6	180.0	490.4	133.2	215.2	100.6	269.4	209.0	258.0	84.0	199.0	124.6	3847.8
Selection of plus trees (PT)		Unitary cost – 30 PLN/szt.																	
	szt.	300	165	335	220	220	185	65	160	90	145	175	260	200	150	70	275	75	3090
	PLN	9.00	4.95	10.05	6.60	6.60	5.55	1.95	4.80	2.70	4.35	5.25	7.80	6.00	4.50	2.10	8.25	2.25	92.70
Establishment of progeny plantations		Unitary cost – 2000 PLN/ha*																	
	ha	3940	1240	3002	1700	2056	1810	640	3510	820	1570	2035	2780	1930	1659	900	1946	1010	32 548
	PLN	7880	2480	6004	3400	4112	3620	1280	7020	1640	3140	4070	5560	3860	3318	1800	3892	2020	65 096
Establishment of conservation plantations		Unitary cost – 2000 PLN/ha*																	
	ha	520	240	600	140	80	300	60	320	100	60	180	720	360	260	100	140	20	4200
	PLN	1040	480	1200	280	160	600	120	640	200	120	360	1440	720	520	200	280	40	8400
Establishment of seedling seed orchards		Unitary cost – 10 000 PLN/ha																	
	ha	10	10	50	25	30	30	5	15	15	5	15	25	30	10	10	35	5	325
	PLN	100	100	500	250	300	300	50	150	150	50	150	250	300	100	100	350	50	3250

Table 1. cont.

Task		Cost in thousand PLN in RDSF																	Total
		Białystok	Gdańsk	Katowice	Kraków	Krosno	Lublin	Łódź	Olsztyn	Piła	Poznań	Radom	Szczecin	Szczecinek	Toruń	Warszawa	Wrocław	Zielona Góra	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Establishment of clonal seed orchards		Unitary cost – 18 000 PLN/ha																	
	ha	10	10	40	45	10	15	15	15	15	5	15	20	30	25	20	60	10	360
	PLN	180	180	720	810	180	270	270	270	270	90	270	360	540	450	360	1080	180	6480
Maintenance of established clonal and seedling seed orchards		Unitary cost – 1500 PLN/ha																	
	ha	20	20	90	70	40	45	20	30	30	10	30	45	60	35	30	95	15	685
	PLN	30	30	135	105	60	67.5	30	45	45	15	45	67.5	90	52.5	45	142.5	22.5	1027.5
Total		**9728**	**3506**	**8907**	**4950**	**5027**	**3134**	**1934**	**8629**	**2444**	**3640**	**5007**	**7965**	**5730**	**4709**	**2593**	**5959**	**2442**	**88 299 450**
Average per annum		**3532**																	

* Only additional cost, above the average cost of commercial reforestations, which results from, among others, higher costs of obtaining FRM.